SUPREME COURT OF NEW JERSEY
A-56 September Term 2018
082253

STATE OF NEW JERSEY,

Plaintiff-Respondent,

v.

MICHAEL OLENOWSKI,

Defendant-Appellant.

REPORT OF FINDINGS OF FACT AND CONCLUSIONS OF LAW

Submitted to the Supreme Court: August 18, 2022

On remand from the Supreme Court of New Jersey by Order of November 18, 2019, to a Special Master for a plenary hearing to consider and decide whether DRE evidence satisfies the reliability standard of N.J.R.E. 702 to allow its admission in evidence.

Joseph E. Krakora, Public Defender, designated lead counsel for defendant-appellant (Mary Claire Wolf, First Assistant Deputy Public Defender; Kelsey Baack, Assistant Deputy Public Defender; and Kimberly Schultz, Assistant Deputy Public Defender, appearing[1] and on the brief; Margaret McLane, Assistant Deputy Public Defender, on the brief).

Matthew J. Platkin, Acting Attorney General, for plaintiff-respondent (Sarah C. Hunt, Deputy Attorney General; Adam D. Klein, Deputy Attorney General; and Mohammad A. Mahmood, Deputy Attorney General, appearing and on the brief; Erik Daab,

[1] "Appearing" indicates counsel who appeared in person for one or more days of the hearing in this matter between September 20, 2021, and January 18, 2022.

Supervising Deputy Attorney General; Robyn Mitchell, Supervising Deputy Attorney General, and Stephen J. Wenger, Deputy Attorney General, appearing).

Defense amici curiae

Steven W. Hernandez, for the National College for DUI Defense (appearing and on the joint amici brief).

John Menzel, for the New Jersey State Bar Association (appearing and on the joint amici brief). Sharon A. Balsamo and Joshua H. Reinitz (appearing)

Aidan P. O'Connor, for the Association of Criminal Defense Lawyers of New Jersey (appearing and on the joint amici brief).

Evan M. Levow, for the DUI Defense Lawyers Association (appearing and on the joint amici brief).

Alexander R. Shalom, for the American Civil Liberties Union.

State amici curiae

Joseph Paravecchia, Assistant Hunterdon County Prosecutor; Laura C. Sunyak, Assistant Mercer County Prosecutor; Monica do Outeiro, Assistant Monmouth County Prosecutor; Gretchen Pickering, Senior Assistant Cape May County Prosecutor; and David M. Liston, Assistant Middlesex County Prosecutor for the County Prosecutors Association of New Jersey (on the brief).

Porzio, Bromberg & Newman, PC, for New Jersey State Association of Chiefs of Police (Vito A. Gagliardi, Jr., David L. Disler, and Weston J. Kulick, on the brief)

LISA, P.J.A.D. (retired and temporarily assigned on recall), Special Master

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I. PROCEDURAL HISTORY

Michael Olenowski was charged with driving under the influence of drugs (DUID), in violation of N.J.S.A. 39:4-50(a), on two separate occasions in 2015. At the time of each incident, while under arrest shortly after driving, Olenowski was evaluated by a Drug Recognition Expert (DRE), each of whom formed an opinion that he was driving under the influence of impairing drugs. Before either case went to trial, Olenowski moved to bar the testimony of the DREs, requesting a hearing under Frye v. United States, 293 F. 1013 (D.C. Cir. 1923), to assess whether the proposed DRE testimony was sufficiently reliable to be allowed in evidence. The municipal court judge denied the motion and allowed the DREs to testify. Following separate trials in the Hanover Municipal Court, Olenowski was found guilty in April and May 2016 of the DUID charges, which constituted his second and third offences in violation of N.J.S.A. 39:4-50(a).

After a consolidated trial de novo in the Law Division, Rule 3:23, Olenowski was again convicted of both offenses and the same sentences that had been imposed by the municipal court judge were imposed. Olenowski appealed, and in an unreported opinion the Appellate Division affirmed his convictions and sentences. (State v. Olenowski, A-4666-16T1, decided 11/27/18.)

Olenowski's petition for certification to the New Jersey Supreme Court was granted on March 8, 2019. (State v. Olenowski, 236 N.J. 622 (2019)). After briefing and oral argument, the Court concluded that a Frye hearing should have been conducted. The Court issued an order on November 18, 2019 (Appendix A), directing that such a hearing be held. In the order, the Court directed the appointment of a Special Master to conduct the hearing and issue a report of findings of fact and conclusions of law, to be submitted the Court for further consideration of the admissibility of DRE evidence.

This Special Master proceeding followed. The first two case management conferences, held on January 7 and February 19, 2020, were conducted in person in my chambers. Following the second case management conference, the Office of the Public Defender (OPD) was designated as lead defense counsel in the matter.

Then COVID-19 struck and the following fifteen case management conferences were conducted virtually, until the eighteenth and final one on September 2, 2021, which was in person at the hearing venue in Burlington County's Olde Historic Courthouse in Mt. Holly. Needless to say, the pre-hearing process, including numerous motions and the exchange of voluminous discovery materials, was significantly hampered and delayed by the many dislocations caused by COVID-19.

The hearing commenced on September 20, 2022. All sessions were in person, with appropriate social distancing and mandatory masking. Testimony concluded on January 18, 2022. The hearing consumed forty-two days of testimony by sixteen witnesses.

Post-hearing briefs were filed on March 11, 2022.[2] This report follows.[3]

II. INTRODUCTION

The issue in this Special Master Proceeding is defined by the Supreme Court's order of November 18, 2019, namely "to consider and decide whether DRE evidence has achieved general acceptance within the relevant scientific community and therefore satisfies the reliably standard of N.J.R.E. 702." The order continued that "as part of the evaluation . . . the Special Master [shall] determine . . . whether each individual component of the twelve-step protocol is reliable; whether all or

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[2] Sb = State's brief
OPDb = OPD's brief
AACPb = brief of amicus curiae New Jersey State Association of Chiefs of Police
ACPAb = brief of amicus curiae County Prosecutors Association of New Jersey
JAb = joint brief of amici curiae National College for DUI Defense, DUI Defense Lawyers Association, Association of Criminal Defense Lawyers of New Jersey, and New Jersey State Bar Association

[3] During the pendency of the Special Master proceeding, Michael Olenowski passed away. Nevertheless, because the issue is of significant public importance and likely to recur, the issue has not been rendered moot with Olenowski's passing, and the hearing proceeded to its conclusion. See State v. Cassidy, 235 N.J. 482, 491 (2018).

part of the twelve-step protocol is scientifically reliable and can form the basis of expert testimony; and whether components of the process present limitations, practical or otherwise."

The twelve-step protocol used by DREs contains the following steps:

1. Breath alcohol test
2. Interview of arresting officer
3. Preliminary examination and first pulse
4. Eye examinations (Equal tracking and pupil size)
    A. HGN (Smooth Pursuit, Maximum Deviation, Angle of Onset)
    B. VGN
    C. Non-Convergence
5. Divided attention tests:
    – Modified Romberg Balance
    – Walk and Turn
    – One Leg Stand
    – Finger to Nose
6. Vital signs and second pulse
7. Dark room exam of pupil size; ingestion site exam (oral and nasal)
8. Check for muscle tone
9. Check for injection sites and third pulse
10. Interrogation, statements, and other observations
11. Opinion of evaluator
12. Toxicological examination

[S-52, attached as Appendix E; See also, e.g., D-4 at pdf 136-75; 20T254-20T261; 21T8-21T59.]

From its early days of development in the 1970s, the Drug Evaluation and Classification Program (DECP) has had at its core several premises, which include the following: (1) the signs and symptoms typically associated with the use of certain defined classes of impairing drugs could be observed by well-trained police officers, some just by general observation, others by the administration of standardized tests that the officers could be trained to administer, and some by ascertaining medically related manifestations of drug ingestion, such as pulse, blood pressure, temperature, muscle tone, certain eye movements and other characteristics, which the officers could also be trained to do; (2) categorization of the classes of impairing drugs could be achieved, with the input of medical and toxicological experts, resulting in distinct categories based upon expected signs and symptoms, rather than other factors such as molecular structure or therapeutic use; (3) these observations would be helpful in ascertaining whether observed impairment was caused by the ingestion of an impairing drug or drugs in one or more of the categories; and (4) these observations and assessments, combined with other information ascertained through other steps in the protocol, would enable these officers, who would come to be known as DREs, to form reliable opinions as to whether the observed impairment of a subject was likely caused by an impairing drug or drugs, and, if so, which category or categories of drugs were responsible.

The "other steps in the protocol" referred to above include ruling out alcohol intoxication with an Alcotest examination and the use of ordinary police work. This would include, for example, questioning witnesses, which might include persons who were with the subject, EMTs, etc.; interviewing the arresting officer to ascertain the driving conduct that resulted in police contact; learning of any admissions the subject may have made and whether any drugs or drug paraphernalia were found; and ascertaining the behavior, general demeanor, appearance and conduct of the subject observed by others before the DRE arrived. Then, of course, the DRE would make his or her own general observations of the subject and engage in a preliminary inquiry about any health or injury issues, whether the subject had taken any medications, and other pertinent information. Throughout the entire time of interacting with the subject, the DRE would continually gather more information and make more observations along these lines.

The DRE would also request a urine sample, but in New Jersey is obligated to advise the subject that he or she has the right to refuse to give one. If the subject waives that right, a urine sample would be provided and sent to a New Jersey State Police laboratory for toxicological assessment. The results of that sample would not be known for at least several weeks, long after the

DRE had recorded his or her opinion about drug use and the observations and information supporting that opinion, in a written and filed report.

Over the decades since the DRE protocol was standardized and widely used across the country beginning in the 1980s, there has been some debate, and in some quarters skepticism, over the reliability of DRE opinions. This was premised in part on the fact that the DRE program was created by police officers. Opponents also questioned the quality of the various studies used to develop and validate the protocol. Criticisms have been made of the design, methodology, and data analysis reported in these studies. Opponents have argued, as the defense does in this case, that these studies were commissioned and paid for by the U.S. Department of Transportation, National Highway Traffic Safety Administration (NHTSA), they were conducted by a small group of researchers who had a vested interest in achieving the result sought by NHTSA, and the studies were not sound. Throughout this time, it was not made very clear who the professional experts were who guided the development of the protocol and the extent of their involvement. Nor, especially with respect to the earlier studies, were the limitations inherent in the studies emphasized.

In its order of November 18, 2019 establishing this proceeding, the Court noted that the parties had "submitted extensive literature, which has not

been examined at an evidentiary hearing, in support of their respective positions." The Court then determined that "the existing factual record [was] inadequate," and a hearing was therefore necessary to develop "a full and complete record."

Over the course of this forty-two-day hearing, numerous experts have provided extensive testimony.[4] The State presented experts in general medicine, emergency medicine, medical toxicology, general toxicology, ophthalmology, optometry, and psychology. The State also produced witnesses who qualified as experts in the DECP, some of whom participated in the development of the protocol from its early days. The defense presented a medical doctor, an ophthalmologist, and two psychologists.[5]

In the course of their testimony, some of these witnesses on both sides discussed the studies conducted over the years regarding DRE performance. The defense witnesses highlighted asserted shortcomings. The State's witnesses defended the studies, pointing out limitations that are inherent in studies of this subject matter, especially in laboratory studies, but also

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[4] Appendix B is a complete list of transcripts from 1T (the first case management conference on January 7, 2020) to 61T (the final day of hearing on January 18, 2022).

[5] Appendix D is a table of witnesses with the transcripts corresponding to their testimony designated.

limitations of a different nature in field studies. Many of these studies, together with several hundred other exhibits,[6] were admitted into evidence.[7]

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[6] Appendix C is a table listing all exhibits.

[7] In its brief, the OPD cites more than forty times to a document that was neither admitted into evidence nor discussed by the experts during the hearing – "Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods," prepared in 2016 by the President's Council of Advisors on Science & Technology (the PCAST report).

The OPD essentially asks the court to take judicial notice that the PCAST report is an authoritative source for general scientific principles regarding assessing the reliability of all scientific tests and evidence, but there is no justification for this. The report, as plainly indicated in its title, focused on "feature comparison methods" for evaluating and comparing things such as DNA samples and fingerprints, which is a subject that is not at issue here. The OPD presented three experts on research design and methodology and one on statistical analysis, but none testified that the PCAST report was regarded as an authoritative source even on the limited subject of feature comparison methods, still less on more generalized scientific testing or on syndromic analysis in particular.

The OPD states that "[o]ur courts rely upon the PCAST Report to help understand the issues surrounding scientific evidence and assess its reliability." [OPDb12 n.4, citing State v. Pickett, 466 N.J. Super. 270 (App. Div. 2021)]. However, this overstates the case and suggests a far broader judicial acceptance of the PCAST report than is supported by the three published opinions referencing it, all of which were discussing types of feature comparison methods, and none of which stated that the PCAST report was regarded as an authoritative source. In Pickett, the court considered a murder defendant's right to evidence in preparation for a Frye hearing, and it observed that the PCAST report supported, but did not mandate, its holding that the defendant was entitled to production of the source code for the probabilistic genotyping used to match the defendant's DNA to evidence at the crime scene. Id. at 279-80. See also State v. Ghigliotty, 463 N.J. Super. 355, 361 n.2, 362 (App. Div. 2020) (referencing PCAST report as one of "four scientific reports that defendant submitted to the trial court" that gave (continued)

The hearing in this case also involved a very elaborate and detailed statistical review of two full years of actual DRE experience in New Jersey from 2017 and 2018. Reports and other relevant documentation from all of these DRE evaluations, totaling more than 5800 cases, including those conducted as part of DRE certification or re-certification (training cases) and those stemming from the detention of actual drivers (non-training cases), were produced and analyzed by statistical experts. Although this documentation, produced by the State without opposition in response to a defense discovery request, was not planned or designed to be a "study," the analysis and results are akin to a large retrospective field study. The State produced two statistical experts, and the defense produced one.

The Court's November 18, 2019 order directed that the Special Master consider and decide the general acceptance issue in accordance with the standard set forth in Frye. A proponent of scientific evidence can prove its general acceptance and reliability in three ways: "(1) by expert testimony as to

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"necessary contextual background information" about methods used for a "toolmark examination" of a bullet); State v. Fortin, 464 N.J. Super. 193, 221 (App. Div. 2020) (rejecting the defendant's argument that PCAST report and other documents regarding the scientific reliability of bite-mark evidence was newly discovered evidence entitling him to a new trial), certif. denied, 246 N.J. 50 (2021), reconsideration denied, 249 N.J. 60 (2021).

the general acceptance, among those in the profession, of the premises on which the proffered expert witness based his or her analysis; (2) by authoritative scientific and legal writings indicating that the scientific community accepts the premises underlying the proffered testimony; and (3) by judicial opinions that indicate the expert's premises have gained general acceptance." State v. Harvey, 151 N.J. 117, 170 (1997).

Of all of the evidence presented in the case, the most important evidence, in my view, was the expert testimony provided by medical and toxicological experts. The State's experts in these fields provided compelling and persuasive evidence that (1) the seven drug categories in the DRE matrix are consistent with comparable matrices used in the medical field and generally accepted in the medical field, and (2) DREs can be and are adequately trained to competently perform all of the scientifically based steps in the DRE protocol and to reliably observe and report on the results, in a manner that is comparable to the training and performance of individuals utilized in the medical field, such as clinical technicians, EMTs, and the like, a practice that is generally accepted in the medical field.

The State's medical and toxicological experts backed up their opinions by reference to recognized medical texts, peer-reviewed articles, and their own extensive and impressive education and experience. The State's key medical

experts, one an ophthalmologist and the other an emergency physician and medical toxicologist, were independent experts. They have never been connected with the DRE program, law enforcement, or NHTSA. They are active practitioners of medicine and scholars in their fields, having done extensive writing, resulting in articles published in peer-reviewed journals, and being editors and authors of textbooks that universally serve as reference sources and teaching materials for doctors and medical students around the country. The only knowledge these witnesses had of the DRE program was gained in preparation for this case.

The testimony of these independent witnesses and the State's other scientific witnesses has established general acceptance of the DRE protocol in the medical field because the protocol is based upon methods and procedures that comport with generally accepted medical methods and procedures in identifying likely drug use and the category of the drug or drugs involved. In medicine this is known as toxidrome recognition. A toxidrome is a toxic syndrome, identified by ascertaining the presence of a constellation of observed clinical effects and manifestations, that taken together, indicate the category or categories of drugs that are the likely cause.

Thus, it is my finding and determination that the State has satisfied its burden of proving general acceptance in the medical and toxicological

communities through the testimony of its expert witnesses in medicine and toxicology. This will be explained in greater detail in this report.

Nothing more is needed. However, because much of the hearing has focused on reports and studies that have been issued over the last several decades, and because these reports were filed with the Supreme Court, which, in turn, ordered this proceeding in order to obtain testimony, discussion, and explanation of the reports and their level of reliability, I have included section IX dealing with the reports. I conclude in that section that the State's DRE experts provided credible and persuasive evidence establishing that the results of those studies demonstrate a very high degree of reliability. This is particularly true of the studies undertaken since 1985. Despite the inherent limitations that cannot be avoided in laboratory and field studies on this subject or in utilizing the DRE protocol in actual law enforcement scenarios, the findings in these studies are consistent with my finding of general acceptance based upon the testimony of the State's medical and toxicological experts. The studies corroborate and support my finding of general acceptance in the medical and toxicological communities based upon expert testimony.

The State's statistical experts also provided compelling and persuasive evidence regarding their analysis of two years of New Jersey DRE data, which is discussed in detail in section VIII. The reports comprising this data were

prepared in real time in everyday police work around the state. Pertinent data from each DRE report and from a corresponding toxicological report (if one existed) were entered into separate data bases compiled by the State and the OPD, which turned out to be substantially similar in all material respects.

The State's statistical experts credibly explained how the records revealed that there was a very high degree of reliability demonstrated by the DREs in identifying drivers who had taken impairing drugs before driving who were later determined through toxicological analysis to have such drugs in their system, i.e., "true positives." For non-training cases where toxicology was available, DREs correctly identified true positive cases between 85.3% and 92.3% of the time, depending on the stringency of the match criteria used. The corresponding "sensitivity" of the New Jersey evaluations, which looks at both true positives and false negatives (i.e., those cases where the DRE opined no impairment but toxicology showed a drug or drugs), showed that, out of the total number of instances where the subjects had drugs in their systems, DREs gave correct opinions between 82.5% and 92.6% of the time for non-training cases, and at a higher rate for all cases overall.

Further, the data revealed that of the 2551 drivers (i.e., non-training cases) with a toxicology report, only eighty-two (or 3.2%) were "false positives," namely where the DRE opined the use of an impairing drug, but

none was revealed by the toxicological analysis. As will be explained in this report, this does not necessarily mean that all of those eighty-two false-positive individuals were innocent or falsely charged. In the section of this report dealing with limitations of chemical testing, section VI, it can be seen that a number of circumstances can exist in which the toxicological analysis misses the presence of drugs.

Also telling, there were 305 individuals who were detained for a potential DUID violation and for whom a DRE evaluation was begun, but as to whom the evaluating DRE concluded that impairment caused by drugs was not present, so no toxicological sample was requested. This number, when combined with the 92 false negative non-training cases – cases where the DRE opined no impairment but the toxicology revealed a drug – shows that DREs were not hesitant to opine that a subject was not impaired by drugs when impairment was not clearly shown. They did so in more than 10% of cases.

The State's statistical experts who evaluated the New Jersey DRE data were both completely independent witnesses. They have had no connection with law enforcement or the DRE program. One in particular has extremely impressive credentials in the statistical field. His academic and professional work over the years has included performing a number of research studies, writing and publishing articles, and editing and peer-reviewing the work of

other researchers in his field. He has also taught statistics at the doctoral level. He is presently chair of the Department of Biostatistics, Epidemiology and Informatics at the Perelman School of Medicine at the University of Pennsylvania. Prior to this case, he had never before testified in any court proceeding of any kind.

As with the studies spanning the last several decades, the testimony of the State's statistical experts regarding the New Jersey DRE data provides further support for my finding of reliability in DRE performance. The New Jersey experience in thousands of cases over a two-year period reveals that, utilizing the DRE protocol, New Jersey's DREs have performed very well in identifying drivers who are unable to drive a motor vehicle safely because of the presence in their system of impairing drugs.

Accordingly, I find that the studies and reports regarding DRE performance over the years and the statistical analysis of the New Jersey DRE data support my finding of general acceptance based on the State's expert testimony. They demonstrate that, allowing for the inherent limitations involved in conducting studies of this nature, the overall results are reliable.

I also note that the State continues to argue before me, as it did before the Supreme Court, that a body of judicial opinions from other jurisdictions either satisfies the third method of proving general acceptance or persuasively

establishes that the DRE protocol is not sufficiently scientific to require the application of the Frye test at all. And the OPD has included a section in its post-hearing brief arguing to the contrary. I have therefore included in this report section X discussing both published and unpublished judicial opinions addressing the DECP. However, given the paucity of cases meaningfully applying the Frye standard, the judicial opinions do not add much to the general acceptance analysis.

To summarize, it is based on the expert testimony in medicine and toxicology that I find that the DRE program replicates generally accepted medical practices in identifying the presence of impairing drugs and the likely category of those drugs in an individual exhibiting indicia of impairment, in which alcohol intoxication has been ruled out by an Alcotest examination and there is no evidence that the impairment stems from medical or injury conditions. Further, the DRE matrix, with its seven categories and a listing of specific and general signs and symptoms typically associated with each category, comports with the medical matrices designed for the same purpose that are generally accepted in the medical field. This testimony also establishes that the training DREs receive is at least equivalent to the level of training provided for comparable activities in the medical field and is sufficient to enable reliable application of the DRE protocol.

I therefore find that the DRE protocol is generally accepted in the medical and toxicological fields by implication. Direct proof is elusive because the evidence makes clear that members of the medical profession generally are not familiar with the DRE program. As Dr. Nelson remarked, "I don't think the medical field thinks much about DREs, honestly." [46T106] Nevertheless, the evidence establishes that the DRE protocol comports with standards and practices generally accepted in the medical and toxicological communities for use in toxidrome recognition. The DRE protocol is a version of toxidrome recognition adapted to law enforcement for use in DUID enforcement.

Accordingly, subject to these caveats, DRE evidence satisfies the reliability standard of N.J.R.E. 702 and should be admissible in evidence.

III. WITNESS QUALIFICATIONS AND CREDIBILITY ASSESSMENTS

This section is a summary of the nature and qualifications of the sixteen witnesses who testified in this matter and my credibility assessment as to each witness. For ease of reference, they are grouped by subject matter as follows:

A. Medical – State

1. Karl Citek, O.D., Ph.D., FAAO
2. Frederick W. Fraunfelder, M.D.
3. Lewis Nelson, M.D.

B. Medical – Defense

1. Neal Adams, M.D. (for OPD)
2. Lawrence J. Guzzardi, M.D. (for amicus)

C. Toxicology – State

1. Bridget D. Verdino, MS
2. Amy Miles

D. DRE Program and Training Facts – State

1. Sergeant Michael Gibson
2. Thomas E. Page

E. New Jersey Data Set Analysis – State

1. Brian D. Martin, Ph.D., JD
2. Enrique Fabian Schisterman, Ph.D. M.A.
3. Nicholas Errico, Detective, DCJ

F. New Jersey Data Set Analysis – Defense

1. Ralph B. Taylor, Ph.D.

G. Psychology – State

1. Dary Fiorentino, Ph.D

H. Psychology – Defense

1. Charles J. Brainerd, Ph.D.
2. Mitchell Earleywine, Ph.D.

Karl Citek, O.D., Ph.D., FAAO[8]

Dr. Citek is a doctor of optometry. He obtained a bachelor's degree in physics from Columbia University in 1984. He subsequently obtained advanced degrees from the State University of New York (SUNY), State College of Optometry, as follows: master's degree in vision science, doctor of optometry (O.D.), and Ph.D. in vision science.

Citek is a professor of optometry at Pacific University College of Optometry in Forest Grove, Oregon. He has been a faculty member there since 1994. In addition to his teaching and academic work, Citek also sees patients in a clinical setting. He is an attending doctor in two clinics, one of which is referred to as a general optometry facility, and the other a low-vision clinic.

He has designed and performed a number of studies on the eyes, in particular with reference to the effects of alcohol and drugs. He has written about fifteen peer-reviewed articles in these areas, and he is a peer reviewer for several journals of optometry.

Citek has a long history of affiliation with the DRE program. Since 2012, he has been a member of the Technical Advisory Panel (TAP) of the International Association of Chiefs of Police (IACP), which administers the

[8] Citek's voir dire examination is at 32T9-32T53. His curriculum vitae was not entered in evidence.

DRE program. He has overseen and observed hundreds of DRE candidates in training making their eye observations and recording them as part of the certification process. He teaches several times each year at DRE schools regarding all of the eye tests. He has qualified as an expert witness in multiple states on multiple occasions and testified in favor of the State in prosecutions for driving under the influence of alcohol or drugs. He has also testified on behalf of the government in several previous hearings in other states regarding the reliability and admissibility of DRE opinions.

Citek testified for seven full days. He was qualified as an expert in (1) optometry, (2) research design and scientific studies, and (3) the DRE program. Throughout his testimony, including under vigorous cross-examination, he described in great detail the structure of the eyes and the mechanisms that cause certain eye movements and conditions. He provided clear explanations as to why the drugs in certain categories cause predictable effects in most individuals. He gave ground when called for, and did not attempt to make every answer somehow favorable to the State. He was very forthright and candid in his testimony. He testified in a highly professional manner. Notwithstanding his built-in bias in favor of the DRE program because of his long affiliation with it, I found him to be a very credible witness

and a very knowledgeable one regarding his field of expertise. I attribute very significant weight to Citek's testimony.

Frederick W. Fraunfelder, M.D.[9]

Dr. Fraunfelder is a board-certified ophthalmologist. He is an eminently well qualified expert with particularized expertise in ocular toxicology. Because the effects on the eyes of a person who ingests toxic substances is a highly disputed aspect of the DRE protocol, Fraunfelder's testimony is of critical importance in assessing the scientific reliability of those aspects of the program. Fraunfelder's educational background, academic pursuits and clinical experience over the last several decades render him an exceptionally high-level expert in this important aspect of the case. Throughout his testimony, which lasted only a half of one day,[10] Fraunfelder displayed very in-depth knowledge of the effects of various categories of impairing drugs on the eyes, the method of testing and observing them, and the effectiveness of training laypersons to perform those tests and reliably make those observations.

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[9] Fraunfelder's voir dire examination is at 40T6-40T25. His curriculum vitae was not entered in evidence.

[10] This was direct examination only. The defense chose not to cross-examine.

Fraunfelder was qualified as an expert in general medicine and ophthalmology. He presently serves as chair of ophthalmology and dean of faculty affairs at the University of Missouri School of Medicine. The hospital at the university is a level IV trauma center. People from all around the state are helicoptered in for serous eye maladies and for the performance of complex eye surgery. Fraunfelder regularly performs such surgery, which most ophthalmologists are not qualified to do. Among these are corneal transplants and complex cataract surgery, for which he is a tertiary referral provider. Patients fly in from all over the country for ocular oncology surgery performed by Fraundelder.

Fraunfelder also devotes considerable time to clinical rounds, teaching and training students, interns, residents and fellows in the course of that activity. As dean of faculty affairs of the medical school, he devotes a portion his time to administrative matters as well.

His medical education, consisting of several components, lasted more than ten years. After medical school and a one-year internship, he completed a one-year residency in internal medicine, followed by a three-year residency in ophthalmology, during which he rotated through the eleven subspecialties in ophthalmology, including neuro-ophthalmology. He then completed a two-year fellowship, which included advanced study in ocular oncology, cornea

transplants, and external eye disease. As he put it in his testimony, after completing all of his training, he has now been a "full-grown" ophthalmologist for about twenty years.

Fraunfelder is affiliated with many professional organizations. He is a former president and current member of the International Society of Ocular Toxicology. This is a national organization which focuses on toxicity of drugs as related to the eye. That organization publishes the Journal of Ocular Pharmacology and Therapeutics. Fraunfelder is also a consultant for the World Health Organization (WHO). He is the only ophthalmologist who provides advice to that worldwide organization regarding ophthalmic issues. He deals with a branch of the WHO called the Uppsala Monitoring Centre in Uppsala, Sweden. His role is to consult on eye side effects from drugs.

He is the director of the National Registry of Drug-Induced Ocular Side Effects. He is a member of the editorial board for Drugs of Today, an authoritative journal on drugs and their effects on the eye, whether therapeutic or adverse. Fraunfelder has been an editorial board member for the Physicians' Desk Reference (PDR), which physicians universally rely upon as an authoritative reference source when looking up drugs, their uses and side effects.

He is a member of the editorial board of the Journal of Ophthalmic Research and Vision Care, which is a peer reviewed journal. He is a reviewer for that publication and for others, including the Journal of Neuro-Ophthalmology and the American Journal of Ophthalmology.

Fraunfelder has authored five books and more than one hundred peer reviewed articles in the ophthalmology field, dealing mostly with ocular toxicity of drugs. Among the books he has authored, one, Drug-Induced Ocular Side Effects, he co-authored it with his father, also an ophthalmologist. That book is now in its eighth edition. Fraunfelder has been involved with it for the last three or four editions, which are published every four years. The book consists of a compendium of side effects of drugs that affect the eye. Information is derived from peer reviewed literature, the authors' national registry website, and information obtained from the WHO, all of which goes into their data base. They then go through a classification system of drug side effects, and categorize each of the expected side effects for each drug as either certain, probable, possible, unlikely, or unclassifiable. In his testimony, he explained the methodology and criteria used in making these classifications. The book is well-recognized and widely used as a reference book by physicians around the country. He has also authored more than thirty book

chapters on ophthalmology for other publications, mostly dealing with ocular toxicity of drugs.

In addition to his writing and his ongoing work as a practicing ophthalmologist, Fraunfelder has also engaged in research regarding the eyes. He has been involved in over twenty clinical trials, mostly dealing with side effects of drugs as they relate to the eye.

Fraunfelder has no affiliation with the DRE program or law enforcement. He comes to this case as a completely independent witness. He exhibited no signs of bias in favor of the State's position. He learned enough about the DRE program in preparation for this case to be able to answer questions sensibly and with knowledge of how the program works.

Fraunfelder provided strong and well-founded medical opinions, backed up by authoritative sources. His qualifications are excellent. He testified with certainty and clarity, illustrating a very thorough knowledge of his subject matter. He was candid in his testimony. For example, he readily acknowledged that neither any one or more of the eye signs or symptoms constitute conclusive proof of any particular drug use, but they are all worthy of consideration as part of an overall pattern and collection of information making up a mosaic that can form the basis for opining that an individual has exhibited a particular toxidrome, the determination of which has been made by

considering multiple relevant factors and information gathered in the overall DRE investigation as the likely cause of the subject's observed impaired behavior. Fraunfelder was a very impressive witness, and I attribute very substantial weight to his testimony.

Lewis Nelson, M.D.[11]

Dr. Nelson is board certified in emergency medicine, medical toxicology and addiction medicine. He was qualified as an expert in (1) medicine, (2) emergency medicine, (3) clinical medicine, (4) clinical pharmacology, and (5) medical toxicology. By virtue of his education and clinical as well as academic experience, he is an expert of the highest caliber. His expertise is in the fields that are among the most important in this proceeding.

He has never had any affiliation with the DRE program. In order to prepare for his testimony, he reviewed DRE training materials in order to familiarize himself with the program. He is a completely independent witness, possessing no bias favoring the State or the DRE program. In his two days of testimony, Nelson exhibited the highest level of professionalism, answering all questions forthrightly and persuasively. He exhibited a high level of

[11] Nelson's curriculum vitae is S-237. His voir dire examination is at 42T13-42T38.

knowledge and confidence in the answers he provided, backing them up with recognized authoritative medical texts and other authoritative sources.

Nelson obtained a B.S. degree with honors from Emory University in 1985. In 1989, he received his M.D., cum laude, from the State University of New York Health Science Center at Brooklyn (Downstate). He interned in general surgery from 1989 to 1990 at Albert Einstein College of Medicine in New York. He then completed a three-year residency from 1990 to 1993 in emergency medicine at Mount Sinai School of Medicine in New York. He was the chief resident in the final year of that program. Finally, he completed a two-year fellowship in 1995 in medical toxicology at the New York City Poison Center, which is a division of New York University School of Medicine.

After completing his education and extensive post-doctoral training programs, Nelson became an assistant professor in emergency medicine at Yale University School of Medicine. His role was principally clinical, teaching residents and others in a clinical setting. After one year at Yale, Nelson returned to NYU Medical School, where he remained for twenty years, from 1996 to 2016, as a professor in the department of emergency medicine. He taught courses in emergency medicine, medical toxicology and

pharmacology. He also served as director of the medical-toxicology fellowship program.

Beginning in 2016 and continuing to the present time, he has been a professor at the Department of Emergency Medicine at Rutgers Medical School. In actuality, Nelson holds more than one position at Rutgers. He also serves as chair of the Rutgers Medical School Department of Emergency Medicine and, simultaneously, he serves as chief of the Division of Medical Toxicology. His involvement and oversight therefore span teaching, clinical work, and the oversight and operations of the faculty and others who specialize in medical toxicology.

Medical Toxicology is a discipline that comprises a group of specialties that address exposures to toxic or potentially toxic substances. These substances, known as toxins or toxicants, have a detrimental effect on persons who ingest or are exposed to them. This is related to but the opposite of the field of clinical pharmacology, which requires specialized expertise in the use of substances for therapeutic purposes. In many circumstances, the same substance could fall into either category depending upon its usage. Nelson referred to opioids as an example. That is a substance that does have a pharmacological purpose, namely to manage pain, in which case it is

administered under the care of a physician. However, in the context of street use, individuals often take opioids for abusive purposes to get high.

The New Jersey Poison Center, both administratively and medically, is under the jurisdiction of the Department of Emergency Medicine. Therefore, the faculty and leadership of the center report to Nelson, who has ultimate medical oversight for it. Nelson is instrumental in providing guidance, leadership, advice, and, of course, his remarkable expertise in addressing, in real-time, toxic emergencies that come through the center.

Nelson's professional affiliations are too numerous to list here. They are itemized with particularity in his very lengthy CV. [S-237] Just to highlight a few items, he is a member of the American College of Medical Toxicology, the leading professional organization for medical toxicologists. He has served as a member of the board of directors and as president of that organization. He is chair of its publications committee. He holds fellowships in the American Academy of Emergency Medicine, the American Society of Addiction Medicine, the Society of Toxicology, and other such organizations.

Nelson has written extensively within his sphere of expertise. He has authored more than 250 peer reviewed articles in medical journals dealing with toxicology. He is the lead editor of Goldfrank's Toxicologic Emergencies (Goldfrank's), which is probably contained in every medical library in the

country, every emergency department, and every poison center. It is also widely used by emergency medicine physicians, internal medicine physicians and pediatricians. He has been the primary author of a number of chapters in Goldfrank's. He has also authored other chapters in other authoritative medical texts and reference books in the field of medical toxicology, including Critical Care Toxicology: Diagnosis and Management of the Critically Poisoned Patient, Emergency Medicine: Clinical Essentials, and Rosen's Emergency Medicine: Concepts and Clinical Practice.

Nelson has been a peer reviewer for a number of medical journals. He is currently an editor of the Annals of Emergency Medicine and the Journal of Medical Toxicology.

The quality of Nelson's testimony matched up with his impeccable qualifications. The knowledge he has gained over the last several decades in the specialized field at the heart of the inquiry in this proceeding came through very clearly during his entire testimony. His opinions were well supported by authoritative sources. His explanations were clear and thorough. He answered questions with a spontaneity and assuredness that reflected the extraordinary depth of his knowledge of the subject. His credibility, as a completely independent witness, provides added strength to his opinions. I attribute very substantial weight to Nelson's testimony.

Neal Adams, M.D.[12]

Dr. Adams is a board-certified ophthalmologist with a clinical practice in the Maryland suburbs of Washington, DC. He obtained a bachelor's degree cum laude in chemistry from Yale University in 1994. He received his M.D. from Johns Hopkins University in 1998. From 1999 to 2002 he did a residency in ophthalmology at the Wilmer Eye Institution in Baltimore, which is the ophthalmology department and eye institute at Johns Hopkins. He then completed a fellowship in 2003 at the same institution in vitreoretinal surgery, followed by an additional fellowship completed in 2005 at the National Institutes of Health, National Eye Institute, in Bethesda Maryland.

From 2005 to 2008, he was an assistant professor of ophthalmology at the Wilmer Eye Institute. From 2008 to 2010, he was an associate professor of ophthalmology at Texas Tech University. From 2018 to the present time, he has been an associate professor of ophthalmology at Georgetown University. He began his clinical practice in 2010. That is his primary professional pursuit, although he continues to do some teaching at Georgetown.

[12] Adams' curriculum vitae is D-591. His voir dire examination is at 61T14-61T34.

Adams was qualified as an expert in (1) general medicine, (2) ophthalmology, (3) clinical trials, (4) medical research, and (5) research design.

Adams has had no training with the SFSTs, Advanced Roadside Impaired Driving Enforcement (ARIDE), or DRE school, and he has never conducted or observed a DRE evaluation. He has written two books, one for physicians and the other for the general public called Healthy Vision.

Adams testified that he has written about a half dozen peer reviewed articles, none of which involve nystagmus or central eye-movement disorders. He has no particular expertise in neuro-ophthalmology, and he acknowledged that neuro-ophthalmologists are subspecialists in ophthalmology who deal with that particular subject. He acknowledged that neuro-ophthalmologists generally possess more expertise regarding nystagmus and central eye-movement disorders than general ophthalmologists such as himself. He has not written any articles on neuro-ophthalmology or peer reviewed for any journals or served on any boards of neuro-ophthalmology journals. This contrasts with the State's ophthalmologist, Fraunfelder, who has been a peer reviewer for more than ten years for the Journal of Neuro-ophthalmology.

In his CV and in his direct voir dire testimony, Adams held himself as the editor-in-chief of a journal known as Eye Reports. On cross-examination,

he acknowledged that this is the only journal with which he has any affiliation as an editor, and he is affiliated with no journals as a reviewer. He further acknowledged that the managing editor of Eye Reports is his daughter. He testified that he has been involved in numerous studies, describing his role as helping with the design, implementation and data analysis. However, he could not say whether any of them were ever published and whether they were published in peer reviewed journals because he never followed up with the principal researchers.

The main thrust of Adams' objections to the DRE program are two-fold. First, he contends there are no authoritative studies that demonstrate reliability and, on the contrary, there are studies demonstrating unreliability. Second, he contends that laypeople simply cannot be trained to adequately and reliably make the observations necessary to deal with the eye examination aspects of the protocol. In his view, only doctors and other medical personnel can perform this function reliably. Thus, he agrees that ophthalmic technicians can make the observations reliably. Yet, he insists that DREs with similar training are incapable of doing so. In any event, he covers this point by saying that when it comes down to rendering an opinion in Step 11 as to whether the subject is impaired and if that impairment is caused by a particular category or categories of drugs, only a doctor has the depth of knowledge and

understanding to render such an opinion. This assertion, of course, ignores all of the other steps in the protocol that are not related to the eyes and that are considered in conjunction with the eye examination results in making a determination of whether the constellation of signs and symptoms fit into one of the defined toxidromes which, based upon other persuasive evidence in this case, are generally accepted in the medical community. .

In observing Adams' manner of testifying, I detected that in answering direct questions he often avoided giving a direct answer by qualifying his answer in such a way as to make it "defense-favorable" without directly answering what was asked. He has testified for the defense in nine cases involving DRE issues.

My overall impression of Adams is that he is a very well educated and well-trained ophthalmologist. His credentials are excellent. I fully expect that he performs very well within the scope of his chosen clinical field. As he testified, he has rarely seen drug-induced nystagmus in his particular area of clinical practice. Based upon his demonstrated defense bias on the subject involved in this proceeding and his manner of his testifying as I have described, his credibility is somewhat compromised. For this reason and further because Adams' expertise regarding ocular side effects of drugs and eye-movement disorders is at a lower level than that possessed by the State's

medical experts, I attribute only moderate weight to Adams' testimony, considerably less than I attribute to the State's medical experts.

Lawrence J. Guzzardi, M.D.[13]

Dr. Guzzardi is a physician, but he has not been engaged in the practice of medicine for more than two decades. During his years in practice, he served primarily as an emergency room physician. He has not seen a patient in an emergency department since 1998, and he has not seen any patients since then except on a very minimal basis in or before 2009, in connection with an ambulance service with which he was affiliated at that time. Guzzardi testified in this case for the defense side, having been called by the defense-affiliated amicus National College for DUI Defense.

Guzzardi received a B.S. in chemistry cum laude from Boston College in 1967. He received his M.D. from Jefferson Medical School in 1971. He served a one-year internship, and then completed a two-year residency in emergency medicine at the University of Kentucky Medical Center in 1978. Although Guzzardi took some courses toward a master's degree in toxicology, he did not complete the program and never obtained such a degree.

[13] Guzzardi's curriculum vitae is A-37. His voir dire examination is at 59T5-59T69.

Between 1978 and 1998, Guzzardi worked in emergency rooms in a number of different hospitals in Pennsylvania, Maryland and New York. The last time he worked in a hospital, and the last time he evaluated a patient in a hospital setting, was 1998.

Guzzardi's board certification status is not straightforward. He was previously board certified in emergency medicine. That certification lapsed in 2009, a fact which Guzzardi readily acknowledged. He contends that he currently holds a board certification in medical toxicology. That certification was issued in 1980 by the American Board of Medical Toxicology (ABMT). However, ABMT no longer exists. There has been a restructuring of the certifying entities in this field. The American Board of Medical Specialties (ABMS) is currently the prevailing certifying agency with oversight for board certifications. That entity does not recognize a certification previously granted by ABMT. Under the current criteria, certification in medical toxicology is deemed a sub-specialty of emergency medicine, and it requires completion of a fellowship in medical toxicology and taking and passing a written examination to obtain the certification. It also requires continuing education to maintain the certification. Thus, although Guzzardi claims that his ABMT certification from 1980 was a lifetime certification and was grandfathered in when the

restructuring occurred, it appears that he does not meet the criteria for and does not hold a current board certification in medical toxicology.

Guzzardi received an MBA degree from the University of Pennsylvania's Wharton School in 1991. Since leaving the practice of medicine in 1998, he testified that his sources of income are twofold. First, his primary source of income is in some form of real estate business, which he did not describe further. Second, he provides expert opinions and testimony in cases such as this. He maintains a website, advertising for potential clients to serve as an expert in these cases. He has testified in hundreds of cases in multiple states (mostly Pennsylvania) in individual DRE cases and in DRE hearings such as this one. He has testified only for the defense in these cases. He said he also takes civil cases, in which he typically testifies on behalf of an injured plaintiff that arose out of DUI or DUID circumstances.

Guzzardi claims he has written a number of peer-reviewed articles. The only one that was put in evidence is a 2017 article published in the Journal of the Pennsylvania Criminal Defense Lawyers Association. [A-19] Guzzardi claimed the article was "very peer reviewed," but when questioned further, it turns out that the "peer reviewers" were criminal defense attorneys.

It is clear that this witness has an extreme bias on behalf of the defense side, from which he has been earning a significant part of his livelihood for the last two decades or more. His bias came through very clearly in his testimony.

Guzzardi was qualified as an expert in (1) medicine, (2) emergency medicine, (3) medical toxicology, (4) the drug influence examination (DIE), and (5) standardized field sobriety tests (SFSTs). His qualifications in these areas had some shortcomings. There has been a lengthy lapse of time since he last practiced medicine. He has never witnessed a DRE examination or attended any portion of the DRE training program. I took this into account when I qualified him as an expert in those fields, noting for the record that these shortcomings did not render him a non-expert in those fields, but they could affect the weight to be given to his testimony.

Guzzardi's overriding criticism of the DRE protocol basically came down to three points. First, many of the steps in the DRE process have not been scientifically tested to establish their reliability. Second, many of the signs looked for and observed are either unreliable or could have resulted from other causes. Third, DREs, with their brief training, are not capable of being qualified to make reliable observations and evaluations to reach a conclusion or opinion with any degree of reliability.

More generally, he further contended that the entire DRE protocol is designed to emphasize sensitivity and minimize specificity. In other words, the program is set up to look for and emphasize clues of drug use rather than in a neutral manner or to lean the other way to protect the rights of the innocent. As part of this criticism, he contended that the way the protocol is set up, particularly with Steps 2, 3 and 10, DREs develop interview bias or confirmation bias because they already have obtained information that leads them to a pre-determined opinion that the subject is impaired by drugs, and this skews all of the other observations and findings in that direction.

However, on cross-examination, he acknowledged many factors that contradict these reasons. For example, he stated that history is eighty percent of medicine. When led down the path of what emergency physicians and their medical staff do in evaluating a patient, he conceded that it is very much the same as what the DREs do. However, he adhered to the distinctions made above, namely that DREs do not possess the required qualifications to make a reliable assessment and they are swayed by confirmation bias, a circumstance that doctors are trained to avoid. He acknowledged that the toxidromes as set up in the DRE matrix are reasonably well structured and are consistent with what is generally accepted in medicine. But, again, he insisted that DREs are not capable of reliably making the necessary observations and assessments.

Overall, I find that Guzzardi's level of expertise in the matters to which he testified is not at a particularly high level. His credibility is compromised in two ways. First, on direct examination he gave all of the answers that favored the defense. When pressed on cross-examination, he tended to argue and split hairs on matters that were more semantic than substantive, exhibiting an effort to avoid giving a direct answer. When pressed further, he substantially conceded many of the points being urged by the State. Some of his testimony, both on direct and cross-examination, was self-contradictory. Second, his previously mentioned extreme defense bias affected his testimony. I give very limited weight to Guzzardi's testimony.

Bridget D. Verdino, MS[14]

Bridget Verdino is currently the supervisor of the toxicology unit at the New Jersey State Police Office of Forensics Sciences (OFS). She holds the title Forensic Scientist III. In this supervisory position, she reviews and guides the scientists under her and manages the toxicology laboratories in the several sites around the State.

Verdino holds an undergraduate degree in chemistry, with a concentration in organic chemistry and analytical chemistry, from Saint Mary's

[14] Verdino's curriculum vitae is S-100. Her voir dire examination is at 28T144-28T166.

University in Halifax, Nova Scotia, Canada. She later obtained a master's degree in forensic toxicology from the University of Florida in 2016. Her course work for this advanced degree included pharmacology as well as forensic toxicology and advanced principles of toxicology, drug metabolism, pharmacokinetics and drug elimination.

Verdino began her employment with the New Jersey State Police as a forensic scientist in 2001. Prior to that time, she had worked in New York as a Criminologist I for the NYPD, and she also worked for a short time in the Hudson County Prosecutor's office as an assistant chemist.

She has taught chemistry, forensic science, and other courses dealing with various aspects of chemistry and forensic science, at the John Jay College of Criminal Justice. She has taken the Robert Borkenstien courses on alcohol and drugs, each consisting of five days. She is a member of the Society of Forensic Toxicologists (SOFT). She is also a member of the New Jersey Association of Forensic Scientists, and recently served as president of that organization.

Verdino has audited the DRE training program. She is not eligible to become a DRE, but this training greatly familiarized her with the nature of the training, the scope of the program, and all of its particulars. She is the direct

liaison with New Jersey's DRE program and works closely with the State Coordinator, Sergeant Michael Gibson.

In her work in OFS, she has personally analyzed or supervised more than 10,000 cases in New Jersey, hundreds of which have been DRE cases.

Verdino proved to be very knowledgeable regarding the effects of drugs on the body, the effects that would be exhibited by a person taking them, and testing procedures to determine whether impairing drugs were present in a sample provided by a subject. She was also well versed on the administrative aspects of the laboratory, including all of the equipment required for the work done there, the procedures contained in the various manuals, some of which she has modified and updated. She also explained the cost-benefit analysis she conducts from time to time when OFS is considering whether to purchase a new piece of equipment.

In addition to coordinating with the DRE chain of command in New Jersey, she also coordinates on a regular basis with other toxicologists and forensic scientists from around the area and throughout the country in her continuing effort to assess appropriate cut-off levels for various drugs, the existence and molecular makeup of new drugs that come into use with ever-increasing frequency, including so-called designer or synthetic drugs.

Verdino explained that the OFS laboratories are accredited at the ISO 17025 rating, which is the gold standard applicable to forensic testing laboratories. This is an important certification and assures that the practices and procedures utilized in the lab are those that are generally accepted in the toxicology community.

Verdino's testimony was very forthright. She demonstrated a very high level of expertise and knowledge of toxicology, forensic science, and the operation of the lab and the procedures required to determine, as applicable in this case, the presence of impairing drugs in the samples provided to the lab. She also explained some of the limitations that are inherent in the process. Some deal with available resources. Others are a result of setting cut-off levels and the constant difficulty encountered by testing laboratories to keep up with the ever-changing new drugs that are constantly appearing and changing, making their detection difficult or impossible.

Verdino's testimony was very authoritative and thorough. She answered all questions, regardless of who posed them, clearly and without equivocation or any signs of withholding or distorting information. She was a very credible witness with a high level of expertise and experience. Her testimony is entitled to very significant weight.

Amy Miles[15]

Amy Miles is the director of the Department of Forensic Toxicology at the Wisconsin State Laboratory of Hygiene, which is within the University of Wisconsin-Madison, in the School of Medicine and Public Health. She obtained a B.S. degree in biology from Edgewood College, Madison, Wisconsin, in 1997. In 2015, she completed a program at the Center for Forensic Science Research and Education in Willow Grove, Pennsylvania, for which she was awarded a certificate in forensic toxicology.

In addition to running the forensic toxicology laboratory for the State of Wisconsin, Miles has developed over the course of her career a national profile in forensic toxicology. Much of her national activity has been in reference to the toxicology testing aspect of the DRE program. She served on IACP's TAP from 2011 to 2019, occupying the toxicologist seat on that panel. She chaired a subcommittee and presented peer reviewed scientific literature to the entire TAP on various subjects related to the DRE program.

In 2002, she audited the DRE training program. She is not eligible to become a DRE, but by going through the training program, she gained

[15] Miles' curriculum vitae is exhibit S-370. Her voir dire examination is at 50T20-50T70.

substantial knowledge of what the program consists of, the materials used, the training given to prospective DREs, and the like.

Her national work keeps her in touch with her counterparts from all states around the country. She has been a member of SOFT since 2004, and she has served as its president. SOFT consists of about fifteen hundred members, mostly forensic toxicologists from around the country who collaborate on emerging issues and practices. For example, and of significant note with respect to the DRE program, SOFT has a designer drug committee that conducts literature searches regarding these drugs, which are more accurately called "novel psychoactive substances" (NPS). Indeed, SOFT is in the process of changing the name of the committee to the NPS committee, which is a more accurate and scientific name. Information developed through this committee is disseminated to state laboratories and toxicologists throughout the country.

Miles is a faculty member at the Robert F. Borkenstein course, teaching the drug portion of that program since about 2010. Since 2011, she has been making presentations before the Supreme Court of Illinois Judicial Conference Committee on Education, provides mandatory judicial education for circuit court judges. She also teaches programs in public health at Wisconsin

University and often makes presentations regarding trending drugs and human performance and the effects of those drugs on those who use them.

In her ongoing national role, Miles regularly speaks to fellow toxicologists from around the country, as well as addiction counselors, probation and parole officers, and the like. Through these many and widespread contacts, she keeps very up to date with ongoing changes in drug culture, the emergence of new drugs and where they are prevalent, and in continuing efforts to equip labs, including her own, to be able to test for them.

Miles has written a number of peer reviewed articles dealing with drugs. She is a peer reviewer for a number of journals, including the Journal of Analytical Toxicology, the Journal of Forensic Sciences, Forensic Science International, and Traffic Injury Prevention.

Miles was qualified in this proceeding as an expert in toxicology, forensic toxicology, and the DRE program.

She explained that the designer drugs are constantly changing and difficult to test for. Cannabinoids are probably the most prevalent in recent times. She tries to keep up with these drugs by her ongoing contacts with DREs, toxicologists, and notices published by the DEA. She explained in depth how any slight variation from one synthetic cannabis analog to another can make the successor version undetectable. She gave a similar explanation

regarding fentanyl, which is also very prevalent, second to the synthetic cannabinoids, and which is also constantly being reformulated into different analogs, which are hard to keep track of.

Miles was an extremely well qualified expert witness. She demonstrated a very high level of expertise in her field. Along with her long-time experience and her very diversified knowledge of practices and occurrences from around the country, her testimony about the DRE program provided a national perspective, which informed the achievements and advances in the program over the years as well as the limitations in toxicological testing, which can be minimized to a reasonable extent but cannot be eliminated. Miles was forthright and clear in her answers. On cross-examination, some questions were put to her that induced answers that were not favorable to the State, and she gave them without evasion or falsification. Miles was very credible in giving her testimony. Coupling that credibility with her outstanding background and long years of experience in her field, she provided much valuable information. Her testimony is entitled to very significant weight.

Sergeant Michael Gibson[16]

Sergeant Gibson is the New Jersey State DRE coordinator. He is a very experienced State Trooper. After serving as a municipal police officer for several years, he completed his New Jersey State Police academy training in 2004 and became a member of the State Police. He underwent DRE training and became certified as a DRE in 2008. He subsequently became a DRE instructor and trained more than 600 police officers in New Jersey to be DREs. Since 2017, Gibson has served as the New Jersey State Coordinator of the DRE program.

Gibson described in detail the training that DRE candidates go through, the testing and certification process required to become a DRE, and the recertification process. He also discussed many other aspects of the program, some of which pre-existed his leadership role and others that he has added to continually improve the administration of the program. He interacts regularly with NHTSA and IACP personnel.

Gibson was a fact witness in this hearing. His purpose was to describe the New Jersey DRE program generally, but more importantly, how it is administered and some of the steps he has been taking to continually improve it. Over his years in the DRE program, and as an instructor and now the State

[16] Gibson's curriculum vitae is in evidence as S-25.

Coordinator, he has taught the DRE curriculum and is thoroughly familiar with the DRE schools, materials, and manuals.

He testified that, as of the time of the hearing, there were about 450 DREs in New Jersey, which is second in the country only to California. The need for such a number reflects that New Jersey is the most densely populated state in the country and contains more miles of highway per square mile than any other state in the country.

Sergeant Gibson presented himself as very well informed on the details of the DRE program generally and the manner in which the program is conducted in New Jersey. I found him to be direct and honest. He listened to questions carefully and gave clear and succinct answers. I did not perceive any intent to deceive or distort facts. He struck me as a "by-the-book" State Trooper and an efficient and effective administrator of the program. He was an informative and credible witness and I give significant weight to his testimony.

Thomas E. Page[17]

Thomas Page has had a long career, dating back to the 1970s, dealing with individuals impaired by alcohol and drugs.

[17] Page's curriculum vitae is in evidence as S-15. His voir dire examination is at 20T38-20T67.

A Detroit, Michigan resident, Page graduated from of the University of Detroit with a bachelor's degree in industrial psychology, which he received magna cum laude in 1971. In 1976, he received an M.A. degree in urban studies from the same university. That program included courses in criminal justice, urban sociology, and urban policy analysis. From 1972 to 1977 Page was employed by the Wayne County, Michigan, Health Department in Detroit as a patient affairs supervisor. Among other functions, he supervised public health workers, including nurses and social workers. His work involved identifying people who were dependent on drugs and referring them to drug and alcohol treatment facilities. He worked with drug rehabilitation specialists and served on a medical team that evaluated the efficacy of drug and alcohol treatment programs. From 1977 to 1980, Page was a police officer in the Detroit Police Department.

Page relocated to Los Angeles in 1981 and became a police officer in the Los Angeles Police Department (LAPD). He was assigned as a field supervisor regarding drug issues. Eventually, Page became the training coordinator of the LAPD DRE unit, and finally the officer in charge of the program. In that capacity, he constantly interacted with people impaired by various drugs, as well as supervising other DREs who were evaluating

subjects. Page estimated that he personally performed or supervised more than 5,000 DRE evaluations.

The DRE program originated in the LAPD. Its early development began in the 1970s. Page joined in that work when he began his employment at the LAPD, and he became one of the founding developers of what was to officially become the NHTSA DRE program in the 1980s.

Page helped to write the curriculum, including portions of the initial curriculum for the program. He went on to teach at DRE schools and was instrumental, along with others, in developing the program and expanding it beyond Los Angeles and beyond California.

Page was the first general chairperson of the DRE section of IACP. He is now a "life member." Throughout his career, he has conducted many educational and training programs, not only for police officers but for lawyers, judges, doctors, forensic scientists, and other groups. His teaching involves recognition of drug use and the signs and symptoms typically exhibited by users of particular drugs or drug categories. He has assisted authorities in many states as well as in foreign countries in establishing DRE programs.

Page has written extensively in published articles and books regarding drug use. One of his books, entitled Medical-Legal Aspects of Drugs was co-authored by Dr. Marcelline Burns, a noted drug researcher. He co-authored

another book with Burns entitled Drug Information Handbook for the Criminal Justice Professional. These books describe signs and symptoms of impairment for hundreds of drugs and are geared toward recognition of those signs and symptoms by non-medical personnel.

Page has testified on numerous occasions regarding drug recognition issues. He has taught extensively at various institutions throughout the United States and in foreign countries. Since retiring from the LAPD in 1999, Page has continued to teach and lecture on drug impairment and recognition matters. He is currently self-employed as a consultant to law enforcement entities, primarily in matters related to alcohol and drug impairment.

Page was the first witness the State called in the hearing. He testified for six and one-half days. Throughout his testimony, he displayed a very extensive knowledge of impairing drugs, and described how various drugs have come and gone from time to time in popular usage, some regionally and some nationally, as well as the more recent proliferation of synthetic or designer drugs. Page's institutional knowledge of the DRE program is probably second to no one.

His function as a witness was to describe how the program had been initiated in the LAPD in the 1970s, how it continued to develop and become more structured and standardized throughout the ensuing decades, DRE

training, certification and recertification requirements, development of the SFSTs, and so forth. He has served on the TAP, which includes professionals in medicine, toxicology, psychology, and other scientific disciplines, as well as police officers and others.

Much of what is described in the section IV of this report entitled Background to the DEC Program and explaining the perceived need for specialized drug recognition training, the inception and development of the DRE program, and the particulars of that program leading up to the current time, were provided by Page in his comprehensive testimony. He was an excellent witness. With his extensive historical knowledge of the program, hands on experience, collaboration with many others in the program around the country, and experience, he provided a valuable service in this proceeding in describing what the DRE program is, the way it has developed, and how it works.

Page was qualified to provide expert testimony in the following areas: (1) the International Drug Evaluation and Classification (DEC) Program, (2) the DRE Program and all of its steps and the component parts of those steps, (3) administering and interpreting the HGN and VGN tests, and (4) the signs, symptoms and behaviors of drug use and impairment.

Page was very candid in his testimony and very professional in his demeanor. Throughout lengthy and vigorous cross examination, he never became argumentative and continued, as he had on direct examination, to answer all questions forthrightly and calmly. He did not engage in efforts to "explain away" points that did not support the State's positions in this case. I detected no evasiveness in his answers throughout his extensive testimony. Notwithstanding the inherent bias he is presumed to have because of his close ties with the DRE program throughout his career, his testimony provided what I deem to be an accurate and fact-based account of the subject matter, which stood up to very probing cross-examination. He was highly credible, and I attribute substantial weight to his testimony.

Brian D. Martin, Ph.D., JD[18]

Dr. Martin was called by the State as an expert in statistics. He was tasked with analyzing the State's spreadsheet of the New Jersey DRE data from 2017 and 2018, with the goal of determining the percentage of cases in which a DRE opinion correlated with a toxicological sample from each subject.

Martin has a very diverse education and experience. He obtained a B.S. degree in physics and electrical engineering from the University of Maryland

[18] Martin's curriculum vitae is S-286. His voir dire examination is at 43T5-21.

in 1989. In 1991, he earned an M.S. in electrical and computing engineering from Carnegie Mellon University. Therefore, his educational background qualifies him as a scientist in various fields. Martin also is an attorney, having earned a J.D. from Loyola Law School at Loyola Marymount University in California in 1999. He has engaged in the practice of law, in various areas, including patent law and intellectual property law.

Finally, Martin holds degrees in psychology, having obtained an M.S. degree in organizational phycology from Alliant International University in 2016, followed by a Ph.D. in organizational psychology from the same university in 2018.

In his work in the field of psychology, Martin has not engaged in any clinical practice. Organizational psychology is a non-clinical pursuit. His work has been in designing studies, reviewing and analyzing data either collected by him or others, and writing reports. In his master's and Ph.D. programs, he took extensive courses dealing with statistics and data analysis. He has also taught graduate level students in these fields. Martin was qualified in this case as an expert in data and statistical analysis.

Throughout his testimony, Martin exhibited a good understanding of the statistical principles that all three of the statistical experts in this case agree guide the analysis of the New Jersey DRE data.

One of the difficulties encountered in this data set is that about 27% of the non-training cases, i.e., actual drivers pulled over in real cases, did not have toxicology. This was mostly because of drivers who exercised their right to refuse to consent to provide a urine specimen. There were also a number of drivers who were not requested to give a urine sample because during the course of the evaluation, the DRE reached the conclusion that that subject was not impaired and would not be charged with DUID and therefore no sample was needed.

By comparison to the State's other statistics expert, Schisterman, Martin's education and experience in statistics is limited. This circumstance, however, does not detract from the expertise that Martin does possess and did exhibit in his testimony. Martin presented himself as very competent in his analysis of the New Jersey DRE data. The method he chose to account for the missing data was a sensible one for the reasons he gave and in the circumstances of this case. Indeed, Schisterman testified that in studies such as these he sees about 80% of the researchers using that method.

Martin testified forthrightly and deliberately, providing answers to counsel on both sides that were direct and straightforward. He did not try to evade any questions. He candidly acknowledged what he knew and what he

did not know. He demonstrated no efforts to embellish, conceal or deceive. He was a very credible witness. His testimony is entitled to substantial weight.

Enrique Fabian Schisterman, Ph.D. M.A.[19]

Dr. Schisterman testified for the State as an expert in statistics. His testimony regarded his statistical analysis of the data sets compiled by both the State and the OPD of the New Jersey DRE cases in 2017 and 2018.
His qualifications are exceptional, as was his testimony. His educational background, experience, academic and professional work over the years in conducting research studies, writing and publishing reports, editing and peer-reviewing the work of other researchers in his field, and his professional affiliations and activities within them, set him apart as an expert of the highest order in his field. He was qualified in this case as an expert in (1) statistics, (2) biostatistics, (3) epidemiology, and (4) the statistics of prognostic and diagnostic factors.

Schisterman received a B.A. degree in statistics, summa cum laude, from Haifa University in 1991. In 1995, he received a master's degree in statistics from the State University of New York (SUNY) at Buffalo. In 1999, he received a Ph.D. in epidemiology from SUNY at Buffalo. In 2000, he

[19] Schisterman's curriculum vitae is S-439. His voir dire examination is at 56T4-56T30.

completed a postdoctoral fellowship at the Harvard University School of Public Health, Department of Epidemiology.

Schisterman is presently Chair of the Department of Biostatistics, Epidemiology and Informatics at the Perelman School of Medicine, at the University of Pennsylvania. In this position, he supervises and puts forward the research plan for the entire department, consisting of the three divisions of biostatistics, epidemiology and informatics. As such, he supervises the approximately two hundred faculty members spread over those three divisions.

In the twenty plus years since completing his education, Schisterman has held various other positions, including as a professor, a researcher, and academic. His CV, consisting of seventy-nine pages lays out the details. [S-439] A few highlights will suffice here. He has taught applied statistics at the university level, including regression analysis, which he defined as a method to evaluate relationships between an independent and a dependent variable. He further explained that applied statistics also includes categorical data analysis. This subpart of applied statistics applies in this case, because it requires analysis of data defined by categories. As Schisterman explained, in the context of this case, an individual has either used drugs or has not used them before driving, and is defined in a category accordingly.

Schisterman has also taught logistics regression for doctoral students at the UCLA School of Public Health. He has taught statistical reasoning in public health at the Johns Hopkins Bloomberg School of Public Health.

In addition to his teaching experience, Schisterman has worked as a research scientist. For example, from 2008 to 2009 he served as the Acting Branch Chief of Biostatistics and Bioinformatics of the Division of Epidemiology, Statistics and Prevention Research at the National Institutes of Health (NIH). From 2010 through 2021, he served as the Branch Chief of the Epidemiology Branch of the Division of Intramural Population Health Research at NIH. In that capacity he supervised approximately seventy people.

Schisterman is currently the Editor-in-Chief of the American Journal of Epidemiology. This is the longest standing journal in the field, having been founded at the time of the 1918 pandemic. It publishes epidemiological papers in all disciplines of medicine, including infectious diseases, cardiovascular disease, and drug-related matters. As editor-in-chief, Schisterman supervises all the editors, each of whom is specialized in a different discipline, and he makes the final decisions about accepting or rejecting papers that will go to a peer-review process.

As itemized in his CV, Schisterman has thus far in his distinguished career published 332 peer-reviewed articles. He has written numerous book chapters, editorials as an editor, and other articles, all of which are reflected in his CV.

Very notably, Schisterman's testimony in this case marks the first time he has ever testified in a court in any kind of proceeding. He has no affiliation with the law enforcement community or the DRE program. His only knowledge of the DRE program is what he has learned in preparing for this case. Therefore, he comes to this case as a completely independent witness, with no agenda or bias and with no preconceived result in mind. Accordingly, he conducted his analysis completely and strictly in accordance with applicable statistical principles. He did not attempt to shape any aspect of that analysis in any way or direction,

Schisterman applied techniques far advanced from those applied by the other statisticians in this case, i.e., Taylor for the defense and Martin for the State. He conducted a multiple imputation analysis on both the State's and the OPD's data sets. He also conducted sensitivity analyses to gauge the robustness of the results. As explained more fully in the section VIII of this report dealing with the statistical analysis, Schisterman's methodology was clearly superior to that of the other statisticians. Schisterman's results

constitute an authoritative and reliable analysis of the data, which I credit completely.

Throughout his testimony, it was abundantly clear that Schisterman possesses superior knowledge in this subject matter. His answers were always direct and clear, regardless of who posed the question. He testified with a resolute firmness, which I find to have been warranted by the depth of his knowledge and experience. He was completely credible and persuasive, and his testimony and opinions were the honest and forthright product of his work, conducted objectively in accordance with established statistical principles. Schisterman's testimony is entitled to very substantial weight.

Nicholas Errico, Detective, DCJ

Detective Nicholas Errico was a fact witness in this case. He serves as a detective in the New Jersey Division of Criminal Justice within the Attorney General's Office. He was tasked with compiling the data from the 2017 and 2018 DRE reports in New Jersey and creating a spreadsheet detailing the relevant portions.

Errico is not a DRE and was completely unfamiliar with the DRE program when he was assigned this duty. He was briefed by the State DRE Coordinator, Sergeant Michael Gibson. Errico was in charge of this project but had several other detectives working with him. Errico received

instructions and input from time to time from several DAGs as to how to interpret some of the information and to answer Errico's questions when there was some uncertainty. The DAGs had the final say on these matters. Errico's role was ministerial, limited to collecting and organizing the information contained in the many DRE reports over the two-year period, which ended up totaling more that 5800, into a spreadsheet. The final document was entered in evidence as S-102, designated "Spreadsheet prepared by State."

In compiling this information, Errico and his colleagues collected and reviewed for each DRE evaluation the face sheet, narrative report, and, where applicable, the toxicology report. For each DRE, they also reviewed the rolling logs, which each DRE is required to maintain. Errico testified that approximately 463 DREs furnished their reports and, as far as he could ascertain, as of the end of 2018 there were approximately 491 DRE officers in the State. Of course, the number of DREs is not static, as a result of which the number would fluctuate from time to time over the two-year span.

Errico testified on four separate days. Two of them were complete days and two were partial days. Errico was a very credible witness. He was well qualified for the task he was assigned based on his prior experience. His testimony revealed that he took great care to examine the necessary materials, followed the instructions given to him, and consulted with the DAGs working

on this case when there were questions, potential inconsistencies in the documents, ambiguities, and the like.

He answered all questions forthrightly and carefully. There was no hint in his testimony that he was giving anything other than truthful answers, with no distortion or withholding of information requested by the questioner.

Errico's testimony is entitled to significant weight.

Ralph B. Taylor, Ph.D.[20]

Dr Taylor testified on behalf of the defense in the field of statistics, analyzing the New Jersey DRE data from 2017 and 2018. He qualified as an expert in (1) data analysis, (2) statistical analysis, (3) research design, (4) research methodology, and (5) criminology.

Taylor presently holds the designation of Professor Emeritus of Criminal Justice at Temple University. He holds a doctorate degree in Social Psychology, which he obtained from Johns Hopkins University in 1977. He had previously received a master's degree in social psychology from the same university. His BA in psychology, cum laude, came from Dartmouth College in 1972.

[20] Taylor's curriculum vitae is D-535. His voir dire examination is at 54T4-54T20.

Taylor has engaged in a career of teaching and research, mostly in the criminal justice field but also in other fields in which data collection and analysis is important. He has authored or co-authored more than eighty papers in refereed social science journals. He has served on the editorial boards of several social science peer reviewed journals. He has also conducted studies through grants, for several different federal agencies, including the National Science Foundation, the National Institute of Mental Health, and the National Institute of Justice. Some of the research he has done has involved policing, in which he worked in collaboration with police departments. He has taught at several universities throughout his career. He has taught courses in statistics to undergraduates as well as graduate students pursuing master's and Ph.D. degrees.

Taylor was engaged by the OPD and tasked with finding the "alignment rate" between DRE opinions and toxicology results based on the data compiled for 2017 and 2018. As I will discuss in the portion of this report dealing with the statistical analysis, there was a problem in the data sets with missing data. This consisted of cases in which there was no toxicological report. Most of the cases in which this data was missing was because the arrested driver exercised his right to refuse to consent to giving a urine specimen. This "missingness"

problem had to be dealt with in the analysis conducted by all three testifying statisticians.

In Taylor's initial report dated July 8, 2021, numbering thirty-seven pages, he conducted a detailed analysis of the data. In that report, he concluded if one made the assumption that a urine sample had been given in all of the missing cases and the toxicological analysis of every one of those samples aligned with the DRE opinion, the overall alignment rate, including the cases in which there actually was a sample, would have been 94.9%. On the other hand, if the assumption were made that a urine sample had been given in all of those missing cases but the toxicology results did not align with the DREs' opinions in any of them, then the overall alignment rate would have been 60.5%. Accordingly, there would have been a range of 60.5% to 94.9% of DRE opinions that matched the toxicology specimens given by all of the arrested drivers.

He cautioned in that report, however, that this range was preliminary only and was potentially misleading for failure to correct for the selection bias problem with the population tested, namely arrested drivers who exhibited sufficient indicia of drug impairment to establish probable cause for arrest and for calling in a DRE for further evaluation. In a subsequent report, and in his testimony, Taylor revised his analysis using a technique to account for the

missingness. He reached the ultimate conclusion that the DRE opinions were no better than chance, and the same level of accuracy could be achieved by flipping a coin in each case. This, of course, was a drastic difference from the range he had preliminarily determined, in which even the bottom end of the range, 60.5%, was significantly greater than chance, and the upper end of the range, 94.9%, was an extremely high accuracy rate.

In his revised analysis, Taylor made the extreme assumption that all of the cases in which there was no toxicology would have resulted in a mismatch with the DRE's opinions. He then applied a statistical method, the one-tailed z-test, to reach his final conclusion that the DRE opinions were no better than chance. Further, although Taylor stated that a mathematical imputation was the preferred method by which to analyze the data in this case, he did not do it because of "[t]ime and resources."

Taylor's final assumption that every single case with missing toxicology would have resulted in a mismatch is illogical, unwarranted, and untenable in this analysis. There is no basis for it. This assumption had the effect of artificially reducing the overall alignment rate. I credit the testimony of the State's statistics expert, Schisterman, that either extreme assumption (all matches or all mismatches) would be unwarranted here and that the number would obviously be somewhere in between. I further credit Schisterman's

testimony that the one-tailed z-test is a relatively rudimentary method to account for clustering in the context of clinical trials and was not an appropriate test for use in this case.

Notably, in its 302-page brief, the OPD did not advocate for any of the opinions Taylor offered or even cite to his testimony, except in connection with a few basic and uncontested statistical principles.

For these reasons, I do not credit Taylor's testimony and attribute no weight to it in my analysis of the statistical significance of the 2017 and 2018 New Jersey DRE data.

Dary Fiorentino, Ph.D.[21]

Dr. Fiorentino is a research psychologist. He does not engage in clinical work. He has a long-term connection with studies of the SFSTs and, through that work, with the DRE program.

He received his undergraduate degree in psychology from California State University in 1987, followed by a master's degree in human factors in 1993 from the same university. Human Factors is a scientific discipline that examines human behaviors and capabilities. In 2008, Fiorentino obtained a Ph.D. from Claremont Graduate University in cognitive psychology. During

[21] Fiorentino's curriculum vitae is S-333. His voir dire examination is at 47T8-47T46.

his studies at the various levels, he took extensive coursework in statistics. He now teaches some statistics courses at several colleges and universities. Throughout his testimony, he demonstrated a very extensive knowledge of statistical principles and practices, particularly as they pertain to the kind of studies and work involved in this case.

In 1995, Fiorentino became a project manager for an alcohol study. He was hired by Dr. Marcelline Burns and Dr. Herbert Moskowitz in their private entity known as Southern California Research Institute (SCRI). After both of those individuals retired, Fiorentino became the owner of SCRI.

Fiorentino teaches the alcohol course at Borkenstein School. Most of his work initially was in the alcohol field, but he expanded his areas of interest to the drug impaired field as well.

According to Fiorentino, a relatively small group of researchers, on an international basis, form a community for traffic safety research. This group, he explained, consists of psychologists, epidemiologists, criminologists, toxicologists and traffic engineers.

Fiorentino has conducted studies of his own as well as literature reviews regarding SFSTs. He has published about a dozen peer reviewed articles and about another fifteen to twenty articles that were not peer reviewed. He has

served as a peer reviewer for a number of journals dealing with traffic safety matters.

Fiorentino testified for three days. He was qualified as an expert in (1) traffic safety research, (2) research methodology, (3) statistical methods in research, (4) research psychology, (5) human factors, (6) standard field sobriety tests, (7) pharmacokinetics, and (8) pharmacodynamics.

Overall, I found Fiorentino to be a very credible and well-informed witness. Of course, because of his affiliation with the DRE program, he has some built-in bias. Nevertheless, I found him to be very forthright in answering questions and I consider the large amount of valuable information he provided to be well supported by his testimony and the many studies and materials upon which he relied. His testimony is entitled to significant weight.

Charles J. Brainerd, Ph.D.[22]

Dr. Brainerd is a well-schooled and well-qualified psychologist, who has spent his long career in academia. He conducts research and writes articles and engages in other related activities. He is not a clinical psychologist. He has taught at a number of universities, and has been a professor at Cornell University since 2005. At Cornell, he has taught statistics and experimental

[22] Brainerd's curriculum vitae is D-528. His voir dire examination is at 52T5-52T41.

design, statistics and methodology, research and design, cognitive psychology, and courses related to memory cognition. Throughout his career, his principal focus has been in the area of memory. He directs the Cornell Memory and Neuroscience Laboratory, and the largest course he teaches is "Memory and the Law."

Brainerd was educated at Michigan State University, receiving his undergraduate degree in psychology and chemistry, then his master's degree in psychology and, finally, his Ph.D. in experimental and developmental psychology from that university.

Brainerd has published hundreds of peer reviewed articles since 1969. He is also a peer reviewer and an editor of various psychological journals. He explained his view that peer reviewed articles are the most authoritative scientific articles because of the total independence of the researcher and because the subject of study originates with the researcher. He contrasted that with agency studies, usually funded and requested by a governmental agency. He contended that such articles or studies do not have the same level of independence because the agency has originated the idea and requested a study in the hopes of validating it. Nevertheless, he candidly acknowledged that there is nothing wrong with agency studies, and he further acknowledged that he has performed them over his career for agencies such as the NIH.

Brainerd was qualified in the following fields: (1) experimental psychology, (2) research methodology, (3) research design, (4) evaluation of research, and (5) mathematical modeling.

As reflected by Brainerd's testimony and his pre-hearing report, the commission he received from the OPD was very narrow. He was asked to (1) set forth the core principles of scientific study that must be observed to render the study scientifically reliable, and (2) review and evaluate three of the early DRE studies, often referred to as foundational studies (Bigelow 1985 (S-2/D-23), Compton 1986 (S-3/D-24), and Adler and Burns 1994 (S-4/D-25)).

In his half day of testimony, Brainerd, after stating the four basic principles of scientific research that he deems necessary to assure reliability, stated that his review of the three foundational studies do not meet those criteria and he does not deem them reliable or authoritative.

Brainerd possesses no expertise in and has very limited knowledge of the DRE program. He engaged in a cursory review of the DRE materials to prepare for his testimony in this case. He could not say whether any of the twelve steps in the DRE protocol are reliable. He said he would have to look into the science underlying each of those steps to see if they are valid, but he was not asked to do so and he has not done so. He conceded that although he deems the three foundational studies unreliable, he would be willing to change

his mind if he saw other subsequent studies or literature or scientific evidence supporting DRE reliability. He has not looked at any other materials because he was not asked to do so by the OPD.

Whether or not the three foundational studies of which Brainerd was critical, standing alone, could establish scientific reliability for the DRE protocol is not the question to be answered in this case. Indeed, when I asked counsel for the State whether he was "arguing that, with nothing else in this case, those three studies alone would carry your burden," he responded, "Absolutely not. I'm not arguing that . . . ." [52T111-3 to 7]

My conclusion is that Brainerd is a very well qualified and experienced research psychologist who was asked to render a very limited opinion in this case. However, there has been a great deal of additional research since those studies were conducted. And, there has been very extensive and comprehensive expert testimony regarding the scientific reliability of the steps in the DRE protocol over the forty-two hearing dates in this proceeding. Thus, because of the very limited scope of Brainerd's testimony, the significance of that testimony is low, and I do not attribute significant weight to it.

Mitchell Earleywine, Ph.D.[23]

Dr. Earleywine is a psychologist. He earned a bachelor's degree at Columbia University, and a Ph.D. degree at Indiana University. Since 1991, he has held teaching positions as an assistant or associate professor of psychology at the University of Southern California and the State University of New York (SUNY) at Albany. He currently serves as a professor of psychology at SUNY Albany. In addition to his teaching duties, Earleywine is also director of the Habits and Lifestyles Laboratory. He has served as a drug counselor and he is a staunch and unabashed advocate for the legalized use of cannabis. He belongs to various organizations that promote legalization. He writes a regular monthly column in High Times, a publication that, by his own terms, is devoted to the cannabis lifestyle. He has been writing his column since 2006. The column is called "Ask Dr. Mitch."

Earleywine was qualified as an expert in the fields of (1) drugs and human behavior, (2) clinical research methods, (3) research psychology, (4) abnormal psychology, also known as psychopathology, and (5) cannabis in general and its cognitive effects.

[23] Earleywine's curriculum vitae is D-529. His voir dire examination is at 53T5-53T14.

The thrust of Earleywine's testimony dwelt on two points. First, an individual who ingests a very high dose of cannabis before driving might not be able to drive safely, but anyone else can with a more moderate dose or a low dose. He did not quantify the doses. Second, there can be no per se test for cannabis to determine impairment as with alcohol. This is because there is no correlation between the quantity of THC in one's system and impaired driving ability.

As to the second point, no one in this case disagrees. The State has not proposed any per se cutoff level. Nor does the State argue that any particular quantity of THC detected in a subject establishes impairment for driving purposes. Indeed, the two toxicologists called by the State testified explicitly that toxicological analysis cannot, by itself, prove impairment. It can only establish the presence of a drug in an individual's system.

As to the first point, no one disagrees that a higher dose of any drug, including cannabis, is more likely to cause impairment or, stated differently, is likely to cause a higher level of impairment to drive than a lower dose. Under the DRE protocol, impairment is ascertained observationally by a DRE in the course of his or her evaluation, which is concluded and memorialized in a written report that includes the indicia of impairment observed. This process

is completed before any toxicology result is obtained weeks later (assuming the driver provided a urine specimen).

Earleywine presented as a qualified psychologist and a credible witness. He answered questions directly, and, from my perspective, truthfully. I do not question that the opinions he rendered are opinions he honestly holds. Earleywine's testimony was limited to a single drug, namely cannabis. Considering his long-term advocacy for the legalization and permissible use of cannabis, he has a built-in bias. Because Earleywine's testimony has practically no probative value with respect to the ultimate issues to be decided in this case, and because his opinions are very likely influenced by his bias, I attribute very low weight to his testimony.

IV. BACKGROUND TO DECP

The foundations of the Drug Evaluation and Classification Program (DECP) were developed by the Los Angeles Police Department (LAPD) in the 1970s. [20T67; S-12; S-33 at * pdf 107; D-4 at pdf 107][24] As noted in the

[24] Notes regarding exhibits and page references:

- For quite a few exhibits, identical copies of the same document were entered into evidence by both the State and the OPD, such as the 1027-page DRE course instructor guide, which is both S-33 and D-4. Throughout this report, I generally cite to one but not both of any duplicate admitted exhibits. All known duplication is indicated on the exhibit list (Appendix C).

(continued)

DRE training manual, "[d]evelopment of the DEC Program began in the early 1970's in response to a growing awareness that many people apprehended for impaired driving were under the influence of drugs rather than alcohol." [D-4 at pdf 107]

Thomas Page was employed by the LAPD full time from 1981 to 1999, working directly with the development of what became the DECP and learning of its pre-1981 origins. [20T41;20T67] At the hearing, Page was qualified as an expert on "[t]he International Drug Evaluation and Classification Program; on the DRE program and all its steps; on all the components of those steps; on administering and interpreting the HGN and VGN tests; and on the signs, symptoms, and behaviors of drug use and impairment." [20T63;20T66-20T67]. He testified that in the late 1970s and early 1980s, LAPD officers were stopping drivers who seemed impaired but had a blood alcohol content (BAC) of zero or well below the statutory level. [20T72] "The typical option" available to officers at that time "was either to let the person go, possibly call

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- Exhibits that are numbered consecutively within the body of the document are referenced with those page numbers. However, many key documents either have no page numbers at all or are numbered in a convoluted or confusing way. For those documents, "at pdf" references the handwritten number that was added to the document by the submitting party, while "at *pdf" references the page that corresponds to the digital page counter on the computer when the pdf version of the document is viewed.

somebody to pick up the person, taking them to a city or a county hospital and try to get a medical assessment of . . . the person to determine if the person was under the influence of something or was – needed a psychiatric evaluation." [20T72]

However, for several reasons the LAPD and city attorney's office concluded that, in most cases, "it wasn't a workable option to get medical – a doctor to determine if somebody was under the influence of drugs and then to come in and testify." [20T77] Officers "occasionally succeeded in having physicians examine some of these low BAC subjects, resulting in diagnosis of drug influence," but "[f]or various reasons, physicians were often reluctant or unwilling to conduct these examinations and offer opinions." [D-4 at pdf 107]

One problem with seeking a medical evaluation was that the doctors "were seeing the person at a different point in time than the officers were," so "the signs and symptoms that the officers had wouldn't match what the doctors saw." [20T73-20T74] Also, many of the doctors at the time "had very little systematic knowledge, particularly about the effects of the drugs of abuse." [20T73]

Thus, under the system as it existed in the 1970s, the police "lacked the means to keep drug-impaired people from driving" and charges for impairment other than alcohol "were almost nonexistent." [20T77]

In the latter half of the 1970s, LAPD Sgt. Dick Studdard "approached Len Leeds, a "former LAPD Narcotics Officer," who "[i]nitiated some independent research by consulting with physicians, enrolling in relevant classes, studying text books, technical articles, etc." and "[s]ecured management-level support within the department to continue research and program development." [D-4 at pdf 107-08] In 1979, a DRE program was officially recognized by LAPD. [D-4 at pdf 108; S-7 at 11]

Meanwhile, in the context of alcohol-impaired driving, field sobriety tests became the focus of research. In the late 1970s and early 1980s, there was increased public and law enforcement focus on removing drunk drivers from the roads. [20T82-20T84] Officers had been using a variety of non-standardized methods to evaluate whether a driver had had too much to drink, including smelling the subject's breath or having the subject "do a walking test, maybe stepping-on-a-curb test to look for maybe things in terms of muscle coordination, alphabet tests, sometimes backwards counting tests, finger-to-nose test of various types." [20T68-20T69] Different officers would "come up with their own ways, and that would be passed on very frequently from a training officer to a younger officer." [20T69] Many officers were concerned about the lack of standardization for these tests. [20T84] An additional concern was that some tests being used, such as the coin-pick-up test, which

required the subject to bend and retrieve small objects from the ground, could lead to the subject falling and being injured [20T68-20T69;20T84]

The Southern California Research Institute (SCRI) was a private company headed by Dr. Herbert Moskowitz and later by his assistant Dr. Marcelline Burns. [20T84-20T85;21T190] In 1975, SCRI contracted with NHTSA to conduct research to determine which of the various methods to test sobriety that were being employed in the United States and around the world "best showed drunkenness." [20T85-20T86;20T91; D-7 at pdf 338-39]

In June 1977, SCRI published the results of a study regarding six tests of sobriety that were commonly used by officers around the country titled "Psychophysical Tests for DWI Arrest," which was authored by Moskowitz and Burns and prepared for NHTSA (1977 SCRI study). [S-19; D-12] The objectives of the 1977 SCRI study "included evaluation of currently-used tests, development of more sensitive and reliable measures, and the standardization of test administration." [S-19 at i] The overall goal was to identify a standard and reliable battery of sobriety tests. [21T190-21T191]

The researchers concluded that, while "[a]ll of the 6 tests were found to be alcohol sensitive," the "[d]ata analysis led to recommendations of a 'best' reduced battery of tests which includes examination of balance (One-Leg Stand) and walking (Walk-and-Turn), as well as the jerking nystagmus

movement of the eyes (alcohol Gaze Nystagmus)." [S-19 at i] The authors noted that "[t]his final, recommended sobriety test battery can be administered without special equipment in most roadside environments, and it can be adapted to yield more precise measurement if administered in the station." [S-19 at 2] Moreover, the recommended battery of three tests could be administered in about five minutes. [S-19 at 2]. The authors stated:

> If balance and walking skills are examined, and the eyes are checked for the jerking nystagmus movement, the officer will have as much information about intoxication level as can be obtained at roadside. Alcohol gaze nystagmus is a particularly valuable measure, which is underutilized in law enforcement and which merits additional study and application.
>
> [S-19 at 2.]

Page noted that the 1977 SCRI study was a foundation study for field sobriety testing.[25] [20T95]

In March 1981, SCRI published the results of another study prepared for NHTSA, titled "Development and Field Test of Psychophysical Tests for DWI Arrest" (1981 SCRI study). [S-20;D-13;20T99-20T100] "Administration and scoring procedures were standardized for a sobriety test battery" consisting of

[25] Notably, the legal BAC limit in California at the time was .10%, but the authors found that "[t]he evaluation data show that substantial impairment typically occurs at a BAC lower" than that. [S-19 at 2] They "suggested that a more appropriate legal BAC limit would be .08%." [S-19 at 2]

the walk-and-turn (WAT), the one leg stand (OLS), and horizontal gaze nystagmus (HGN) tests, and "[t]he effectiveness of the standardized battery was then evaluated in the laboratory and, to a limited extent, in the field." [S-20 at i] The 1981 SCRI study concluded that "[a]dministration, scoring, and interpretation procedures and criteria for the three-test battery have been refined and evaluated," and "[u]nder laboratory conditions and in the hands of adequately trained personnel, the test battery is a sensitive index of BAC and of impairment." [S-20 at 72] The study also confirmed the findings of the 1977 SCRI study that "gaze nystagmus is an outstandingly useful tool for the officer at roadside," particularly where the "angle of onset" of the nystagmus was estimated with precision. [S-20 at 72]

Regarding evaluating the three-test battery in the field, the 1981 SCRI study concluded that, because of "the limited nature of this field study," definitive conclusions could not be made. [S-20 at 72-73]. However, it noted that "the data do clearly suggest positive results due to the use of the battery, and it recommended "a subsequent field evaluation, repeating essentially the same study design with a sample which is both larger and broader." [S-20 at 73]

Three tests emerged from SCRI's research as the safest and most effective tests to determine alcohol impairment – the HGN, WAT, and OLS

tests. [20T86-20T89] Page stated that "the research that was done on the tests showed that those tests, individually, and then together were even better" at assisting officers "to accurately identify those" whose BAC exceeded the then-statutory standard of .10%. [20T89] The three-test battery was designed to be used at roadside by police, and it began to be used routinely in Los Angeles in the early 1980s. [20T92;20T122-20T124]

In September 1983, NHTSA issued a Technical Note titled "Field Evaluation of a Behavioral Test Battery for DWI" (1983 NHTSA study). [S-21][26] The 1983 NHTSA study built on the 1977 SCRI study, which recommended the use of a three-test battery consisting of the one-leg stand, walk-and-turn, and HGN tests, and on the 1981 SCRI study, which "standardized the procedures for administering and scoring each test and collected data on their effectiveness in a controlled setting." [S-21 at 1-2] The 1983 NHTSA study sought to (1) "develop standardized, practical and effective procedures for police officers to use in reaching an arrest/no arrest decision when giving one or more of the three sobriety tests;" (2) "test the feasibility of use in operational conditions by police officers;" and (3) "secure

[26] Note: The SFST instructor guide incorrectly asserts that the 1983 NHTSA study was published by SCRI. [S-49 at *pdf 338] However, the 1983 NHTSA study does not mention SCRI, and it only mentions Burns in connection with the prior studies. [S-21 at 12]

data to help determine if the tests will discriminate about as well in the field as in the lab." [S-21 at 3] The study concluded:

> The results of the field evaluation:
>
> Confirm the laboratory findings regarding the ability of the sobriety test battery to effectively discriminate between drivers with BACs less than 0.10% an [sic] drivers with BACs over 0.10%.
>
> Demonstrate that the three sobriety battery tests (Gaze Nystagmus, Walk & Turn and One Leg Stand) can be easily and effectively used in the field by police officers who have received a one day training session.
>
> Indicate that the test battery appears to be about as effective as the use of PBTs [preliminary breath test devices] in improving the BAC distribution of those arrested (e.g., a reduction of false positives).
>
> Suggest that the gaze nystagmus test is the most powerful of the three if only one is used, and that the combination of gaze nystagmus and walk and turn offers the most potential for discriminating between those above and below .10% BAC.
>
> [S-21 at 11]

Following the issuance of the 1983 NHSTA study, the three-test battery recommended by SCRI and NHTSA "[r]eally began emerging as the standardized protocol that officers and DUI enforcement – or DWI enforcement should be using." [20T128] Officers around the country began using the three-test battery more and more often to evaluate alcohol

impairment, and they became known as the SFSTs. [20T145; D-7 at pdf 69; D-9 at 5]

In 1986, the Advisory Committee on Highway Safety (ACHS) of the IACP passed a resolution recommending that law enforcement agencies adopt the SFSTs and implement their use. [D-9 at 4] A few years later, the ACHS promulgated national standards for the "selection, training, recertification and decertification of SFST practitioners and instructors," which were approved by the IACP. [D-9 at 4]

At the same time SCRI and NHTSA were developing and studying the SFSTs in the 1980's, the LAPD was developing procedures for a "Drugged Driver Detection" program. [D-23 at pdf 2;D-4 at pdf 109] With various modifications and the eventual assistance of NHTSA, the LAPD program ultimately became the DEC Program. [S-29 at 1; D-4 at pdf 109; 20T160-20T161]

In the 1980s, Los Angeles was experiencing "lots of drug use epidemics," of which "[p]robably the biggest one" was phenylcyclohexyl piperidine, commonly known as phencyclidine and sometimes called Angel dust (PCP). [20T132] PCP use "was really ubiquitous in LA at one period of time." [20T133] The use of crack cocaine was also an epidemic in Los Angeles in the mid-1980s. [20T138-20T139; 20T145]

Page became a DRE with the LAPD "sometime in the 1980s." [20T44] He was later the training coordinator of the LAPD DRE unit, then the officer in charge of the program. [20T44-20T45] He testified that he "became directly involved" with the DRE program in 1985. [20T56] Page assisted in developing the curriculum for the LAPD Drugged Driving Detection program that eventually became the DECP. [20T158-20T159] The LAPD "put on a class . . . taught by police officers," including Page. [20T160-20T161]

In the early 1980s, NHTSA "began to assist LAPD in validating the DRE program" [D-4 at pdf 109; see also S-29 at 1; S-12 at 1] The LAPD and NHTSA "worked together to develop the Drug Recognition Expert (DRE) training as we know it today." [D-4 at pdf 109] NHTSA considered the studies that developed and validated the SFSTs for investigating alcohol-impaired driving as "[t]he first step" toward developing the DEC program. [D-4 at pdf 109]

In 1984, NHTSA and the National Institute on Drug Abuse jointly sponsored a laboratory study by the Behavioral Pharmacology Research Unit of the Department of Psychiatry & Behavioral Sciences at The Johns Hopkins University School of Medicine, the results of which were published in May 1985 in a report titled "Identifying Types of Drug Intoxication: Laboratory

Evaluation of a Subject-Examination Procedure" (Johns Hopkins study).[27] [S-2; D-23] Eighty volunteer subjects either received placebos or were dosed with cannabis, a CNS depressant, or a CNS stimulant and then "rated independently by each of four LAPD Drug Recognition Experts." [S-2 at i, 2]. The examination procedures used by the participating DREs "were derived from those developed and used by the Los Angeles Police Department in their Drug Recognition Program." [S-2 at 1] However, Page noted that the Johns Hopkins study was conducted before the DRE program had become standardized. [20T154-20T155] It "was a modified evaluation, not done in the field, not done with arrestees, but with volunteers that came in and very controlled levels of just a handful of drugs." [20T157]

Nevertheless, the "basic conclusions" of the Johns Hopkins study "were that the modified evaluation that these four officers used enabled these officers to determine if somebody was impaired by drugs and the category or type of drug that was causing the impairment with a high degree of accuracy." [20T156] Page said that the Johns Hopkins study showed "within and without the department that this drug recognition idea or at least protocol was still in the development stage had merit." [20T157]

[27] This is also referenced in the literature and testimony as the Bigelow study.

In 1985, in connection with its "research effort designed to validate the LAPD drug recognition program," NHTSA conducted "a field study in which [LAPD] police officers employed the drug recognition procedure with real suspects under field conditions." [S-3 at ii] The LAPD field study considered evaluations by twenty-five DREs of one hundred seventy-three subjects who had been arrested during the summer of 1985 on suspicion of driving under the influence of a drug or a combination of a drug and alcohol." [S-3 at 3-5] Page helped to coordinate the LAPD field validation study. [20T159; 20T162-20T163; S-3 at iii). The examining officers used the basic elements of the eventual 12 step DEC program, but there were some differences. [20T165-20T166]

NHTSA published the results of the LAPD field study in February 1986 in a technical report authored by NHTSA employee Dr. Richard P. Compton entitled "Field Evaluation of the Los Angeles Police Department Drug Detection Procedure" (Compton report). [S-3; D-24; 24T115-24T118] The report noted:

> The important results showed that:
>
> - When the police officers claimed drugs other than alcohol were present they were almost always detected in the suspect's blood (94% of the time).

- The police officers were able to correctly identify at least one drug other than alcohol in 87% of the suspects evaluated in this study. Most of these suspects had used multiple drugs (other than alcohol).

- When the DREs identified a suspect as impaired by a specific drug, the drug was detected in the suspect's blood 79% of the time.

[S-3 at i]

The Compton report concluded that "[t]he results of the two studies conducted by NHTSA appear to show that the LAPD drug recognition procedure provides the trained police officer with the ability to accurately recognize the symptoms of many types of drug use by drivers." [S-3 at 24]

Following the positive results reported in the Johns Hopkins study and the Compton report, NHTSA, in conjunction with the LAPD, developed a standard curriculum to train DREs outside of the LAPD. [S-12; 20T161] Page explained that NHTSA monitored the course developed by the LAPD and, in about 1987, it "came out with a suggested formal curriculum." [20T161; 21T128] "So there was a pilot curriculum that was delivered, and subsequently there was a lot of changes and evolvement to make that better." [20T161] Page "wrote parts of the initial curriculum and continued to have a role for many years in the revisions of the entire curriculum and standards too." [20T45]

Page noted that, in his work with both the Compton study and developing the curriculum to train other officers, he "would interface with"

professionals from outside the LAPD, such as "medical staff of the City of Los Angeles, . . . "other medical professionals, including Dr. Burns and her colleagues, as well as other scientists, toxicologists." [20T160] He remained involved in updating and improving the training curriculum after NHTSA took the reins, and the curriculum developers consulted and received help from "various fields," including medical doctors, toxicologists, psychologists, occupational nurses, emergency nurses, and neuro-ophthalmologists. [20T169-20T170;20T173-20T175] Page recalled that the late Dr. Jacob Behar was one of the first neuro-ophthamologists to consult on the program. [20T170] Page remarked that Behar was from Miami rather than the Los Angeles area, but he noted "[t]here's not a lot of them in the country." [20T170].

Page also identified a number of medical texts he relied upon in working on the program in the early days, including Goodman & Gilman's Pharmacological Basis for Therapeutics and the Diagnostic and Statistical Manual (DSM). [20T201] He noted that he purchased "[m]any hundreds of dollars of books" himself due to the limited budget at the LAPD. [20T201]

Page further explained that he drew upon and relied on the body of knowledge he had accumulated in dealing with drug users and drug-addicted individuals when he worked for the Wayne County Michigan Health

Department in Detroit before becoming a police officer. [20T42; 20T200] Part of his job at the time included interviewing and identifying individuals who were dependent on drugs and referring them to treatment facilities. [20T42-20T43]

In about 1987, Page and his LAPD colleagues developed the first "symptomatology matrix," which has evolved into a different format over the years, but has remained "very similar." [20T201] The current matrix is in evidence. [S-44] Page explained that it is not designed to be used "mechanistically," but it is "really a reference tool" to assist DREs in assessing a subject. [20T202-20T203]

Also in 1987, the IACP[28] and its Highway Safety Committee began "to participate in the development and national expansion of the DECP, as well as

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[28] According to the IACP's website:

> The International Association of Chiefs of Police IACP) is the world's largest and most influential professional association for police leaders. With more than 31,000 members in more than 165 countries, the IACP is a recognized leader in global policing, committed to advancing safer communities through thoughtful, progressive police leadership. Since 1893, the association has been serving communities worldwide by speaking out on behalf of law enforcement and advancing leadership and professionalism in policing worldwide.
>
> [https://www.theiacp.org/about-iacp (last reviewed August 11, 2022).]

to oversee the credentialing of certified DREs," at NHTSA's request. [S-29 at 1] "Since that time, the program has grown both nationally and internationally. Additionally, IACP's role in coordinating and overseeing the program has also expanded." [S-29 at 1] The IACP "became the regulating and certifying body for the international program." [20T168]

In 1988, NHTSA "requested that the IACP develop a system of nationally accepted program standards." [S-137 at 3] In order to develop and maintain uniform standards, the IACP established the TAP." [S-137 at 3] "With the assistance of TAP, the International Standards for [DECP] were established to assist with the criteria for the selection, training, and certification of DREs and aid in ensuring the continued high level of performance of the [DECP] is maintained." [S-137 at 3]

Page testified that the "numbers do vary" as to members of TAP, but it is typically composed of a medical doctor, a "behavioral optometrist who specialized in the eye movement," and a toxicologist, as well as DREs, program coordinators, and "educational institutions that might be involved in DRE." [20T177-20T178] TAP was "really designed to have some structured way of making sure" that new medical information, drugs, laws, and research were taken into account and the protocol continually improved. [20T176-20T177] Page said NHTSA "became directly involved with controlling" the

DRE program in 1989, but he remained personally involved in updating and improving the training curriculum. [20T167-20T168]

Initial expansion of the DECP outside of Los Angeles took place in in 1987 in Arizona, Colorado, New York, and Virginia. [20T170-20T171; S-7 at 11] A year later, Utah, Indiana, and California outside of Los Angeles were added to the pilot program. [S-7 at 11] This was due, in large part, to federal funding provided pursuant to the Anti-Drug Abuse Act of 1988, PL 100–690 (HR 5210), PL 100–690, November 18, 1988, 102 Stat 4181 (ADAA). [D-28 at 13; 20T170-20T171]

The program began in New Jersey in 1991. [26T53] By mid-1992, "DEC programs existed in one or more law enforcement agencies in 23 States and the District of Columbia." [S-12]

As of the time of the hearing in Fall 2021, all fifty states and all seven Canadian provinces had certified DREs. [S-29 at 10-11; S-7 at 11; 20T193-20T194] Other countries, including Australia, Norway, Germany, and the United Kingdom, have used similar evaluation programs "based on officer's recognition and interpreting of signs and symptoms." [20T194]

V. DRE TRAINING

According to the IACP Drug Evaluation & Classification Program 2020 Annual Report (IACP Report), there were 8,150 DREs in the United States as

of December 31, 2020. [S-29 at 2-3] Canada had an additional 1389 DREs. [S-29 at 2]

The IACP Report stated that New Jersey had 462 certified DREs. [S-29 at 11] Gibson confirmed that, as of the time of his testimony in October 2021, there were over 450 certified DREs in New Jersey (26T63).

New Jersey had the second highest number of DREs in the nation, following California with the highest, at 1437. [26T63; S-29 at 10] Texas followed New Jersey with 371 DREs, followed by Wisconsin with 331, New York with 322, and Florida with 317. [S-29 at 10-11] Twenty-three states had fewer than 100 DREs in 2020. [S-29 at 10-11]

In order to become a DRE, officers must successfully complete several levels of training beyond the basic training they receive to become police officers.

First, officers must complete the five-day "DWI Detection and Standardized Field Sobriety Testing" course (SFST course), the curriculum for which was developed and is standardized and controlled by NHTSA and IACP. [26T79-26T80; S-49; D-7; S-50; D-18] Participants in the SFST course "receive blocks of instruction on the three phases of DUI detection, motor vehicle in motion, personal contact, and pre-arrest screening." [26T79; D-7 at pdf 4] They also learn to administer and score the three tests of which the

SFSTs are comprised – the HGN test, the WAT test, and the OLS test. [26T79; D-7 at pdf 4] During a "wet lab," participants practice administering the SFSTs on fellow classmates and volunteers who have not consumed alcohol as well on subjects who have." [26T79-26T82; D-7 at pdf 14-15]

The instructor guide and participant manual for the SFST course are issued by NHTSA and the IACP, with the 2018 versions being the most recent. (26T83; 28T21; S-49/D-7; S-50/D-18). The SFST instructor manual is 648 pages long, and the participant manual is 598 pages long, each consisting of sixteen multi-page sessions on the SFSTs and a forty-two page long "Introduction to Drugged Driving." [D-7; D-18] At the conclusion of the SFST course, participants must pass a written examination with a score of eighty percent or better. [26T84-26T85; D-7 at pdf 597]

Next, prospective DREs in New Jersey must complete the Advanced Roadside Impaired Driving Enforcement (ARIDE) course before being considered for training as a DRE, with rare exceptions. [26T88; 26T140-26T141]. The ARIDE course was "developed under the auspices and direction of the NHTSA and IACP" in 2009, and it "prepares police officers and other qualified persons to conduct various drug-impairment detection tests at roadside for use in drugged-driving investigations." [S-30 at * pdf6] The course is "a stand-alone" course that consists of sixteen hours of training for

participants who have already completed the SFST course. [25T28-25T29; 26T88; S-30 at *pdf 8-9; D-7 at pdf 11]. It was "created to address the gap in training between the Standardized Field Sobriety Testing (SFST) and the Drug Evaluation and Classification (DEC) programs." [D-9 at 4]

The ARIDE course provides additional instruction regarding the SFSTs, as well as an overview of the seven drug categories and indications of use taught as part of DRE training, although "not in great detail." [26T89-26T90; 26T94-26T95] The 406-page instructor guide and 394-page participant manual for the ARIDE course, both most recently revised in 2018, include nine multi-page sessions. [S-30; D-396; S-31]

Both the SFST course and the ARIDE course are "highly recommended" by NHTSA, but "neither will qualify an officer to serve as a DRE." [D-7 at pdf 7]

Successful completion of the ARIDE course is not a prerequisite for DRE training in all states, but Gibson made it a prerequisite in New Jersey after he became coordinator, and he has "requested an enhanced standard . . . to make it absolutely mandatory." [25T28-25T29; 26T90-26T91]

After completing the SFST course and, where required, the ARIDE course, officers seeking to become DREs must complete three phases of training – (1) the two-day Drug Evaluation and Classification (Preliminary

School), sometimes called the "preschool," (2) the seven-day Drug Recognition Expert Course (DRE course), which entails fifty-six additional hours of classroom instruction and a written examination, and (3) field evaluations [25T29-25T39; 26T95; 26T100; S-33; S-34; S-47; S-48]

The preschool includes sixteen hours of instruction, during which participants receive information regarding the twelve-step DECP and the seven drug categories used by DREs. [26T96-26T98; S-47; S-48] The purpose of the preschool is to give participants an overview of the DECP and to begin teaching them skills to use on the job. [25T29;] The preschool covers ten sessions, set out in the 275-page instructor guide and 261-page participant manual. both revised as of 2018 [S-47; S-48]

Next, DRE applicants must complete the second phase of DRE training, which is the seven-day DRE course. [25T30; 26T100] Participants receive instruction regarding the "seven different drug categories in great detail, general indicators, signs and symptoms," physiology, the eye examination, the vital signs evaluated during the DRE process, and polydrug use, among other things. [26T104-26T105] "They practice the 12-step process, receive information on every step of the process, how to perform the process in the standardized system manner," and they "will also perform another wet lab evaluation." [26T98; 26T105]

Like the guides and manuals for the SFST, ARIDE, and preschool courses, the instructor guide and participant manual for the seven-day DRE course were issued by NHSTA and IACP and most recently revised in 2018. [D-4; D-8] The instructor guide is 1027 pages long, the participant manual 981 pages, and each volume outlines thirty sessions or "blocks" of detailed classroom instruction. [D-4; D-8; 26T104] Gibson testified that, in New Jersey, some blocks of instruction are given by medical professionals, a flight paramedic, and DRE instructors who are also EMTs. [26T105] He explained that participants "receive information regarding the 12-step process numerous times. They practice the 12-step process, receive information on every step of the process, how to perform the process in the standardized system manner." [26T105]

The "DRE symptomatology matrix" is included in the DRE course manual. [26T107-26T108; S-36; S-44; D-4 at pdf 797-98; D-8 at pdf 757-58; Appendix F] Potential DREs are taught to use the matrix as "a reference tool" and "a guide," but not to apply it "rigidly." [26T108]

Gibson testified that the DRE course is typically offered three times per year in New Jersey, with a class size of between twenty and thirty, and that it is "[e]xtremely difficult." [26T109]. Participants must pass a 100-question written examination with a score of at least 80% at the end of the DRE course.

[26T138; 27T153] Under an enhanced standard effective in New Jersey, participants must pass the examination on the first attempt and cannot retake the test. [26T138-26T139; S-43]

The third and final phase of training is "the field testing process," which Gibson testified could "take anywhere from 40 to 60 hours to perform." [26T121] Each DRE candidate must complete a minimum of twelve evaluations, six of which must be "hands-on, which means they'll perform the 12-step process themselves on a suspected impaired driver" and six of which can be evaluations done while another trainee takes the subject through the process. [25T30; 26T122; S-42 at 14]

Participants must evaluate subjects impaired by a minimum of three of the seven drug categories. [25T30-25T31; 26T126] All training evaluations are supervised by a DRE instructor. [26T122]

Training evaluations are typically done in a setting such as a shelter or treatment program where subjects have ingested drugs and are asked to participate in an evaluation, and they are advised that they will not be criminally charged. [25T31-25T32; 26T125] Occasionally, training

evaluations occur as part of actual roadside stops under the supervision of a DRE instructor. [25T30][29]

Subjects provide a urine sample, which is tested by an OFS toxicology unit [26T123-26T125; 26T140] At least seventy-five percent of a participant's field evaluations, or nine out of twelve, must be supported by forensic testing, applying the DECP standard. [26T126] Under that standard, if the participant opines one drug category, the laboratory analysis must confirm it; if the participant opines two drug categories, the laboratory analysis must confirm at least one of the two; and if the participant opines three or more drug categories, the analysis must confirm at least two of the drugs opined. [26T126; S-42]

Page explained that the seventy-five-percent standard was recommended by "toxicologists that actually headed up programs around the country" because of their awareness that toxicological laboratories "cannot find everything," but only "what they're testing for." [20T180-20T181]. The toxicologists "felt that 75 percent of a corroboration by the laboratory really was sufficient and really gave them confidence that this is – that the

[29] In Canada, due in part to "a lack of sufficient numbers of impaired subjects available for observational testing," the IACP has approved the use of "professional actors" in up to five evaluations. [S-42 at 15]

evaluations are working, that the officers are making correct decisions." [20T181].

Page further elaborated that over the years since the seventy-five-percent standard was set, it has never been changed, although there has been an ongoing dialog between the TAP and toxicologists. [20T182-20T183]. The toxicologists insist that with the constant coming and going of new designer drugs, the difficulty in establishing cutoff levels that are appropriate for newly discovered drugs for which reference standards can be obtained, budgetary constraints and other practical limitations, the seventy-five-percent standard should remain in effect, and it has to the current time. [20T181-20T183].

Miles explained that requiring "more stringent standards such as a perfect match" was not really feasible because "[t]here's just too many variables that we can't control for that." [51T15] Identifying drug presence in the field setting is "not like a laboratory study where we know what's been dosed and how much and when. There's still a lot of variables that are unknown. So to control for those, we allow the 75 percent." [51T15]

VI. LIMITATIONS ON CHEMICAL TESTING

Toxicological analysis – testing urine or blood for drugs – is far more complex and time-consuming than administering a breath alcohol test, and for

a number of reasons the information contained in a toxicological report is limited and may be imperfect.

Chemical testing at a laboratory "takes a while." [50T72] A laboratory must purchase and maintain complex instruments that, through multi-step processes, can enable analysts to identify and confirm the presence of a particular drug or metabolite in a biological specimen. [50T23] Laboratories must implement and verify testing methods for a variety of drugs with differing properties. [50T23-50T24] When deciding on and developing the method to test for a particular drug, the laboratory has to understand the "parent" compound, all of the metabolites, and whether those metabolites are present in urine or blood. [50T64]

Laboratories must also purchase and maintain a certified reference material or standard for each and every substance for which they test. [28T200; 28T222-28T229; 50T172] If a laboratory seeks to test for both a parent compound and the metabolites of a particular drug, it must purchase a reference standard for each. [50T172]

A. Toxicology may show the presence of a drug or metabolite, but it does not, alone, indicate impairment

One significant limitation is that a toxicological report can reveal the presence of a drug or metabolite in a urine or blood sample collected from a subject, but that alone does not establish whether or to what degree the subject experienced impairment. The presence of a drug does not, by itself, reveal when it was ingested or how or when it impacted a subject's behavior. [29T64; 29T147-29T148; 50T203; 51T19; 51T60; 60T41-60T42]

As Verdino explained, a positive toxicology report "infers use but not necessarily recent use or impairment." [29T64] Miles noted that a toxicological analysis is "simply measuring drug; sometimes concentration, sometimes just presence." [50T203] A toxicological report can note the presence of a drug found and, in circumstances where blood is tested and the drug is quantified, "maybe reference it to therapeutic ranges," but it is not "a measurement of impairment." [50T203] Some drugs can be ingested at a low level that does not cause impairment or at a higher dose that does, but toxicology will show only that the drug was ingested, not its effects. [29T132-29T133] Similarly, toxicology may detect but does not reflect the impact of multiple drugs or alcohol in combination with drugs on a particular subject. [50T236-50T237]

Moreover, different drugs have different "pharmacokinetic profiles," meaning the manner and speed at which the drug goes through the processes of absorption, distribution, metabolism, and excretion in the human body. [50T64] In some circumstances, a urine sample that tests positive for a drug or metabolite may reflect a drug whose psychokinetic effects were over well prior to the subject operating a vehicle. [51T125-51T126; D-517 at 554] As Guzzardi explained, urine will show that a drug was ingested, but depending on the drug it could have been days or even weeks prior to when the urine sample was given. [60T41-60T42]

Thus, toxicology can support a DRE's opinion regarding the category of drug opined by confirming the presence of that drug in a subject's system, but toxicology alone does not show the level or timing of any impairment resulting from ingestion of the drug. [28T170; 29T64; 50T80; 51T19; 51T60;51T162]

B. Different people react differently to drugs based on many factors

The effects of a substance can vary from person to person based on individual reaction and tolerance, as well as by dose and type of substance used. [28T167-28T168; 29T56-29T57; 50T174; 50T214; 50T222-50T228; 51T153] The effects can also vary depending on whether the substance is in the process of being absorbed, distributed, metabolized, or excreted by the

subject's body. [50T228-50T230; 51T16-51T18; 51T153]. Two different subjects may metabolize the same drug at different speeds. [28T178; 29T68]

Guzzardi explained that "in general the amount of drug in the blood correlates with the expected effects of that drug" [60T39-60T40], but because of tolerance to drugs and other factors, "an individual can have a high level of a drug in their system and be perfectly neurologically normal, or they can have a relatively low level . . . and have detrimental central nervous system effects." [60T39]

A toxicological report cannot establish what phase of a particular drug's cycle the subject was experiencing. [50T230] A toxicological report does not show anything about the cognitive functioning or physical coordination of the subject at any particular time. [28T169] Toxicology also cannot show the method by which a drug was ingested, which can affect how quickly or slowly the subject experienced pharmacokinetic effects. [28T174]

C. Toxicology may not show the presence of any drug or metabolite even though the subject was under the influence of a drug while driving

One of the most significant limitations of toxicology is that it can fail to show the presence of certain drugs. No instrument exists that can provide a readout of all drugs present in a particular biological sample. [50T81]

Miles explained that, due to several factors, laboratories "will never test for every drug that's out there," despite diligent efforts to do so and "the best technology today." [50T79-50T80] "So if a DRE finds impairment, opines a category, and our testing is negative, that doesn't mean that the evaluation was incorrect; it likely points to our toxicology is lacking." [50T80]

1. "Cut off" levels

One limit to toxicology confirming the presence of a drug can be the quantity required for the laboratory to report a positive result. The laboratory will set a "cut off" level for the quantity of each substance tested, which is the decision point between positive or negative. [28T216-28T216; 29T30-29T33; 50T73] A drug or its metabolite may be present in a sample, but if it is in a quantity below the cut off level, the laboratory will report a negative result. [28T216; 50T73; 51T59]

Miles gave an example from her own laboratory shortly after she first became involved with the DRE program in 2004. [50T73-50T74] After comparing the test results for THC with associated DRE reports and researching what colleagues in other laboratories were doing, her laboratory determined that the cut off level it was using for THC was too high and it was underreporting the presence of THC in its toxicological reports. [50T73-50T76]

Similarly, some drugs can be present at a level that is toxic but still in such a small concentration that the laboratory may not be able to detect it. [50T184; 51T32] Fentanyl and fentanyl analogs, for example, are synthetic opioids as to which use has been steadily increasing in recent years, but they are difficult for laboratories to detect. [50T185-50T186; 51T50-51T51; S-375]. These drugs can be toxic at very low concentrations, making them "potentially fatal overdose drugs" that laboratories "simply can't see well enough to detect them." [50T184]

In some cases, a drug can "be at an impairing level even if it is below the level that can be detected by forensic testing." [51T16]

2. Quick dissipation

Some drugs metabolize rapidly and their remaining indications in a biological sample may be too low for the laboratory to detect. [50T81] Laboratories will look for metabolites in those circumstances, but finding the substance can be "a big challenge." [50T82]

For example, some synthetic cannabinoids can dissipate very quickly. [50T104] Cocaine and the major metabolite of heroin also dissipate very quickly and may not be detectable if the sample is not collected shortly after use. [28T178-28T179; 50T186] Given enough significant delay in obtaining

and testing a sample, a drug could dissipate to the point where the laboratory could no longer detect it in a sample. [50T214]

3. New drugs

Novel psychoactive substances (NPS), also known as designer drugs, are "new compounds or substances that are used as drugs of abuse that are not scheduled or controlled and are usually synthesized in a clandestine manner, meaning it's not Merck, it's not Pfizer, it's not a regulated place." [50T82] Without sufficient information, laboratories cannot detect any NPS. [51T54-51T57; 51T59]

According to one August 2018 study admitted into evidence:

> The use of novel psychoactive substances (NPS) has grown in popularity throughout the past decade. As of December 2017, there were 779 NPS registered to the United Nations Office on Drugs and Crime (UNODC) Early Warning Advisory on NPS. Synthetic cannabinoids are the most common NPS and are a structurally diverse class with over 250 specific cannabinoids reported to be available. Illegal laboratories make simple modifications to one or more structural components to mimic the effects of Δ9-tetrahydrocannabinol (ΔTHC), evade laboratory detection, and challenge law enforcement, regulatory frameworks, and medical care providers. These new designer drugs are commonly referred to as either "K2" or "Spice".
>
> [S-346 at 2 (footnotes omitted).]

Miles explained:

> Again, even with the best and greatest innovations in technology, there are constantly chemical changes occurring to either drugs that exist or newly synthesized drugs that simply evade our ability to detect them.
>
> It could be concentration. It could be its fragmentation pattern we're just not familiar with. It just sort of depends.
>
> [50T81-8 to 15.]

There are organizations that track and report on NPS as information becomes available, but it is difficult to "stay on top of it." [50T84-50T85]

And even when laboratories are aware of an NPS, they cannot immediately test for it. Developing a validated method to test for a new drug is "a pretty long and labor-intensive process" that "just takes time". [50T24-50T25; 50T74; 50T212; S-377 at 443] Laboratories need to first identify any new drug for which they "want to try to pursue testing," then create a method for doing and validating the test "to ensure the testing is accurate and complete." [50T23] They may also need to purchase equipment or tools specific to various NPS in order to identify them, but with NPS "what's prevalent one month may not be seen for the rest of the year." [29T23-29T24]

In addition, reference standards might not be available for NPS. [29T24; 29T27-29T29; 50T173] Verdino testified that she has had the experience of contacting reference material manufacturers only to be told the company was

not aware of the NPS or what metabolites were excreted by it. [29T28] The manufacturer will often not create a reference standard for an NPS until it gets many requests from laboratories because "[i]f they don't know it's prevalent or being abused or that we need it, it's not cost-effective for them to make all sorts of different reference materials if they're not going to be purchased." [29T28-29T29]

In the past few years, the creation and use of synthetic cannabinoids have "really exploded" on the NPS landscape, with hundreds now in existence. [29T18; 29T22; 50T83; 50T103; S-377 at 440-41] Synthetic cannabinoids are only created illicitly because there is "no medicinal purpose" for them. [50T101-50102] Miles explained that detecting the presence of a synthetic cannabinoid in a sample can be difficult because a laboratory might focus on a parent compound that could dissipate quickly, but the many different variations in the drugs complicate identifying the metabolites. [50T204] The laboratory analysts may not know which variety of synthetic cannabinoid "is trending" at any given place and time, "[s]o to know what chemical structures to be looking for is always difficult." [50T104]

Verdino testified that the OFS toxicology units "do not pursue synthetic cannabinoids in toxicology." [29T20-29T21]. She explained:

> At least five years ago we did an evaluation on synthetic cannabinoids, specifically, the JWH line of

> synthetic cans. And we discovered that the ever-changing face of synthetic cannabinoids was too daunting for the laboratory to keep up with. There's so many being derived every day, and we couldn't – sorry – with a screening test we couldn't keep up.
>
> And the manufacturers of the screening tests couldn't keep up. The manufacturers of the certified reference materials couldn't keep up. And this type of class drugs needs a specific pretreatment in order to see the drug in biological matrices.
>
> [29T21-6 to 17.]

Other issues, such as the fact that synthetic cannabinoids metabolize into compounds that are either not detected or need a "secondary treatment" to be detected by the laboratory's equipment, increased the difficulty the OFS toxicology units had in testing. [29T21-29T22; 29T25-29T26] "So it was decided that the amount of time needed, and money, to confirm these novel drugs just wasn't effective for our scientists to pursue." [29T22]

Other "designer drugs," such as fentanyl analogs and "many benzodiazepines," have no medicinal purpose but are nevertheless used "on the street." [29T19]. The OFS makes an effort to track and analyze drug trends and patterns in its casework, but testing for new drugs takes time. [29T59-29T61] For example, the OFS toxicology units did not routinely screen for fentanyl until 2019, although its use began before that. [28T214; 29T38] Because of the opioid epidemic and the increasing prevalence of the drug, OFS

"focused on getting a screening validated and implemented to test for fentanyl," which it was encountering in "upwards of 25 percent of our cases." [28T234-28T235]

4. Other practical considerations limiting testing

Some drugs may evade detection through toxicological testing due to limitations imposed by equipment, funding, and other practical considerations. For example, the OFS toxicology unit tests do not detect the presence of LSD because the drug "is ingested in very small amounts, and our instrumentation cannot detect those low quantities." [28T231-28T232] Verdino testified that a liquid chromatography/mass spectrometry (LC/MS) instrument would likely be able to detect LSD, but the OFS only has two of those instruments, used for other testing purposes. [28T232] To ensure fair treatment throughout the state, the OFS would need to equip all four of its toxicology units with LC/MS instruments before any could use one. [28T233; 29T75]

The OFS toxicology units routinely screen samples for fourteen drugs or drug classes, but there are some CNS depressants and narcotics that would not be detected by the screening tests. [28T213-28T214; 28T221-28T222; S-101 at 41]

Also, in New Jersey, the toxicology units will not test a sample for drugs in the inhalant category unless it has information that the DRE opined that the

subject was impaired by an inhalant. [28T206] If the DRE gives that opinion, the sample will be sent to "a different laboratory" for testing, but otherwise toxicology will not reveal drugs in the inhalant category that may be present. [28T206]

The OFS must do a cost-benefit analysis to ensure that its toxicology units are screening for prevalent drugs such as fentanyl, the trade-off for which might be not screening for some lesser used drugs. [28T234-28T235] The toxicology units "used to test for propoxyphene, which is Darvon, for many, many years," but it stopped because it was so rarely seen that performing a routine test for it "was wasted money." [28T235] Similarly, the toxicology units no longer screen for methylenedioxymethamphetamine (MDMA) because its use is no longer prevalent. [28T214]

Miles noted that not all laboratories have the same, or even sufficient, instrumentation. [50T44-50T45] She testified that her laboratory in Wisconsin generally has "more innovative and newer technologies than crime labs" across the country, but even her lab has trouble detecting NPS. [51T20; 51T58] Also, many laboratories do not receive adequate funding. [50T189] This makes it particularly challenging to purchase innovative equipment and to acquire the personnel required to implement it. [50T192]

In New Jersey, the OFS has six laboratories throughout the state, four of which "house drug and toxicology units." [28T171] These laboratories are internationally accredited under ISO 17025 standards by the ANSI National Accreditation Board. [28T172-28T173][30] Forensic laboratories are not obliged to receive or maintain such accreditation, but Verdino explained that it gives the general public confidence that the laboratories are "following certain procedures that are standardized and generally scientifically accepted within the community." [28T172-28T173] Such accreditation is one way to ensure that the OFS toxicology units produce valid and consistent results. [29T107; 50T193]

VII. TOXIDROME RECOGNITION

A. Preliminary Discussion

In section IV, Background to DEC Program, it was shown that the drug recognition matrix, now commonly referred to as the DRE matrix, was first developed in about 1987, and has remained substantially the same ever since. [S-44, Appendix F] Attached as Appendix G is a related document entered in

[30] The OFS website explains that "[t]o be accredited a laboratory must follow and stay compliant to the over 500 ISO 17025 International Standards, in addition to ANAB supplemental requirements." https://nj.gov/njsp/division/investigations/forensic-sciences.shtml (last viewed August 11, 2022)

evidence as S-45 entitled "Drug Evaluation and Classification Drug Category Examples," which DREs use as a reference source listing examples of commonly used drugs in each of the seven categories. [26T113] The categories are "classified through the IACP and medical community" based upon "[t]he pattern of effects, signs and symptoms, general indicators that are based off of medical research." [26T113-26T114]

In the Frye analysis, the scientific communities to which these drug classifications belong, and for which the State is obligated to prove their general acceptance, are the fields of medicine and toxicology. The evidence has established that there is nothing new in the medical and toxicological fields about classifying toxic drugs into categories based upon the effects and manifestations they cause, rather than other characteristics such as therapeutic usage or molecular structure. What is new in the context of this case is that neither the Appellate Division nor the New Jersey Supreme Court has issued an authoritative opinion on whether the classifications in the DRE protocol comport with similar classifications that have been generally accepted in the medical and toxicological communities.

That is the first inquiry that must be analyzed. As part of the analysis, it must also be shown that the expected signs and symptoms within each of the categories in the DRE matrix are those that the medical and toxicological

communities have also generally accepted. If the State has established that the seven categories and the signs and symptoms generally associated with each of them are consistent with what has long been established and generally accepted in the medical and toxicological fields, then the State has established the reliability of the framework upon which the DRE protocol is based.

There is nothing in the evidence to establish that the medical community has directly generally accepted the DRE protocol as a valid and reliable classification of toxic drugs.[31] This is not because there is debate or disagreement within the medical community. It is because the DRE protocol is basically unknown to the medical community. When Nelson, the State's emergency physician and medical toxicologist, was asked whether "the medical field generally accepts the way DREs do things," he responded, "I don't think the medical field thinks much about DREs, honestly." [46T106] Indeed, most doctors just do not know anything about the DECP, as Nelson did not before he got involved in this case.

[31] The State placed in evidence a 2010 resolution of the American Optometric Association [S-146] and similar resolutions or memoranda of various state or county optometric or medical associations issued between 1994 and 2017 [S-147, S-148, S-149, S-150, S-151, S-152] supporting or endorsing the DRE program. These are very cursory and boilerplate documents, and little or no testimony was provided regarding the circumstances of their adoption. I attribute no weight to them in my analysis in this case.

Nevertheless, the State's medical experts have provided very persuasive opinions that the DRE protocol would be accepted in the medical community because the DRE classifications and corresponding signs and symptoms are very comparable to and consistent with what has been generally accepted in the medical community. Indeed, the two medical experts for the defense, an emergency physician and an ophthalmologist, have generally agreed with this proposition. Although each of them has taken exception to some of the particulars, they have expressed their general position that the DRE categories and associated signs and symptoms accord with similar matrices that are generally accepted in the medical community.

If that first inquiry results in a finding of reliability of the DRE matrix itself, the second inquiry is whether DREs can be and are adequately trained to make the assessments required by the DRE protocol in order to reach a reliable opinion, based upon the DRE matrix and other information, as to which one or more classifications are likely responsible for the observed impairment of a subject.

Before making the two analyses referred to above, it is helpful to make clear at the outset what the definition of "impairment" is in the context of the DRE protocol and, more broadly, as an element of a violation of N.J.S.A. 39:4-50 for driving while "under the influence of intoxicating liquor, narcotics,

hallucinogenic or habit-producing drug." Throughout the hearing, defense counsel and some defense witnesses have argued or testified that the DRE protocol is deficient for not containing a clear definition of "impairment." Arguments have been made that there is no "medical" definition utilized, and no clear and objective definition utilized in the DRE materials or in many of the studies that have been done. For example, Adams, the ophthalmologist produced by the defense, testified that "[t]he word 'impairment' is not clearly defined in the DRE program and DRE literature," and he said this is an important shortcoming "[b]ecause if you're trying to classify somebody as being impaired, you have to know, well, what does being impaired mean?" He quoted the medical definition set forth by the American Medical Association as "a deviation, loss, or loss of use of any body structure or body function in an individual for a health condition, a disorder or a disease." [61T39-61T49] These positions are baseless.

The DRE materials define impairment as "[o]ne of the several terms used to describe the degradation of mental and/or physical abilities necessary for safely operating a vehicle." [S-42 at 9] When cross-examining two State witnesses, Page and Gibson, defense counsel elicited testimony that this definition was derived from the California Vehicle Code, not from a medical

or scientific source, and suggested it was therefore a law enforcement definition. [23T89-23T91; 27T165-27T167]

Verdino, a toxicologist, testified that the general definition of "impairment" is "a diminished ability to perform a task." [28T167] Nelson, an emergency physician and medical toxicologist with extensive experience and expertise with toxic drugs and their effects on individuals, similarly described the general definition of "impairment" as "the inability to perform a task as one normally would." [46T77] He continued to explain that impairment is "task-specific," and someone can be impaired with respect to one task but not with respect to another. [46T77] Thus, the "degree of impairment depend[s] on the complexity of the task that's being performed." [46T77-46T78] For example, he noted that walking is a pretty simple task, but walking through an obstacle course is more complex. Driving is "certainly more complicated than walking." [46T78] Nelson explained further:

> Q. Sorry, Doctor. So could you tell us what is it about driving and what it entails that makes it a complex task?
>
> A. As I was saying, part of it is the speed at which this is being done. And a lot of it has to do with the amount of information that has to be processed in a given period of time.
>
> You know, if you're sitting in a chair, there's not much that is going to happen. If you're walking, you

have to look out for bumps in the road. But you're doing it at a walking pace.

If you're driving, you have to look out for potholes at 60 miles an hour, not to mention other cars coming at you, traffic lights, the rearview mirror, the music playing on the radio. So the more sensory inputs you have, the more complex and divided your attention might be to the task at hand.

Q. Okay. I guess, do different categories of drugs cause different kinds of impairment that are relevant to complex tasks such as driving?

A. They cause different and similar sorts of impairment. I mean, most of them impair your judgment, which is a big part of that, you know, executive functioning you need in order to do things.

So I think in – I can't think of many drugs and substances that we use that don't impair your judgment. And some impair your performance, your – you know, your ability to react quickly to a changing situation. Some impair your level of consciousness in both directions. I mean, people could be too stimulated or too sleepy to drive, for example.

[46T80-5 to 46T81-10]

Fiorentino, a research psychologist produced by the State, explained how a driver's attention is divided between a "tracking task" and a "peripheral task:"

Well, the very nature of driving is a divided attention task. As we drive, we do many things at the same time. We maintain lane position. In other words, we don't veer off our lane. We have to maintain the vehicle, you know, between the lines of our lane. We

> maintain speed so that we don't crash into vehicles in the front or have vehicles in the back crash into us. We monitor the environment for what's going on – an obstacle, a child playing ball with the ball crossing the street. And we make judgment calls on what is safe at any given time.
>
> [47T71-21 to 47T72-6]

In the end, the controlling definition of impairment and "under the influence" is a legal one. N.J.S.A. 39:4-50(a) contains no definition, and thus the definition has been fashioned by the Supreme Court and is well settled, dating back more than a half century. The Court has utilized the same concepts described in the testimony of the State's witnesses mentioned above. The definition is of necessity a general one, and it is completely consistent with the definition in the DRE materials. It applies whether the offense is for driving while under the influence of intoxicating liquor or under the influence of drugs. As the Court explained in a 1975 case involving driving under the influence of drugs:

> The language "under the influence" used in the statute has been interpreted many times. Generally speaking, it means a substantial deterioration or diminution of the mental faculties or physical capabilities of a person whether it be due to intoxicating liquor, narcotic, hallucinogenic or habit-producing drugs. In State v. Johnson, 42 N.J. 146, 165, 199 A.2d 809 (1964), an intoxicating liquor case, we stated that "under the influence" meant a condition which so affects the judgment or control of a motor vehicle operator as to

> make it improper for him to drive on the highway. More recently, in State v. DiCarlo, 67 N.J. 321, 338 A.2d 809 (1975), we held that an operator of a motor vehicle was under the influence of a narcotic drug within the meaning of N.J.S.A. 39:4-50(a) if the drug produced a narcotic effect "so altering his or her normal physical coordination and mental faculties as to render such person a danger to himself as well as to other persons on the highway." Id. at 328, 338 A.2d at 813.
>
> [State v. Tamburro, 68 N.J. 414, 420-21 (1975).]

Our courts continue to routinely apply the standard articulated in Tamburro in both drug and alcohol cases. See State v. Franchetta, 394 N.J. Super. 200, 202, 206 (App. Div. 2007) (affirming trial court's finding that "while defendant was not 'high,' he was physically impaired as a result of ingesting cocaine" because the "rebound" or "hangover" effects of the drug "included slurred speech, uncoordination, and lack of coherency"). See also, e.g., State v. Morris, 262 N.J. Super. 413, 421 (App. Div. 1993) (finding evidence of slurred speech, loud and abrasive behavior, disheveled appearance, bloodshot eyes, and strong odor of alcohol on the defendant's breath sufficient to sustain a conviction for DWI); State v. Cryan, 363 N.J. Super. 442, 455-56 (App. Div. 2003) (same); Div. of Motor Vehicles v. Lawrence, 194 N.J. Super. 1, 2 (App. Div. 1983) (noting that the term driving "while impaired" in another state's statute had substantially similar meaning to driving "under the influence" in N.J.S.A. 39:4-50(a)). "The statute does not require that the particular narcotic be identified." Id. at 421.

Thus, the definition of impairment or under the influence in the DRE context is whether the subject of the evaluation is experiencing a "substantial deterioration or diminution of the mental faculties or physical capabilities" as a result of the ingestion of any drug or drugs to the point where driving is "improper" or a "danger" to the subject "as well as to other persons on the highway."

Indeed, when counsel for the State read some of these definitions to the defense emergency physician, Guzzardi, and asked whether they described the proper tests for impairment in the context of driving a motor vehicle, Guzzardi said, "I agree with that definition, and it seems to be very reasonable to me." [60T52-60T53]

One further note on proofs required for a violation of N.J.S.A. 39:4-50. In an alcohol case, it has long been acknowledged by our courts that proof of the quantity of alcohol in a person's blood is not required, although an alternative means of proof is through a per se test on a properly calibrated and operated Alcotest device. In what is commonly referred to as an "observational" case, where there is no Alcotest reading in evidence, proof of intoxication can be established by observations that anyone can make, whether a layperson or police officer, based upon the common knowledge people have long had of indicia of alcohol intoxication. These include such things as slurred speech, staggering, bloodshot eyes, impaired coordination and balance,

and the like. And, in most alcohol cases, proof of consumption of alcohol is easily established, typically by the odor of alcohol on the defendant's breath or an admission of consuming a small quantity of an alcoholic beverage, which is perfectly legal (e.g., "a couple of beers").

With drugs it is different. The effects of various drugs or drug categories are not within the common knowledge of laypersons. The many signs of impairment, including those typically exhibited by a person impaired by alcohol consumption, are observable to laypersons, but the connection of those indicators to the ingestion of any one or more drugs is beyond the knowledge of laypersons. There may or may not be other evidence from which an inference could be drawn that observed impairment was caused by the use of drugs, such as admissions or finding drugs or drug paraphernalia in the car or on the person of the defendant. However, admissions are often ambiguous or disputed, and other evidence as well may not support an inference of drug use as the cause of an individual's observed impairment.

The DRE program has been developed as a means of enabling the State to place before the court evidence from a specially trained police officer who can provide a reliable opinion, based upon criteria that are generally accepted in the medical and toxicological communities, that the impairment the officer

observed in a subject was likely caused by the ingestion of one or more impairing drugs contained in one or more of the seven categories.

N.J.R.E. 702 allows for expert testimony by a person possessing "scientific" knowledge, "technical" knowledge or "other specialized" knowledge if it will assist the trier of fact to understand the evidence or to determine a fact in issue. The rule further provides that such a witness must be qualified as an expert by "knowledge, skill, experience, training, or education." In the context of DRE testimony and the issue in this case, two categories of expertise are implicated. As argued by the State, a DRE testifies and renders an opinion based upon his or her specialized knowledge regarding a fact in issue, namely whether the defendant was under the influence of an impairing drug at the time of operation. However, the validity and admissibility of the DRE's opinion must be based upon scientific expertise provided by experts in medicine and toxicology. Therefore, it is necessary in this proceeding to assess the general acceptance and reliability of the medical and toxicological science that underpins the DRE training and the opinions DREs seek to express in court testimony. And, as a corollary, it must also be determined whether police officers can be and are adequately trained to administer and assess the scientifically based portions of the twelve-step protocol.

If the evidence in this case establishes that the State has proven the general acceptance and reliability of both the protocol and the training, DREs would be permitted to provide expert testimony based upon their specialized knowledge, which they have acquired through their training, education and experience. If the Court ultimately finds that the DRE protocol is reliable, and that the scientifically based aspects of it are generally accepted in the relevant scientific communities (primarily medicine and toxicology) the Court will essentially have taken judicial notice of the reliability of the scientifically based components of the protocol. This would obviate the need for prosecutors to produce medical and toxicological experts in individual cases.

Thus, for example, looking at S-44 [Appendix F], it will have been established that in the medical field, both generally and within the sub-specialties of medical toxicology and ophthalmology/optometry, HGN is typically exhibited when a person has taken CNS depressants, dissociative anesthetics or inhalants, but not when a person has taken CNS stimulants, hallucinogens, narcotic analgesics or cannabis. Likewise, muscle tone is likely to be flaccid with CNS depressants or narcotic analgesics, but rigid with CNS stimulants, hallucinogens or dissociative anesthetics. With cannabis, muscle tone is expected to be normal, and with inhalants, it might be normal or flaccid.

Naturally, these specific indicators are not always present in all people who use drugs in the different categories. There are many factors at play, including tolerance, general physiology, metabolism rates, time and dosage taken, and the like. Also polydrug use further complicates the analysis, and the evidence has shown that most drug users typically use more than one drug at a time. Verdino, for example, commented that when testing for drugs in New Jersey "we see polydrug use more often than not." [29T45]

Laypersons, including police officers, would not know these things without the specialized training DREs receive. But the underlying science that is taught in those training sessions must be established as reliable and generally accepted in the relevant scientific communities to withstand Frye analysis in this context.

B. General Acceptance in the Medical and Toxicological Communities

I will now address the first aspect of the toxidrome recognition issue, whether the seven drug classifications in the DRE matrix and the expected signs and symptoms generally associated with each of them comport with comparable matrices that have been generally accepted in the medical and toxicological communities.

As stated in the introduction section of this report, some of the debate or skepticism about the origins and development of the DRE program appears to

be based on the perception that it was created by police officers and a small group of researchers who were being funded by NHTSA and were biased and were providing reports favorable to what NHTSA was seeking. This perception seems to discount or disregard the fact that substantial medical input from various specialties and disciplines were received throughout the development process, and that this input was bona fide and taken seriously and incorporated into the creation of the matrix, breaking down the impairing drugs into seven distinct categories and itemizing accurately, as generally accepted in the medical and toxicological communities, the signs and symptoms likely to be observed by individuals using drugs in each of the categories.

To the extent that any such perception has existed over the years and whether it continues to exist today, the medical testimony in this case makes it abundantly clear that the seven toxidromes in the DRE matrix are generally accepted in the medical and toxicological communities and that the signs and symptoms associated with them (both specific manifestations and general indicators) are those that are generally accepted in these communities. Indeed, there was really no dispute on this point.

Nelson explained that the term toxidrome "is a contraction of toxicological syndrome" and is used interchangeably with "toxic syndrome." [42T38-42T39]

He explained that a syndrome is "a collection of findings that will help define an entity" that medical professionals recognize through collecting information and performing tests, giving as an example a migraine headache syndrome, which would be different than a tension headache syndrome. [42T39-42T40] A syndrome is typically "suggestive of a diagnosis" rather than a clear-cut diagnostic test. [42T41-42T42] However, "in the right clinical context with the right supportive information, syndromes are essentially diagnostic." [42T42]

A toxic syndrome or toxidrome is "a syndrome due to a toxin" or a "toxicant." [42T41-42T42] There are many recognized toxidromes, including "some classically defined ones." [42T41] Nelson gave an example:

> Like the opioid toxidrome would be a nice one where we think about somebody who's got a depressed level of consciousness, they have small pupils, they have depressed respiratory drive, they might have absent or reduced bowel sounds. And those things together, when you see them, while they may not be pathognomonic, meaning diagnostic for, that syndrome, they're very representative of that syndrome; and in the right context, they're essentially diagnostic.
>
> [42T-11 to 20.]

Toxidrome recognition is "widely used in most medical specialties," including emergency medicine in particular. [42T40] Nelson explained that, with respect to drugs of abuse:

> Well, they interfere with our normal physiological process. For the most part, I think it's probably safe to

> say that all drugs of abuse have effects on the brain and on our emotions and perceptions and things like that. So while they might have effects on other organs and organ systems, for the most part drugs of abuse have effects on our brain. So they get into the brain, and they change the way the brain works to cause very specific syndromes that we see when people use those drugs.
>
> [42T44-19 to 42T45-3.]

Nelson testified that toxidromes are generally accepted in the medical community and the medical toxicology community. [42T47]

Guzzardi agreed that in medicine toxidromes are developed, representing a combination of symptoms that are typically observed with use of "drugs or other toxins." He said they represent "classic manifestations of particular types of drugs because those drugs have numerous effects on the physical and central nervous system" and, therefore, drugs can be categorized by the "combination of their physical and mental characteristics." The use of such toxidromes are designed to help practitioners determine the cause of impairment and "they are absolutely accepted in medicine." [60T108] Guzzardi further acknowledged that the arrangement of drugs in these categorizations are "not developed through peer-reviewed journals or anything like that; they're developed through real life." [60T109] He said the steps in the DRE protocol track what a doctor would do with a patient who might be suffering from the effects of ingesting a toxic substance. The first step is to

take a history. He said it is generally accepted in medicine that the "history is 80 percent of medicine." [59T11] He also agreed that the seven DRE toxidromes and their listed signs and symptoms are substantially accurate. [60T115-60T116]

Guzzardi acknowledged that the use of a toxidrome matrix and the practice of toxidrome recognition is generally accepted in the medical community, and it should not be expected that every symptom listed would be exhibited or, if it is exhibited, it might have a different cause. [60T109-60T112] Further, he acknowledged that you look at many symptoms and characteristics exhibited by the patient until you meet a certain critical mass indicating that the condition is probably caused by a toxidrome of a certain type of drug or drugs. [60T112-60T113] Finally, Guzzardi said that using the toxidrome recognition procedure, the doctor could be wrong but often would be right and, although it is not a hundred percent foolproof, "[y]ou can make a reasonably accurate tentative diagnosis using the toxidrome." [60T113] The doctor would then order laboratory testing or perform other tests in an effort to confirm the diagnosis. [60T114-60T115]

When Guzzardi was asked why that is not exactly what DREs do under the DRE protocol, he answered:

> A. I would agree that the methodology, history, physical, and laboratory testing are somewhat similar.

I would say that the competence of the individual doing the testing would be markedly different in a medical situation. I would say the thoroughness of the history would be markedly different, the ability to understand the nuances of the physical examination would be markedly different, and that certainly the testing that would be done in the DRE would be different.

. . . .

Q. You would agree with me, though, that that protocol is the protocol used in medicine despite your concern that the people doing it just aren't very good?

A. Yes.

[60T115-11 to 60T116-1]

Guzzardi's bottom-line opinion about the entire DRE protocol and the toxidrome matrix it utilizes can be summed up in the following colloquy:

Q. But you've already said that the individual components are very similar to the components of a medical exam and a significant portion of the rest of the protocol outside of the SFSTs are exactly what medicine does?

A. I did.

Q. And so you would agree with me that the method that the DRE is using is the same method that is used in medicine and is generally accepted in medicine?

A. It's similar to the methods used in medicine, and those methods are time-tested in medicine.

[60T118-12 to 22]

And later:

> Q. So you would agree with me, then, that the 12 steps of the DRE protocol are either similar or the same as the steps that would be used in the medical profession. And the real issue that you have with the DRE program is sometimes the DRE evaluators aren't as good as doctors?
>
> A. I would say that would be a summary of my opinion, yes.
>
> [60T148-11 to 18]

Notably, Guzzardi acknowledged that in 1979 he authored an article entitled "A Novel Approach to the Problem of Heath Care in Jails." At that time, he was an assistant professor at the University of Kentucky, and he was also an active practicing emergency physician. In his testimony, he said these jails in Kentucky were very small operations and the people that ran them were referred to as "jailers." He compared them to "mom-and-pop" operations. As he described it these individuals were "real laypeople," and were nothing like "the sophisticated correctional officers we have today or the – certainly not for police officers. I believe that they're so much better educated and trained than were the jailers." [60T144 to 60T146]

Guzzardi helped to design a thirty-hour course to teach these jailers how to recognize common medical emergencies. [60T145] Among the topics taught in this course were recognizing symptoms of drug overdoses and drug

withdrawal, alcohol ingestion, barbiturate ingestion and tranquilizer ingestion. The course was taught by using toxidromes. He acknowledged that the jailers were taught to consider many factors because "you don't just want to take a quick glance at someone and reach a conclusion." [60T147]

The defense ophthalmologist, Adams, discussed the aspects of the DRE matrix pertaining to the various eye examinations in the DRE protocol. He stated that matrices of this type are used in medicine as a guide, namely as a screening tool, but never as a diagnostic tool. He referred to these matrices as "a nice tool," but "[y]ou can't hang your hat on it." He stated that a screening tool can help guide you "to say, okay, there's a possibility that this individual might have this condition" whereas "[a] diagnostic tool is a tool that's used to say with some sort of certainty this individual has this condition." [61T50 to 61T51] He continued that the DRE matrix is "well-intended and there is data that supports we can use it to guide." However, he insisted that only a diagnostic tool, which has "some degree of certainty," can be relied upon. [61T51-61T52]

Adams also expressed the view that laypersons, including police officers, simply cannot be trained to assess the eye movements in a matrix such as this for the purpose of finding impairment. [61T54-61T56] Of course, the purpose of the matrix is to consider all signs and symptoms, not only those

exhibited by the eyes, as part of a basis for reaching an opinion that the subject likely ingested one or more drugs in one or more of the categories listed in the matrix. The fact of impairment is based upon the DRE's observations of the subject, both generally and in the performance of various psychophysical tests, along with the scientifically related steps in the protocol, including such things as vital signs, muscle tone and eye movements.

Nelson expressed a very different view of the significance and role of the matrix. The fundamental distinction is inherent in the definition of a diagnostic test, as distinct from the practice of toxidrome recognition. Nelson explained that in the medical field such things as x-rays, blood tests to detect cholesterol levels, and antigen tests are diagnostic tests because they are "typically fairly objective." They have performance characteristics that are generally very good, "but they tend to rely on a definitive objective standard whereas toxidrome recognition requires piecing together certain pieces of information that individually might be objective or slightly subjective but together paint a coherent picture." [46T64-46T65] As Nelson expressed it, "If there's a test to order I would say yes. Not everything has a test, but if it does, we would order it." [46T24] Thus, if the preliminary diagnosis is a broken arm, "you order x-rays to confirm that." [46T24] However, when asked what

you do if there is no definitive test that exists to confirm your initial assessment, Nelson said:

> It's common. I mean, pretty much the word "syndrome" implies that there's no diagnostic test. So everything we call syndromes – and toxicological syndromes are a good example. There really is little in the way of truly credible real-time testing that will help us make a decision as to the actual diagnosis. So we base our decision on next steps based on our syndromic analysis.
>
> [46T24-8 to 18]

This fundamental viewpoint is completely consistent with the credible and undisputed testimony of the toxicologists in this case, namely that not all drugs can be tested for and testing will not always reveal the presence of an impairing drug even if it is present in the person's system. This could be because the amount still in the person's system when the sample was given had dropped below the cutoff level for which the lab tests, or because of an undiscovered and unknown designer drug for which the lab cannot possibly test, and so forth. Thus, Nelson's basic premise is that testing for drugs is not like having the availability of a clearly objective test such as an x-ray or MRI. It is good to "support our diagnosis" made through our toxidrome recognition analysis. [46T90-46T91] However, he recognized that the expected signs and symptoms in each toxidrome category do not always manifest themselves the same way in different people or even in the same person at different times with

different dosages, polydrug use, or other factors. [46T240-46T242] He explained that "when you see these findings in combination in the right patient, they largely predict the category they're listed in." [46T242] However, "[t]hey're not perfect. They're syndromes. These are not objective diagnostic tests. But if you got back a [confirmatory] diagnostic test in a patient with this syndrome, then you'd feel pretty good about it." [46T242] He then went on to state examples: "We don't test for meperidine, for example. We would never find it. We don't test for fentanyl. We wouldn't find it." [46T242] Thus "if people come in looking like this, and we think they used fentanyl for various circumstantial reasons, that they're more likely than not – much more likely than not, probably almost diagnostically more likely to have used fentanyl." [46T242-46T243]

Whenever the subject of the applicable "gold standard" came up in this hearing, all witnesses who were asked said it is toxicological analysis. That is not because it is a definitive test. It is because it is the best test available in this context.

Nelson described the general procedure of toxidrome analysis conducted by doctors, in the course of clinical work, seeking to reliably arrive at a diagnosis of a particular category of drug use and develop a plan for care. [46T10-46T17] This begins with asking a patient why they are there, what is

their chief complaint, getting a medical history and asking what drugs or medications they have taken. [46T11-46T12] Nelson said that patients are not always honest about their drug use, and indeed are often not honest about a lot of their history, but mostly regarding drug use. [46T13] Nevertheless, it is information you must obtain in the best way possible. [46T13-46T14] If any one or more other individuals came in with the patient, you question them as well to get additional information. The same with emergency medical services personnel or police officers if they are present. [46T13-46T14; 46T93-46T94] Vital signs are taken, and the results also have a role in the toxidrome analysis. He explained how each of the vital signs might indicate one drug or another. [46T14-46T17] Throughout the discussion, he emphasized that none of these factors, individually or considering a few at a time, will reveal a reliable answer. The analysis must consider all relevant factors. [42T58; 46T19-46T21] And, throughout this description, Nelson emphasized that certain manifestations might have been caused by something other than drugs. [46T10-46T17]

The assessment of the patient continues with an assessment of their eyes, including pupil size and reaction to light, as well as eyeball movement. [46T18-46T19] He would then perform basic coordination tests, typically including the Romberg test, the finger-to-nose test, heel-to-shin test, and

examination of the patient's gait. [46T20-46T21] You listen for the content of their answers to your questions to assess their cognitive functioning and their manner of speaking, whether slurred or normal or something else. [46T21-46T22] Throughout the process, the doctor is analyzing the patient's condition, but never based on a single piece of information, because "we always want to get multiple perspectives on the problem." [46T19-46T21]

This process is the process that the DRE program was modeled after, and it is one that is regularly utilized and accepted in the medical community. It is also recognized as valid and generally accepted in the general toxicology and medical toxicology communities.

In the medical setting, medical professionals also consider external factors of which they become aware during their interaction with the patient. These are factors that are not directly associated to the toxidromes, but they can be helpful. For example, Nelson explained that track marks increase the likelihood that a patient's condition was caused by drugs as opposed to a medical condition. The same would be true, for example, if the patient or someone who brought the patient in said they found empty pill bottles nearby or white powder under the nose of the patient. [46T29-46T30]

Nelson explained that these procedures are standard processes in the medical field, followed by doctors and nurses in emergency rooms across the

country. This is what medical students and residents are taught. It is the process that is laid out in medical textbooks. [46T28-46T31]

Nelson further explained that the diagnostic tests that have the capacity to be definitive to either confirm or rule out the suspected condition have been tested and proven in terms of accuracy and precision and studied in diverse patient populations and diverse settings. Therefore, "we know how it performs when we apply it to our patients and patient populations." [46T31] If some suspected condition has a diagnostic test that's perfect, such that "[i]t's always right or always wrong," you get that test. [46T32] "But for things that don't have tests, that we just have syndromic analysis, it's a little softer to make that decision." [46T32] Thus, Nelson concluded that "[f]unctionally," in the context of searching for the presence of a drug in someone's system, syndromatic analysis or toxidromic analysis [is] the equivalent of a diagnostic test. [46T32]

Regarding the designation of toxicological testing as the gold standard, Nelson commented that "it doesn't have to be perfect, but it's got to be what we've accepted as the best answer we can get." He continued that, in the context of seeking to detect the presence of drugs in a person's system, the syndromic analysis is indeed "a diagnosis." [46T35]

Nelson's position is consistent with the testimony of both toxicologists, Verdino and Miles, that laboratories cannot be expected to pick up every drug that is opined by a DRE. Indeed, many of these drugs are unknown and have no reference standard or testing procedure. Polydrug use, which is prevalent with a majority of drug users, complicates the analysis further. The amount of the drug in a person's system may be below the cutoff level for testing. The drug may be of a type that metabolizes very quickly. These are but some of the reasons why the "gold standard" in this case is not a definitive test, and therefore not within the definition of a true diagnostic test. It may be confirmatory, or it may not. And, of course, it is also possible that a particular subject had not ingested any impairing drug or a drug in one or more of the categories opined by the DRE.

As previously discussed in the section V of this report dealing with DRE training, when the TAP was formulating various policies, including the pass/fail criteria for DREs-in-training during the field-testing portion of the training program, a seventy-five percent corroboration rate was established. Under that standard, after DREs complete all classroom training and pass their written examination, they also have to pass a field test before becoming eligible for certification. This typically spans a number of weeks during which the trainees assess a minimum of twelve subjects and evaluate them using the

first ten steps in the protocol under the supervision of an instructor. Then, for Step 11, they render their opinion as to whether the subject is impaired by drugs and if so in which category or categories. They would complete their DIE and toxicology would then be obtained.

The DRE opinion would then be compared with the toxicological results, and it is required that the trainee have corroboration in at least seventy-five percent of his or her cases. The certification match criteria requires that if the DRE opines one or two categories, the toxicology must reveal the presence of at least one of those categories, and if the DRE opines three or more categories, the toxicology must reveal the presence of at least two of those categories. [51T14; S-42 at 15] The DRE certification match is the more stringent of two criteria used in studies.[32] This standard takes into account an allowance for the limitations on chemical testing, as discussed in that section of this report.

The seventy-five percent level was recommended by the toxicologists participating in the development of the protocol. This was not an arbitrary standard. It was one deemed within the toxicological community as a

[32] The more lenient standard, referred to as the DRE impairment match, requires only that if the DRE opines the presence of one or more categories of drugs and toxicological analysis reveals the presence of any impairing drug, it is deemed a match.

reasonable corroboration rate. This standard remains in effect today, notwithstanding continuing dialog between toxicologists and others on the TAP and throughout the DRE program. Miles testified that the seventy-five percent standard for certification is appropriate mainly because of "limitations of toxicology testing," and also "just the general nature of drugs, how they can cross categories. And then pharmacokinetics within the ingestion of those drugs." [51T14-51T15] Thus, she explained why a more stringent standard, such as a perfect match, for example, should not be imposed:

> There's just too many variables that we can't control for that – you know, it's not like a laboratory study where we know what's been dosed and how much and when. There's still a lot of variables that are unknown. So to control for those, we allow the 75 percent.
>
> [51T15-12 to 17]

Miles then explained some of the variables, including concentration, cutoff levels, time of consumption, life cycle of various drugs, absorption, distribution, metabolism and excretion. [51T15-51T18] Miles, like other witnesses with long years of experience involving drug users, said that, based on her review of thousands of DRE cases, polydrug use was present "most of the time." This phenomenon also creates greater difficulty in identifying a specific drug category every time. [51T20-51T21]

In the course of Nelson's testimony, he gave a detailed analysis of the seven drug categories as they have been formulated in the DRE program. [42T79-42T87; S-36; S-45] He then referred to authoritative texts, including Goldfrank's, of which he is the lead editor. Nelson is also a co-author of Chapter 3, entitled "Initial Evaluation of the Patient: Vital Signs and Toxic Syndromes." [S-240] That source defines "toxidromes," coined from the phase "toxic syndromes" as "groups of signs and symptoms that consistently result from particular toxins." [S-240 at 28] The text further provides that "[t]hese syndromes are usually best described by a combination of vital signs and clinically apparent end-organ manifestations." [S-240 at 28; 42T50-42T51] Nelson then described the kind of manifestations that are looked for in the medical and medical toxicological fields, which are very similar to those contained in the DRE program, and he explained how, physiologically, the person's body is affected, thus resulting in the manifestations exhibited. [42T51-42T70]

Nelson compared the seven categories in the DRE matrix with the eight categories in the comparable matrix published in Goldfrank's. [42T81-42T82] He stated these were "essentially consistent" with each other and both are valid methods for delineating drug categories. [42T82] Indeed, he said that two of the categories in Goldfrank's could have easily been combined into one,

which would have made the similarity even much closer. He also noted that other medical texts might group toxins in slightly different ways, but "in general they're going to be very similar to one another. [42T80] He therefore concluded that the categorization of syndromes in the DRE matrix was valid and consistent with the similar matrix that is recognized and generally accepted in the medical and medical toxicological communities. [42T81-42T83] Nelson also reviewed the signs and symptoms listed in the DRE matrix, including the specific manifestations and general indicators, as well as qualifying footnotes. He stated that a comparison of the indicators listed in Goldfrank's to the indicators in the DRE matrix, both specific and general, including qualifying footnotes, matched up very well. [42T84-42T88]

Nelson then went through each of the seven DRE toxidromes explaining at great length and in great detail the effects on the body that result in the typical signs and symptoms that are shown. He continually referred to authoritative texts as his source of authority. These included Goldfrank's, of which he has been a contributing author to many of the chapters, including Chapter 3, explaining the signs and symptoms of the categories in the Goldfrank's toxidrome set-up. He also authored chapters in and relied upon Critical Care Toxicology: Diagnosis and Management of the Critically Poisoned Patient; Emergency Medicine: Clinical Essentials; and Rosen's

Emergency Medicine: Concepts and Clinical Practice. [42T31; 42T33-42T234; S-213; S-214; S-215; S-225; S-231; S-235; S-272; S-274; S-275; S-277] Based upon his extensive training and experience in medical toxicology and the principles and practices of toxidromic analysis, backed up by multiple authoritative sources, he concluded that the descriptions of signs and symptoms in the DRE matrix are similar to those which are generally accepted in the medical and medical toxicology communities.

He agreed with all other experts that the presence of drugs in a person's system cannot definitively establish that the drug is responsible for that person's condition. However, he opined that the presence can corroborate the clinical findings suggesting that condition. [46T90] He reiterated that a positive toxicological result "is something we like to add in to support our diagnosis," which was made based upon clinical findings. [46T90-46T91]

Nelson concluded his direct testimony by responding to a series of questions dealing with each step in the DRE protocol. [46T92-46T103] He was asked whether each step corresponded to what is generally done by medical professionals when a patient is suspected of having ingested drugs. In each case, he responded affirmatively, at least in general, and sometimes qualified by whether a particular assessment was indicated in light of the medical professional's goal to make a medical diagnosis and decide upon a

treatment plan. However, step-by-step he found nothing in the DRE protocol that was not used in the medical protocol either as a matter of course or where the clinician deemed it appropriate for a more complete evaluation.

With respect to Step 11, in which the DRE forms his or her opinion, Nelson agreed that in the healthcare setting doctors make a preliminary diagnosis, based upon their syndromic analysis, identifying a toxidrome based on the totality of their evaluation and all of the signs and clinical findings. [46T102-46T103] Generally, in the healthcare context, toxicological testing is requested that, as previously discussed, "can corroborate, but not alone prove a preliminary assessment of drug intoxication." [46T103]

Nelson stated that the steps in the DRE program are similar to the techniques utilized and the information gathered that go into toxidromic analysis. [46T104] He also agreed that "those techniques and information that are used [are] generally accepted in the medical community." [46T104] He also agreed that the clinical effects and general indicators listed in the DRE matrix could be indicative of drug intoxication and that they are the same clinical effects and general indicators that are considered by the medical community, and which are generally accepted by the medical community, as being relevant to a toxidromic analysis. [46T104-46T105]

One of the more controversial aspects of the DRE protocol is with the eye exams. Nelson, although not an ophthalmologist, is very well qualified to discuss the eye signs identified in the DRE protocol and their relationship to one or more of the seven categories of drugs in the toxidromic analysis. He is, after all, a medical doctor with particular expertise in medical toxicology, for which he was qualified as an expert, and in his knowledge of toxidrome recognition.

Nelson explained that when seeing patients in clinic, eye exams are not always indicated by the nature of the problem, but if they are indicated they would be performed and conducted in a manner very similar to how they are done under the DRE protocol. Likewise, he stated that the eye signs in the DRE protocol are "generally accepted in the medical community as relevant to determine a patient's condition and treatment," and in "assessing whether the patient's intoxicated and the potential source of that intoxication." [46T97] He stated that the eye signs as contained in the DRE protocol are generally accepted in the medical community as "a prominent feature of certain toxidromes," and "as a means of determining the presence of drugs . . . in a person's system." [46T97-46T98] Likewise, Nelson, testified that doctors, like DREs, conduct dark-room exams to assess pupil size and activity in reaction to different light levels, which is "generally accepted in the medical

community as being a means of assessing neurological function and evaluating toxidromes." [46T99-46T100]

Nelson's authoritative and persuasive testimony regarding the eye-exam component of the protocol was buttressed by more detailed explanations and opinions by Fraunfelder, an ophthalmologist, and Citek, an optometrist.

Fraundelder's qualifications are detailed in the portion of this report listing the witnesses, setting forth their qualifications, and commenting on the nature their testimony. I reiterate a few of his qualifying affiliations here for context. He is a member and former president of the International Society of Ocular Toxicology. He is the only ophthalmologist worldwide who is a consultant to the WHO. His affiliation is with a branch of the WHO named the Uppsala Monitoring Centre, in Uppsala, Sweden, which tracks drug side effects for every part of the body, not just the eyes. He consults with that entity regarding eye side effects. [40T17-40T18] He is also the director of the National Registry of Drug-Induced Ocular Side Effects. [40T28] Fraundelder has been a peer-reviewer for more than ten years for the Journal of Neuro-Ophthalmology, the subspecialty of ophthalmology dealing with central eye movements. [40T19] This topic is particularly significant with respect to the eye components of the DRE protocol, and Franunfelder's particular expertise in this area adds great weight to his testimony. Along with his ophthalmologist

father, Fraunfelder is the co-author of Drug-Induced Ocular Side Effects, which is periodically updated, and published its most recent eighth edition in 2020. [40T26; 40T32; S-119; S-120; S-128; S-131; D-593] Fraunfelder has been a participant with his father since the fifth edition was published. [40T32] This authoritative reference source catalogs the many thousands of legal and illegal drugs that cause ocular side-effects. [40T26-40T31] It is universally used by ophthalmologists, optometrists, medical doctors, and medical students generally around the country and is a leading source of this information. [40T30-40T31; 33T11; 33T31-33T32; 33T102; 33T105] In the book, the Fraunfelders classify the drugs based upon a 1976 article by Ralph Edwards in an authoritative journal, Drugs of Today, a publication for which Franufelder is currently an editor. [40T28] This classification system has been in use since 1976 and is generally accepted in the medical community. [40T28-40T29] In the book, each drug is classified "to say a side effect is certain or is probable or is possible or is unlikely or unclassifiable." [40T27] The classifications are formulated using peer-reviewed literature, data submitted to the Fraundelders' national registry website, and information Fraunfelder obtains through the WHO regarding side effects reported from drugs around the world. [40T26-40T29] Fraunfelder explained in detail how

each classification is determined and what it means to practitioners who utilize this reference source.

Undoubtedly, Fraunfelder is a leading expert in the recognition of the effects of individual drugs and categories of drugs on the eyes. He provided detailed testimony regarding the seven categories listed in the DRE matrix. He agreed that the classifications are consistent with those generally accepted in the medical community. He also agreed that the signs and symptoms attributed to each, including the specific signs, general indicators and footnote qualifiers, are also consistent with those that are generally accepted in the medical community. In rendering these opinions, he drew upon his own experience in clinical work, as well as his extensive research and writing on the subject. He has published more than one-hundred peer-reviewed articles, most of which have dealt with the toxic effects of drugs on the eyes, and he has participated in at least twenty clinical trials, mostly dealing with the side effects of drugs as they relate to the eyes. [40T20-40T22]

Fraunfelder testified regarding each of the eye signs that are addressed in the DRE protocol. These included eyelid tremors, an involuntary movement of the eyelids typically associated with THC-containing compounds; conjunctival injection, commonly known as pink eye or red eye, also caused by cannabis use; ptosis, commonly known as droopy eyelids, associated with the use of

narcotic analgesics, including fentanyl and opioids; mydriasis, namely dilatated pupils, commonly associated with CNS stimulants such as methamphetamine, amphetamine and cocaine, and occasionally with CNS depressants; miosis, which is constricted pupils or, when constricted to a great extent referred to as pinpoint pupils, associated with opioid use; lack of convergence (LOC) which is seen with cannabis and CNS depressants, such as alcohol, barbiturates or benzodiazepines, and also sometimes with inhalants; and nystagmus, which he defined as an involuntary movement of the eyes, consisting of jerking of the eyes in the fast phase and a contralateral movement in the slow phase, which he discussed at great length. [40T33-40T58]

With respect to each of these specific eye observations, he also said four other things: (1) it is generally accepted in the medical/eye vision care community that the specified drugs are associated with those specified observations; (2) making those observations is not at all difficult; (3) laypeople, including police officers, can be trained and are regularly trained rather easily in conducting all of those evaluations and accurately making those observations; and (4) there are conditions other than drug use, of which he gave examples for each of the eye observations, that could cause the same movements. [40T33-40T72]

Based on this last point, Fraunfelder went through a discussion of why doctors and other medical professionals always look for patterns and utilize this information in conjunction with other symptoms and other information. [40T48-40T55] Judging any of these points alone does not automatically prove that a particular drug has been ingested.

Steps 3, 4 and 7 in the DRE protocol contain provisions that require eye examinations. I will address steps 3 and 7 first, and then step 4.

Step 3 is a preliminary eye examination in which the DRE checks for unequal pupil sizes, unequal tracking, and resting nystagmus. [D-4 at pdf 151-58, 198, 272; S-48 at *pdf 97; 26T191-26T193; 26T208] The DRE moves a stimulus, which could be a pen-light, a pen, or a finger slowly from side-to-side and observes whether the two eyes are following it together in tandem. The pupil sizes are also compared to see that they are equal in size. An observation is made to see whether there is any resting nystagmus present, that is, without moving the eyes to maximum deviation. [26T225-26T226] Any irregularity on these assessments could be indicative of a medical condition, such as head trauma or a stroke, that might require medical attention. [D-4 at pdf 157; S-48 at pdf 50; 20T111-20T113; 26T234-26T237] As previously described, Fraunfelder opined that the procedure to make these assessments is easily done, and, in the practice of ophthalmology, ophthalmic technicians

typically perform this function. He opined that police officers can easily be trained to do so and make the necessary observations.

Step 7 is the dark-room examination, in which the DRE evaluates the subject's pupil size under three different lighting conditions, normal room light, near total darkness, and direct light. [D-4 at pdf 145, 186-87, 199-213; 21T25; 27T78-27T80] The DRE uses a card, with pupil sizes depicted on each side ranging from 1.0 to 9.0 mm known as a pupilometer. [S-52; Appendix E; D-4 at pdf 199; 21T25; 27T80-27T81] The purpose is to gauge whether the pupils constrict uniformly in direct light, dilate uniformly in dark light, reaching the prescribed ranges for each of those categories, and exhibit the prescribed normal range in ordinary room light.

Fraunfelder explained that as a general practice in clinical ophthalmology, the pupils are observed in a normally lit room with a bright light and a low light, and if any abnormalities are detected, they would then proceed to a dark-room evaluation to assess whether any significant medical condition might be present. [40T42] He said that is the main difference between what ophthalmologists do and what DREs do in this component of the eye-examination, but in all other respects it is similar and that "absolutely," ophthalmologists do dark-adapted pupil exams if they are indicated. [40T42-40T44] Fraunfelder also opined that these exams are easy to do, they can be

done by a layperson who can be trained to observe pupil size differences, and the observations are easy to make. [40T44] Indeed, in his clinical work, an ophthalmic technician performs this evaluation, using a card with pupil sizes ranging from 1 to 10 mm. [40T43] Fraunfelder concluded that this component of the eye exams in the DRE protocol is substantially similar to what is done in medical practice.

Step 4 is probably the most controversial aspect of the eye exams. It requires the DRE to assess (1) HGN, which contains three components, testing for (a) lack of smooth pursuit, (b) nystagmus at maximum deviation, and (c) angle of onset of nystagmus prior to 45 degrees; (2) VGN; and (3) non-convergence. [D-4 at pdf 159-61; S-48 at * pdf 51; 21T9-21T10; 26T237-26T238]

As mentioned elsewhere in this report, in order for a police officer to be eligible to enroll in the DRE training program, one of the criteria is that the officer has successfully completed the SFST training course. [26T79-26T80] Further, under the enhanced standard applicable in New Jersey since being implemented by Gibson as the State Coordinator, candidates for the DRE program must also have taken and successfully completed the ARIDE course, which provides more detailed and advanced SFST training and provides

preliminary general instruction on the DRE protocol and its seven drug categories. [25T28-25T29; 26T88; 26T90-26T91

The instructor guide for the basic SFST course describes HGN as an "[i]nvoluntary jerking of the eye, occurring as the eyes gaze to the side," and further notes that the subject is usually unaware that it is happening and is powerless to stop or control it. [D-7 at pdf 67, 350; 355] It is further stated that in addition to alcohol (which is a CNS depressant), HGN can be caused by other CNS depressants, inhalants, and dissociative anesthetics. [D-7 at pdf 350] This portion of the guide describes various other types of nystagmus and includes references to signs that they might be caused by a medical condition and not drug use, but then states that for purposes of the SFSTs, gaze nystagmus is separated into three types, horizontal, vertical and resting. [D-7 at pdf 350-34, 358-61] Similar descriptions are given for VGN and resting nystagmus, with associated drug categories specified and diagrams to assist. [D-7 at pdf 355-57]

The guide sets forth the procedures to be followed and the signs to look for in the three-component HGN test:

- Lack of Smooth Pursuit (Clue Number One) – The eyes can be observed to jerk or "bounce" as they follow a smoothly moving stimulus, such as a pencil or penlight

- The eyes of an impaired person will not follow smoothly, i.e., windshield wipers moving across a dry windshield

- Distinct and Sustained Nystagmus at Maximum Deviation (Clue Number Two) – Distinct and sustained nystagmus is evident when the eye is held at maximum deviation for a minimum of four seconds and continues to jerk toward the side

Unimpaired people also may exhibit a slight jerking of the eye at maximum deviation, but this will not be evident or sustained for more than a few seconds.

- Onset of Nystagmus Prior to 45 Degrees (Clue Number Three) – The point at which the eye is first seen jerking. If the jerking begins prior to 45 degrees it is evident the person has a BAC above 0.08, as shown by recent research.

The higher the degree of impairment, the sooner the nystagmus will be observable.

[D-7 at pdf 362 (emphasis in original)]

Further instructions are given in the guide regarding angle of onset prior to 45 degrees with HGN, and procedures for VGN. [D-7 at pdf 356; 367-69; 392]

The overall method instructed for performing the three-component HGN test is to test for lack of smooth pursuit first, followed by examination for nystagmus at maximum deviation and angle of onset prior to 45 degrees. [D-7 at pdf 362; D-4 at pdf 188-93]

After completing the HGN and VGN portions of the eye test, the officer tests for lack of convergence (LOC), which simply means that the subject's eyes will not cross. [D-4 at pdf 71, 76, 195-97] More particularly, a stimulus is utilized and moved in a circular motion several times at a distance, the subject is instructed to follow the stimulus and, during this preliminary step, the officer observes whether the eyes are able to follow it. The stimulus is then moved in slowly toward the bridge of the nose, and the officer observes whether, as the stimulus gets closer, both eyes converge toward the center, each continuing to follow the stimulus. The stimulus is moved to about two inches from the bridge of the nose and held there momentarily. If both eyes have converged, the officer moves the stimulus back and repeats the process. [D-4 at pdf 195-97] LOC is present if one or both eyes are unable to converge at all, or, even if both do converge, they are unable to remain converged for at least one second and instead bounce back to the center of the eye socket. [D-4 at pdf 195-97; S-31 at *pdf 160] The DRE instructor guide notes that the test for LOC is "very simple," but it "may not be as reliable as the other eye tests because some people may have an inability to cross their eyes normally." [D-4 at pdf 195] This is one example of how DRE's are taught not to give dispositive effect to any single sign or symptom of drug use, but to consider everything and attribute lesser or greater significance to some elements.

The defense position with respect to the nystagmus components of the eye tests is that laypersons cannot be adequately trained to assess these movements, there are many variations, they are complicated and nuanced, and they require assessment by a doctor or other medical professional. Both of the medical professionals called by the defense, Guzzardi and Adams, held to this view.

The primary purpose of all aspects of the eye examinations is to provide information to be considered with much other information collected in the overall DRE evaluation, in an effort to determine whether the ingestion of drugs in one or more of the seven toxidromes is the likely cause of the subject's observed impairment. With respect to nystagmus, the instruction materials discussed above make it clear that only what is commonly known as "jerk" nystagmus is to be considered.

DREs are taught that HGN is characterized by the reaction of the eyes to a stimulus moved horizontally, with the eyes following it until reaching maximum deviation at one side, namely the end point from which the eyes can move no further with the head having remained still. At that point, the examiner holds the stimulus still for a minimum of four seconds and looks for a movement consisting of a slow drift away from the point of gaze, followed by a rapid phase in which the eyes jerk back to the point of gaze. There is no

dispute that these eye movements are involuntary and cannot be manipulated by the subject.

During that four or more seconds at maximum deviation, the examiner must note nystagmus that is both "distinct and sustained." [D-7 at pdf 301] This means it must be plainly and obviously visible to the naked eye and it must continue during that minimum four-second period. [D-7 at pdf 362, 367] Thus, the officer would have to observe a number of rapid movements back toward the point of gaze after the slow drift away from the point of gaze, and they must be plainly noticeable and unquestionably present in order to be "distinct." It must not require the use of any specialized infrared or other equipment to visualize it. [D-7 at pdf 303] Further, it must not be so slight that it is barely noticeable, and it must not consist of only a fleeting movement. [32T108-32T109] It must continue for a minimum of four seconds in order to satisfy for the "sustained" component. [D-7 at pdf 362-63; 367]

A six-point scoring system determines whether HGN is present with three clues for each eye. [D-7 at pdf 369] The examiner looks for clues of nystagmus in each eye in each of the three HGN component parts: (a) lack of smooth pursuit, (b) distinct and sustained nystagmus at maximum deviation, and (c) onset of nystagmus prior to 45 degrees. If four or more clues are present, it is determined that HGN is established. [D-7 pdf at 369]

Fraunfelder defined Nystagmus as "an involuntary movement of the eyes, sometimes, quote/unquote, jerking of the eyes in the fast phase and a contralateral movement in the slow phase." [40T55] He acknowledged that there are different kinds of nystagmus, and various classification systems for them, which include "jerk nystagmus versus a pendular nystagmus." [40T56] However, after describing several other potential classifications and types of nystagmus, he said "[t]he simplest way to think about it is, though, directional and jerk, because that's the most common way we talk about it is jerk nystagmus and which direction it's occurring in." [40T56]

Citek defined it similarly: "As a simple observation without using any specialized instrumentation, making observations with our own eyes, we really can only distinguish two types of nystagmus. One is pendular nystagmus, the other is a jerk or beat nystagmus." [33T122] He explained that the former has little amplitude and equal speed as it moves back and forth within fixed limits. The latter, i.e., jerk nystagmus, "occurs when there's a slow drift away from the point of fixation and a fast move[ment] back to the point of fixation." [33T122-33T123] DREs look for jerk nystagmus at maximum deviation and for angle of onset.

Regularly over the past twenty years, Citek has taught the course on eye exams at DRE schools in Oregon and Washington State and some other states.

[34T91] He also periodically lectures at conferences and teaches courses to already certified DREs and prosecutors that delve into greater depth on the eye movement exams by DREs and the anatomy and physiology of the eyes. [32T38-32T42; 34T90] For many years, he has been affiliated with the DRE program and has served on the TAP for a number of years. [32T37; 34T95] During this time, he has overseen and observed hundreds of DRE candidates in training making their eye observations and recording them as part of the certification process. He teaches prospective DREs what to look for and has observed them very frequently making these observations in real time. [34T91-34T95] He stated that even without all of those many observations, he knows from his experience as an optometrist that distinct and persistent jerk nystagmus is very easy to observe. Having seen DREs and DRE candidates make the observations so many times supports his belief that officers can be trained to reliably make these observations. [34T93; 34T126-34T127]

In addition to this testimony and the instructor guide's written procedures for HGN testing, a training video was presented in the hearing through Gibson's testimony, and it depicts, in the portion of the video entitled "Impaired Eye Performance Alcohol" what a DRE would expect to see when examining an individual impaired by alcohol in the maximum deviation portion of the HGN test. [S-73; 27T32; 27T38] This depiction accords with

the written materials in the instructor manual and the descriptions given by Fraunfelder and Citek of what distinct and sustained jerk nystagmus at maximum deviation looks like.

Adams insisted that the DRE definition of nystagmus as nothing more than "an involuntary jerking of the eye" is inaccurate. First of all, his reliance on this limited short-hand definition in DECP manuals ignored the more expansive definitions and explanations in the SFST manuals and training materials that I have previously discussed. Further, he persisted in his contention that the "nystagmus" in this eye movement is in the slow drift away from the point of gaze, although he acknowledged that following the slow movement away from the gaze, the eye "may jerk back" and "[t]hat jerk is part of the process of nystagmus in some cases." [61T64-61T65] In the end, Adams conceded that "jerk nystagmus" is "a form of nystagmus." [61T155] While the characteristics of the slow phase are sometimes relevant to diagnosing an underlying disorder or abnormality, [See S-454 at 4277; S-461 at 1135], and this may be an important assessment to be made as part of a medical examination, it is not relevant in the DRE context. The testimony has established that distinct and sustained jerk nystagmus at maximum deviation or at an angle of onset prior to 45 degrees, and distinct and sustained vertical nystagmus at maximum elevation are indications of the use of certain drugs.

Adams also contended that at least half of the general population, even without impairment caused by alcohol or drugs, have nystagmus. He cited an article to that effect in his expert report. When first asked about it at the hearing, he said that he did not recall the article but was basing it on his experience as an ophthalmologist. [61T195-61T196] When Adams was presented details regarding the "2010 study by Whyte" he had cited in his report, he acknowledged that "the examiner in this case measured small-amplitude physiologic gaze-evoked nystagmus using an infrared system." [61T197] He conceded that DREs look for nystagmus using only the naked eye, and he had not "ever heard of DREs having such an infrared system to test subjects." [61T199]

When confronted with a peer-reviewed article entitled "The Prevalence of Nystagmus: The Leicestershire Nystagmus Survey," which concluded that the prevalence of nystagmus was estimated to be 24 per 10,000 people, he said he was not familiar with the article, but if it stated that prevalence level "that's not correct." [61T193] He also said he was aware of the testimony previously given in this hearing by Citek and Fraunfelder citing the Leicestershire article. [61T192-61T193] Thus, he had never read the article but said that without even looking at it he knew it was incorrect. He then shifted to a new explanation, saying that physiologic end-gaze nystagmus is very common, up

to 50 percent, depending on the study you look at. [61T193-61T194] It appears that Adams placed his reliance on the Whyte study, in which subjects were examined with an infrared device. This is because, as Adams testified, physiologic HGN "occurs as a normal function of the human body without disease or drug intoxication." [61T155; 61T158] Physiologic nystagmus is of very low amplitude and very little movement. It is hardly perceptible and often is not perceptible. It is not sustained. It fatigues quickly. [32T109-32T110; 32T127-32T128; S-454 at 4286; S-461 at 1148]

Adams was questioned about a peer-reviewed article in an authoritative text, Albert and Jakobiec, Principles and Practice of Ophthalmology, Third Ed., Ch.312, which states "that drug induced nystagmus is one of the most common forms of nystagmus seen in clinical practice." [61T31; 61T171; 61T190; S-454 at 4290] Adams promptly responded that he disagreed, which he then revised to "[i]t depends on what kind of clinical practice you're in." [61T189-61T190] He then said, "It's one of the least common that I would see." [61T190]

For HGN to be counted as a clue in the six-point scoring system, the nystagmus must be the jerk type, which is easily distinguishable from pendular nystagmus, and it must be both distinct and persistent.

I credit the opinions and the bases for them provided by Nelson, Fraunfelder and Citek over those of Guzzardi and Adams regarding the ability of trained police officers to be capable of performing the eye examinations in Steps 3,7, and 4 and reliably making the required observations with respect to nystagmus and other eye manifestations. The State's medical experts are much better qualified and possess much greater expertise as a result of their extensive training and long years of experience in dealing with ocular toxic side effects in hands-on clinical practice and in their academic work. See their qualifications in section III of this report. Their testimony on these points was much more persuasive than that of the defense experts.

Guzzardi has not been engaged in the practice of medicine for more than two decades, and he has not had the level of training or acquired the level of expertise in drug related matters comparable to that of Nelson, Fraunfelder and Citek.

As reflected in his CV [D-591], Adams has authored only about a half dozen articles, none dealing with drug induced ocular side effects, nystagmus or other topics relevant to the issue in this case. He also has not engaged in editorial or peer reviewing roles on such subjects. He has written two books. One, Healthy Vision, is for the general public and published in several languages. The other deals with retinal anatomy.

Adams is a well-qualified practicing ophthalmologist. However, it is apparent, as noted in the recent discussion of some of his inaccurate and conflicting testimony on very important aspects of this case, that Adams does not have any notable background or particularized expertise in the side effects of drugs on the eyes. As he said, seeing patients with drug-induced nystagmus is not part of his clinical practice, and he has rarely seen it. Further, I perceived a bias on his part for the defense position. This is the ninth DRE case in which he has testified for the defense. The errors and inconsistencies mentioned above, had they not been effectively challenged through cross-examination, would have certainly favored the defense. I found his manner of testifying to be less than totally candid at times. He often avoided providing a direct answer to a direct question by digressing from the specific question asked, and he sometimes became argumentative.

Citek, unlike Fraunfelder and Nelson, has been closely involved with the DRE program for many years – he has taught DRE courses, served on the TAP, and testified in favor of the DECP on many occasions. Notwithstanding his partiality in favor of the DECP as compared to the other medical witnesses presented by the State, I found Citek to be very credible. Significantly, he candidly acknowledged various disagreements and imperfections relating to the DECP. For example, he conceded that the finger-to-nose test has been a

recurring issue on the TAP, which has considered reviewing it, and that this test, as well as the modified Romberg test, have no standardized scoring system and can be subjective. [35T38-35T45; 35T51] Similarly, he acknowledged that some states outside of New Jersey are non-compliant with a few of the standardized protocols as recommended by IACP and allow deviations, such as allowing DREs to conduct roadside evaluations or to "reconstruct" DIEs based on retrospective data. [35T99-35T101; 35T110-35T111]

Fraunfelder summed up the relationship of all of the eye exams to the toxidrome recognition process. He was asked whether eye signs in the protocol such as pupil dilation "contribute to a determination to whether cocaine has been ingested," in other words whether it is "part of a pattern that you would be looking for," and whether "patterns [are] something that the medical profession uses." [40T48] He answered as follows:

> Yes. I think pattern is key, especially when talking about drug toxicity. Because you're not looking at just one sign on the eye or in the body or in the history or in any part of the medical evaluation; you're looking at a variety of things, and you want to see a pattern.
>
> In drug toxicity we look for the pattern of plausible time relationship to when the side effect occurred. We're looking for a plausible biological mechanism.

> We know this drug causes vasodilation, for instance. So we would see red eyes. That makes sense. We're looking for the side effect to go away when you stop the drug. That's part of the pattern. We're looking for the drug side effect to come back when you take the drug again. That's part of the pattern.
>
> It's probably not fair to parse out just one thing and blame that one thing without looking for the pattern.
>
> [40T48-11 to 40T49-4]

He then testified that the DRE protocol uses essentially the same procedure as used in the medical profession in trying to determine a pattern:

> I think there's similar crossover to what the DEC program and the DRE examiners do to what we as medical doctors do.
>
> Q. Could you expand on that? Like, in what way?
>
> A. Specifically on Steps 4 and 7, Step 4 being identifying nystagmus and smooth pursuit and Step 7 identifying pupil abnormalities.
>
> What is done by the drug recognition expert is also performed by our technicians, our doctors, our residents, our fellows, and other allied health people that we get to assist us in the clinics.
>
> [40T50-14 to 24]

C. Training and Confirmation Bias Arguments

The State presented a strong case for general acceptance in the medical and toxicological communities based on the testimony of its scientific expert

witnesses. The defense position is multifaceted, but in essence it reduces to two assertions: (1) police officers cannot be adequately trained to reliably perform the DRE protocol, and (2) the effect of confirmation bias is fatal to reliability in the DRE protocol. I will address these in turn.

Throughout this section, I have included discussion of testimony by the State's witnesses that I find credible and persuasive to establish that the training is comprehensive and effectively equips DREs with the necessary specialized knowledge to do what is required of them in the protocol. Because the analysis in this section deals with toxidrome analysis as generally accepted in the medical and toxicological communities, the references have focused on the similarity in training and performance between DREs and medical technicians. I have also referenced the testimony of Page, Gibson and others who have described the training, certification process, structural features and administrative procedures in the DRE program. Indeed, this report includes a section devoted completely to DRE training. In addition, I now elaborate further.

Earlier in this section, I referred to Nelson's explanation that "toxidrome recognition requires piecing together certain pieces of information that individually might be objective or slightly subjective but together paint a coherent picture." [46T64-46T65] Nelson also expressed the view that "a

nonmedical professional [can] be taught the principles of toxidrome recognition, so the idea that certain signs and indicators are consistent with certain toxidromes." [46T63] Further, he agreed that "a nonmedical professional [can] be trained to perform the steps involved in evaluating what signs might be present in an individual case." [46T63] One-by-one, he went through a litany of questions asking whether nonmedical professionals can be trained in looking for and observing each of the categories of expected signs and symptoms, and he testified that they can. [46T58-46T63]

He based these opinions on his personal experience with technical assistants working in his clinic and, more broadly, on experiences he has had and of which he has direct knowledge involving the training of nonmedical personnel in other contexts.

He described his participation in a workshop program conducted for the Department of Homeland Security (DHS) for the analysis of toxic chemical syndromes. [46T52-46T54; S-271] This would be relevant in the event of a terrorist attack. [46T54-46T55; 46T133] The trainees were nonmedical personnel, mostly police and some military. [46T54-46T56] In that program, they defined nine classifications of chemical substances around "clinical presentations" rather than "other options" because first responders should describe toxidromes on what they see in patients, i.e., signs and symptoms they

observe. [46T57-46T58] This is the same framework as used in the DRE program, and he is of the opinion that it is effective and that nonmedical personnel can be adequately trained in this regard.

Nelson went through an item-by-item discussion of what the DHS workshop participants were trained to check for, including vital signs, eyes, etc., all of which is similar to the DRE training. He found no problem with this and opined that they can be trained adequately. [46T59-46T63] He said it is not so hard to do and that laypersons can be trained to identify toxidromes based on the signs and symptoms they observe. [46T63]

As I noted earlier in this section regarding Fraunfelder, he opined that laypeople, including police officers, can be trained rather easily to conduct all of the required eye observations, which are not difficult to make. He also based his opinion on his own experience with ophthalmic technicians in his clinical practice as well as experiences he has had or knows of outside of the clinic, some of which deal with eye evaluations and others that do not.

He noted that EMTs and other first responders are trained in the use of automated external defibrillator instruments (AEDs) to apply an electromagnetic pulse to the heart to restart it or put it into a normal rhythm. [40T124-40T126] These devices are used in life-and-death situations, and to be used safely, the operator must follow very precise procedures. [40T126]

They are used by police officers and first responders. They are also used on airlines and in public buildings, by trained laypersons. AEDs actually shock the subject, and they can be dangerous. [40T124-40T126] He also discussed studies with which he was familiar and deemed reliable dealing with other areas in which laypeople have been successfully trained to perform medical tasks. These included programs in first responder bleeding control and tactical combat casualty care. [40T118-40T123]

Another program trains laypeople to successfully place supraglottic airways. This device is a plastic tube to be placed into the airway to intubate someone who is unable to breathe on their own. This is a lifesaving device. Correct placement is critical. Fraunfelder explained that the epiglottis is "that area that is in the part of the trachea right by the esophagus. And when you put an airway in a human being, you want to bypass the epiglottis and not go into the esophagus. You go into this bifurcation. Going into the stomach is bad; going into the trachea is good." [40T131-40T134]

He also discussed a study in which it was determined that trained laypeople could estimate the total area of body surface burned as well as professionals. This is important because the greater the area burned the higher the mortality rate. [40T135-4oT136] Another study showed the success rate

in identifying melanoma was higher using photographs as visual aids than with the traditional ABCD method. [40T138-40T139]

All of these examples show that laypersons – not just police officers but any laypersons – are routinely trained to reliably make assessments and perform medical tasks.

He described how he and his colleagues recruit and quickly train individuals to be ophthalmic technicians, which enables them to reliably perform all of the same eye tests that DREs perform. [40T116-40T117] Indeed, Fraunfelder said "one of our most successful things that we do is training laypeople to help us with our eye exams." [40T118]

Fraunfelder also discussed an organization in which he is involved through his teaching hospital, and similar organizations from other teaching hospitals around the country, providing services in underserved parts of the world. In particular, he mentioned activities in Mexico, Venezuela and Africa.

Among other things, he and his colleagues train laypeople in those locales to conduct general eye exams, check eye pressure, and recognize eye-movement disorders with field-of-vision tests. [40T113-40T114] They also train them to perform procedures like removing a foreign body or scraping off a herpes dendrite from the eye. [40T114] And, because cataracts are a major cause of blindness in these areas, they actually train some of the local

laypeople to perform simple cataract surgery. [40T114-40T115] Fraunfelder said they walk these individuals through their first few procedures and when they leave, those individuals are on their own to perform them as needed. [40T115] Fraunfelder and his colleagues go back periodically to check up on how they are doing, and they have found the results to be very good. [40T115-40T116] The people they train to do this are "usually tribal leaders or people who show an interest, people who have good hands, people who may care for people within their community, volunteers." [40T115] Fraunfelder opined without qualification "that laypeople can be taught to do what's in the DEC program." [40T117]

The defense presented the testimony of Guzzardi and Adams to support its position on inadequate training. The State's medical experts, particularly Nelson, Fraunfelder and Citek testified to the contrary. As I have discussed previously, I find these State experts to be much better qualified and knowledgeable about the effects of drugs on the human body and the physiological processes that cause the signs and symptoms that DREs look for. I find the State's evidence much more persuasive than that of the defense in establishing that the training is more than adequate for this purpose. Indeed, in section V of this report dealing with DRE training, it is shown that the training is very rigorous, the manuals are voluminous, and much information is

covered, all of which is sufficient to qualify a DRE candidate who passes the required written and field tests to reliably make the necessary observations and assessments.

The credible evidence on this issue clearly establishes that police officers can be and are adequately trained to reliably perform the DRE protocol.

The defense argues that DREs will be unduly influenced by confirmation bias because the mere fact that they are called in tells them that the subject to be evaluated (1) was probably, although not always, driving in an erratic manner, (2) was deemed by the arresting officer at the roadside to be impaired, thereby establishing probable cause to arrest for driving under the influence of alcohol or drugs, and (3) was brought to the police station and subjected to a breath test on a reliable evidential instrument, resulting in a determination that little or no alcohol was present, thus ruling out alcohol as the source of the observed impairment. Thus, before the DRE even sees the subject, the DRE develops a bias of a high likelihood that this individual is impaired by drugs. Then, when the DRE interviews the arresting officer in Step 2, additional information might be passed along, such as admissions, finding of drugs or drug paraphernalia, details about the defendant's behavior at roadside and in the police station, performance on SFSTs, overall demeanor, and the like. This

strengthens the DRE's bias. From that point on, the defense argues, the DRE is likely to look for indications that will further confirm the bias the DRE already has, namely that this person is probably impaired by drugs.

According to Guzzardi, doctors are trained to avoid confirmation bias, and they will not be influenced in the same manner. Further, this phenomenon is unlikely with a doctor, because the doctor's focus is on making a medical diagnosis and planning a treatment course, as opposed to a police officer who is seeking evidence to charge and convict a defendant for driving under the influence of drugs.

The State has produced evidence through several witnesses, including Page and Gibson, that DREs are instructed to always keep an open mind and, at Step 3, when the DRE makes his or her own preliminary examination of the defendant to reach a "fork in the road" decision point. In other words, with the information they have learned from the arresting officer combined with their own preliminary assessment of the defendant, the DRE should make his or her own determination of whether to proceed with the evaluation required under the DRE protocol or to abort that evaluation because the defendant does not appear to be impaired by drugs to the extent of making it unsafe to drive, or that the defendant might be suffering from a medical condition or injury or is drowsy or any number of other things preliminarily assessed by the DRE that

would make it inappropriate to proceed with the evaluation. Likewise, at any time during the DRE evaluation, which typically takes about one hour, the DRE may decide to stop the evaluation because the evidence being gathered in the course of that evaluation is simply not sufficient to charge the defendant with DUID. Or the DRE may conduct a full evaluation and come to the conclusion that the subject is not impaired by drugs.

The data that has been accumulated in this hearing regarding actual DRE cases in New Jersey over a two-year period further supports the State's position on this issue. As detailed in section VIII of this report dealing with NJ data analysis, out of roughly 4000 non-training evaluations performed in New Jersey in 2017 and 2018, there were 305 subjects who provided no urine sample because the evaluating DRE saw insufficient indications of impairment by drugs and 92 subjects who the evaluating DRE opined were not impaired by drugs even though toxicology later revealed some drug or drugs present. The DREs made these non-impaired determinations notwithstanding the existence of probable cause to arrest and all the factors the defense argues create undue confirmation bias. This shows that, even after all of the prescreening and the very high prevalence in this population of drug-impaired drivers, DREs "exonerated" more than ten percent of the subjects they were called in to evaluate. Some of those individuals might have been charged by the arresting

officer with other driving offenses, such as speeding or careless driving, but there was no DUID charge, which is the focus of this confirmation bias argument.

Based upon this data and the testimony by State witnesses about the manner in which DREs are trained in this regard, I reject the confirmation bias argument advanced by the defense.

VIII. NEW JERSEY DRE DATA FROM 2017 AND 2018

A. Background of Discovery Requests and Compilation of Data Sets

At the first case management conference conducted in the remand proceeding, held on January 7, 2020, counsel and I were discussing discovery materials that should be produced and made available to the experts. [1T47-1T53] I noted that, based on the unofficial numbers provided by the State, New Jersey DREs had conducted about 2,000 evaluations per year and it would be interesting to see the statistics for the most recent years for which the State had complete data, 2017 and 2018, including information regarding the extent to which toxicology results supported impairment opinions and the number of subjects as to which the DREs opined no impairment. [1T53-1T58] We also discussed that the number of instances when a subject admitted to ingesting some type of drug was information that would be of interest and that it should be reflected in the DRE reports. [1T73]

The State agreed that this would be relevant information and stated that it believed it could provide it to the court and counsel within thirty days. [1T58; 1T79]

The OPD noted that it "would be interested in essentially the raw data" underlying any statistics, meaning the logs and reports kept by the DREs, "to see how it correlates and how it doesn't . . . what the DRE log looks like, what the toxicology result is and what the reports say." [1T76] The OPD anticipated making "a pretty comprehensive discovery request" that would encompass this data and provide a "case study" or "snapshot" that could yield useful statistics. [1T77] It agreed to examine the materials that the State said it could voluntarily collect and produce within thirty days and to then follow up with requests for additional discovery needed. [1T84]

Paragraph 4 of Case Management Order #1 (CMO#1) addressed this issue and provided:

> By February 6, 2020, the State will provide data and information regarding the DEC program in New Jersey for the years 2017 and 2018 including at a minimum for each year (a) the total number of evaluations conducted by DREs, (b) the number of evaluations resulting in an opinion by the DRE that the subject was under the influence of a drug, (c) the number of evaluations in which a urine sample was provided by the subject, (d) the results of those urine samples and their correlation to the opinion rendered by the DRE, (e) the number of evaluations in which the subject admitted to ingesting or inhaling some

> substance other than alcohol, whether a prescription medication, controlled dangerous substance, or other drug, and (f) the conclusions of the DRE in those evaluations that did not include an opinion that the subject was under the influence of a drug.

At the second case management conference, held on February 19, 2020, we had an extensive discussion regarding the problems encountered by the State in gathering the ordered information. [2T12-2T22] The State explained that there was "no State central clearinghouse for this data," and the general statistics that it had previously mentioned were compiled by the IACP from information self-reported by the "roughly 500" DREs in the state. [2T13-2T14; 2T20-2T22] In order to comply with CMO#1, the State had to procure records from all of the DREs individually, and about 25% of them had not responded to the State's letters requesting the documents. [2T15-2T16] Moreover, the toxicology reports were typically in the possession of the arresting officer's agency rather than the DRE who did the evaluation, so those documents often had to be collected separately and then paired with the appropriate case number. [2T14-2T15] The State was still in the process of inventorying the data coming in and "putting it into some kind of workable database." [2T25-2T26]

The State confirmed that it had collected at least 500 complete DRE evaluations, including a toxicology report where a urine sample was given.

[2T38-2T39] I ordered that "[b]eginning forthwith and continuing on a rolling basis in increments of 500, the State will provide the information ordered in paragraph 4, subparagraphs (b) through (f), of Case Management Order #1 (CMO#1), together with the raw data source for that information, including DRE evaluation forms, narratives, rolling logs, and toxicology reports." [Case Management Order #2 (CMO#2) at par. 1] On February 26, 2020, I entered a protective order to prevent disclosure of personal identifying information regarding the individual subjects named in the documents.

Initially, I ordered that the State complete the rolling production by March 31, 2020. [CMO#2 at par. 1] However, collection and production was significantly delayed due to the COVID-19 pandemic, by the State learning that it had underestimated the total number of reports to be processed, by disputes between the parties concerning the completeness of the production, and other issues. [See Case Management Order #5, dated May 28, 2020 (CMO#5) at par. 1; Case Management Order #6, dated July 1, 2020 (CMO#6) at par. 1; Case Management Order #7, dated August 6, 2020 (CMO#7) at par. 1]

Eventually, by the end of September 2020, the State had produced all of the raw data that it was able to collect, totaling 5844 reports. [7T7; Case Management Order #8, dated September 10, 2020 (CMO#8) at par. 1] The

OPD had follow-up questions and discovery requests regarding which reports resulted from training versus non-training evaluations, were unclear or incomplete, or were potentially duplicative, and the parties focused on resolving these issues for a few months. [7T9-7T11; Case Management Order #10, dated October 15, 2020 (CMO#10) at par. 1; Case Management Order #11, dated November 17, 2020 (CMO#11) at par. 2]

By the time of the case management conference on February 9, 2021, although the parties had not fully resolved all questions and discrepancies, the difference between their calculations of training versus non-training evaluations was so minimal that I made a finding that they had been substantially resolved. [11T18-11T19; Case Management Order #13, dated February 9, 2021 (CMO#13) at par. 1] Similarly, discrepancies regarding illegible or potentially missing toxicology reports had been reduced to a total of 93 items, compared to 2531 lab reports that had been produced; therefore, given the small number of differences, I found that the discrepancies in this category had also been substantially resolved. [CMO#13 at par. 2] I ordered the parties to continue their cooperative effort to further refine their numbers and eliminate the remaining discrepancies and to exchange their respective data on Excel spreadsheets to facilitate this process. [CMO#13 at par. 3]

I had anticipated and ordered that the parties make their best efforts enter into a stipulation regarding the data and produce a single spreadsheet collecting the pertinent information, particularly the information specified in paragraph 4, subparagraphs (b) through (f), of CMO#1, noting any lingering discrepancies. [11T19-11T20; CMO#13 at par. 4]). Although they made some efforts towards accomplishing this, the parties were ultimately unable to agree on how to categorize and record certain information, so the State and the OPD ultimately generated separate spreadsheets compiling the raw data. [Case Management Order #15, dated March 16, 2021 (CMO#15) at pars. 1-3; Case Management Order #16, dated April 14, 2021 (CMO#16) at pars. 1-3; Case Management Order #17, dated May 4, 2021 (CMO#17) at par. 1; S-102; D-542]

Both data sets were entered into evidence at the hearing. [S-102; D-542] The State's data set contained 5,855 total cases, while the OPD's data set contained 5,843. (S-102, D-542). As detailed in the following subsections, Martin reviewed only the State's data set, while Taylor and Schisterman each reviewed both data sets. [43T21-43T26; 54T51-54T52; 56T98; 57T79] For

purposes of the relevant analysis provided by the experts and discussed below, any discrepancies between the two data sets were insignificant.[33]

B. Statistical Analysis Terminology

The experts explained certain terms relevant to their statistical analyses of the New Jersey data sets, and understanding them is necessary to a discussion of the testimony of Martin, Taylor, and Schisterman.

In evaluating how often the DRE opinions captured in the data sets correctly opined that a subject was impaired by drugs, the experts considered the toxicology results to be the "gold standard," and they looked to see how often the toxicology results were consistent with the DRE evaluations. [43T163; 46T33;56T43] Schisterman explained that, for purposes of statistical analysis, the gold standard "is the truth," but he also noted that the gold

[33] The State's data set contained fourteen columns of specific facts keyed towards providing the information ordered in CMO#1. [S-102] The OPD's data set contained many additional columns of information that were evidently gleaned from the raw data. [D-542] But the OPD did not present a witness to explain the significance of those additional columns or how the information contained in them was compiled. [D-542] Taylor (1) authenticated D-542 as the spreadsheet the OPD provided to him, and (2) testified that he and a "trusted graduate student" performed a "coding check" to (a) compare a "representative random sample" of pages of the raw data against the spreadsheet, and (b) determine that the OPD's transfer of information from the raw data to the spreadsheet was "good but not perfect." [54T55; 54T58-54T66; D-543] However, the data analysis about which Taylor testified during direct examination was based on the State's data set and the columns as compiled by the State. [55T41]

standard is not a perfect standard, in virtually every context. [56T43; 57T15] When analyzing the New Jersey data sets, toxicology results were "the best available way" to detect the presence of impairing drugs, but this gold standard was imperfect. [57T15] Nelson, too, noted that the gold standard is "the best test we have" to determine whether a given condition is present, but it is "typically not perfect." [46T33-46T35]

The OPD contends that, because proponents of the DRE protocol "claim that it tests for drug-induced impairment," a proper gold standard in the context of evaluating DRE opinions would have to be a test "that measures impairment" and not just drug presence. [OPDb58-OPDb59; OPDb256] If such a test existed, it would perhaps be a better gold standard to use, but such a test does not exist, and the OPD does not explain how one could be developed or used.

Accepting toxicology results as "the truth" of drug impairment status is not without drawbacks. As detailed in section VI of this report, toxicology testing has certain inherent limitations, including that subjects may have ingested certain drugs, such as synthetic cannabinoids, that will not be detected by the laboratory. In such cases, a DRE opinion of impairment by cannabis may be correct, even though the toxicology report indicates that no drug was found. Also, toxicological testing of urine cannot quantify the drugs found or

determine when or to what extent a subject was impaired by them. Nevertheless, there is no dispute that toxicological testing is highly accurate in detecting the presence of many impairing drugs and can serve as confirmation of a DRE's opinion. As such, toxicology results are the best-available gold standard to use in this context, and they serve as a reasonable proxy for the condition of drug-induced impairment.

Using the toxicology results as the gold standard, all of the DRE opinions in cases containing those results in the New Jersey data sets could be characterized as one of the following: true positive, false positive, true negative, or false negative. [43T56-43T60; 57T5-57T6; S-450] True positive (TP) cases were those in which the DRE opined impairment, and the toxicology results showed drugs in the subject's system. [43T56-43T57; 57T5] False positive (FP) cases were those in which the DRE opined impairment, but the toxicology results showed no drugs in the subject's system. [43T57; 43T64; 57T6] In true negative (TN) cases, the DRE opined no impairment, and toxicology revealed no drugs in the subject's system. [43T57-43T58; 57T6] In false negative (FN) cases, the DRE opined no impairment, but toxicology revealed drugs. [43T58; 57T6] The numbers of cases falling into each of these four categories could be used to calculate percentages for both

sensitivity and specificity, as well as overall accuracy. [43T60; 56T146; S-450][34]

Sensitivity "focuses on the nature of the test to be able to detect true positives." [56T42; 56T146] In other words, when viewing the population of subjects that have the "condition," sensitivity measures how good the test at issue is in detecting the presence of that condition. [43T59; 57T6] In the context of this case, sensitivity calculates the percentage of times a DRE correctly opined the presence of drugs out of the total number of instances where the subjects had drugs in their systems. [43T61] Sensitivity is calculated by dividing the number of true positives by the sum of true positives and false negatives. [43T59; 56T146; S-450]

Specificity focuses "on the other side of the equation, which is trying to focus on identifying true negatives. It's the ability of the test to identify true negatives." [56T43] Specificity "is when we're looking at just the condition not being present." [43T59] In the DRE context "specificity is answering the question, conditional that we know that you don't have the drugs in your system, how likely is it that the police officer will call you a negative?"

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[34] The formulas for making these calculations are as follows:

Sensitivity = TP/(TP + FN) [56T146; 57T6; S-450]
Specificity = TN/(FP + TN) [56T146; 57T7; S-450]
Accuracy = (TN +TP)/(TP + FN + TN + FP) [43T58]

[57T7] Specificity is calculated by dividing the number of true negatives by the sum of true negatives and false positives. [43T60; 56T146]

Accuracy "is a global measure" of a test that "summarizes the ability of the test being able to truly discriminate between true positives and true negatives." [56T42] Accuracy "considers both when this condition is present and when the condition is not present." [43T58] It is "the most commonly valued statistic associated with a test." [43T93] Accuracy is calculated by taking the sum of true negatives and true positives and dividing it by the sum of all four potential outcomes – true positive, false positive, true negative and false negative. [43T58]

C. Issue of Missing Toxicology Data

Before making calculations regarding sensitivity, specificity, accuracy, or other related statistics, the experts had to choose a method of dealing with or accounting for the relevant "missing data" in this case, meaning the approximately 27% of total DRE evaluations that did not have any toxicology results that could be used as a standard against which to measure the DRE opinions. [42T84; 43T36-43T37; 43T42; 43T46] Martin noted that 27% of missing data "is a relatively high percentage." [42T84]

The State's data set contained 5855 total cases, of which 1,534 had missing toxicology values. [43T36-43T37] In most of the 1,534 cases with

missing toxicology, specifically 1,117 or 72.8%, the reason for the missing data was that the subject refused to provide a urine sample when asked to consent to do so. [43T74-43T75; S-51 at *pdf 49] In some other cases, specifically 305 (19.9% of 1,534), the police obtained no urine sample because the DRE had come to the conclusion that the subject was not impaired by drugs. [43T74] The remaining 112 (7.3% of 1,534) cases were missing toxicology results for other reasons, such as because the subject was unable to provide a sample, suffered from a medical condition, or was impaired by alcohol. [43T75] Thus, the missing data in this case was "a function of the situation," not due to a poorly designed experiment or project. [43T87]

Missing data is a common issue for researchers. [43T90; see also S-281 at *pdf 2 ("Missing data are a rule rather than an exception in quantitative research."); S-430 at 568 ("Missing data are a pervasive challenge in biomedical research.")] Data can be missing completely at random, missing at random, or missing not at random. [43T211; 56T87; S-430 at 569] When the probability of having a variable with missing data does not depend on any observed or missing variables, the data is missing completely at random. [43T212; S-430 at 569] An example of this type of missingness would be if a large mail-in survey was missing some results because of an error by the post office. [43T212]

Missing at random means that the missingness is related to the observed data, but not the unobserved data. [43T213-43T214; 56T90; S-430 at 569] This means that a variable in the data set can explain why the data is missing. [56T90]. An example of this would be where researchers obtained more completed surveys from male participants and knew that males were more likely than others to complete the survey. [43T214]

Missing not at random is where "the missingness patterns is linked to one or more observed variables in the dataset." [55T104] It "occurs when the probability of missing depends on the missing value itself." [S-281 at *pdf 2] "For example, missing data on the income variable is likely to be [missing not at random], if high income earners are more inclined to withhold this information than average- or low-income earners.. [S-281 at *pdf 2]

The options researchers and statisticians have when dealing with missing data are to (1) delete the cases with missing data from the data set, sometimes called listwise deletion, or (2) impute values for the missing data based on one of several alternative methods – "meaning you can make an estimate as to the data and input that estimate into where the missing data is located." [43T77-80; 43T85; see also S-291 at 63-71] All methods of imputing missing data rely, at least in part, on the existing data to estimate the missing data. [43T81]

Martin took the listwise deletion approach in what he termed his "data screening" step, checking for "missing values, missing data" and removing cases with no toxicology results before performing his statistical analysis on the remaining cases. [43T35-43T38; S-102] The State's data set contained 5855 cases and, after removing those with missing data, Martin had 4275 cases, or about 73% of the total, to analyze. [43T42; 43T46] Of the remaining 4275 cases, 40.3%, or 1724, were training cases, and 59.7%, or 2551, were non-training cases. [43T42; 43T46; S-293] As detailed in the following subsection, Martin calculated many statistics using the 4275 cases, including sensitivity, specificity, accuracy, and false positive rate for training cases, non-training cases, and total cases.

The effect of the listwise deletion approach is that the results of any analysis done on the remaining data essentially reflect an assumption that the missing data is missing completely at random, that "the individuals who were missing were exactly the same as individuals who were in the data set and, therefore, you can remove them." [56T46-56T47] The practice of listwise deletion "is not uncommon," even where data is not missing completely at random. [56T46] Schisterman noted that, "[a]ctually, 80 percent of the papers that are being written in medical journals actually use that technique," and "[r]emoving the data is the most common method of dealing with missing

data in epidemiological studies." [56T46; 56T126; S-440] Martin noted that deleting cases with missing values was "the default option" for certain popular statistics-analysis software, including one Taylor acknowledged he had "worked in." [43T77, 43T88; 54T13; S-291 at 63]. One article entered into evidence noted: "Among studies that showed evidence of missing data, 97% used the listwise deletion (LD) or pairwise deletion (PD) method to deal with missing data." [43T90; S-281 at *pdf 2]

Martin acknowledged that "the preferred technique would be to use a mathematical imputation process; however, [he] did not readily see how a mathematical imputation process could be crafted for this scenario." [43T85] He testified that "it's appropriate to use mathematical models" for data imputation "when you're dealing with data that's numerical." [43T82-43T83; S-291 at 67-70] Martin considered using a mathematical model in this case, but he "did not feel like any of those options were viable with this data set" because, "[i]n this case, we have categorial data" rather than numerical data. [43T83]

This was not an impediment for Schisterman. As noted in section III, the witness qualifications section of this report:

> He has taught applied statistics at the university level, including regression analysis, which he defined as a method to evaluate relationships between an independent and a dependent variable. He further

> explained that applied statistics also includes categorical data analysis. This subpart of applied statistics applies in this case, because it requires analysis of data defined by categories.
>
> [p. 59, infra.]

Taylor acknowledged that "[i]n order to evaluate a diagnostic test for predictive validity, "one would want to have compensated adequately for the missing data." [54T92] He stated that the method of listwise deletion was "okay" in circumstances where data is missing completely at random, but in other circumstances listwise deletion could potentially create a misleading picture. [54T118-54T119] Taylor's "primary concern with Dr. Martin's analysis" was his use of listwise deletion, which he said "did not compensate adequately" for the missing data. [55T14-55T15]

Taylor noted other methods of addressing missing data, besides the listwise deletion approach, stating, "there's multiple imputation, there's inverse probability weighting, and there is hot-deck missing imputation." [54T110; 54T133] He said that "[e]ach different approach has its own limitations, its own advantages, and a stronger program of assessment would have done four or five, at least, different ways to look at the data and take into account the missing data patterns." [54T134]

Although he recommended using several approaches to analyzing missing data, Taylor stated that he did not conduct that analysis himself due to "[t]ime and resources." [54T134]

Taylor's approach to addressing the missing data was that he "coded the data." [54T123] He said he did not assume anything about the results of the missing data, but "simply built a new category that puts together the cases that don't match, DRE and toxicology did not align, and missing data and any other reason for not having DRE opinions or toxicology." [54T122-54T123] Despite his contention that he made no assumptions about the results of the missing data, the approach Taylor took was, mathematically, the same as making the extreme assumption that every case with missing toxicology was a mismatch – that the DREs would not have offered a correct opinion in even a single one of the 1,534 cases with missing toxicology. [55T31; 55T162]

Schisterman noted that Martin's analysis "was based on this assumption that the people who are missing" toxicology results "are identical to the people who are in the data set," while Taylor's "assumption [wa]s that every person who was missing was a mismatch." [56T69] In Schisterman's view, Taylor made "an extreme assumption that says that everybody who did not have the toxicology report was a mismatch." [56T68] He acknowledged that Martin did not take the other extreme – assuming that all missing data would be a

match – but without further analysis, he "didn't know which one is right, where the truth lies." [56T69]

Schisterman performed a multiple imputation analysis on both the State's and OPD's data sets. [54T135; 56T98; 57T79] Multiple imputation is a method by which the evaluator reconstructs the missing data multiple times in order to evaluate it. [57T79]

Schisterman explained that, "first of all, I have to identify the variables that I think that may explain the missingness. [56T127] Then, "there is an iterated process that the computer does itself that, once I identify those variables, it will create multiple data sets that are completed . . . repeatedly at different iterations." [56T127-56T128] He continued:

> And so usually it's done approximately between 20 and 50 times.
>
> And then the end of the procedure is that, when I have each data set that is complete, will end up with a statistic that is combined across all the different data sets.
>
> So the estimator at the end, the final number that I have is the average of all this 10 or 20 or 50 data sets. It's a way to account for all different possibilities.
>
> [56T128-4 to 13]

Schisterman explained that "[t]he other techniques of imputation are not state of the art today. There are newer techniques. So multiple imputations is one of the newer techniques." [56T97]

Schisterman noted that the multiple imputation approach "has the assumption of missing at random." [56T102] He explained that a researcher "could tell if something is missing completely at random compared to missing at random," but "there is no data that could tell you if something is missing not at random or missing at random." [56T96; 56T199-56T200]

In order to test the robustness of his results with respect to the missing at random assumption, Schisterman performed a "sensitivity analysis" simultaneously with the multiple imputation analysis. [56T98; 56T100-56T102] The sensitivity analysis was "not about the sensitivity of the test," but was "something slightly different." [56T98] In the sensitivity analysis, Schisterman "evaluate[d] what will have happened to my results if I check all the possible combinations of data that I was missing," which would provide him with "an idea of how much the results were robust to the missing data." [56T98-56T99] The sensitivity analysis allowed Schisterman to consider "how much my results will be affected by the assumptions I have to make" regarding whether the data was missing at random or missing not at random. [56T101]

Having weighed the experts' testimony regarding the missing toxicological data and various methods of addressing it, I find that Martin's method of listwise deletion, while not ideal, was an appropriate approach to take in evaluating the New Jersey data sets. The method is commonly used in statistical analysis to account for missing data, even in circumstances where the data is not missing completely at random. Here, the toxicology results were not missing completely at random, so the underlying assumption of the listwise deletion method that the missing data would have essentially mirrored the existing data cannot be empirically tested and verified. Nevertheless, as a practical matter is seems unlikely that the subset of cases with missing data would have varied greatly from the subset of cases with data, especially because the DRE's do not rely on – or even know about – toxicology results before rendering an opinion on drug impairment.

I reject Taylor's approach of coding the data in such a way that all cases with missing toxicology were treated the same as a mismatch. He offered no explanation that could justify this approach, and I find that it was extreme and unwarranted to account for the missing data in this way. Having all cases with missing data fall into a single category, either match or mismatch, would have been highly improbable, but assuming a global mismatch was especially unreasonable in these circumstances, given the high prevalence of subjects

with positive toxicological results in the subset for which data existed. Taylor's approach also effectively assumed that all of the 305 subjects who were not asked to provide a urine sample because the DRE saw no impairment would have tested positive for drugs. Moreover, I note that Taylor endorsed other approaches to addressing missing data, including doing a multiple imputation analysis, but he did not follow that approach himself due to "[t]ime and resources."

Schisterman's use of multiple imputation, together with a sensitivity analysis, was the best of the three methods used by the experts to address the missing data, and it provided a greater level of confidence in the results.

D. Data Analysis Offered by the Experts

1. Martin

Using the State's data set, Martin calculated sensitivity, specificity, and accuracy for training cases, non-training cases, and total cases, using two types of match criteria. He reviewed and analyzed the State data set with the aim of examining the relationship between the DRE opinions and the identified toxicology results. [43T21-43T26; S-102]

Martin analyzed the data using two match criteria – "impairment match" and "certification match." An impairment match meant that the DRE opined that a drug other than alcohol was present and the toxicology confirmed some

impairing substance, although not necessarily the drug opined. [43T46-43T47; S-293] Certification match indicated a match under the DECP criteria. [43T50-43T51]. The certification match criteria were "more stringent" than the impairment match criteria. [43T51-43T52]

In his analysis, Martin used the term "hits" for true positive cases and "correct rejections" for true negative cases [43T39-43T41; 43T52; 43T56-43T57] He included as false negatives in his calculations both (1) standard false negative cases where the DRE opined no impairment but the toxicology revealed a drug, of which there were 92, or 3.6% of non-training cases, and (2) cases he termed "misses," where the DRE opined one type of drug and the toxicology result showed the presence of a drug that did not align with that. [43T40-43T41; 43T52; S-293] He did not alter the terminology for false positive cases. [43T40] The total numbers of "hits" and "misses" changed depending on the match criteria used, but true negatives, standard false negatives, and false positives remained the same. [43T41-43T42; S-293]

As noted above, Martin examined the 4275 total cases that included toxicology results, 1724 of which were training cases and 2551 of which were non-training cases. [43T37; 43T46; S-293]

Looking at true positives under the impairment match, Martin calculated that 4071 of the overall 4275 cases, or 95.2%, were hits. [34T48-43T48; S-

293] For the non-training data alone, the hit percentage was 92.3%, or 2354 out of 2551 [43T49; S-293] The hit percentage for the training cases was 99.6%. [S-293]

Under the certification match criteria, 3869 of the total 4275 cases, or 90.5%, were hits. [43T53; S-293]. The percentage of hits for the non-training cases was 85.3%. [43T53; S-293] The hit percentage for the training cases was 98.2%. [S-293] Martin noted that he "would expect a lower number of hits" under the more-stringent certification match criteria, as compared to the hits under the impairment match criteria. [43T51-43T52]

Looking at standard false negative cases, under both match criteria there were 92 cases, or 2.2% of the total. [S-293] There were no "misses" under the impairment match criteria. [43T48-43T49; S-293] Under the certification match criteria, there were 202 of 4275 overall, or 4.7%, and 178 of 2551 non-training cases, or 7%. [43T53; S-293]

Out of 4,275 cases Martin analyzed, no drugs were shown in the toxicology result in only 112 total cases and in 105 non-training cases [43T65; 45T76-45T77] Of these, 87 of the 4275, or 2%, were false positives. [43T47-43T48; S-293] Looking at non-training cases only, 82 of the 2551, or 3.2%, were false positives. [43T49; S-293] 5 of the 1724 training cases, or .03%, were false positives. [S-293]

As to true negative cases, termed correct rejections by Martin, there were 25 total out of the 4275 cases examined, or .06% [43T65; S-293] Looking at non-training cases, 23 out of 2551, or .9%, were true negative cases. [S-293]

Martin used these numbers to calculate sensitivity, specificity, and accuracy. [43T61-43T62; S-293] He testified that sensitivity was "high," being 97.8% under the impairment match and 92.9% under the certification match. [43T62; S-293] Martin noted that sensitivity is important in the criminal justice context because "[i]t's important that the DREs be able to accurately identify if someone is under the influence of drugs." [43T66]

The specificity was "low" using these numbers, being 22.3% under both the impairment and certification match. [43T62; S-293]

The overall accuracy calculated by Martin was 95.8% under the impairment match criteria and 91.1% under the certification match criteria. [43T61; S-293] Martin described these as "a fairly high level of accuracy." [43T61]

However, Martin acknowledged a problem with calculating specificity with the data set provided, noting that because the "specificity-related data is small," it may not be providing a true picture of specificity, which could be "more accurately determined with a larger number of data entries." [43T66-

43T67; 43T99; 45T81] As noted above, specificity is calculated using the numbers of true negative and false positive cases, and out of the 4,275 cases with toxicology results that Martin analyzed, there were only 112 cases that fell within these categories [43T65]

Martin thought the lack of data needed for a good specificity calculation was caused by the pre-screening of subjects before DRE involvement and the fact that, where DREs opined no impairment, toxicology samples were generally not taken. [45T79-45T84] This occurred in 305 non-training cases, as previously discussed in various sections of this report. He also thought that a potentially low or unreliable specificity would be more of a concern in another context, for example with an HIV test. [43T69-43T71]

2. Taylor

I note that, in its 302-page brief, the OPD identified Taylor as a testifying expert, but it did not advocate for any of the opinions he offered or even cite to his testimony except in connection with a few basic and uncontested statistical principles. [OPDb54; see also OPDb19; OPDb23; OPDb29; OPDb31-OPDb34] Similarly, with the one exception discussed below, the defense amici cited to Taylor's testimony only to the extent that it aligned with undisputed principles or was critical of some of the studies of the DECP discussed in section IX of this report. [see JAb13, JAb18, JAb22-

JAb23, JAb33] Because of that, and for the reasons noted in the credibility discussion above, I find that the testimony and opinions Taylor offered in this case were not relevant or useful, and I will discuss them only to the extent necessary to elucidate other findings and conclusions and put them in context.

On direct examination, Taylor did not offer his own calculations, from either data set, on sensitivity, specificity, or a global assessment such as accuracy. Although he testified for two days, his testimony essentially boiled down to the view that the "value added of DRE opinions" could not be determined from the information provided by the New Jersey data sets, that "the connection between DRE opinions and toxicology remains unknown for multiple reasons." [54T167; 55T11]

Regarding Martin's calculations, Taylor testified that his own "robustness test . . . suggest[ed] a different conclusion" than Martin's when looking at the State's data set. [54T133.] Specifically, he testified that, after using his coding method to account for the missing toxicology results, he calculated an "alignment rate" of 60.9% under the impairment match criteria and 56.4% under the certification match criteria [54T131-54T133] After applying a "one-tailed z-test" to these findings, he concluded that he could not "reject the idea" that the DRE opinions were "no better than random guessing" under the impairment match criteria and that the results were "no different, no

better than random guessing" under the certification match criteria [54T312-54T133]

Taylor acknowledged on cross-examination that, in one of the reports he authored in the case, he had calculated an "alignment rate" between DRE opinion and toxicology of 60.5% for non-training cases using the OPD data set. [55T19-55T20] He said this was "an initial estimate" that was "potentially misleading because of the data problem." [55T19]. He conceded that that his alignment rate was significantly lower than Martin's match rate because of the method he used to account for the missing data, resulting in the use of "a different denominator" that included "many, many missing cases." [55T24-55T25; 55T161] He agreed that if the cases with missing toxicology were re-classified from missing to aligning, the alignment rate would be 94.9%. [55T30-55T32]

In their brief, joint amici point to Taylor's opinions that, "after accounting for the missing data, there was only a 50-50 chance of the DRE correctly identifying drug impairment."[35] [Jab22] However, the bases for Taylor's no-better-than-chance opinion were (1) the alignment rate he calculated after coding all missing data as a mismatch, and (2) the application

[35] The joint amici brief miscites this testimony as 55T132-55T133; the correct cite is 54T132-54T133.

of the "one-tailed z-test" to the resulting data. [54T123; 54T130-54T132; D-544]

I have already rejected Taylor's coding method and found that it was an unreasonable way to account for the missing toxicology results. By using his coding method to account for the missing data, Taylor ignored the practical reality that the DRE opinions would likely have been correct as to at least a significant portion of the cases with missing data, thereby artificially reducing his alignment rate to an unreasonable degree. Taylor used that unreasonable alignment rate as a basis for his testimony that DRE opinions were no different from random guessing.

Similarly, Taylor's use of the one-tailed z-test suffers from the same problem, namely the assumption that calculations based on his unreasonable alignment rate could be credited. Moreover, I credit Schisterman's testimony that characterized the one-tailed z-test as a "relatively rudimentary method to account for clustering in the context of clinical trials" and noted that Taylor had other "methods that are more sophisticated and more precise" at his disposal, had he chosen to use them. [56T184-56T185; 56T191-56T192]

By not relying on Taylor's opinions, the OPD effectively abandoned the argument that DRE opinions are no better than random guessing. The joint

amici advance the argument, but I reject it as inconsistent with the credible statistical testimony.

3. Schisterman

Schisterman looked at both the State's data set and the OPD's data set. [56T98; 57T79; S-429 at 11-12] He "wanted to try to take a balanced approach to read and reanalyze the data and try to see if the concerns raised either by Dr. Martin or Dr. Taylor or the approach that they have taken, the assumptions that they have made, were either valid or not . . . So I wanted to see how robust were the results to the concerns either raised by Dr. Martin or Dr. Taylor." [56T68]

Schisterman performed a multiple imputation analysis on both data sets. [56T98; 57T79] After incorporating the missing data into the existing data using multiple imputation, he calculated a range of sensitivity from 82.5 to 92.6 for non-training cases under the DRE certification match criteria. [56T113-56T114] The lower number of 82.5 was based on the extreme assumption that every single person with missing toxicology results would have tested negative, while the 92.6 was based on the opposite assumption, that they all would have tested positive. [56T113; 57T44-57T45; S-429 at 9-10] This considered, as to non-training cases, "the combination of the observed data plus the reclassification of the missing data into all the possible

combinations." [56T114] Schisterman characterized this as "a really very good sensitivity." [56T113]

The range for the specificity of the non-training cases, on the other hand, after the multiple imputation analysis, had a minimum of 2.5 and a maximum of 72.1. [56T114; S-429 at 9-10] "So that gives me a lot of pause, all right, because it could be the specificity goes from being terrible, 2.5, to being quite good, to 72.1." [56T114] Schisterman did not "feel confident that the specificity results [we]re reliable," because the results changed dramatically depending on the assumptions made about the missingness." [56T114]

Overall, Schisterman concluded that "the sensitivity is quite robust," but the specificity raises concerns regarding whether "it's estimatable at all." [56T116]

Schisterman also took the State's data set and made calculations for sensitivity, specificity, accuracy and kappa under the impairment match criteria and the DRE certification match criteria, using the listwise deletion method to account for missing data (S-429/Table 1) [56T48-56T549; 56T60-56T61; 56T139; S-429 at 11] His results using the State's data set and Martin's method were "quite consistent with Dr. Martin's results." [56T52; S-429 at 11] He also applied the listwise deletion method to the OPD's data set (S-429/Table 2). [56T60-56T61; S-429 at 11] Schisterman concluded from this

analysis that "clearly the sensitivity is consistent across these two data sets, is very close one to the other." [56T61] Because of this consistency, he "didn't doubt the validity of the data entry and the analysis of both data sets." [56T62]

However, the specificity was not consistent between data sets because the specificity calculations "in both data sets [we]re based on extremely small numbers." [56T63] Specificity is calculated using the numbers for true negative and false positive cases, and Schisterman explained that "what happened is – is in the data set that we have, the number of true negatives, the number on this piece, false positives plus true negatives, is really, really small to make sure that these estimators are stable." [56T147] For example, Schisterman's recollection was that one data set indicated that there were seven true negatives, while the other indicated that there were five. [56T63] These were "extremely small numbers" that did not provide "enough true negatives" to meaningfully calculate specificity. [56T63]

Schisterman then used multiple imputation "to answer the same questions" answered in Table 1 and Table 2 of S-429. [56T50; S-429 at Table 3 and Table 4] After this analysis, Schisterman remained "consistently confident about the sensitivity estimation" as to both the State's data set and

the OPD's data set, but he did not "put too much weight into the estimation of the specificity." [56T142]

He noted that he did not have the data to conclude whether the specificity was good or bad. [56T144] "The data is not sufficient to estimate the specificity at all. And so that's what happens when you have a small sample size for some strength; in this case, specificity." [56T144]

Although Schisterman calculated numbers for accuracy and kappa using both data sets and both the listwise deletion and multiple imputation methods of accounting for the missing toxicology results, he explained that, because of the problem with specificity, he "wouldn't make too much of the accuracy in this case either or the kappa." [56T143-56T144; S-429 at 11-12] The only estimator he felt "really confident" about was sensitivity [56T144] He testified that all of the global calculations that rely on knowing the specificity, such as accuracy, positive likelihood ratio, and negative likelihood ratio "are not trustworthy because the specificity is not estimated correctly or reliably." [56T160; 57T26-57T27] The same is true of positive predictive value and negative predictive value. [57T26; 57T121-57T122] He concluded that "[a]ll the global measures of the test that sometimes we want to know, I cannot make with this data set." [56T160] Schisterman's opinion was that any calculations depending on "the false positives and the true negatives, I cannot guarantee

that the results are either good or bad. It could be perfect; it could be terrible. We just don't have the data in this setting." [57T24]

Schisterman noted that "[i]nfinite statistics" could be calculated – "you can calculate almost anything you want," but "[t]he question is what's the question that you're trying to answer? That determines what's the appropriate statistic that you should be using." [56T45]

Schisterman believed that it was not his "place to say" whether sensitivity or specificity was a more important statistic in this case because he did not have the background to do that. [57T19-57T20] Nevertheless, he noted that "[n]ot every test is equally important in all situations," and "the question that we have in front of us" is important. [57T10] He explained:

> So what I'm trying to say is that, in general, we want always to have really, really high sensitivity and specificity, but context have implications. What are the consequences of misclassifying somebody as a negative when it's positive, or what are the consequences of misclassifying somebody who was tested – who was told to be positive and found it is negative?
>
> * * *
>
> So I can't – it is important to think that – to say that we always aim for 100 percent sensitivity and 100 percent specificity. But sometimes there is context specific that needs to give one or the other more importance.
>
> [57T11-24 to 57T12-15.]

Depending on the context and the question being posed, "sometimes sensitivity is more important; sometimes specificity is more important; sometimes both are more important – are important." [57T41]

The data sets also did not provide information that would enable Schisterman to determine how well a DRE could predict the presence of drugs in the general driving population. [57T59] Because there was "already a process of screening" that occurred prior to the DRE evaluations that limited the subject population to one including subjects whose (1) actions had provided the arresting officer with probable cause to believe they have violated N.J.S.A. 39:4-50, and (2) breath test results showed a BAC seemingly inconsistent with their perceived impairment, the subject population being studied by the DREs had a type of selection bias known as a referral or verification bias as compared to the general driving population. [56T75-56T76; 56T81]

Schisterman explained that such a bias "will lead to inflated sensitivity and deflated specificity if I was trying to evaluate the test in the general population. But it will be consistent if I'm trying to evaluate it in this population." [56T76] Thus, the sensitivity Schisterman calculated would likely be inflated as to the general driving population, but "[i]t's correct for

anybody who gets stopped" for some driving-related behavior and is referred to a DRE. [57T60]

Schisterman noted that he would not be concerned that the specificity of a test might be inflated as to the general population in a circumstance where "my population study is anybody who gets referred for further testing." [56T80; 57T58] "So the answers are – always depends on the question you're asking. And the population that you study is part of the question that you're asking." [56T80]

E. Findings and Conclusions Regarding Data Sets

Essentially, the data sets comprised of the New Jersey DRE evaluations from 2017 and 2018 constituted a fairly large, retrospective field study. As discussed in section IX of this report, other retrospective field studies typically had far fewer DRE evaluations to analyze. Similar to other retrospective field studies analyzing evaluations in which the DREs completed the entire DRE protocol, the New Jersey data had inherent limitations but was generally favorable in showing that DREs can reliably and consistently identify subjects whose impairment is the result of ingesting drugs.

Martin calculated a high overall accuracy level of DRE opinions as 95.8% under the impairment match criteria and 91.1% under the certification match criteria. [43T61; 43T61; S-293] This is a useful indication that the

opinions of New Jersey DREs are correct in the vast majority of cases, notwithstanding the fact that the very small number of true negative and false positive cases in the data sets calls the statistical reliability of this exact accuracy level into question.

I credit Schisterman's, and to a lesser extent, Martin's, testimony that specificity could not be reliably calculated from the New Jersey data due to the small number of true negatives and false positives in the New Jersey data set and that, as a consequence, calculations such as overall accuracy that rely on the same numbers as the specificity calculation are also problematic.

However, I also accept Schisterman's testimony that sensitivity could be reliably calculated from the available data. Looking at only non-training cases, Martin's calculations after listwise deletion showed a high sensitivity of 96.2% under the impairment match and 89.0% under the more stringent DRE certification match. [43T62; S-293] Schisterman's numbers after multiple imputation for non-training cases under the DRE certification match were slightly lower but overall consistent with Martin's, showing a range of sensitivity from 82.5 to 92.6. [56T113-56T114]

Sensitivity is an important number for analyzing the effectiveness and reliability of the DRE protocol. It shows that, in the population of subjects with drugs in their systems, a DRE will almost always correctly opine that a

drug is present – i.e., DREs are excellent at identifying true positive cases. A high sensitivity also means that the numbers in the other component of the formula – false negative cases – are comparatively small, meaning that the DREs will rarely fail to opine impairment by drugs when drugs are, in fact, present in the subjects. And of course, the existence of some false negative cases does not reflect badly on the effectiveness or reliability of the protocol. Indeed, given the limitations of using toxicology results as a gold standard for drug impairment, a DRE might well correctly opine that a subject is not impaired, notwithstanding the fact that some drug is present in the subject's urine.

The OPD contends that specificity, not sensitivity, is "the most important metric in assessing the usefulness of the program," [OPDb109] but this is not correct, particularly in the context of this case, where specificity cannot be determined to be either good or bad due to an absence of data. In some ways, the fact that the numbers of true negatives and false positives in the New Jersey data set were very small supports the conclusion that DREs in this state are doing their job well.

The very small number of true negative cases – just 23 of the 105 non-training cases showing no drugs in the toxicology sample – was essentially the result of a system in which, not only was the overall subject population pre-

screened, but urine samples were generally not requested from the individual subjects the DREs determined were not impaired by drugs and who would not be charged with a DUID offense. The circumstances where, practically speaking, a true negative was most likely to occur were precisely those in which no confirming toxicology was available, specifically the 305 cases where the DRE opined no impairment and requested no sample. Had toxicological results been available for the 305 subjects who fell into this category, a clearer picture of true negative cases would have been available. [57T133]

On this point, Schisterman offered his general opinion, emphasizing that "this is an opinion; this is not statistics." He noted that after the prescreening leading up to DRE evaluations the data shows that "they let go a lot of people who are not using. Most of the people who are not using are being let go. So that's already part of the specificity of it." [57T133]

Martin noted that a "true picture of specificity" would result from using the protocol to evaluate "a random sample of all drivers rather than" just those who provided probable cause to arrest and a non-alcohol-use basis for examination by a DRE. [43T68] A field study presenting a random sample of all drivers, including real-life drug-impaired drivers, might theoretically provide sufficient data from which specificity, and by extension overall

accuracy, could be calculated more reliably than with the New Jersey data sets. However, constitutional limits, as well as cost and other practical considerations, would make such a study impossible.

Significantly, the number of false positives in the overall data set was very low – only 82 out of 2551 non-training cases (3.2%) and 87 out of the total 4275 cases with toxicology (2%). Moreover, some of these could have been due to the limitations of toxicological testing rather than an error by the DRE, such as a case in which the subject ingested a synthetic cannabinoid or an unknown designer drug or a drug for which the laboratory does not typically test. Although Schisterman testified that this very small number, as well as the very small number of true negative cases, made calculating specificity and global computations as to the entire data set problematic, neither he nor any other witness disputed that the number of true positive cases was very small.

Certainly, the OPD's contention that the data showed "an alarmingly high false positive rate" is wholly unsupported.[36] [OPDb106] The OPD also

[36] The OPD disregards the very low percentage of false positives in the non-training cases and, again relying on the non-evidential PCAST report, repeatedly asserts that (1) in the criminal justice context, a "false positive rate" of more than 5% is unacceptable, (2) the false positive rate of a test should be calculated using the difference between 1 and the number for specificity (FPR = 1 – SPC), and (3) using that calculation, the New Jersey data sets (and most of the studies (continued)

contends that the 82 false positives in the non-training cases were people who "would have been incorrectly criminalized based on the DRE officer's opinion." [OPDb112] This contention, however, ignores the reality that some of those 82 subjects could have been impaired by drugs not revealed through standard toxicological testing. Moreover, DRE opinions are not, like Alcotest results, a basis for per se convictions, so it is not correct to characterize subjects as "criminalized" by them. It is simply one piece of evidence for the factfinder to consider and weigh. A factfinder might give a DRE opinion that a subject was impaired by drugs less weight where a negative toxicology result is also in evidence, particularly if the drug opined by the DRE was one that would be expected to show in a toxicology result, but this does not render DRE opinions generally unreliable as evidence.

The OPD also contends that "[s]uspect admissions . . . are the single best predictor of positive toxicology result; better than any other step or combination of steps of the DRE protocol, thus demonstrating that DRE officers' purported expert opinions are not doing the work of predicting the drug-positive cases." [OPDb106-OPDb107] It claims that the high correlation

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discussed in section IX) show false positive rates far in excess of 5%. [OPDb60; OPDb82-OPDb91; OPDb100-OPDb101; OPDb110; OPDb161; OPDb208-OPDb210; OPDb217; OPDb267-OPDb271] This argument, however, ignores that the calculation it advocates requires a reliable specificity number to generate a reliable false positive rate, which was not the case here.

between admissions of drug use and toxicology results "further demonstrat[e] that the protocol does not add anything to the search for truth," and it points to Schisterman's "odds ratio analysis" as supporting the proposition that "admissions are a better predictor of positive toxicology results than the rest of the DRE protocol." [OPDb113-OPDb117] Of course, there are not admissions in all cases, and sometimes the alleged "admission" is ambiguous or disputed. Moreover, the OPD ignores the context of the testimony and Schisterman's actual opinion. Schisterman was not "evaluat[ing] what factor was more important than another and how to find the best model," but "was just trying to evaluate if the DRE remains an independent better-than-chance than any other factors," in response to Taylor's suggestion that a DRE opinion was no better than a guess. [57T137; S-429 at Tables 5 and 6] Most important, Schisterman's conclusion was that, even accounting for admissions as a separate factor, DRE opinions remained "statistically significant" and were "an independent predicting factor" when evaluating the relationship between DRE opinions and toxicology results [56T170-56T172; 57T109]

Finally, I reject the OPD's contention that "the difficulty in compiling this data, as well as missing, duplicate, and inconsistent data entries raise questions about the overall reliability of the New Jersey DRE program." [OPDb107-OPDb108] As detailed above, the OPD requested the raw data,

which the State provided without objection, and the parties spent many months examining and refining it until creating and admitting into evidence two substantially similar spreadsheets. The OPD contends that the "immense effort" undertaken by the State to produce and compile the data, by itself, "demonstrates that DRE officers are not keeping complete and accurate records." [OPDb108] I do not find this persuasive.

Similarly, although the State acknowledged that not every DRE who was certified in 2017 and 2108 responded to its inquiries, and although the OPD established, primarily through its cross-examination of Errico, that there may have been some missing reports or errors or duplication in compiling the data, nothing in the record suggests that these inaccuracies were pervasive or statistically significant.

As Schisterman repeatedly noted, in evaluating statistics, one must look at the question being asked. Here, the very high sensitivity and very low number of false positive cases are helpful factors in analyzing the pertinent question, i.e., can DREs following the protocol reliably identify drug impaired drivers in the population they have been trained to evaluate. I find that the experts' analysis of the New Jersey data sets establishes that, over a two-year period, DREs in New Jersey, in actual, real-time enforcement situations, correctly opined the presence of impairing drugs in arrestees who did have

such drugs in their systems as established through toxicology testing (true positives) at an extremely high rate, at or approaching 90%. Also, the number of non-training cases in which the DREs opined the presence of impairing drugs but the toxicology testing revealed no drugs (false positives) was very small in number (82 out of 2552 = 3.2%). The New Jersey data thus offers persuasive corroboration of the expert testimony showing that DREs can be trained to recognize impairment caused by toxidromes.

IX. STUDIES AND REPORTS

One of the three ways to establish general acceptance in the relevant scientific community under the Frye standard is through "authoritative scientific and legal writings." State v. J.L.G., 234 N.J. 265, 281 (2018). Both parties in this matter have introduced numerous studies examining aspects of the SFSTs and the DECP, and both parties discuss many of those studies at length in their briefs. The State contends that "[a] wide breadth of both agency- and peer-reviewed publications show that the DECP and the SFSTs are valid and reliable," suggesting that the studies in evidence qualify as authoritative scientific writings sufficient to satisfy the general acceptance standard. [Sb320]

I will discuss the SFST-related studies first, starting with those addressing alcohol alone and then considering those concerned with the ability

of the SFSTs to detect the use of drugs other than alcohol. Next, I will discuss the studies relating specifically to the DECP.

A. SFST studies

Participants in SFST training are taught about six foundational studies, three undertaken between 1977 and 1986, and three between 1995 and 1998. [21T175-21T178; D-7 at pdf 337-49; D-18 at pdf 290-303]

1. Early field sobriety studies – 1977 to 1986

As detailed in section IV regarding the background of the DEC program, SCRI and NHTSA conducted three studies – one lab study (the 1977 SCRI study (S-19), one combined lab and field study (the 1981 SCRI study (S-20), and one field study (the 1983 NHTSA study (S-21) – in the late 1970s and early 1980s in an effort (1) to determine which of the many non-standardized field sobriety tests typically being used by officers were the best at detecting drunkenness, and (2) to develop a practical and standardized set of such tests that would be feasible to use in roadside stops. The result was the three-test battery known as the SFSTs, which is comprised of the HGN, WAT, and OLS tests and which by 1986 the IACP had recommended be adopted nationally by law enforcement agencies.

Regarding the first three studies, the 1977 SCRI study, the 1981 SCRI study, and the 1983 NHTSA study, the SFST participant manual notes that

SCRI initially examined the six "most commonly used field sobriety tests" used in the United States, but "[t]he research showed these three tests," specifically the HGN, WAT, and OLS tests, "were the most accurate," while "the remaining tests were merely reassessing the same skills." [D-18 at pdf 293] The manual states that the 1983 NHTSA study, which built on the two earlier SCRI studies, "was the first significant assessment of the workability of the standardized tests under actual enforcement conditions," and that "[t]he results of this study unmistakably validated the SFSTs." [D-18 at pdf 296-97]

The early SFST studies gave some attention to which of the three components of the SFSTs was the most accurate. The 1983 NHTSA study reported expected and calculated accuracy scores for each component, and it noted that its results suggested the HGN test was "the most powerful of the three" tests among the SFSTs "if only one is used" and that combing the HGN and WAT tests "offers the most potential for discriminating between those above and below .10% BAC." [S-21 at *pdf at 6, 9-10, 13] Notwithstanding this conclusion, the study also noted that its data "should NOT be used to draw conclusions about using only one test given by itself as opposed to using another one of the three by itself." [S-21 at *pdf 10]

Fiorentino testified that the accuracy numbers calculated for the individual tests in the 1983 NHTSA study were "pretty impressive numbers,"

but the contemporary understanding is that, unless a subject cannot perform a given component of the SFSTs for some reason, officers should administer all three tests. [47T183] He explained that "it turns out that the tests appear to tap into different cognitive domains," noting for example that a subject must "think about" the WAT and OLS tests, but not the HGN test [47T183-47T184] "And so we didn't know that then, but we know now, that you can use – the understanding that different tests tap into slightly different domains is potentially useful for diagnostic purposes." [47T184]

2. 1995-1998 studies

NHTSA undertook three additional field validation studies between 1995 and 1998 – the 1995 Colorado study, 1997 Florida study, and 1998 San Diego study. [D-15; S-302; S-312] SFST training participants are taught that "[e]ach of these studies has shown the SFSTs are scientifically validated and are a reliable method for distinguishing between impaired and unimpaired drivers." [D-7 at pdf 344-45; D-18 at pdf 298-99]

a. 1995 Colorado study

"A Colorado Validation Study of the Standardized Field Sobriety Test (SFST) Battery" (1995 Colorado study) was a field study funded by the Office of Transportation Safety, Colorado Department of Transportation, using

NHTSA funds, and it was conducted by Marcelline Burns of SCRI[37] and a deputy from the Pitkin County Sherriff's Office in Aspen. [D-15 at pdf 1] The researchers collected about 300 records from SFST evaluations performed between February and July 1995 on subjects suspected of driving while intoxicated, and they analyzed the arrest/release decisions of thirty-one officers from six police agencies in Colorado. [D-15 at pdf 16; 22T15-22T16). The study focused on the 234 cases with a known BAC from a breath or blood sample. [D-15 at pdf 19]

"The primary study question was, 'How accurate are officers' arrest and release decisions when the SFSTs are used by trained and experienced officers?'" [D-15 at pdf 3; 22T25] The SFST training manual notes that the 1995 Colorado study "was the first full field study that utilized law enforcement personnel experienced in the use of the SFSTs." [D-7 at pdf 346] The officers had been trained in administering the SFSTs between 1985 and 1994 and had an average of seven years, 8 months overall policing experience. [D-15 at pdf 13, 16]

Colorado law at the time provided that drivers with a BAC of 0.10% and higher were guilty of DUI, while drivers with a BAC between 0.05% and

[37] Fiorentino was a technical consultant with SCRI at the time and was a member of the project staff for this study and for the 1997 Florida study discussed below. [D-15 at pdf 2; S-302 at *pdf 3]

0.10% were guilty of the lesser offense of driving while ability impaired. [D-303 at 1195; 22T17] After analyzing the 234 cases with breath or blood samples and the corresponding arrest or release decisions, the researchers determined that:

> 93% of the decisions to arrest were correct.
> 64% of the decisions to release were correct.
> 86% of overall decisions to arrest or release were correct
> [D-15 at pdf 21]

The study noted that "officers seldom erred when they decided to arrest a driver," and the errors that did occur were more likely to be "on the side of releasing drivers than on the side of incorrectly arresting drivers." [D-15 at pdf 3] "Overall, 86% of the officers' decisions to arrest or release drivers who provided blood or breath specimens were correct." [D-15 at pdf 3] The study concluded that "the SFSTs are valid tests; i.e., they serve as indices of the presence of alcohol at impairing levels." [D-15 at pdf 3; 22T27]

b. 1997 Florida study

"A Florida Validation Study of the Standardized Field Sobriety Test (S.F.S.T.) Battery" was undertaken by Burns of SCRI and an officer of the Pinellas County Sheriff's Office in Largo, Florida. [S-302 at *pdf 1] It was a research project sponsored by the State Safety Office, Department of

Transportation, State of Florida "in cooperation with" NHTSA. [S-302 at *pdf 1] The SFST training manual notes that it was "the second SFST field validation study undertaken" and "was the first study conducted at the lower BAC limit of 0.08." [D-7 at pdf 347]

The study hypothesis for the 1997 Florida study was that properly trained officers with experience administering the SFSTs would be correct in making arrest decisions ≥ 90% of the time, without access to a preliminary breath test instrument. [S-302 at *pdf 11]

Subjects were detained at roadside and asked to perform the SFSTs due to some evidence of impairment. [S-302 at *pdf 11] Eight officers who had "specialized training in DUI enforcement, including SFST training" administered the SFSTs on the subjects [S-302 at *pdf 12] Each officer had made hundreds of DUI arrests before taking part in the study. [S-302 at *pdf 12-13] The researchers excluded from the analysis instances where the officer used sobriety tests in addition to the SFSTs. [S-302 at *pdf 13]

The SFSTs were administered as part of roadside stops occurring between June and September 1997. [S-302 at *pdf 16] The researchers considered records from 313 cases, 256 of which had BAC results obtained after the SFSTs were administered. [S-302 at 16] Observers were present for

242, or 64%, of all stops, and they obtained voluntary breath samples where possible from subjects released by the officers. [S-302 at *pdf 13-14]

The study found that, measured against a 0.08% BAC standard, 95.6% of decisions to arrest were correct and 82% of release decisions were correct. [S-302 at *pdf 21, 38] Of the nine subjects who were arrested but found to have BACs less than 0.08%, five had BACs over 0.06%. [S-302 at *pdf 21]

The study based its "correct" and "incorrect" arrest and release decisions solely on the tested BAC level. [S-302 at *pdf 10] It noted, however, that "[i]n the broader sense of impairment, the labels may or may not accurately reflect correctness or error. It is important to understand that a driver incorrectly-arrested in terms of the BAC standard of 0.08% may have been dangerously impaired by a lower BAC or by some other drug or condition." [S-302 at *pdf 10] In some cases, officers suspected or subjects acknowledged drug use besides alcohol, but that was not considered as part of the study. [S-302 at *pdf 20]

The 1997 Florida study noted that "[t]he three tests" of the SFSTs "have been incorporated into Drug Influence Evaluations (DIEs) which are conducted by certified Drug Recognition Experts (DREs) whenever an individual is suspected of being drug-impaired," and it stated that the SFSTs "provide important evidence of drug impairment" and "contribute" to opinions by

DREs. [S-302 at *pdf 8] The study did not, however, analyze DRE evaluations or the role of the SFSTs in those evaluations, evidently basing this comment on the 1994 Adler/Burns study discussed below. [S-302 at *pdf 8-9]

The 1997 Florida study concluded that "the SFSTs not only aid police officers in meeting their responsibility to remove alcohol-impaired drivers from the roadway, they also protect the rights of the unimpaired driver." [S-302 at *pdf 38] "SFST validity has now been demonstrated in Florida, California (1997),[38] and Colorado (1995)," and "[t]here appears to be little basis for continuing legal challenge." [S-302 at *pdf 38; 22T69-9 to 22]

c. 1998 San Diego study

"Validation of the Standardized Field Sobriety Test Battery at BACs Below 0.10 Percent" was a study conducted by Anacapa Sciences, Inc., and submitted to NHTSA in August 1998 by authors Jack W. Stuster and Burns. [S-312 at *pdf 1] The study was prompted by "[t]he trend to reduce statutory DWI limits to 0.08 percent BAC." [S-312 at *pdf 5; D-7 at 347] The SFST training manual states that "[t]his is the most current research used to describe

38 The "California (1997)" study referred to the 1998 San Diego study, which was not published until August 1998 but which looked at roadside stops in San Diego on dates ending in November 1996, about eight months before the stops analyzed in the 1997 Florida study began. [S-302 at *pdf 8; S-312 at *pdf 23]

the accuracy of the SFSTs" and the study "should be referenced in court whenever possible." [D-7 at pdf 348]

The data used in this study was collected from traffic stops occurring between May and November 1996 made by seven officers of the San Diego Police Department. [S-312 at *pdf 3, 23] The officers were from the department's "special alcohol-enforcement unit," trained in administering the SFSTs [S-312 at *pdf 18] They received a 4-hour refresher course before taking part in the field study [S-312 at *pdf 18]

The "data analysis plan" for the 1998 San Diego study "was designed to answer" the following:

> • How accurately do the tests discriminate between subjects who are above or below 0.08 and 0.04 percent BACs?
>
> • Which of the components of the SFST battery is/are the best predictor(s) of BAC?
>
> • How reliable, or consistent, are the tests?
>
> • Are the tests usable by police officers? Are they readily accepted by officers and prosecutors?
>
> [S-312 at *pdf 21]

The study included 297 total subjects, with 24 being under 21 years old. [S-312 at *pdf 26] Of these subjects, about 73% were arrested for DWI, 22% received warnings, and 5% were cited for a motor vehicle violation other than

DWI. [S-12 at *pdf 26] Portable breath-testing devices were used on all subjects after the SFSTs were administered, including those subjects who were released because the officers estimated a low BAC. [S-312 at *pdf 19-21]

The study showed that officers had "a high degree of accuracy" in their arrest and release decisions. [S-312 at *pdf 18] Based on estimations of a 0.08 BAC, the data showed a 90% accuracy rate for correct arrest decisions, a 94% accuracy rate for correct release decisions, and an overall accuracy rate of 91%. [S-312 at *pdf 28] It concluded that "[t]he results of this study provide clear evidence of the validity of the Standardized Field Sobriety Test Battery to discriminate above or below 0.08 percent BAC." [S-312 at 38] Although the officers' estimates of BAC between 0.04 and 0.08 were less accurate, the study noted that its results "strongly suggest that the SFSTs also accurately discriminate above or below 0.04 percent BAC." [S-312 at 38][39]

The six foundational SFST studies are informative, but their applicability to these proceedings is somewhat limited. The SFSTs were designed to identify tests that would be effective in assessing drunkenness, and

[39] Eight years after completing the 1998 San Diego study for NHTSA, Stuster re-analyzed the same collected data and published the results in a peer-reviewed journal, reaching substantially the same conclusions. [S-145 at 610-14; 48T28-48T31] He stated that the 1998 San Diego study "provided statistically significant evidence" that officers administering the SFSTs can accurately "discriminate above or below 0.08% BAC." [S-145 at 614]

the foundational studies all dealt exclusively with the ability of officers to detect alcohol impairment. The SFSTs alone were not designed to detect impairment by drugs other than alcohol.

Thus, the central question at issue in the studies (i.e., can officers determine through administering the SFSTs whether a subject exceeds a specific statutory BAC level) is distinct from the question at issue in this hearing. The BAC level of subjects undergoing a DRE evaluation is established by Alcotest in step one of the protocol, not through the SFSTs. Indeed, even in alcohol-only cases in New Jersey, SFSTs are used as evidence of impairment, not to establish a particular BAC.

While the DECP incorporates the SFSTs within the twelve steps, they are not administered as an isolated unit. The WAT and OLS tests are administered as part of a broader array of psychomotor tests, and HGN is administered as part of a broader examination of eye signs and symptoms. In addition, the HGN test has more significance in SFSTs administered to suspected drunk drivers because nystagmus is only expected to be present with a few drug categories, including CNS depressants, which include ethanol.

Notwithstanding these limitations, the studies and the testimony relating to them support the conclusion that the SFSTs can assist officers trained to administer them to identify cognitive and psychomotor impairment in subjects.

This, in turn, supports the conclusion that the WAT and OLS tests incorporated into the DRE protocol are useful tools for the DRE to detect impairment.

Also, while the significance of the presence of nystagmus is different for the DRE than for the officer looking for alcohol intoxication, the SFST studies support the conclusion that officers can be trained to perform the HGN test and recognize nystagmus.

Page testified that administering the SFSTs can help DREs determine if a subject's cognitive faculties and physical capabilities have deteriorated to the point where it would be improper for that person to drive. [25T226]

Similarly, Fiorentino testified that "[t]he ability to divide attention is severely affected by alcohol and other drugs." [49T67] "In its simplest form, driving is a divided attention task . . . It's the integration of many, many processes." [49T67] Thus, the SFSTs can be used to identify impairment by drugs as well as alcohol. [48T77-48T78; 48T138; 49T71]

3. Other alcohol-related SFST studies

The parties introduced into evidence and have discussed in their briefs a few other studies analyzing the SFSTs, most in the context of evaluating alcohol impairment. Three studies conducted between 2002 and 2007 focused on aspects of HGN.

In 2002, the article "Sobriety Tests for Low Blood Alcohol Concentrations," for which A. James McKnight was the lead author, was published in the peer-reviewed journal Accident Analysis & Prevention (2002 McKnight article). [S-132; S-303 at 1193; 32T115-332T116] Regarding the HGN test, the authors were comparing the results of the test if administered on a subject who was seated as opposed to standing.[40] [S-132 at 305; 32T116] The study concluded that the HGN test was "as valid when administered to a seated subject as one standing." [S-132 at 305; 32T117]

The research in the McKnight article, in part, motivated Citek and two other researchers to do their own study the following year comparing the seated and standing postures and adding "the supine posture." [S-134; 32T64-32T65; 32T117] They published the peer-reviewed article "Nystagmus testing in intoxicated individuals" in Optometry in November 2003. [S-134 at 695; 32T63] Looking primarily at HGN, but also VGN, the researchers wanted "to determine whether the subject's posture would make any difference either in the appearance of indicators on the different eye tests . . ., or if it would affect the evaluator in making those observations." [32T64-32T65]

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[40] The 2002 McKnight article discussed other "measures involving performance and appearance" that could potentially be used "to establish probable cause for requesting breath tests," but it was admitted limited to its discussion of HGN. [S-132 at 305; 32T116]

The authors discovered a "statistically significant" difference between evaluations performed on seated subjects as opposed to subjects in either of the other postures, which they attributed to some difficulty the evaluators had in seeing the eyes of the seated subjects. [S-134 at 708; 32T80; 32T92] However, they concluded that the statistical differences were "not of practical significance to the officer in the field" because "evaluators typically observed fewer than two signs on subjects with BACs below 0.04%, and four or more signs on subjects with BACs at 0.10% and higher, regardless of posture." [S-134 at 708; 32T80; 32T92]

In 2007, Burns did a series of experiments focusing on the HGN test, submitting the report titled "The Robustness of the Horizontal Gaze Nystagmus Test" to NHTSA in September 2007. [D-423] In response to arguments that "variations from standard procedures in HGN administration affect its validity and should render testimony about it inadmissible," Burns conducted three experiments that "examined the effects of procedural variations in administration of the HGN test," specifically variations in the placement and speed of the stimulus, the participants' posture, and the functional vision of the subject. [D-423 at *pdf 3] Burns concluded that the data "demonstrate[d] the validity of the HGN test with both standard and varied testing procedures. The variations did not alter the occurrence of, or the

observations of, HGN." [S-158 at *pdf 3, 8-9] She stated that "HGN is a robust phenomenon." [D-423 at *pdf 9]

In addition to these studies focusing on HGN, Citek and several other authors published the results of a study they conducted in "Sleep Deprivation Does Not Mimic Alcohol Intoxication of Field Sobriety Testing," published in the peer-reviewed Journal of Forensic Sciences in September 2011. [S-136; 32T119] Citek testified that the authors "were curious to see if sleep deprivation," meaning wakefulness for at least twenty-four hours, would significantly impact performance on the SFSTs and similar psychomotor tests. [32T120]

The researchers analyzed data collected from evaluations performed by six volunteer DRE-trained officers during nine sessions, over the course of which twenty-nine subjects were each evaluated after sleeping normally and after a night of sleep deprivation, both prior to and after consuming alcohol. [S-136 at 1171-72; 32T120-32T121] The evaluators were not aware of whether the subjects were rested or sleep deprived, what their BAC levels were, or which three of the subjects "within each state of restedness were maintained as placebo drinkers," meaning that they were given "just enough alcohol to create a breath odor of alcohol." [S-136 at 1172] The authors' data indicated that "[t]he presence and number of validated impairment clues

increase[d] with increasing blood alcohol concentration but not with SD [sleep deprivation]. [S-136 at 1170] They concluded that "[w]hile SD can affect cognitive ability and certain physiological responses, the results of this study suggest that there is no evidence that it affects eye movements or motor skills assessed with FSTs in a manner that would lead a law enforcement officer to conclude that the suspect is intoxicated, unless intoxication also is present." [S-136 at 1177; 32T133]

While these non-foundational alcohol-related studies are interesting, they do not significantly inform the question at issue – the scientific reliability of DRE evaluations.

4. SFST studies and the DECP

The State contends in its brief that "[t]here is a solid body of research showing that the SFSTs are useful to detect drug-induced impairment." [Sb390] However, they cite to and discuss only three studies admitted into evidence that examined a relationship between the SFSTs[41] and drugs (S-157, S-140 and S-319). [Sb249-Sb251; Sb390-Sb399]

[41] I refer here only to the SFST three-test-battery as a unit. As detailed elsewhere in this report, the State provided convincing testimony and other evidence that HGN and other eye-related tests are generally accepted and reliable indicators of various toxidromes.

a. 2005 Papafotiou study

The article "An evaluation of the sensitivity of the Standardised Field Sobriety Tests (SFSTs) to detect impairment due to marijuana intoxication," was authored by K. Papafotiou, J.D. Carter, and C. Stough, and published in the peer-reviewed journal Psychopharmacology in 2005. [S-157; 34T16] The researchers noted that the police in Australia were currently using the SFSTs "to test for driving impairment associated with drugs other than alcohol," and the goal of the study was "to assess whether the SFSTs provide a sensitive measure of impairment following the consumption of" THC. [S1-40 at 107; 34T18]

This was a laboratory study done in Australia. [S-140 at 107; 34T17] At three testing sessions that occurred at least a week apart, researchers had forty subjects smoke cigarettes that were either a placebo or that contained one of two doses of THC. [S-157 at 108-09; 34T18] The subjects then performed the SFSTs three times – after 5 minutes, 55 minutes, and 105 minutes. [S-140 at 107]

The authors concluded that "the consumption of THC does impair performance on the SFSTs," and that "the higher the content of THC consumed, the greater the number of participants" were judged to be impaired. [S-157 at 111] The authors also explored "the addition of a new sign, head

movements or jerks," which they found improved the predictive validity of the SFSTs when testing for THC intoxication. [S-157 at 107-11]

Relating "the findings of the present study . . . to real-world scenarios," the researchers stated that "[t]he findings indicate that the SFSTs provide sensitive measures of impairment, even when a relatively low dose of THC has been consumed." [S-157 at 112] The authors noted, however, that (1) it was "difficult to ascertain" whether the THC doses they administered were similar to those of actual cannabis users, and (2) "the application of the SFSTs to assess" drivers who ingested other drugs as well as THC could "only be inferred from the findings of the present study." [S-140 at 112]

b. 2014 Porath and Beirness SFST study

In 2014, Amy J. Porath[42] and Douglas Beirness published "An Examination of the Validity of the Standardized Field Sobriety Test in Detecting Drug Impairment Using Data from the Drug Evaluation and Classification Program" in the peer-reviewed journal Traffic Injury Prevention (Porath/Beirness SFST study).[43] [S-140; 48T140-48T141] The objective of

[42] At the time of some later studies referenced below, Porath's last name was Porath-Waller, but she returned to using Porath. For convenience and to avoid confusion, I refer to her throughout as Porath.

[43] Porath and Beirness together, and Beirness alone, also conducted a number of studies on the DECP, which are discussed below.

the study was "to examine data from the components of the SFST that are recorded during DEC evaluations as a means to assess the validity of the SFST in identifying impairment among suspected drug-impaired drivers." [S-140 at 127; 48T142]

The authors used "multinomial logistic regression"[44] to examine retrospective data from 2,142 DRE evaluations that had been conducted in Canada between 1995 and 2009 in which the DREs opined that the subjects were either not impaired (140 cases) or were impaired by CNS stimulants (852 cases), CNS depressants (135 cases), narcotic analgesics (312 cases), or cannabis (703 cases), and had toxicological results to compare with the opinions. [S-140 at 125-27; 48T143-48T146] They concluded that their "findings provide support for the use of the SFST as a screening tool for law enforcement to identify impairment in persons who have used these categories of drugs." [S-140 at 125; 48T157]

[44] Schisterman explained that regression analysis is "a method to evaluate relationships between an independent and a dependent variable." [56T15]. Taylor testified that "multiple regression . . . and other various multivariate procedures, including mixed models and other techniques" are methods that look "at the relationship between multiple items, two variables or more." [54T14]

c. 2020 Fiorentino study

In 2020, Fiorentino, Page, and Samuel W. Evans authored "The Usefulness of SFSTs in Detecting Drugs Other than Alcohol," based on a study they conducted in Flint, Michigan. [S-319; 48T82] The study was not published in a peer-reviewed journal. [47T40; 49T134] The researchers wanted to collect data to analyze whether the SFSTs were useful in detecting drugs other than alcohol. [48T84]

Between October 2018 and May 2019, the researchers collected data regarding "arrestees selected at random while they awaited processing" at the Genesee County Jail, who agreed to participate. [S-319 at i; 48T85-48T87] The SFSTs were administered to the subjects by officers trained to do so. [S-319 at i; 48T87] Fiorentino testified that the conditions in which the SFSTs were administered were analogous to field conditions. [48T130]

A total of 527 subjects agreed to participate, for which BAC results were available for all and urine drug tests were available for 524. [S-319 at ii; 48T95] The BAC testing revealed that about 87.1% of participants had no alcohol in their systems, 5.8% had BACs between .001 and .079, and 7% had BACs of .08 and above. [S-319 at ii] As to the 524 urine test results, 94 subjects tested negative for all drugs, 219 subjects tested positive for one drug, 131 tested positive for two drugs, 37 tested positive for three drugs, 25 tested

positive for four drugs, 11 tested positive for five drugs, 4 tested positive for six drugs, and 3 tested positive for seven drugs. [S-319 at ii; 48T100-48T101]

Each test in the SFSTs was examined alone and in combination with the others, although the authors noted that "officers in the field make decisions based on the totality of the circumstances, not on the results of a single test." [S-140 at ii] The authors acknowledged limitations in the study, one of which was the failure of their plan to use a saliva test to check for recent cannabis use. [S-319 at 56] Nevertheless, they concluded that "the study allows for some useful observations," including that "as hypothesized, the three individual SFST tests detect different patterns of impairment." [S-319 at 57] They noted that, considering the tests individually, "HGN . . . correctly identified 89.1% of CNS Depressants, but only 33.6% of any one or more drugs. WAT, on the other hand, correctly identified 80.8% of any one or more drugs, but only 37.2% of CNS Depressants." [S-319 at 57] Looking at the SFSTs as a whole, "as it is normally done at roadside," where the evaluators scored the minimum number of clues on at least two of the three SFST tests, "there was reliable detection of cocaine, marijuana, CNS depressants, CNS stimulants, and narcotic analgesics," but "[t]here was no reliable detection of amphetamine, barbiturates, buprenorphine, methadone, methamphetamine, and oxycodone." [S-319 at 57]

The authors concluded that the data overall supported the hypothesis that the SFSTs, alone and in combination, are useful in detecting impairment from drugs other than alcohol. [S-319 at 58; 48T124; 48T138]

While these studies offer support for the proposition that the SFSTs may be useful in detecting impairment by certain drugs as well as alcohol, they are not broad or decisive enough to constitute the "solid body of research" the State asserts. While all of the studies collected data supporting a potential link between administering the SFSTs alone and an ability to detect impairment by at least some drugs, none constituted the type of comprehensive look at the issue that would be necessary to establish a conclusive link.

The 2005 Papafotiou study dealt only with detection of THC, and it was a laboratory study, so its translation to a field application is unknown. The 2014 Porath and Beirness SFST study examined the SFSTs in relation to only four drugs, and the data obtained led the researchers to the conclusion that the SFSTs could be used successfully as a "screening tool," not that they could reliably detect impairment. Finally, the 2020 Fiorentino study was a preliminary study with arrestees rather than drivers, and it showed that the SFSTs produced reliable detection as to only some categories of drugs.

As far as it relates to the ability to detect alcohol impairment, the body of literature related to the SFTS that the parties entered into evidence and cite

in their briefs provides consistent and persuasive support for the conclusion that, administered as a unit, the three tests can be used to reliably detect alcohol impairment. The WAT and OLS tests assess various psychomotor skills necessary for driving that are adversely affected by alcohol consumption. The HGN test reveals lack of smooth pursuit and nystagmus to an evaluator qualified to administer it and, as discussed elsewhere in this report, police officers can be trained to administer the test and interpret its results.

These principles inform the relationship between the application of the SFSTs and the detection of drugs other than alcohol, but somewhat indirectly. While the studies fall short of showing that the SFSTs are, on their own, tests that can establish impairment by drugs, they do show that the inclusion of the SFSTs in the DECP is beneficial and assists the DRE in evaluating whether subjects are physically capable of safely driving a vehicle and in observing many of the signs and symptoms related to detecting ingestion of many types of drugs.

B. DECP studies

1. Foundational DECP studies

As discussed in the section on the background of the DECP above, two foundational studies were conducted before the protocol was fully developed and before NHTSA, working with the LAPD, established a standard training

curriculum for all DREs in 1987. These were the Johns Hopkins study (a/k/a the Bigelow study), a 1984 laboratory study involving eighty volunteer subjects and modified evaluation procedures, and the 1986 LAPD field study (a/k/a the Compton study) of one hundred seventy-three subjects arrested on suspicion of driving under the influence. [S-2; S-3] Details of these studies, described as "two stages of validation," are included in the DRE training manual. [D-8 at pdf 72-81]

A third study, entitled "Drug Recognition Expert (DRE) Validation Study," was issued in June 1994 by Eugene Adler of the Arizona Department of Public Safety and Burns of SCRI and was sent to the Arizona Governor's Office of Highway Safety (the Adler/Burns study). [D-25; S-4] The Adler/Burns study is also considered to be a foundational study and is referenced in the DRE training manual. [D-8 at pdf 82; 20T213; 21T127; 25T216-25T220]. The Adler/Burns study was the only foundational study conducted after the protocol was standardized. [21T128]

DRE training participants are taught that "[t]he overall conclusion of the laboratory and field studies is the DEC Program is an effective tool for law enforcement." [D-8 at pdf 82]

a. 1985 Bigelow study

The Johns Hopkins study was a "laboratory simulation assessment" of the "approach to recognition and identification of drug intoxication" that the LAPD was developing in its DRE program. [S-2/D-23 at pdf 4] It involved eighty subjects and procedures that were "derived from those developed and used" by the LAPD. [D-23 at pdf 1] However, the study designers decided that "it was necessary to use a rating procedure somewhat different from that used by the raters in their field situations," so the existing LAPD procedures were modified. [D-23 at pdf 8; 20T156-20T157; 25T204-25T207] Among other things, the evaluation was limited to twenty minutes, no breath alcohol tests were administered, and participants were not searched for physical evidence or "evidence of route of drug administration" such as needle marks. [D-23 at pdf 8; 20T157; 24T69-24T70]

The modified evaluation procedure had three components: (1) an interview where the subject was asked about medical history, drug use history, and "recent eating, sleep and alcohol use," (2) an "examination of objective physiological signs, including pulse rate, blood pressure, oral temperature, pupil size, pupil response to light and dark, nystagmus, smoothness of visual pursuit, perspiration and salivation," and (3) four field sobriety tests to assess

"psychomotor performance and ability to remember . . . instructions." [D-23 at pdf 8]

Participants were "normal, healthy adult male volunteers between 18 and 35 years of age" who had reported using cannabis. [D-23 at pdf 5] Before being allowed to take part in the study, participants were interviewed, examined, and screened. [24T44-24T45; D-23 at pdf 5] Only those "found to be without significant medical or psychiatric disturbances, to be without substantial patterns of illicit drug abuse, to be taking no medication, and showing adequate performance on the psychomotor tasks and questionnaires were accepted for participation." [D-23 at pdf 5]

Each participant (1) took a pill that was either a placebo or contained the CNS depressant secobarbital, the CNS depressant diazepam, or the CNS stimulant d amphetamine, and (2) smoked a cigarette containing either THC or no drug at all. [D-23 at pdf 7; D-4 at pdf 113-14] Except for secobarbital, which was administered at only one "strong" dose, each drug was administered at either a "weak" dose or a "strong" dose. [D-23 at pdf 7; D-4 at pdf 114-15] The CNS depressant and CNS stimulant doses were "approximately three to six times the typically recommended therapeutic dose." [D-23 at pdf 7] The THC dose was "selected on the basis of pretesting as being in the middle to

upper range of doses typically achieved by occasional marihuana users in the community." [D-23 at pdf 7]

Neither the examiners nor the participants knew the nature or dose of the pill and cigarette given to the specific participants. [D-4 at 114] The participants "were instructed to cooperate with the raters, to answer their questions, and not to try to trick or mislead the raters." [D-23 at pdf 6] Also, if the participants believed they had received a certain drug or no drug, they were not to share this information with the examiners. [D-23 at pdf 6] Each examiner rated the participants in a "private examination room" and had no contact with the other examiners during the evaluation period. [D-23 at pdf 6-7]

The Johns Hopkins study concluded that, based on the "global judgment-of-intoxication data" analyzed, the evaluators "were able to perform quite well in accurately identifying the drug classes administered to subjects and did so with a relatively low rate of false positive errors." [D-23 at pdf 20; 25T214-25T215]

As taught to participants in DRE training, the results of the Johns Hopkins study showed that the evaluators:

- correctly identified 95% of drug-free subjects as "unimpaired"

- classified 98.7% of high-dose subjects as "impaired"

- correctly identified the category of drugs for 91.7% of high-dose subjects

[D-4 at pdf 116; D-23 at pdf 12, 16; 24T50-24T53; 24T98; 25T207-25T217]

The evaluators were less successful in classifying subjects who had been given low doses, identifying as intoxicated only 17.5% of those who received the weak dose of d-amphetamine and 32.5% of those who smoked the weak dose of THC. [D-4 at pdf 117; D-23 at pdf 12; 24T93-24T94; 24T101] And even with subjects given the higher dose of d-amphetamine, the DREs rated the subjects as intoxicated in only eleven out of forty cases, or 27.5% of the time. [D-23 at pdf 12; 24T100-24T101; 25T207-25T215]

As the study explained:

> As dose increased, detection and identification of intoxication increased. As might be expected, many individuals who had received active drug – especially one of the lower doses – were judged not to be intoxicated. These might be viewed as cases which were "missed" by the raters; however, while it is known they received active drug, it is not known whether an objective behavioral intoxication resulted.
>
> [D-23 at pdf 19]

As Page noted in his testimony, the evaluators in the Johns Hopkins study identified a number of subjects who had taken a drug as not intoxicated

because they "didn't see impairment and so they didn't identify it," but they very rarely misidentified the drug taken by those subjects they considered intoxicated. [24T100-24T108] "So it's incorrect as far as the research is done, but it's not incorrect in terms of what a DRE is supposed to do. . . . Officers are not a drug test." [24T100] Page said that the Johns Hopkins study was a "pilot study that, in and of itself, it's interesting, but it just furthers the body of knowledge" in the field. [24T101]

b. 1986 Compton study

The Compton study involved field evaluations by 25 DREs of 173 adult subjects who had been arrested. [S-3 at *pdf 3-5] All subjects that the examining DRE concluded were under the influence of a drug other than alcohol were asked to consent to a blood test. [D-24 at pdf 9] Blood tests were not given to the 18 subjects the DREs determined were not under the influence of a drug. [20T25702; D-24 at pdf 8-9]

Although the DREs determined that 201 subjects were under the influence of a drug, only the 173 who provided a blood sample were included in the study analysis. [D-24 at pdf 14] Twenty-two subjects refused to provide a blood sample, and six provided a urine specimen instead of blood. [D-24 at pdf 14] The researchers noted that suspects could request a urine test instead of a blood test, but "[f]or the purposes of this study only a blood

sample was useful" because many drugs could be detected in urine long after they were ingested. [D-24 at pdf 12] The study noted that "[t]he suspects who did not provide a blood sample did not differ from the suspects who did in terms of age, sex, race, BAC level, day of the week they were arrested, etc." [D-24 at pdf 14]

The blood tests were screened for alcohol and seven types of drugs. [D-24 at pdf 13] If the DRE believed a drug not included in the screening test was present, the laboratory tested for the specific drug indicated. [D-24 at pdf 13] Of the 173 blood samples collected from the subjects, no alcohol or drugs were detected in 1 sample, a single substance was detected in 47 samples, and two or more substances were detected in 125 samples. [D-24 at pdf 17]

This study "predate[d] the development of the actual formal standardized curriculum and procedure" for the DECP, although the basic elements of the eventual protocol were included. [D-24 at pdf 11; 20T165-20T166; 24T150] The protocol was "standardized shortly thereafter," within three years of the study. [24T150-24T151]

The study results showed, among other things, that subjects had drugs other than alcohol in their systems 94% of the time when officers opined a drug was present. [D-24 at pdf 3] The study noted:

> The police officers participating in this study were faced with a formidable task of determining whether

> subjects brought to them were under the influence of drugs, and if so, what drugs. Determining what drugs the suspects had used was severely complicated by the fact that such a large percentage of the suspects the DREs evaluated had used multiple drugs (in over 70% two or more drugs were detected in the blood samples). There were over 40 different drug combinations detected in the blood of the suspects. There is little doubt that many of these drug combinations resulted in specific drug symptoms being masked or altered in some way.
>
> In the face of these complications, these officers, trained in the LAPD drug recognitions procedure, were quite accurate when they judged that suspects had used drugs.
>
> [D-24 at pdf 30]

The Compton study concluded that its results, together with the results of the Johns Hopkins study, "appear to show that the LAPD drug recognition procedure provides the trained police officer with the ability to accurately recognize the symptoms of many types of drug use by drivers." [D-24 at pdf 30]

The study had some inherent limitations. As Compton noted, "[t]his study was not designed to fully evaluate the DREs ability to discriminate between drivers under the influence of drugs and drug-free drivers." [D-24 at 29] Because toxicological samples were not collected from subjects the evaluators deemed unimpaired, "[t]here [wa]s no way to determine whether any of these subjects were actually under the influence of drugs." [D-24 at 29]

Moreover, the blood samples obtained "were not screened for all possible drugs the suspects might have taken," and the laboratory tests had limitations [D-24 at 29]

Page noted that when the DREs in the Compton study "claimed drugs other than alcohol were present, they were almost always detected in the subject's blood at the time." [25T215] He acknowledged that "there was a lower number of actually identifying the category of drug." [25T216]

DRE trainees are taught that the "key finding" of the Compton study was that "[f]or more than nine out of ten of the subjects (92.5%), the blood test confirmed the presence of at least one drug category 'opined' by the DREs." [D-8 at pdf 80]

c. 1994 Adler/Burns study

The Adler/Burns study was a retrospective study that analyzed 500 records of DRE evaluations performed in Phoenix between 1989 and 1993, all the records available for the time period. [D-25 at pdf 10; 20T215; 24T158] Sixteen suspects refused to provide specimens, so the researchers analyzed 484 evaluations. [D-25 at pdf 45]

The DREs followed the entire 12-step protocol. [20T213]

Of the 484 evaluations reviewed, the laboratory analysis detected a single drug in 163 specimens (33.7%), two or more drugs in 253 specimens (52.3%), and no drug in 68 specimens (14%). [D-25 at pdf 11, 40]

"Of the 416 specimens for which the laboratory reported one or more drugs, the DREs correctly identified at least one drug in 378 specimens (91%)." [D-25 at pdf 11] In 378 cases, the DRE opined at least one drug that was found to be present in the specimen, although in some of the cases the DRE also either opined another drug that was not present or did not list a drug that was. [D-25 at pdf 45-46, 51; 25T222] The researchers characterized these cases as "hits." [D-25 at pdf 44]

In 26 cases, the DRE opined that the subject was not impaired by drugs, and the toxicology confirmed that no drugs were present. [D-25 at 45] These cases were characterized as "correct rejections." [D-25 at pdf 44] The study noted: "Thus, the DRE decisions were supported by laboratory analysis for 404 (83.5%) of the 484 specimens, and were not supported in 80 cases (16.5%)." [D-25 at pdf 45]

Of the 80 opinions not supported by toxicology, 42 (8.4%) were "false positive" cases in which the DRE opined that the subject was impaired by a drug, but the laboratory detected no drug in the specimen. [D-25 at pdf 40, 44-46, 52] The remaining 38 cases (7.6%) were comprised of instances in which

the toxicology detected the presence of at least one drug, but DRE either opined no drug was present or opined the wrong drug. [D-25 at pdf 44] Researchers characterized these as a "miss" by the DREs. [D-25 at pdf 44-45] There were 14 cases "where all drugs were missed." [D-25 at pdf 51]

The study findings were intended to "specifically address the question, 'Do the DRE methods accomplish their stated purpose. i.e., the correct identification of drug impairment, as demonstrated by DRE opinions and specimen analyses?'" [D-25 at pdf 9] The study noted that the "DRE opinions identified and classified drug-impaired drivers with a high level of accuracy," and false positives "were few in number." [D-25 at pdf 3, 11; 20T215-20T217; 25T217] The authors concluded that "the DRE program, supported by the toxicology laboratory, is a valid method for detecting and classifying drug-impaired individuals." [D-25 at pdf 3]

These three foundational studies are informative, and they generally support the proposition that the DECP is reliable. However, they are insufficient by themselves to constitute a level of authoritative scientific writing sufficient to satisfy the general acceptance standard. The Bigelow study was, as Page said, a pilot study that furthered the knowledge in the field, but by itself did not establish scientific reliability because the laboratory

procedures used were significantly different than the DECP, which itself had not even been standardized at the time.

The Compton and Adler/Burns studies are useful and provide generally positive support for the DECP. However, the number of subjects in Compton was small, and the study was done before the protocol was standardized, even though the essential elements were in place. The Adler/Burns study, finding that DRE opinions were supported by toxicology 83.5% of the time, was instructive and positive, but it looked at less than 500 cases and was the only foundational study considering the complete and standardized protocol.

2. Other field and retrospective studies

Several field and retrospective studies have been undertaken since the foundational studies and were entered into evidence and discussed by the parties. They are of varying utility as an aid to assess the reliability of the DECP.

a. 1992 Preusser report

This retrospective study, "Evaluation of the Impact of the Drug Evaluation and Classification Program on Enforcement and Adjudication," was sponsored by NHTSA and issued in December 1992 (1992 Preusser study). [S-12; 20T217; 20T222; 43T109] It was authored by D.F. Preusser, R.G. Ulmer, and C.W. Preusser. [S-12 at *pdf 3]

The authors noted that DECP "has developed a standardized, systematic method for law enforcement personnel to determine whether observed impairment of drivers (or others) is due to drug use, and if so, to identify the class or classes of drugs involved." [S-12 at *pdf 6] It explained that "the study's overall objective was to evaluate the direct and indirect impact DEC has on the enforcement/adjudication system." [S-12 at *pdf 8] It was "a large-scale effort to identify, collect and analyze existing data sets covering impaired driving enforcement and adjudication." [S-12 at *pdf 9]

The study "looked at the overall impact of the [DRE] program by individual states, how active were DREs, what drugs were they spending time on, all those aspects of the program." [20T218] Page stated that the researchers examined cases involving DREs from "multiple localities" over the course of about five years, and they generally concluded:

> It works. People are arrested that would not be arrested. Opinions are considered to be accurate. DREs are highly sought after, are highly trained, but there is room for improvement in the program.
>
> [20T222-3 to 6.]

Page testified that the study showed "that the overall result of an 84 percent corroboration of drug presence held when the five most commonly named drug categories were involved." [20T224]

The 1992 Preusser study looked at data from eleven different police agencies in five states from 1987 through 1991. [S-12 at *pdf 3, 9-11, 23; 43T110-43T111]. The selected agencies were "located in states which were among the earliest to implement DEC." [S-12 at *pdf 23] The researchers compared those agencies with nine "similar police agencies without DEC." [S-12 at *pdf 3, 11, 23]

"Overall, 1842 suspects were evaluated; most of the DRE drug opinions were confirmed by chemical tests; and most of the confirmed suspects were convicted." [S-12 at *pdf 3] Out of the 1842 suspects, there were 1711 evaluations where the DRE opined that the subject was impaired by a drug or drugs, 1469 of which had toxicology. [S-12 at *pdf 24-25; 43T111-43T112] Drugs were found in 84.1 percent of the toxicological samples, and no drugs were found in 15.9 percent. [S-12 at *pdf 25] When matching the specific drug category opined with the toxicology, "DREs were found to be correct in judging at least one drug class in 74.4 percent of the cases." [S-12 at *pdf 26] Based on the match criteria used in the DRE program, the study found 84.1 percent accuracy. [43T112]

The authors noted that the laboratories performing the toxicology had differing "methods and/or test criteria" that may have accounted for some false positive results and lowered the overall accuracy rate. [S-12 at *pdf 59] They

believed that it was "entirely possible that low levels of a given substance of different metabolites or different drugs from the same general class could be confirmed at different rates across the many labs."

The authors also observed that "only four of the current seven drug categories occur[red] with any real frequency in the drug impaired arrest population," specifically cannabis, CNS stimulants, CNS depressants, and narcotic analgesics. [S-12 at *pdf 21, 58] Hallucinogens and inhalants were rarely found, and PCP was "found by some DEC programs and not others." [S-12 at *pdf 58]

The study's focus was more on the practicalities and benefits of DRE training for law enforcement and the implementation of a DEC program, and less on testing or validating the program itself. [S-12 at *pdf 31, 57-58] The authors concluded:

> The present results show that DEC programs are associated with a marked increase in impaired driving charges against suspects whose impairment is related to one or more drugs other than alcohol. These suspects are typically convicted of an impaired driving charge. However, the actual numbers of DRE cases are far below expectations and trained DREs may not be getting enough cases to maintain their skills and enthusiasm.
>
> [S-12 at *pdf 59]

b. 1993 Hardin study

This "Minnesota Corroboration Study: DRE Opinions and Toxicology Evaluations" was authored by Glenn G. Hardin, Robert F. Meyer, and S.G. Jejurikar of the Minnesota Bureau of Criminal Apprehension, Forensic Science Laboratory. [S-5 at *pdf 1; 20T226; 43T113] The authors looked at 71 field cases from August 1991 through March 1993 as to which a DRE opined that the subject was under the influence of a drug and for which a urine sample was provided. [S-5 at *pdf 1-2, 43T113] They excluded from their corroboration calculation the five cases as to which the DRE had opined the subject was not under the influence. [S-5 at *pdf 11]

The authors found an 84.5% corroboration rate overall, and a 91.8% corroboration rate for cannabis alone, evidently applying the certification match criteria. [S-5 at *pdf 2; 20T226] Applying the impairment match criteria, the overall corroboration rate was 88.7%. [S-5 at *pdf 3;43T113-43T114]

The study concluded that "[t]he DRE protocol, if followed properly, appears to be a useful screening tool for predicting whether a subject is under the influence of drugs." [S-5 at *pdf 2]

c. 2009 Beirness/Canada study

In 2009, Beirness, Erin Beasley, and Jacques Lecavalier published "The Accuracy of Evaluations by Drug Recognition Experts in Canada" in the Canadian Society of Forensic Science Journal (Beirness/Canada study) [S-22 at 75] Their objective was "to illustrate the accuracy with which police officers trained as Drug Recognition Experts (DREs) can identify the category of drug(s) ingested by persons suspected of being impaired as the result of drug use." [S-22 at 75]

The researchers considered data from 1420 evaluations performed by DREs in Canada, both training and non-training evaluations, and they excluded about 5% of the cases due to missing toxicology results. [S-22 at 77; 43T116-43T1179; 45T9] A total of 1349 evaluations remained after this listwise deletion. [S-22 at 77]

The analysis showed that "in most cases (92.1%) the opinion of the DRE matched the drug class found as a result of toxicological analysis." [S-22 at 77] Of the 1349 cases analyzed, only 45 subjects, or 3.4%, had "no psychoactive substances present" in the toxicological sample. [S-22 at 77] In 36 of these 45 cases, the DRE accurately opined that the subject was not impaired by drugs. [S-22 at 77] "In only 9 cases (<1%) did the DRE indicate a drug to be present and no drug was found."

The authors calculated sensitivity, specificity, accuracy, and other "[s]tandard psychometric measures" using what Martin termed the impairment match criteria. [S-22 at 78; 43T117] Crediting the DRE with a correct opinion where the toxicology showed the presence of any drug, the 1349 cases included 1,243 true positive cases, 36 true negative cases, 61 false negative cases, and 9 false positive cases [S-22 at 78; 48T175-48T177] Using these numbers, the authors calculated sensitivity of 95.3%, specificity of 80%, a "false alarm rate" of 20%, a "miss" rate of 4.7%, and an accuracy rate of 94.8%. (S-22 at 78; 48T176-48T179).

The authors also examined these measures for cases where the toxicology results matched the DRE opinions specifying cannabis, CNS stimulants, CNS depressants, and narcotic analgesics. [S-22 at 78-79] "There were insufficient cases to generate these measures" for the other drug categories – hallucinogens, dissociative anesthetics, and inhalants. [S-22 at 78] The accuracy rate was slightly lower using this match criteria, ranging from 86.7% for CNS depressants to 89.3% for CNS stimulants, [S-22 at 79].

The authors concluded that "[o]verall, the analysis of DEC cases indicates that drug evaluations conducted by DREs in Canada are accurate. An overall accuracy rate of 95% provides confidence in the use of the DEC procedure to detect persons impaired by substances other than alcohol." [S-22

at 79] They also noted that "[t]he findings also indicate that some drug classes are more difficult to detect accurately than others," concluding that "[t]he variable accuracy rates among the different classes of substances require further investigation and suggest that further work may be necessary to identify and specify the most reliable signs and symptoms of particular classes of drugs." [S-79 at 79]

d. Porath and Beirness 2009-2019 studies

The same authors who, as noted above, conducted a study on the SFSTs in 2014 also conducted three studies of the DECP between 2009 and 2019. [S-332; S-365; S-330]

i. 2009 Porath and Beirness study

The first, "Toward a More Parsimonious Approach to Drug Recognition Expert Evaluations," was published in the peer-reviewed journal Traffic Injury Prevention in 2009 and authored by Porath, Beirness, and Erin E. Beasley. [S-332 at 513; 49T35]

The researchers had access to 1576 Canadian DEC evaluations conducted from 1995 to 2008, and this study analyzed the 742 cases that included a toxicological sample, showed either the presence of no drug or a single drug, and as to which the DRE's opinion of the category of drug present was correct. [S-332 at 514-15; 49T38-49T39] There were "56 no-drug cases"

where the DRE opined that the subject was not impaired and the toxicological results showed no drug present and 686 cases where the DRE opined impairment by a category of drugs confirmed by the toxicology, specifically 301 cases of CNS stimulants, 38 cases of CNS depressants, 133 cases of narcotic analgesics, and 214 cases of cannabis. [S-332 at 54-15; 49T34-49T36).

Looking at the correlation between observed signs and symptoms and correct DRE opinions, the researchers first examined "univariate associations between the various DEC indicators and drug categories," and then performed a multinomial logistic regression analysis. [S-332 at 515-16] The objective of the study "was to statistically identify the set of signs and symptoms from existing single-drug category DEC case files that best predict the class of drug used by suspected drug-impaired drivers." [S-332 at 516] The authors concluded that their findings "suggest[ed] that DREs can focus on a limited set of signs and symptoms when determining the category of drug ingested by the suspect without significantly compromising the accuracy of their evaluations" and that "the amount of information collected during a DEC evaluation could possibly be reduced." [S-332 at 517]

The authors recommended future research "directed toward identifying the drug-related cues that best predict common drug combinations," which, in

turn, could "lead to improvements in the ability of DREs to enforce drug-impaired driving laws." [S-332 at 518]

ii. 2010 Porath and Beirness study

The second, "Simplifying the Process for Identifying Drug Combinations by Drug," was published in Traffic Injury Prevention in 2010 (2010 Porath and Beirness study). [S-365; 51T26] This study was essentially a follow-up to the study the authors had published the year before, this time looking at drug combinations rather than single drugs. [S-365 at 454; 51T27] Specifically, the purpose of the study was "to statistically determine the set of signs and symptoms that best predict 3 common combinations of drug classes, including CNS stimulants with cannabis, CNS stimulants with narcotic analgesics, and cannabis with alcohol." [S-365 at 454]

For this study, the researchers had access to 3489 Canadian DEC evaluations conducted from 1995 to 2009, and they analyzed 692 two-drug cases and 127 no-drug cases, again where the toxicological results were in accord with the DRE opinion. [S-365 at 454-55] Again looking at the correlation between observed signs and symptoms and correct DRE opinions, the researchers first examined "bivariate associations between the various DEC indicators and drug combinations," and then performed a multinomial logistic regression analysis. [S-365 at 455]

The researchers' findings "revealed that a statistical model that includes 11 clinical indicators significantly predicted the correct drug combinations," and, as in their prior report, they posited that "the amount of information collected during a DEC evaluation could possibly be reduced." [S-365 at 458] DREs, they stated, could "focus on a limited set of key signs and symptoms when determining the categories of drugs ingested by the suspected drug-impaired drivers without significantly compromising the accuracy of their evaluations." [S-365 at 458] However, they added that their "statistical model of 11 clinical indicators [wa]s not perfect, which underscore[d] the need for the other drug-related signs and symptoms and the observational skills of the DRE to assess the totality of drug symptomatology." [S-365 at 458]

iii. 2010 Porath and Beirness study

"Predicting categories of drugs used by suspected drug-impaired drivers using the Drug Evaluation and Classification Program tests," was another article authored by Porath and Beirness, and it was published in Traffic Injury Prevention in 2019. [S-330; 48T161-48T165]

For this study, the researchers examined 1,512 DEC evaluations conducted from 2000 to 2012 in eleven states "that were geographically distributed across the United States." [S-330 at 3; 55T90] The objective of the study "was to determine which combination(s) of elements of the DEC

protocol offer the best predictive validity of the category of drug responsible for impairment in the most efficient and effective manner." [S-330 at 6] As they had done before, the researchers looked at the correlation between various observed signs and symptoms and correct DRE opinions, first examining "bivariate associations between the various DEC indicators and drug categories," and then performing a multinomial logistic regression analysis. [S-330 at 4]

They concluded that "DREs should be careful to review a set of key signs" and that the results of the study "could help form the basis of a core set of indicators that DREs could initially consult to form their opinion of drug influence." [S-330 at 8] They further noted that "[d]rug use indicators related to the appearance and physiological response of the eye were found to contribute the most to the prediction of the drug category responsible for the impairment." [S-330 at 8]

e. 2016 Hartman study

In 2016, Rebecca L. Hartman, Jack E. Richman, Charles E. Hayes, and Marilyn A. Huestis authored "Drug Recognition Expert (DRE) examination characteristics of cannabis impairment," published in the peer-reviewed journal Accident Analysis and Prevention. [D-435; S-108; 32T205] The

objective of the study was "to determine the most reliable DECP metrics for identifying cannabis-driving impairment." [S-108 at 219]

The study included an examination of 302 DRE evaluations performed in nine states from 2009 to 2014 as to which the evaluating DRE opined the subject was impaired by cannabis only and toxicological results confirmed the presence of THC with no other drugs (subject population). [S-108 at 220-21; 32T208] The "comparison group" consisted of 302 "[p]olice officers and volunteers evaluated as part of DRE training programs" in five states during the same time period [S-108 at 220-21; 32T208]

The researchers analyzed the signs and symptoms commonly observed in the subject population and compared them to those of the comparison group, particularly with regard to the "eye examination (including HGN, vertical gaze nystagmus [VGN], and lack of convergence [LOC] tests), . . . divided attention psychophysical tests (including Modified Romberg Balance [MRB], WAT, OLS, and finger to nose [FTN])," and "dark room examinations (pupil examination under three different lighting conditions: room light, near-total darkness, and direct light)." [S-108 at 220-21, 225-26; 32T206-32T210]

The authors reported that "the most reliable impairment indicators" as to cannabis specifically "included elevated pulse, dilated pupils, LOC, rebound dilation, and documented impairment in 2 of 4 psychophysical tasks," and that

"[c]ombined observations on psychophysical and eye exams produced the best indicators of cannabis impairment." [S-108 at 227] They concluded that "[t]he results of this research support the cannabis impairment training taught in the DECP." [S-108 at 227]

f. 2021Vaillancourt study

"Drugs and driving prior to cannabis legalization: A 5-year review from DECP (DRE) cases in the province of Quebec, Canada," was a retrospective study authored by Lucie Vaillancourt, Edith Viel, Cynthia Dombrowski, Brigitte Desharnais, and Pascal Mireault, and it was published in Accident Analysis and Prevention in 2021. [S-317]

Cannabis use had recently been legalized in Canada, and the purpose of the study was "to provide a portrait of pre-legalization DUID cases in the province of Quebec (Canada)." [S-317 at 4] The authors examined data from 2,982 DECP cases between 2014 and 2018, which "provide[d] a thorough portrait for the province of Quebec (Canada), including prevalence of drugs and their categories, new psychoactive substances occurrence, as well as gender, age and geographical distribution." [S-317 at 3, 7] The study population was comprised of "all alleged drugged drivers arrested with signs of impairment following a DECP investigation" where a toxicological sample was available. [S-317 at 4] The authors reported:

> Testing of the biological samples revealed only 66 negative cases (2%). A full concordance between the DRE's opinion and toxicological results, where at least one substance detected in the biological sample matched every suspected category, was observed in 2 356 cases (79%). A partial concordance, where at least one substance detected matched at least one suspected category, was observed in 2,640 cases (89%). In 270 cases (9%), no substances found matched the DRE's opinion. Finally, 6 cases (0.2%) were excluded from this analysis because the DRE did not give a final opinion or ended the evaluation before completion.
>
> [S-317 at 3.]

The analysis showed that a combination of two drugs or more was detected in 79% of cases. [S-317 at 3] At least one drug "with impairing potential" was found in 98% of cases, and the category of drug suspected of causing the impairment was accurately pinpointed, with at least one drug matching one of the DREs' opined drug categories, in 89% of cases. [S-317 at 6-7] The authors noted that the study was "a window in the pre-legalization era" that provided "important and complete data on DECP cases" in the province of Quebec. [S-317 at 7]

Some of the studies entered into evidence are of only marginal value because they were a bit off point from the questions to be determined in this matter – whether the DECP and/or its component parts are sufficiently scientifically reliable to warrant the admission of DRE opinions as evidence.

The Preusser report, for example, was primarily concerned with implementation of the DECP and the impact of that implementation on the adjudication of drugged-driving cases. It did not purport to be an objective analysis of the accuracy of DRE opinions.

The chief concern in the Porath and Beirness 2009-2019 studies was not the overall accuracy of DRE evaluations, but whether the DECP could be improved by isolating specific variables shown to best correlate with specific drugs. To that end, the researchers did not look at all available DRE evaluations, but only specific single-drug or limited drug-combination evaluations as to which the DRE opinion was correct. Focusing solely on cases where the DRE "got it right" was sensible and appropriate in the context of those studies. Similarly, the Hartman study was limited to an analysis of the DRE protocol metrics related to cannabis impairment.

These studies were all exploring potential avenues to narrow or refine the DECP, so their focus was correspondingly narrow. Here, however, the issue is not whether the DECP could be streamlined or whether the protocol would be just as good without some elements, or might be better with the addition of elements not currently part of the protocol. Rather, the question is whether the protocol as it stands is sufficiently reliable for admission into evidence.

The Hardin, Beirness/Canada, and Vaillancourt studies are all more relevant because they actually assessed the overall reliability of DREs evaluating subjects in the field. As a very small study with only 71 subjects, the Hardin study is the least helpful. Both the Beirness/Canada and Vaillancourt studies, however, reviewed data from a large number of evaluations (Beirness/Canada 1,349 and Vaillancourt 2,982) conducted over several years.

In many ways, these studies are akin to the statistical experts Martin's and Schisterman's analysis of the New Jersey data sets, discussed in section VIII. For the reasons discussed in that section, I find these studies similarly supportive of the reliability of the DECP, although done in other jurisdictions with fewer case samples.

These field studies were limited in much the same way as the statistical analysis of the New Jersey data sets. Constitutional and practical limitations make a double-blind study impossible, and the screening process in actual field evaluations, which ensures that the only subjects included are those that (1) displayed behavior providing probable cause of a DUI violation, and (2) did not have a BAC level sufficiently high to account for that behavior, inevitably lead to a subject population where the condition is extremely prevalent. As a consequence of this, cases in which drugs are actually not in

the subject's system, whether false positive cases or true negative cases, are small in number. Moreover, because toxicology is typically not performed on the "negative" cases – i.e., those cases where the DRE opines that the subject is not impaired – whether those cases are true negatives or false negatives remains undetermined. However, while these circumstances mean that the studies do not and cannot answer the question of how accurate DREs are in identifying drug impairment among the general population, or even the general driving population, the studies are nevertheless useful and informative for purposes of this hearing.

DREs are not asked to assess whether random persons walking down the street may have ingested some type of drug. Rather, DREs are asked to assess the degree and likely cause of impairment for subjects who have both (1) displayed affirmative signs of impairment sufficient to provide probable cause to arrest for driving under the influence, and (2) have a BAC level, reliably established through a scientifically-reliable instrument, that shows either no or limited alcohol consumption. The subject population for the field studies was, therefore, an appropriate subject population to assess whether DREs can reliably do what they are tasked with doing.

I note that the sensitivity – or correct correlation between positive toxicological samples and DRE opinions – in these similar field studies varied

between just under 84% to about 95%, which is tellingly close to the numbers calculated by Martin and Schisterman in their analyses of the New Jersey data sets.

3. Laboratory studies

In contrast to the various field studies that have taken place since the three foundational DECP studies, there have been only a few laboratory studies conducted relating to the DRE protocol since the lone foundational laboratory study – the 1985 Bigelow study. As laboratory studies provide controls unavailable in the field and the ability to conduct a double-blind study, it is tempting to look to them as potentially a more objective measure of the reliability of the DECP. However, as detailed below, the laboratory studies that were entered into evidence were constrained by procedures that diverge in very significant ways from the complete protocol and the inability to replicate common field conditions, most specifically the inability to replicate the dosing levels and multi-drug use commonly seen in the field.

a. The Heishman studies

Stephen J. Heishman, Edward G. Singleton, and Dennis J. Crouch conducted two laboratory studies, one in 1996 and one in 1998, examining which variables in DRE evaluations corresponded best with certain specific drugs. [S-57; S-58] Both studies were financially supported by NHTSA and

the Intramural Research Program of the National Institute on Drug Abuse and published in the Journal of Analytical Toxicology. [S-57 at 468, 482; S-58 at 503, 513]

The 1996 study was entitled "Laboratory Validation Study of Drug Evaluation and Classification Program: Ethanol, Cocaine, and Marijuana," and its goals were "to determine the validity of the DEC evaluation variables and the accuracy of the DREs' evaluation in predicting whether research volunteers had been administered ethanol, cocaine, or marijuana." [S-57 at 475] The authors noted that "[t]he ultimate goal of this and future studies [wa]s to refine the DEC evaluation by determining which variables are best predictors of drug intake across a range of drug classes, thereby aiding the DREs in their decision process." [S-57 at 469]

The subjects in the1996 study were eighteen community volunteers, all with a history of alcohol, marijuana, and cocaine use. [S-57 at 469] Each subject participated in nine different sessions, separated by at least forty-eight hours. [S-57 at 470] Thus, the eighteen subjects yielded data from 162 sessions and, after an adjustment,[45] "a total of 158 valid cases" for analysis. [S-57 at 472]

[45] Due to an issue with THC absorption, the marijuana sessions for two subjects were excluded from the analysis. [S-57 at 472]

Twenty-eight DREs from eight states participated in the study. [S-57 at 469] The subjects were told that the purpose of the study was to "investigate the effects of commonly abused drugs on behavior, mood, and performance." [S-57 at 470] They were instructed not to discuss with the evaluators which drug they thought they had been given. [S-57 at 470] For each session, the subjects were given either a placebo or one of varying doses of the substances. [S-57 at 469-70]

The researchers used a protocol that was "an abridged version of the DEC evaluation used in law enforcement contexts." [S-57 at 470] They did not "question subjects about recent drug use, nor did they interrogate subjects to solicit admissions about drug use." [S-57 at 470] The evaluations were designed to take about twenty-five minutes in total. [S-57 at 470-71]

Where DREs believed subjects were impaired, they "recorded their prediction of the drug class(es), including ethanol, that were causing the impairment." [S-57 at 471]. If the DREs reached the conclusion that a subject was not impaired, they "could indicate a non-impairing dose of ethanol or drug and identify the drug class." [S-57 at 471]

The authors detailed each variable of the modified protocol used and how it related to each of the doses and substances administered. [S-57 at 470-80] They used a "discriminate function analysis" to determine which set or

subset of variables were the "best predictors" for each substance. [S-57 at 471-75]

Regarding the numbers overall, the authors stated:

> Of the 158 valid DEC examinations, DREs concluded impairment was present in 81 cases, which were compared with toxicology to assess the consistency of DREs' predictions. Toxicology confirmed the presence of a drug class if (a) an active dose of that drug was administered on that session or (b) the predose urine drug test for that session was positive for the drug class. Of the 81 impairment predictions, toxicology was positive for any drug(s) in 75 cases (92.6%). Under IACP standards, DREs' predictions were consistent with toxicology in 41 cases (50.6%). These 41 consistent cases included 9 in which the DRE concluded the subject was impaired by ethanol alone. Because the DRE's breath test provided a priori confirmation of ethanol, an ethanol-only prediction was guaranteed to be consistent. Excluding those 9 cases resulted in 72 predictions that named some nonethanol drug class. The DREs' predictions were consistent with toxicology in 32 cases (44.4%).
>
> [S-57 at 475]

The authors concluded that their findings "suggest[ed] that predictions of impairment and drug use may be improved if DREs focused on a subset of variables associated with each drug class, rather than the entire DEC evaluation." [S-57 at 481]

The second study authored by Heishman and his colleagues was "Laboratory Validation Study of Drug Evaluation and Classification Program:

Alprazolam, d-Amphetamine, Codeine, and Marijuana," and it was published in October 1998. [S-58 at 503] The authors explained:

> In this second study, we examined the validity of the DEC evaluation variables in predicting whether research volunteers had been administered alprazolam, d-amphetamine, codeine, or marijuana. A secondary goal was to determine the accuracy of the DREs' evaluations in detecting if subjects had been dosed with these drugs. The ultimate goal of these studies is to refine the DEC evaluation by determining which variables are best predictors of drug intake across a range of drug classes, thereby aiding DREs in their decision process.
>
> [S-58 at 504]

The authors sought to "evaluate the validity of the individual variables of the DEC evaluation as predictors of drug intake under controlled laboratory conditions." [S-58 at 504]

In this study, "48 community volunteers entered one of four drug experiments depending on their drug history." [S-58 at 504] Again, the subjects submitted to a modified DECP evaluation, and they were instructed not to discuss the drug they thought they had taken with the DREs evaluating them. [S-58 at 504] Each subject participated in six sessions, yielding "a data set containing 288 cases," which, after accounting for some sessions where DREs were not available, resulting in a total of "280 valid cases." [S-58 at 506]

Twenty-eight DREs from eight states performed the evaluations. [S-58 at 504] They "were not permitted to interrogate subjects, except for two questions about physical defects and vision problems." [S-58 at 504]

As with the 1996 study, the researchers' focus was on identifying which variables in the DREs' evaluations best predicted impairment by the different drugs administered to the subjects. [S-58 at 506-12] They concluded that the "[r]esults of this and our previous study indicate that a certain subset of variables of the DEC evaluation can be used to predict accurately acute administration" of the drugs studied, and "predictive validity was optimal when predictions were made using 2-7 variables from the DEC evaluation." And just as they had in the earlier study, the authors concluded that their findings "suggest[ed] that predictions of impairment and drug use may be improved if DREs focus on a subset of variables associated with each drug class rather than the entire DEC evaluation." [S-58 at 513]

As to overall results, the authors noted:

> When DREs concluded subjects were impaired, their drug-class decisions were consistent with the administration of any active drug in 76% of cases, but consistent with toxicology under IACP standards in only 32% of cases. Thus, it would appear that DREs are able to detect drug-induced impairment in general, but have difficulty discriminating between various drugs.
>
> [S-58 at 512-13]

Notwithstanding this seemingly poor overall accuracy rate, the authors concluded that "[t]he DEC evaluation is a valid test to identify recent drug use. [S-58 at 513] Also, citing many of the DECP studies discussed above, the authors stated that the studies "attest to the validity of the DEC program as a measurement of drug-induced behavioral impairment." [S-58 at 504]

The authors noted that the data from both the 1996 and 1998 studies "clearly indicate that the variables of the DEC evaluation alone did not permit DREs to predict impairment and drug class with the accuracy observed in field studies." [S-58 at 513] They noted that "[t]here were several differences between the controlled laboratory conditions of these studies and typical field conditions that might account for this discrepancy," including that the DRE evaluators in the study (1) obtained no "preliminary evidence (e.g., impaired driving, drugs or drug paraphernalia in possession, odor of marijuana) that is suggestive of drug use," which is often available in the field, (2) may have been misled by the "odor of marijuana," which emanated from "subjects in the alprazolam, d-amphetamine, and codeine experiments" as well as those actually dosed with THC, (3) were not permitted to interview the subjects or ask about drug use, (4) were evaluating subjects who, for the most part, had taken drugs producing "only moderate behavioral effects" as opposed to the "clearer clinical and behavioral signs of impairment" found in the field, and

(5) were incorrectly "told that several drug classes and drug combinations might be administered" to the subjects they evaluated for the study. [S-58 at 513]

b. The Shinar study

"Drug identification performance on the basis of observable signs and symptoms," by David Shinar and Edna Schechtman, was published in Accident Analysis and Prevention in 2005. [D-428] The study was expressly "not an evaluation of the DECP program and the officers' skills at using the program, but only an evaluation of the observed signs and symptoms and predictors of drug impairment." [D-428 at 844]

The authors re-analyzed the data from Heishman's 1998 study, but they treated differently from Heishman those instances where the DREs had both listed an impairing drug and opined that the subject was unimpaired, an apparent inconsistency. [D-428 at 843; 37T6-37T12; 49T26-49T28; S-58 at 503] They concluded that officers were able to "detect drug impairment at statistically significant levels above chance," and it was "possible that detection levels would be significantly higher . . . with higher dose levels." [D-428 at 849]

The authors were critical of the foundational DECP studies, contending that they "suffered from either inadequate methodological controls, or from

very limited data." [D-428 at 844] However, they acknowledged that "a completely objective and fully comprehensive evaluation of the trained officers' performance [wa]s essentially impossible" because, "in the natural environment," the interview of the subject is "an important component of the evaluation process," DREs "have a fairly accurate knowledge of the prevalence of different drugs on the street," subjects "are typically arrested for suspected impaired driving, and thus have already manifested obvious impaired behavior," and the drugs taken by subjects "may be much more potent than safe doses used in a controlled administration study." [D-428 at 844]

I find that the laboratory studies – the two Heishman studies and Shinar's re-analysis of the data – have only marginal usefulness to this proceeding.

In its brief, the OPD stresses the comparatively bad overall accuracy numbers in the Heishman and Shinar studies as compared to the field studies. [OPDb86-OPDb90] It contends that the studies show that "[t]he markedly lower sensitivity, specificity, and overall accuracy rates for the studies that removed suspect admissions demonstrates the high predictive power of those admissions." [OPDb269-OPDb270] They argue the studies "establish that when the fully non-scientific steps of the DRE protocol are removed – when police officers are not permitted to interrogate suspects about their history of

drug use and their present drug use – the DRE protocol fails to do what it is supposed to do." [OPDb90]

This conclusion, however, is based on an oversimplification of the laboratory studies' procedures and conclusions. Although removal of interrogation of the subjects was a significant difference, the researchers did not simply remove the possibility of admissions and other "fully non-scientific steps" from the protocol and leave the rest intact. There were several other factors that rendered the data gleaned unhelpful or distorted if used as a measure for the accuracy of the portions of the truncated DRE protocol that was administered.

First, in at least some cases, the DREs would have encountered "an odor of marijuana" emanating from subjects who had smoked a placebo, which the authors themselves acknowledged was potentially "misleading." [S-57 at 480; S-58 at 513.] Similarly, the authors acknowledged that the DREs were told that "several drug classes and drug combinations might be administered" to each subject, but only a single drug alone was actually administered. [S-57 at 481; S-58 at 513]

Also, the dosing levels permitted in a laboratory study might not accurately reflect those actually encountered in the field. In the 1998 Heishman study, the authors acknowledged that the doses administered in the

laboratory produced "only moderate behavioral effects." [S-18 at 513] "It is possible that impaired drivers encountered by DREs have used greater drug doses or used drugs for a longer period of time than subjects in this study and thus may exhibit clearer clinical and behavioral signs of impairment." [S-58 at 513].

Perhaps the most significant difference between the subjects taking part in these laboratory studies and those actually evaluated by DREs in the field is that the subjects in the laboratory each participated in multiple sessions, giving them the opportunity to effectively practice and improve upon their performance of psychomotor tests. [S-57 at 470-72; S-58 at 506]. Fiorentino testified that "repeated exposure to the instructions, to the SFSTs, it's potentially biasing the evaluation because the more times a participant has to do the SFSTs, the more learning there is." [47T86-47T87] He explained:

> A. One of the important aspects, fundamental aspects of the sobriety test is the ability to understand and remember the instructions, especially on the walk-and-turn and the one-leg stands.
>
> So repeated exposures to those instructions over time make the test easier and easier to perform, and thus the tests lose sensitivity.
>
> Q. So what does incremental learning for the SFST do in terms of the methodology and the results of the study?

> A. Because it's easier to perform the task, it becomes – there's a term that we use. It becomes almost overlearned, automatic. And after repeated exposure, there's less cognitive processing in terms of remembering how to apply the instructions to the task.
>
> So it becomes easier and easier to perform and as it does, it becomes less sensitive to the effects of drugs of interest.
>
> [49T29-1 to 18.]

Here, the Heishman study design had the same subjects performing the SFSTs over and over again – over the course of nine sessions for the 1996 study and six sessions for the 1998 study. [S-57 at 470-72; S-58 at 506]

Because of all these factors, I do not credit the OPD's contention that the comparatively low accuracy numbers found in these laboratory studies undercut the strong and persuasive findings of the most meaningful field studies discussed above.

Overall, the results of the many studies related to the DECP that have been undertaken since 1985 and that were entered into evidence by the parties support the State's position that the DRE protocol has consistently been found to be a reliable method for detecting impairment by drugs. The findings of the studies discussed in this section, despite the inherent limitations that cannot be avoided in actual law enforcement scenarios, are consistent with my findings regarding the New Jersey data set analysis in section VIII, and they

corroborate and support my findings regarding the credible expert testimony in section VII.

X. JUDICIAL OPINIONS RE DECP

One of the three ways to establish general acceptance under Frye is "by judicial opinions that indicate the expert's premises have gained general acceptance." In re Commitment of R.S., 339 N.J. Super. 507, 536 (App. Div. 2001), aff'd, 173 N.J. 134 (2002) (quoting Harvey, 151 N.J.at 170). See also, e.g., State v. Cavallo, 88 N.J. 508, 522-24 (1982) (noting that "the general acceptance of psychiatric witnesses in court" was supported by judicial opinions, but case law failed to show that psychiatric testimony regarding the "likelihood that an individual behaved in a particular manner on a specific occasion" was generally accepted); State v. King, 387 N.J. Super. 522, 544 (App. Div. 2006) (discussing "persuasive judicial decisions in other jurisdictions supporting the reliability of the proffered evidence").

Regarding the general acceptance of the DECP and the admissibility of DRE testimony, a review of case law from around the country shows no published case in which a court has rejected DRE testimony as inadmissible. To the contrary, courts around the country have routinely allowed admission of the evidence. However, because only a couple of jurisdictions have applied the Frye standard and because the judicial reasoning behind the admission of

DECP evidence varies widely from court to court, this unanimity does not provide convincing support that the DECP has been generally accepted in the relevant scientific communities. Nevertheless, a review of the relevant case law is useful.

Only two jurisdictions – Washington and New York – have considered the admissibility of DRE testimony under the Frye standard, and only Washington provides a high court discussion of the issue. In State v. Baity, 991 P.2d 1151 (Wash. 2000), the Supreme Court of Washington held that the DEC protocol "meets the mandate of Frye." The Baity court held that Frye applied because "the evidence does have a scientific aspect, which tends to cast a scientific aura about the DRE's testimony." Id. at 1157. The court found that "[t]he relevant scientific communities for the assessment of DRE evidence include pharmacologists, optometrists, and forensic specialists," and that "[f]or these disciplines, DRE evidence is generally accepted." Id. at 1160. The court "analyz[ed] the DRE protocol and the approach of other courts to its admissibility" and found that (1) "the DRE protocol and the chart used to classify the behavioral patterns associated with seven categories of drugs have scientific elements meriting evaluation under Frye," and (2) it was "accepted in the relevant scientific communities." Ibid.

However, the Baity court noted that its opinion was "confined to situations where all 12-steps of the protocol have been undertaken," and it cautioned that officers "may not predict the specific level of drugs present in a suspect." Id. at 1160. "The DRE officer, properly qualified, may express an opinion that a suspect's behavior and physical attributes are or are not consistent with the behavioral and physical signs associated with certain categories of drugs." Id. at 1160-61. Accord City of Seattle v. Levesque, 460 P.3d 205, 211-13 (Wash. Ct. App.), review denied, 468 P.3d 621 (Wash. 2020) (holding that a non-DRE officer who "had received training in field sobriety tests" but was not a DRE was "not qualified to opine that a defendant's behavior is or is not consistent with that associated with a specific category of drug").

New York courts have also applied the Frye test and found DRE testimony to be admissible. In People v. Quinn, 580 N.Y.S.2d 818 (N.Y. Suffolk Co. Dist. Ct. 1991), rev'd on other grounds, 607 N.Y.S.2d 534 (N.Y. App. Div.1993), the trial court applied the Frye standard and held that evidence of both HGN and the DRE protocol was admissible. The court "considered the credible and unrefuted testimony of nine witnesses each of whom stated that both HGN and the protocol permit the DRE to reliably and accurately determine whether an individual is impaired, and if so, by what

classification of drug." Id. at 826. It also noted that "nothing contained in the protocol is a new invention," but was "rather a compilation of tried and true procedures utilized by medical science and the law enforcement community in similar contexts for many years." Ibid. The defense called no witnesses in Quinn. See also People v. Villeneuve, 649 N.Y.S.2d 80 (3rd Dep't 1996) (rejecting a challenge to the admissibility of testimony of a police officer as a drug recognition expert); People v. Rose, 794 N.Y.S.2d 630, 631-32 (Dist. Ct. 2005) (noting that Second and Third Department courts have held that requirement that a defendant's impairment must be shown to have been caused by a specific drug can be met through "opinion testimony from police trained as drug recognition experts as to the identity of the drug causing the impairment.")

Two jurisdictions – Nebraska and Oregon – have upheld the admissibility of DRE testimony applying the state-equivalent of the Daubert standard.

In State v. Daly, 775 N.W.2d 47, 58 (Neb. 2009), the Nebraska Supreme Court applied the Daubert standard and held that "the underlying principles of the DRE protocol are basic and familiar." The court cited the foundational studies discussed in this report and noted that "[b]ased largely on that data,

every court to have considered the issue has concluded that testimony based upon the DRE protocol is admissible into evidence." Id. at 58-59.

The defendant argued that the DRE protocol was unreliable and that the cited studies "were not peer reviewed and were methodologically flawed," while "other studies, suggesting that the DRE protocol is less reliable, were peer reviewed and used more sound methodology." Id. at 59. The court was not persuaded, noting that, "[a]though not always published in a peer-reviewed journal per se, DRE research has been the subject of considerable scientific scrutiny." Id. at 60. The defendant urged the court to rely on the Heishman studies, but the court noted that the methodology for those studies had been criticized and those studies "could not realistically predict the scientific reliability of the DRE program in the field because they examined an abbreviated evaluation that is different from the standardized protocol that is actually used." Ibid. Moreover, the court noted that "an erroneous DRE evaluation will probably err on the side of the suspect," so that "[t]he risk of a false positive is low." Id. at 61.

On the issue of general acceptance in the scientific community, the Daly court rejected the defendant's argument that "the DRE protocol as a whole is the single 'theory or technique' that must be generally accepted," and that the relevant scientific community should include pharmacologists, neurologists,

toxicologists, behavioral research psychologists, forensic specialists, and medical doctors. Ibid. Noting that the DRE protocol was "uniquely tailored to the exigencies of law enforcement," the court held that "the relevant question is whether the tests that make up the protocol are generally accepted," not whether the protocol as a whole is used in the scientific community. Ibid. The court was persuaded by expert testimony that "each step in the DRE protocol reflected techniques that were accepted in the medical community for diagnostic purposes and were either consistent with the medical community's method of performing those examinations or based on a sound understanding of the central nervous system." Ibid. Moreover, the court noted that "the entire protocol is based on the generally accepted principle that drugs affect vital signs and change the physiology of the body." Ibid.

"The issue is not whether any single observation is reliable enough to be dispositive – instead, it is whether an opinion based upon all of the relevant observations is reliable enough to be admissible." Id. at 62. The court concluded that "a law enforcement officer with the training and experience offered by DRE certification is sufficiently qualified to testify, based on his or her evaluation, that a suspect was under the influence of drugs." Id. at 63.

In State v. Sampson, 6 P.3d 543, 558 (Or. Ct. App. 2000), the court held that the DRE protocol satisfied the state's iteration of the Daubert standard.

Concluding that "the relevant scientific community includes physicians, toxicologists, and vision experts, each of whose fields have studied the protocol extensively,"[46] the court held that "the state offered enough evidence with respect to the scientific acceptance of the DRE protocol" to satisfy the applicable standard. Id. at 553. The court acknowledged "the existence of spirited dissent," but held that "the DRE protocol has achieved a significant degree of acceptance within the relevant scientific community that weighs in favor of its admissibility for the purpose of establishing the influence of controlled substances." Ibid.

The Sampson court based its holding, in part, on "the requirement of toxicological corroboration of the results," which greatly reduced the risk that a DRE's opinion could be unduly subjective. Id. at 556-57. Later opinions by Oregon courts have reiterated the need for toxicology, but nevertheless held that some elements of DRE testimony are admissible without it. See State v. Aman, 95 P.3d 244, 248 (Or. Ct. App. 2004) (acknowledging that "evidence of individual tests or observations that are components of the DRE protocol"

[46] The court rejected the trial court's finding that the relevant scientific community included "law enforcement," noting that "[p]olice officers are normally competent to testify concerning matters within the province of their own training and experience, including observational techniques that are part and parcel of the DRE protocol," but they were not qualified to "validate its underlying scientific basis." Id. at 553.

could potentially be admissible "as nonscientific evidence of drug impairment or some other condition," but "an incompletely administered DRE protocol is not, itself, admissible as scientific evidence"); State v. Rambo, 279 P.3d 361, 365 (Or. Ct. App. 2012) (where "no urinalysis results were assessed," DRE "could testify to his opinion based on and relating to defendant's blood alcohol content, her statements, the HGN test, her performance on the field sobriety tests, her pupil size, and the needle injection sites on her body," but not regarding "defendant's pulse rate, temperature, the dark room test, and the muscle examination"); State v. Downing, 366 P.3d 1171, 1184-85 (Or. Ct. App. 2016) (noting that "if a proper foundation is laid for it, the results of an evidence-gathering technique that is a part of the 12–step DRE protocol is independently admissible").

Courts in some other jurisdictions have held that the state equivalent of the Daubert standard applied, but without detailed discussion of whether DRE testimony met that standard. In State v. Chitwood, 879 N.W.2d 786, 788-89 (Wis. Ct. App. 2016), for example, the Wisconsin appellate court held that, contrary to the trial court's ruling, the Daubert standard applied to the DRE protocol. Noting that "[t]he DRE protocol has been the subject of several published studies and peer reviews, which indicate that it is a sufficiently valid methodology for identifying if a person is impaired by drugs," the court

remarked that the defendant did not dispute that "when used in its entirety, the DRE protocol is reliable." Id. at 797. The question before the Chitwood court was whether the DRE's testimony was sufficiently reliable where the defendant was "wearing a cervical collar and on a backboard in the trauma room of the emergency room," making only a partial evaluation possible. Id. at 790. The trial court allowed the testimony after the DRE "explained that the twelve steps were 'the ideal process,' but that it was 'common,' for example where a person was involved in a motor vehicle accident, to be unable to conduct all twelve steps." Ibid. The DRE also stated that his "training included scenarios where only a partial evaluation could be conducted." Ibid. The appellate court found no error, noting: "[The DRE's] determination may have been 'more reliable' if he had been able to conduct the entire examination, but we are satisfied that his determination was sufficiently reliable based on those tests he was able to conduct." Id. at 801.

In February 2021, the Court of Appeals of Alaska held that, "taken as a whole, the twelve-step DRE protocol is scientific evidence subject to the Daubert/Coon[47] standard," but it did not make a determination as to whether

[47] State v. Coon, 974 P.2d 386 (Alaska 1999). (adopting the Daubert standard in Alaska), abrogated on other grounds, State v. Sharpe, 435 P.3d 887, 900 (Alaska 2019).

the protocol met the standard. Bragaw v. State, 482 P.3d 1023, 1030 (Alaska Ct. App. 2021). The court reasoned:

> The protocol's original development and ongoing validity depend upon the scientific knowledge of physicians and toxicologists to attribute specific physiological, pharmacological, and behavioral observations to particular controlled substances. Indeed, we note that the national DRE certification board includes scientists and medical professionals as essential members – an indication of the importance of these other fields to the DRE protocol. We acknowledge, as have all other courts to address this issue, that many of the individual features of the DRE protocol would not amount to scientific evidence on their own. But we agree with the Oregon court that blending scientific and observational techniques into a "systematized and standardized," multi-step procedure – conducted by an officer with a highly specialized certification who testifies to a "battery of medicalized tests" and then concludes with a "complicated end-stage analysis" as to the nature and origin of a defendant's impairment – creates a substantial likelihood that "a juror's perception of the validity of each component will likely be enhanced by the scientific imprimatur of the whole."
>
> [Id. at 1029-30 (citations omitted).]

The Bragaw court noted that its holding was "a narrow one" and it did "not intend to suggest that officers cannot testify to their personal observations or to proper lay opinions." Id. at 1030. The court remanded for a new trial, at which "the trial court must determine whether the DRE meets the standard for admissibility of scientific evidence under Daubert/Coon." Id. at 1032.

Most jurisdictions examining the issue have held that DRE evidence does not need to satisfy either a Frye or Daubert standard because it is not scientific, and this is a position the State continues to advocate in this case. [Sb578-Sb580].

In one of the first cases to address the issue, the majority of the highest court in Minnesota, in State v. Klawitter, 518 N.W.2d 577 (Minn. 1994), held that the DRE protocol was not required to satisfy the Frye standard. It found that "following the protocol does not involve any significant scientific skill or training on the part of the officer," and that "the protocol, in the main, dresses in scientific garb that which is not particularly scientific." Id. at 585. Holding that "the protocol in question does not demand the kind of scrutiny required for the presentation of some novel scientific discovery or technique," the court noted that "[t]he real issue is not the admissibility of the evidence but the weight it should receive." Ibid. The Klawitter court was, nevertheless, concerned that designating "an officer trained in the art of observation pursuant to the protocol" a "drug recognition expert" inappropriately suggested the opinion had a scientific basis or should be given greater weight. Ibid. Thus, the court suggested that "[p]erhaps the officer can be called a 'Drug Recognition Officer' or some other designation which recognizes that the officer has received special training and is possessed of some experience in

recognizing the presence of drugs without suggesting unwarranted scientific expertise." Ibid.

Courts in several other jurisdictions have followed the reasoning of the Klawitter court, holding that the DECP is not "scientific" in nature. Relying largely on Klawitter, the federal district court for the District of Nevada held that "DRE testimony is governed by Rule 702, but not by Daubert, on the basis that the DRE's testimony is not 'scientific' in nature, but based upon observation, training and experience." United States v. Everett, 972 F. Supp. 1313, 1321 (D. Nev. 1997).

Similarly, in State v. Aleman, 194 P.3d 110, 112 (N.M. Ct. App. 2008), the court held that the DRE protocol was "not scientific in its entirety" and the State "laid an adequate foundation to introduce the individual scientific steps" involved. The court noted that the Daubert standard was inapplicable "in cases where expert testimony is based solely upon experience or training," rather than scientific knowledge. Id. at 113-14. It agreed with the courts in Klawitter and Everett "that many of the individual steps of the Protocol can easily be identified as non-scientific." Id. at 114. Pointing to "the officer's interview, the preliminary examination of the suspect, the assessment of vital signs, and the examination for injection sites," the court stated that these steps "merely document a series of observations of 'the common physical

manifestations of intoxication,' and these symptoms are self-explanatory." Ibid. (citation omitted).

Nevertheless, the Aleman court held that "some of the individual steps of the Protocol are scientific processes and therefore require a scientific foundation," specifying HGN testing and toxicological analysis. Id. at 114-15. The inclusion of these steps did not "mandate a Daubert analysis for the entire Protocol," but the State had to establish the foundation for the individual scientific tests that formed parts of the protocol. Id. at 115. As a whole, the court held a DRE provided "other specialized knowledge" rather than scientific testimony. Id. at 117. In the alternative, the Aleman court reviewed each factor of the Daubert standard and held that, even assuming the DRE protocol was subject to that standard, the testimony of the DREs was admissible. Id. at 117-21. See also United States v. Engle, 428 F. Supp. 3d 1259, 1280 (D. Wyo. 2019) (declining to apply the Daubert factors for scientific expert testimony to DRE testimony, noting that "[a]lthough the observations of a DRE are long-established and used in the medical community, they are not necessarily 'scientific' in nature, but are rather based on 'observation, training and experience'"); Williams v. State, 710 So. 2d 24, 28-31 (Fla. Dist. Ct. App. 1998) (holding that Frye (1) did not apply to the "general portion" of the DRE protocol because it was "not scientific, and (2) did not bar admission of "quasi-

scientific" evidence of HGN, VGN, and LOC because those tests were based on principles that were well established, so "there [wa]s simply no need to reapply a Frye analysis"); State v. Layman, 953 P.2d 782, 786 (Utah Ct. App. 1998) (holding that the DRE's testimony was not subject to the state's standard for the admission of scientific evidence because it was "an expert's personal observations and opinions based on his or her education, training, and experience"), aff'd, 985 P.2d 911 (1999).

In many cases jurisdictions, the admissibility of DRE testimony is clear, even though no published case has addressed the specific basis of that admissibility. See, e.g., Mace v. State, 944 S.W.2d 830 (Ark. 1997) (holding that trial court did not abuse its discretion in qualifying DRE for the "narrow purpose" of opining whether the defendant "was impaired because of some kind of intoxicant" because the DRE's "specialized training and knowledge aided the circuit court in determining this fact in issue"); State v. Brandenburg, 882 N.W.2d 875 (Iowa Ct. App. 2016) (noting DRE testimony "identifying the signs of drug intoxication" formed part of substantial evidence showing the defendant guilty of DUI); People v. Lenz, 141 N.E.3d 359, 379 (Ill. Ct. App. 2019) (noting that the DRE "opined that defendant was under the influence of a combination of central nervous system depressants and narcotic analgesics" and the applicable DUI statute "requires no greater specificity"); Curtis v.

State, 937 N.E.2d 868, 870-71 (Ind. Ct. App. 2010) (rejecting the defendant's argument that the evidence was not sufficient to sustain his conviction for DUI and stating that "[a] DRE is a standardized, 12-step program designed to determine whether an individual is impaired" and that "it is possible to infer the type of substance that caused impairment by using a seven-category evaluation matrix"); Burton v. Com., 300 S.W.3d 126, 141 (Ky. 2009) (acknowledging that "drug recognition testimony is admissible based upon personal observation, examination, and testing," but holding that the trial court abused its discretion in admitting testimony of a DRE who had reviewed records and had not personally observed the defendant); State v. Teesateskie, 863 S.E.2d 644, 650 (N.C. Ct. App. 2021) (rejecting the defendant's argument that there was insufficient evidence of drug impairment, primarily because a DRE "testified that he formed an opinion" as to the defendant's impairment); Davis v. State, 856 S.E.2d 411, 416 (Ga. Ct. App. 2021) (noting that an officer " certified as a DRE, was allowed to testify as an expert in DUI and drug recognition at trial"); State v. Guerra, 497 P.3d 1106, 1113 (Idaho 2021) (finding sufficient evidence for a conviction where a DRE "testified about the results of the drug recognition evaluation at trial").

In Maine, DRE testimony is admissible by operation of statute, and apparently has been since 1993. Me. Rev. Stat. tit. 29-A, § 2525 (providing, in

pertinent part, that "[i]f a law enforcement officer certified as a drug recognition expert by the Maine Criminal Justice Academy conducts a drug impairment assessment, the officer's testimony about that assessment is admissible in court as evidence of operating under the influence of intoxicants").

The OPD relies on unpublished trial-level cases, including the Maryland case State v. Brightful, K-10-40259 (Cir. Ct. Carroll Cty., Md., March 5, 2012), 2012 Md. Cir. Ct. LEXIS 1, which it describes as "the most recent court to hold a Frye hearing on the DRE protocol," and two Massachusetts cases, Commonwealth v. Callahan (Pittsfield District Court Docket. 1627CR0789) (March 30, 2019)), and Commonwealth v. Mulvey (Worcester District Court Docket 1962CR2017 (Jan. 21, 2019)). [OPDb290-OPDb293; Da1-Da24]] These cases, however, are not persuasive and, in any event, are in conflict with other unpublished decisions from the same jurisdictions.

In Brightful, the trial court held a Frye hearing over the course of ten days and granted the defense motion to exclude the testimony of the DRE. Id., slip op. at 1, 40. The court heard testimony from six experts presented by the State, including Citek, and three defense experts, including Adams, considered some of the studies admitted into evidence in this case, and examined case law from other jurisdictions. Id., slip op. at 4-39. It held that "[t]he DRE Protocol

fails to produce an accurate and reliable determination of whether a suspect is impaired by drugs and by what specific drug he is impaired," and it found the proffered testimony inadmissible. Id., slip op. at 27-39. The court was persuaded that "the drug recognition protocol is a new and novel technique because it purports to create a protocol for police officers to render a medical diagnosis." Id., slip op. at 37.

By contrast, one year later in State v. Crampton, 121222-C, (Cir. Ct. Montgomery Cty., Md., March 18, 2013), a different circuit court in Maryland held a similar hearing with many of the same witnesses, but it reached a different conclusion. [Ra178-Ra192].[48] See also § 7:63, Drug recognition experts, 8 Maryland Practice: DUI Handbook (2021 ed.). The Crampton court held that the Frye "general acceptance" standard was inapplicable because "the DEC protocol and a DRE's conclusions regarding impairment are not new or novel scientific evidence because they are not based upon new or novel scientific principles or techniques." Id., slip op. at 11 [Ra189]. The court specifically rejected the defense argument that "attempted to equate a DRE's

[48] When citing to Brightful, the OPD should have, but did not, include a copy of the Crampton opinion with its materials under Rule 1:36-3 as a "contrary unpublished opinion[] known to counsel." The Crampton case is unavailable on either Westlaw or Lexis, but a copy was included in the Appendix to the Brief on Behalf of the State of New Jersey, filed with the Court on June 19, 2019. [Ra178-Ra192]

opinion regarding impairment with a 'differential diagnosis' performed by doctors on a daily basis." Id., slip op. at 12 [Ra190].

The unpublished Massachusetts case law cited by the OPD similarly fails to support its contention that DRE testimony should not be admissible, or even that it is not generally admissible in Massachusetts. In March 2019, applying the Daubert standard, a judge in the Massachusetts District Court granted a defense motion to "exclude testimony of or reference to a drug recognition expert." Commonwealth v. Callahan (Pittsfield District Court Docket. 1627CR0789) (attached to OPDb at Da15-Da24). Based on a very limited record, the court held that the DRE could testify regarding his observations of the defendant and his "extensive training in investigating impaired drivers," but he could not give an opinion as to whether the defendant was under the influence of drugs and could not testify as an expert (OPDb at Da15-Da17; Da24).

Similarly, in Commonwealth v. Mulvey, (Worcester District Court Docket 1962CR2017 (Jan. 21, 2019) (attached to OPDb at Da1-Da14), the court conducted a "Daubert-Lanigan"[49] analysis and concluded that the evidence presented by the Commonwealth "was insufficient to establish its burden that the DECP evaluation process has been generally accepted in the

[49] Commonwealth v. Lanigan, 641 N.E.2d 1342 (Mass. 1994)

relevant scientific community and subjected to critical peer review and publication." The only witness at the evidentiary hearing was a state trooper who observed but did not conduct the DRE evaluation of the defendant. [OPDb at Da2] The only documentary evidence the prosecution presented was the three DECP foundational studies, the rolling log and DIE report specific to the defendant, and three other items not discussed in the opinion and not entered into evidence in this case. [OPDb at Da2-Da3; Da9-Da11]

Neither the Callahan nor Mulvey opinions suggest that DRE testimony is generally excluded in Massachusetts, but other case law suggests that it can be admissible. In Com. v. Ferola, 889 N.E.2d 436, 437 (Mass. App. Ct. 2008), for example, the appellate court noted that the Commonwealth presented (1) the testimony of a DRE, and (2) toxicology results consistent with prescription drugs taken by the defendant. The court held that "[t]he evidence was ample that the defendant was operating a motor vehicle on a public way while under the influence of the CNS depressants Klonopin and amitriptyline," and also that "the evidence was sufficient to establish that the defendant's capacity to operate her vehicle was impaired by these substances." Id. at 438. The court reversed the defendant's conviction because, under the Massachusetts DUI statute, proof that the substance at issue was one specifically defined by statute was required, but the prosecution failed to show

that Klonopin or amitriptyline were among the defined substances. Id. at 439. Implicit in the Ferola decision was the assumption that the DRE testimony was admissible but that the totality of the evidence simply failed to make the required link between the drugs used by the defendant and those proscribed by statute.

In sum, appellate level courts addressing the issue of the admissibility of DRE evidence have routinely and uniformly held it to be admissible, although the reasoning varies depending on the jurisdiction. Some unpublished trial level opinions have come to a contrary result, but those cases are unpersuasive outliers where the court did not have the benefit of the extensive record developed in this case.

XI. ANALYSIS OF INDIVIDUAL COMPONENTS AND PRACTICAL LIMITATIONS

The Court directed me, as part of the evaluation of whether DRE evidence has achieved general acceptance within the relevant scientific community, to "determine, among other relevant issues, whether each individual component of the twelve-step protocol is reliable; whether all or part of the twelve-step protocol is scientifically reliable and can form the basis of expert testimony; and whether components of the process present limitations, practical or otherwise." [Appendix A at 3-4]

These determinations can be expressed in relatively short order because much of what they require has already been discussed in this report.

A. Individual Components

The State presents a primary position, followed by various alternative positions on whether the DRE protocol is scientific, and therefore subject to Frye compliance. Initially, the State contends that, as a whole, the DRE protocol is not scientific. It acknowledges that three of the twelve steps have a scientific basis. These are Step 1 (the Alcotest examination), Step 4 (HGN, VGN and non-convergence eye examinations), and Step 12 (toxicological analysis.) The State continues that Step 1 has been judicially approved as scientifically reliable in State v. Chun, 194 N.J. 54 (2008). It further contends that no party disputes the scientific nature of the toxicological examination or that it is done in accordance with all applicable reliability standards in the New Jersey State Police OFS laboratories. As to Step 4, the State argues that the credible testimony of its medical experts, particularly Fraunfelder and Citek, established that these tests are generally accepted in the medical community as revealing known effects on the eyes caused by certain drugs. Finally, the State contends that the evidence establishes that DREs can be trained to perform these tests correctly and reliably make the necessary observations of the eye movements involved.

However, by acknowledging that Step 4 is "scientific," but not also making the same acknowledgement regarding other steps that include assessments of other features of the eyes and their movement and reactions under certain conditions, the State is conflating what is scientific with the ease of observation. According to the State, the eye observations that are contained in the protocol, other than Step 4, are easy to make, whereas the Step 4 observations are more difficult. These are inconsistent positions. All of the eye movements, in all of the steps that provide for them, have relevance to the toxidrome recognition process. Thus, interpretation of the eye movements is scientifically based, regardless of how difficult or easy the movements are to observe.

Likewise, the State argues that certain other tests, such as taking a subject's pulse, blood pressure, or temperature are easy to do and within the common knowledge of laypersons, and therefore they are not scientific. Again, in this context, their relevance is only meaningful within the toxidrome recognition analysis.

Thus, as I explained in section VII, the toxidrome recognition section of this report, two aspects of expertise under N.J.R.E. 702 are implicated here. One is the specialized knowledge that DREs acquire that enable them to reliably administer the tests and make the observations and gather the

information required by the DRE protocol and, by assessing the information and the many observations, some scientifically based and some not, to determine whether the subject is impaired by drugs and if so by which category or categories in the DRE matrix. The validity of the DRE matrix and the procedures and methods for applying it require another aspect of expertise under N.J.R.E. 702, namely scientific expertise.

The State further urges that all of the non-scientifically based observations, namely the long-recognized typical indicia of impairment whether by drugs or alcohol, are observations that laypersons are capable of making without any specialized knowledge. These would include such things as general demeanor, manner of speaking, bloodshot or droopy eyes, staggering, and the like.

Therefore, the State sums up its primary position by saying that everything that is easily observable is, by definition, not scientific. And, in addition to the Alcotest examination and toxicology analysis, only the more difficult aspect of the eye examinations in Step 4 are scientific. And, all three of those that it concedes to be scientific, are generally accepted in their respective scientific communities.

Alternatively, the State argues that even if the entire protocol is evaluated as a single entity, "the whole cannot be assessed by those scientific

communities associated only with its individual components, it must be judged with those in the scientific community that studies the whole." The State argues that the appropriate scientific community is the "traffic-safety research and analysis community," which is a "multidisciplinary community of professionals" in this specialized field. [Sb590] The problem is that this is not a recognized "scientific" community. It includes traffic safety engineers, law enforcement professionals, DRE coordinators and officers, and other nonscientists, working in conjunction with scientists from assorted disciplines. This is, by the State's acknowledgement, a very limited group of categories and individuals, selected by the State for inclusion on an ad hoc basis.

The defense argues that "[t]he individual steps of the DRE protocol cannot be isolated from one another - it is the entirely subjective DRE protocol as a whole that forms the basis for any DRE officer's opinion and testimony." Alternatively, the defense argues that individually the steps "are either unreliable predictors of positive toxicology or not beyond the ken of the jury and thus not appropriate topics for expert testimony." [OPDb294]

In my view, the appropriate analysis in the Frye context is found in the evidence regarding toxidrome recognition. This is because Frye requires reliability to be assessed based on general acceptance in the appropriate scientific community. I have concluded that the appropriate scientific

communities are medicine and toxicology because it is in those communities that toxidrome recognition has been long established and generally accepted. Because the DRE protocol is not widely known by members of those communities, proof of actual general acceptance is elusive. So this is not a typical fit for the Frye paradigm. As I have previously expressed, the medical and toxicological testimony by the State's experts has persuaded me that those communities would generally accept the DRE protocol because it is in all material respects the same as theirs, including the level of training required. Thus, for Frye purposes, I have concluded that the DRE protocol has been impliedly generally accepted in the medical and toxicological communities.

Although DRE opinions are based on all of the steps, which follows the medical toxidrome recognition model, the individual steps can be isolated for purposes of analysis. Some of the steps, most notably Steps 1 and 12 are clearly scientific in their entirety. Others are scientifically based. These are the steps that have a medical basis for inclusion in the toxidrome recognition process, including such things as vital signs, eye movements and muscle tone. Other components are clearly not scientific. These would include such things as obtaining statements from the subject and from others with knowledge of the subject's conduct and behavior, observing signs of recent ingestion of drugs or track marks and finding drugs or drug paraphernalia on the subject's

person or in the subject's vehicle. These are sometimes referred to as "external" factors, because they are outside of the toxidrome indicators, but they are also valuable pieces of information to assist in toxidrome recognition both in medical practice and in a police investigation.

My assessment of each step is as follows:

Step 1, the Alcotest examination, is scientific and it is clearly reliable.

Step 2, interview by the DRE of the arresting officer. This is not a scientific step. It is an information gathering part of a routine of police investigation. It is reliable in the overall assessment made by the DRE. Credibility and weight are left to the factfinder.

Step 3, preliminary examination and first pulse. The preliminary assessment by the DRE is a general and nonscientific step. The first pulse is scientific. Both are reliable, and, as with Step 2, are subject to credibility and weight assessment by the factfinder.

Step 4, the more complex eye examination, involving the three-component HGN evaluation (consisting of smooth pursuit, nystagmus at maximum deviation, and angle of onset of nystagmus), VGN, and non-convergence assessment. Both the performance of the test and making the required observations are scientifically based. I have found that trained DREs

can perform these assessments reliably. As with all other evidence, they are subject to credibility assessments and weight allocation by the factfinder.

Step 5, divided attention tests. These tests, including the modified Romberg, WAT, OLS, and finger-to-nose tests, have been in use for decades and have been generally accepted by our courts as indicia of impairment. They test balance, coordination, the ability to divide attention and perform more than one task at a time, all of which bear on one's ability to perform the complex task of driving a motor vehicle. Although these tests have a somewhat subjective element to them, they are generally reliable, and as with everything else, are subject to credibility and weight allocations by the factfinder.

Step 6, vital signs and second pulse. These are scientifically based but easily performed tests, and they are reliable, subject to the same caveats as in the prior steps.

Step 7, dark room checks of pupil size and evaluation of nasal and oral cavities for recent ingestion. The dark room eye exams are scientifically based, and not difficult to perform. The nasal and oral cavity exams are routine police work. They are not scientific, and they are easily performed. These procedures, subject to the same caveats, are reliable.

Step 8, muscle tone assessment. The testimony establishes that DREs are taught to assess for this throughout the course of their interaction with the subject, not only when touching the subject's arm to feel the muscle tone. More particularly, if muscle tone is rigid, the subject's movements will be stiff and robot-like, as will the subject's manner of walking. On the contrary, if muscle tone is flaccid, the subject's movements and gait will be very loose and rubbery. This assessment is scientifically based and is reliable, subject to the same qualifications.

Step 9, check for injection marks and third pulse. Checking for injection marks is not scientific. In the course of regular police experience and police work, it is expected that a police officer would be able to distinguish between fresh injection marks and older ones. I do not consider this a circumstance that pushes this into the scientific category. In any event, it is a reliable assessment by a police officer subject to the same caveats. The third pulse is scientifically based, easily done, and generally reliable subject to the same caveats.

Step 10, interrogation of the subject, statements made by the subject, and other observations. In this step, after assuring that the subject has been Mirandized, and, if not, administering Miranda warnings before questioning, DREs are trained to engage in a conversational discussion, which would include the subject's activities and whether the subject has recently taken any

drugs. This is routine police work, and it is reliable, subject to the same caveats.

Step 11, opinion of the evaluator. After completing the first ten steps, the DRE checks over the face sheet to make sure that all observations made have been recorded, and refers to the DRE matrix as a guide for allocating signs and symptoms he or she has observed to the appropriate category or categories. The DRE assesses whether a significant coherent pattern establishes a likelihood that the drugs in that category or categories are the cause of the impairment the DRE has observed throughout the process. The DRE then records his or her opinion both on the face sheet and narrative sections of the report. For all of the reasons I have discussed in this report, and subject to the limitations discussed, it is my finding that the DRE opinion in Step 11 is reliable evidence to be placed before the factfinder as to whether the subject is impaired and if so whether the likely source of that impairment is the ingestion of drugs in one or more categories in the DRE matrix. Of course, this evidence is also subject to the factfinder's assessment of credibility and assignment of weight.

Step 12, the toxicological analysis, performed by the well-trained and very competent toxicologists in the OFS laboratories, which are ISO 17025 certified, is reliable. As detailed in section VI and in the following subsection,

this does not mean it is infallible or without limitations. As the evidence clearly established in this case, toxicology analysis is the gold standard in this context, but, like all gold standards in various areas of science, that designation means it is the best objective test available, not that it is definitive.

One final comment about the individual reliability of the various steps. It has been universally agreed by all of the witnesses, including all of the experts in this case, that an evaluator, whether in the medical context or a DRE, would never form an opinion that would be accepted as reliable based upon any one or even a few isolated factors. All of the observations must be taken into consideration and assessed together. As Nelson described it, "toxidrome recognition requires piecing together certain pieces of information that individually might be objective or slightly subjective but together paint a coherent picture." [46T64-46T65]

I now go on to discuss the Court's final individual charge, whether components of the process present limitations, practical or otherwise.

B. Limitations

On the topic of limitations of the protocol and its components, section VI of this report discusses in some detail significant limitations inherent in step twelve, the toxicological examination. DREs encounter hundreds, or even thousands, of different drugs that are potentially impairing. New designer

drugs are being created every day, and the drugs that are commonly used on the street are constantly changing. Many, if not most, of the subjects DREs evaluate have ingested more than one potentially impairing drug. In this landscape and given the intrinsic nature of toxicological testing as described by the toxicology experts, even where a subject consents to provide a urine sample and that sample is meticulously examined and tested by one of New Jersey's four ISO-17025-certified drug and toxicology units, it is often difficult to determine with complete assurance exactly what potentially impairing drugs were present in that subject's body, either when the sample was given or earlier when the subject was taken into custody.

This does not alter the fact that the results of toxicological analysis of subjects evaluated by DREs are very important. As discussed in section VIII on the New Jersey data sets, despite its limitations, toxicology is the best available measure – i.e., the gold standard – for determining whether impairing drugs or their metabolites are present in a given subject and are the likely cause of the subject's observed impairment. A biological sample was provided by about 73% of the non-training subjects evaluated, and the toxicology results from those samples showed that drugs were present in the vast majority of subjects that DREs opined were impaired. Also as discussed above, toxicological analysis is a central aspect of the DRE certification and re-

certification process. Moreover, notwithstanding the inherent limitations of chemical testing, it is certainly useful to the ultimate search for truth in most cases to have laboratory results of the tests performed on a subject's urine sample as part of the overall body of evidence to be considered by the factfinder.

Another practical limitation relates to subjects who refuse to provide urine samples for toxicological analysis, which consists, as discussed above in section VII, of about 20 % of all non-training subjects as to which DREs complete an evaluation. The State notes that subjects may refuse to provide a urine sample to complete Step 12 of the protocol, in which case the only feasible alternative to going without toxicological analysis altogether is to obtain a warrant for a blood draw, which presents many practical difficulties. [Sb104-Sb106; Sb540; Sb557-Sb558; Sb593; AACPb10-AACPb12; AACPb16; ACPAb15-ACPAb16] The OPD, on the other hand, notes that "police get warrants all the time," and it contends that officers could, without undue difficulty, simply obtain a warrant for a blood sample in all routine cases where the subject does not consent to a urine sample, not just those involving serious injury or death as is the current practice. [OPDb254-OPDb255; OPDb299-OPDb300] The OPD suggests that completion of Step 12 should be a prerequisite for admission of the DRE opinion in all cases,

contending that the toxicological analysis "is critical to the DRE program" because it "finally provides an objective and reliable measure of whether someone has taken a drug and which drug it was." [OPDb252]

Imposing a universal toxicological analysis requirement as a prerequisite for the admissibility of a DRE opinion would not only discount the imperfections of toxicological testing, it would ignore the important fact that toxicology is not considered by the DREs and plays no role in forming their opinions. Although included in the protocol as Step 12, the results of any available toxicological analysis are not known to DREs until well after their opinions are formed and their reports written. Toxicological results are not a necessary element of the toxidrome process discussed in this report, and they should not be made a prerequisite to the admissibility of a DRE opinion. Toxicology is appropriately viewed as another piece of evidence for the factfinder that corroborates, or fails to corroborate, the DRE opinion – potentially affecting the weight accorded the opinion but not affecting its admissibility.

Both toxicologists testified in conformity with this view. Verdino explained that, in DRE cases, the role of the OFS laboratories is to attempt to confirm the DRE opinion. [28T202-28T206; 28T221; S-101 at 33] She said that toxicology testing "corroborates the observations of the officers." [29T64] Miles gave similar testimony. [50T80; 50T215; 751T80-51T81; D-521 at 7]

And as Nelson explained in the context of toxidrome recognition in medicine, a corroborating toxicological result "is something we like to add in to support our diagnosis" of a toxidrome, but it is the identification of the syndrome itself that is "essentially diagnostic," and that identification is based on the clinical findings and supporting information rather than toxicology. [42T42; 46T90-46T91]

Thus, whether a toxicological analysis is absent in a given case or whether one is present and supports the DRE opinion fully, partially, or not at all, is simply another of the many factors to be weighed and considered by the factfinder in a particular case.

In addition, as a practical matter, imposing a toxicology prerequisite would force the police in most, if not all, refusal cases either to (1) forego prosecution for DUID, or (2) obtain a warrant (or prove an exigency) and compel a blood draw. The first option would unduly favor subjects who refuse to cooperate with the police and would be contrary to the public policy embedded in N.J.S.A. 39:4-50 of ensuring that impaired drivers are eliminated from the roadways.

The second option would be impractical and expensive. Currently, the police seek warrants to obtain a blood sample in a "[v]ery small" number of DRE cases. [27T189] The NJSP SOPs instruct police to obtain a warrant for a

blood draw only in cases of accidents resulting in serious injury or death, but these cases relatively few and rarely involve DREs. [S-51 at 11-12; 27105; 27T112] Expanding warrant requests to include all, or even a significant number, of subjects who refuse to provide a urine sample for Step 12 of a DRE evaluation would entail a major shift in police policy, likely necessitating an executive branch decision. And even assuming such a policy were adopted, other considerations could make obtaining a warrant unduly expensive or impractical. In the case of some drugs, the time lost in obtaining a warrant and blood sample could result in the dissipation of the evidence of drug use. DRE evaluations are "typically in the middle of the night" [27T111], and it would burden the police, particularly small departments that may have a skeleton crew, to impose a routine warrant requirement. Also, actually obtaining the blood samples would require medical facility involvement and cooperation, which is not something within a police department's budget or control.

A different type of practical limitation related to the testing of a subject's urine is that New Jersey's implied consent law, unlike similar laws in most other states, does not impose any license suspension or other administrative penalty on subjects who refuse to provide a urine sample to test for drugs. N.J.S.A. 39:4-50.2(a) provides, in pertinent part, that "[a]ny person who operates a motor vehicle on any public road, street or highway or quasi-public

area in this State shall be deemed to have given his consent to the taking of samples of his breath for the purpose of making chemical tests to determine the content of alcohol in his blood." Drivers who refuse to provide a breath sample when arrested are subject to a fine, the installation of an ignition interlock device, and license suspension. N.J.S.A. 39:4-50.4(a).

Most states have statutes providing that driving on their roadways not only constitutes consent to provide a breath sample to test for alcohol, but also implied consent to provide a urine and/or blood sample to test for the presence of drugs, and those states impose administrative penalties for refusal similar to those imposed in New Jersey for refusal to undergo a test for BAC.[50] Some of

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[50] See, e.g., Ala. Code § 32-5-192(a)(1) (Alabama; implied consent to tests of a driver's "blood, breath, or oral fluid for the purpose of determining the content of any impairing substance or substances within a person's system"); Ariz. Rev. Stat. § 28-1321(A) (Arizona; implied consent to tests of a driver's "blood, breath, urine or other bodily substance for the purpose of determining alcohol concentration or drug content"); Colo. Rev. Stat. Ann. § 42-4-1301.1 (Colorado; tests of a driver's "blood, saliva, and urine for the purpose of determining the drug content within the person's system"); Conn. Agencies Regs. 14-227b-2(a) (Connecticut; implied consent to a "chemical analysis for determination of the alcohol or drug content, or both, of such person's blood"); Del. Code tit. 21, § 2740(a) (Delaware; tests of a driver's "blood, breath and/or urine for the purpose of determining the presence of alcohol or a drug or drugs"); Ky. Rev. Stat. Ann. § 189A.103(1) (Kentucky; tests of a driver's "blood, breath, and urine, or combination thereof, for the purpose of determining alcohol concentration or presence of a substance which may impair one's driving ability,"); N.Y. Veh. & Traf. Law Ann. §§ 1194(2)(b)(1) (New York; tests of "breath, blood, urine, or saliva, for the purpose of determining the alcoholic and/or drug content of the blood"). See also (continued)

these statutes also expressly provide that evidence of refusal to provide a sample for testing is admissible in any related DUID prosecution.[51] Only a very few states limit their implied consent laws to tests for blood alcohol content, as New Jersey does.[52]

As a practical matter, the prosecution of DUID cases would be impacted if New Jersey's implied consent law were expanded to include urine tests for drugs as well as breath tests for alcohol and to impose similar administrative penalties for both types of refusal. Of course, that would be a legislative determination, not a judicial one.

Birchfield v. North Dakota, 579 U.S. 438, 463 (2016) (noting that the Court's "prior opinions have referred approvingly to the general concept of implied-consent laws that impose civil penalties and evidentiary consequences on motorists who refuse to comply," and that its holding that an actual blood draw requires a warrant or warrant exception should not "be read to cast doubt" on such implied consent laws).

[51] See, e.g., Ariz. Rev. Stat. § 28-1388(D) (Arizona; noting that "evidence of refusal is admissible in any civil or criminal action or other proceeding"); Me. Rev. Stat. tit. 29-A, § 2521 (Maine; providing that refusal is admissible at trial and can be an aggravating factor at sentencing).

[52] See, e.g., Mass. Gen. Laws ch. 90, § 24(f) (1) (Massachusetts; a driver "shall be deemed to have consented to submit to a chemical test or analysis of his breath or blood in the event that he is arrested for operating a motor vehicle while under the influence of intoxicating liquor"); Wash. Rev. Code § 46.20.308(1) (Washington; a driver consents "to a test or tests of his or her breath for the purpose of determining the alcohol concentration in his or her breath").

Another limitation of evaluating drug-impaired as opposed to alcohol-impaired drivers relates to both the toxicological evaluation of Step 12 and Step 1, the BAC test. In State v. Tischio, 107 N.J. 504, 514-18 (1987), and Chun, 194 N.J. at 71-74, the Court detailed the evolution of both the law making it an offense to drive with a specific BAC level and the development of scientifically reliable instruments to measure BAC. See also State v. Cassidy, 235 N.J. 482, 502-04 (2018) (describing development and scientific acceptance of instruments measuring BAC).

In 1951, the Legislature enacted N.J.S.A. 39:4-50.1 (repealed in 1990), which provided that a BAC of 0.15 or higher created a presumption of intoxication. Tischio, 107 N.J. at 514-15. "The primary purpose of" of the Legislature in creating the statutory presumption "was to eliminate the necessity for expert and other testimony relating to the existence and degree of intoxication" in alcohol cases. Id. at 515. See also Chun, 194 N.J. at 71-72 (noting that N.J.S.A. 39:4-50.1 was enacted "to address growing difficulties and confusion surrounding the evidentiary burden for establishing operation of a vehicle 'under the influence'").

Proof of an individual's BAC was obtained through an evidential breath test. See Cassidy, 235 N.J. at 502-03 (noting that "the results of evidentiary breath-testing instruments" had been used to establish BAC "[f]or over fifty

years"). In 1964, the Court referenced various breath-testing instruments "in common use," including the drunkometer, the alcometer, the breathalyzer, the drunkotester and the intoximeter, and it noted that "[a]ll are now generally scientifically recognized as sufficiently reliable." State v. Johnson, 42 N.J. 146, 170 (1964).

In 1983, as a result of "mounting scientific findings" that "almost everyone experiences reduced driving ability at and above 0.10 [BAC]," the Legislature adopted an amendment to N.J.S.A. 39:4-50(a) making driving with a .10 or higher BAC a per se offense. Id. at 516. However, even when the Court decided Tischio in 1987, it noted that "[m]ost persons" were impaired at 0.08% BAC, ibid., and in the ensuing five years the Legislature enacted statutes creating (1) "an even more stringent standard" of 0.04% BAC "to be applied to drivers of commercial vehicles," N.J.S.A. 39:3-10.13, and (2) "a new per se offense, which applies to drivers who are under the legal drinking age," N.J.S.A. 39:4-50.14. Chun, 194 N.J. at 73-74.

In 2003, "[i]n order to comply with federal highway funding requirements, the statutory standard of 0.10 percent BAC" in N.J.S.A. 39:4-50 "was reduced to 0.08 percent BAC." Id. at 74. Over the years, as the per se BAC level was reduced, penalties for second and third offenders became "increasingly harsh," making "the Legislature's view that drunk driving is not

to be tolerated" plain. Ibid. In Chun, the Court held that, with certain specified conditions, the Alcotest instrument being used in New Jersey was a scientifically reliable breath-testing device. Id. at 65.

In short, where alcohol impairment alone is involved, for over seventy years there have been both (1) a widespread consensus that driving with a BAC at or above a specified level is unsafe, and (2) an available, non-invasive, and scientifically reliable instrument to measure whether an individual's BAC meets or exceeds that specified level. Where drug impairment is involved, however, neither of these things is true. Different drugs affect different users differently, polydrug use creates even more permutations and variations, the features of which include additive, overlapping, antagonistic, or null effects, and there is no consensus that a specific amount of any one particular drug – much less most or all of the many potentially impairing drugs currently available – will generally render a subject unable to safely operate a motor vehicle. Just as significant, even if a specified measure of a particular drug in a biological sample could be dependably equated with impairment, the drug-detecting equivalent of a breath-alcohol-testing device does not exist.

XII. LEGAL STANDARD AND CONCLUSION

N.J.R.E. 702 provides that "[i]f scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to

determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education may testify thereto in the form of an opinion or otherwise."

As the Court has explained:

> To satisfy the rule, the proponent of expert evidence must establish three things: (1) the subject matter of the testimony must be "beyond the ken of the average juror"; (2) the field of inquiry "must be at a state of the art such that an expert's testimony could be sufficiently reliable"; and (3) "the witness must have sufficient expertise to offer the" testimony.
>
> [J.L.G., 234 N.J. at 295 (citing State v. Kelly, 97 N.J. 178, 208 (1984).]

The second requirement – assuring that the proposed expert testimony is "sufficiently reliable" – is the issue in this matter. "The rationale for this requirement is that expert testimony seeks to assist the trier of fact," and "[a]n expert opinion that is not reliable is of no assistance to anyone." Kelly, 97 N.J. at 209.

In criminal cases, our courts have "continued to rely on the Frye standard to assess reliability." Id. at 280. This standard "requires trial judges to determine whether the science underlying the proposed expert testimony has 'gained general acceptance in the particular field in which it belongs.'" Ibid. (quoting Frye, 293 F. at 1014). As discussed in this report, a proponent of scientific evidence can prove its general acceptance and reliability in one or

more of three ways: (1) through expert testimony; (2) by authoritative scientific and legal writings; and (3) by judicial opinions. See Cassidy, 235 N.J. at 492; J.L.G., 234 N.J. at 281; Harvey, 151 N.J. at 170; Kelly, 97 N.J. at 209-10; Cavallo, 88 N.J. at 521 (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)).

Showing proof of the trustworthiness of a scientific technique or instrument before allowing the admission of evidence regarding it has long been a requirement in New Jersey, even pre-dating the 1923 Frye decision. As the Court explained in 1955:

> Through the years our courts have properly been called upon to recognize scientific discoveries and pass upon their effects in judicial proceedings. When fingerprint evidence was not accepted as universally as it is now, the Court of Errors and Appeals was required to deal with the contention that the trial court had erred in permitting an expert to testify as to the art of fingerprinting and its use as a means of identification; in holding that the testimony had properly been admitted Justice Minturn in State v. Cerciello, 86 N.J.L. 309, 314 (E. & A. 1914), aptly said:
>
> > "In principle its admission as legal evidence is based upon the theory that the evolution in practical affairs of life, whereby the progressive and scientific tendencies of the age are manifest in every other department of human endeavor, cannot be ignored in legal procedure, but

> that the law, in its efforts to enforce justice by demonstrating a fact in issue, will allow evidence of those scientific processes which are the work of educated and skillful men in their various departments, and apply them to the demonstration of a fact, leaving the weight and effect to be given to the effort and its results entirely to the consideration of the jury. Stephen Dig. Ev. 267; 2 Best on Ev. 514."

[State v. Dantonio, 18 N.J. 570, 576 (1955).]

The general acceptance or comparable standard has frequently been applied in cases examining mechanical devices or instruments. See, e.g., Chun, 194 N.J. at 91-92 (the Alcotest); Dantonio, 18 N.J. at 582-83 (affirming the admission of evidence from "radar speedmeters"); State v. Walker, 37 N.J. 208, 215-16 (1962) (noting lack of proof of general scientific acceptance of the reliability of a polygraph); State v. Cary, 49 N.J. 343, 352(1967) (remanding for a determination of "whether the voiceprint technique and equipment are sufficiently accurate to produce results admissible as evidence").

The general acceptance standard has also been applied to expert testimony regarding syndromes. Kelly, 97 N.J. at 211 (noting "the record before us reveals that the battered woman's syndrome has a sufficient scientific basis to produce uniform and reasonably reliable results as required by State v. Cavallo, and Evid.R. 56(2)"); State v. Townsend, 186 N.J. 473, 491-92 (2006)

("It is beyond debate that 'battered women's syndrome has gained general acceptance as a scientific doctrine within the professional community.'") (quoting Kelly, 97 N.J. at 225). See also J.L.G., 234 N.J. at 303 (holding that evidence of child sexual abuse accommodation syndrome did not satisfy Frye standard). Accord State v. Hurd, 86 N.J. 525, 536 (1981) (noting that "the policy reasons embodied in the general acceptance standard are germane to hypnotically refreshed testimony"), abrogated on other grounds by State v. Moore, 188 N.J. 182 (2006).

Proof of general acceptance within a scientific community "can be elusive" and "involves more than simply counting how many scientists accept the reliability of the proffered [technique]." Cassidy, 235 N.J. at 492 (quoting Harvey, 151 N.J. at 171). The proponent of the evidence must show that "[t]he technique or mode of analysis used by the expert [has] a sufficient scientific basis to produce uniform and reasonably reliable results so as to contribute materially to the ascertainment of the truth." Kelly, 97 N.J. at 210; Cavallo, 88 N.J. at 517. See also Cary, 49 N.J. at 352 (noting that "the prosecutor must satisfy the trial judge that identification by voiceprint technique and equipment has a sufficient scientific basis to produce uniform and reasonably reliable results and will contribute materially to the ascertainment of truth").

The general acceptance standard "does not mean that there must be complete agreement in the scientific community about the techniques, methodology, or procedures that underlie the scientific evidence." Chun, 194 N.J. at 91-92. As the Chun Court explained:

> Even "the possibility of error" does not mean that a particular scientific device falls short of the required showing of general acceptance. [Romano v. Kimmelman, 96 N.J. 66, 80 (1984)] As we long ago recognized, "[p]ractically every new scientific discovery has its detractors and unbelievers, but neither unanimity of opinion nor universal infallibility is required for judicial acceptance of generally recognized matters." Johnson, supra, 42 N.J. at 171, 199 A.2d 809. Neither "complete agreement over the accuracy of the test [nor] the exclusion of the possibility of error" is required. Harvey, supra, 151 N.J. at 171, 699 A.2d 596.
>
> [Id. at 92.]

See also, e.g., Romano, 96 N.J. at 80 ("Scientific acceptability need not be predicated upon a unanimous belief or universal agreement in the total or absolute infallibility of the techniques, methodology or procedures that underlie the scientific evidence.")

The proponent of scientific evidence has the burden to "clearly establish" general acceptance. See Cassidy, 235 N.J. at 493; Chun, 194 N.J. at 92.

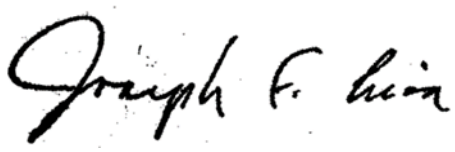
I conclude for all of the reasons stated in this report that DRE testimony is reliable. The reliability is established by the expert testimony presented by the State, which establishes that the DRE protocol replicates generally accepted medical practices for identifying the presence of impairing drugs and their likely identity through a toxidrome recognition process. This testimony has also established that the DRE matrix comports with matrices designed for this purpose and generally accepted and used in the medical field. This testimony has also established that the training DREs receive is comparable to that received by medical technicians and that DREs are thus enabled to reliably apply the protocol. Therefore, by implication, the DRE protocol as a whole and its individual components are generally accepted in the scientific communities to which they belong, namely medicine and toxicology.

As with all evidence, and as I have stated repeatedly regarding each individual step, DRE evidence and the DRE opinion will be tested by cross-examination and the factfinder will ascribe to it such credibility assessments and weight allocations as he or she deems appropriate.

The State has clearly established that the Frye standard for admissibility has been met. Accordingly, based upon the evidence in this hearing, DRE

evidence satisfies the reliability standard of N.J.R.E. 702 and should be admissible in evidence.

Respectfully submitted,



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

Dated: August 18, 2022

Table of Appendices

Appendix A

SUPREME COURT OF NEW JERSEY
A-56 September Term 2018
082253

FILED
NOV 18 2019
CLERK

STATE OF NEW JERSEY,

Plaintiff-Respondent,

v.

MICHAEL OLENOWSKI,

Defendant-Appellant.

ORDER

This matter having come to the Court on a grant of certification, 236 N.J. 622 (2019), to determine whether the testimony of an officer who is a certified Drug Recognition Expert (DRE) is admissible at trial and, if so, under what circumstances; and

Defendant having been charged with driving while intoxicated, contrary to N.J.S.A. 39:4-50, and related offenses, and the Municipal Court having denied defendant's motion to hold a hearing under Frye v. United States, 293 F. 1013 (D.C. Cir. 1923), to assess the admissibility of DRE evidence at trial; and

The State, over defendant's objection, having introduced evidence of the twelve-step process that officers apply to assess drug influence and

impairment, as well as the specific results against defendant, through the testimony of certified DREs; and

Defendant having introduced a written report and testimony of an expert witness, who asserted there has been insufficient scientific study to date to conclude that drug influence evaluations performed by DREs are reliable and valid, and that such evaluations should include toxicological screening for various types of substances; and

Defendant having been convicted in Municipal Court and, after a trial de novo, in the Superior Court, and that conviction having been affirmed on appeal; and

The Court having granted amicus curiae status to the Attorney General of New Jersey, the American Civil Liberties Union and the Public Defender, the New Jersey State Bar Association, the Association of Criminal Defense Lawyers, the County Prosecutors Association, the DUI Defense Lawyers Association, the National College for DUI Defense, and the New Jersey State Association of Chiefs of Police; and

The parties and amici having raised and argued questions about the scientific reliability and admissibility of DRE evidence, and having submitted extensive scientific literature, which has not been examined at an evidentiary hearing, in support of their respective positions; and

The Court having determined on prior occasions that, when resolution of a critical issue depends on a full and complete record, the Court should await, before decision, the development of such a record, see State v. Cassidy, 230 N.J. 232, 232-33 (2017); State v. Henderson, 208 N.J. 208, 228, 305-06 (2011); State v. Moore, 180 N.J. 459, 460-61 (2004); and

The Court having heard argument of the parties and having concluded that the existing factual record is inadequate to test the validity of DRE evidence; and

The Court having concluded that, until such a record is established, the Court should not address the question of the admissibility of the DRE evidence presented in this case under N.J.R.E. 701 or 702; and for good cause shown:

It is ORDERED that the matter is remanded summarily to a Special Master for a plenary hearing to consider and decide whether DRE evidence has achieved general acceptance within the relevant scientific community and therefore satisfies the reliability standard of N.J.R.E. 702, see Cassidy, 235 N.J. at 491-92; State v. J.L.G., 234 N.J. 265, 301 (2018); Frye, 293 F. at 1014; and it is further

ORDERED that, as part of that evaluation, the parties shall address and the Special Master determine, among other relevant issues, whether each individual component of the twelve-step protocol is reliable; whether all or

part of the twelve-step protocol is scientifically reliable and can form the basis of expert testimony; and whether components of the process present limitations, practical or otherwise; and it is further

ORDERED that the Honorable Joseph F. Lisa, retired Presiding Judge of the Appellate Division serving on recall, is appointed to serve as the Special Master, with his consent; and it is further

ORDERED that, subject to any rulings by the Special Master regarding the proofs to be submitted on remand, defendant and the State shall each present testimony, scientific studies, and other proofs, including expert testimony, in support of their respective positions; and it is further

ORDERED that the Special Master shall determine the extent of the participation of the amici identified above in developing the record; and it is further

ORDERED that the Special Master shall make findings of fact and conclusions of law after hearing testimony and the parties' arguments; and it is further

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

ORDERED that after the hearing is completed, the Special Master shall expeditiously complete and submit a written report of his findings to the Court; and it is further

ORDERED that upon the filing of the Special Master's report on remand, the parties and amici shall each have thirty days to serve and file briefs and appendices 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 after briefing is completed, the Clerk of the Court shall schedule the matter for additional oral argument; and it is further

ORDERED that jurisdiction is otherwise retained.

WITNESS, the Honorable Stuart Rabner, Chief Justice, at Trenton, this 18th day of November, 2019.

Heather J Baker

CLERK OF THE SUPREME COURT

Appendix B

TRANSCRIPTS

Case Management Conferences:

1T (Jan. 7, 2020)
2T (Feb. 19, 2020)
3T (April 28, 2020)
4T (May 28, 2020)
5T (July 1, 2020)
6T (Sept. 10, 2020)
7T (Oct. 1, 2020)
8T (Oct. 15, 2020)
9T (Nov. 17, 2020)
10T (Jan. 7, 2021)
11T (Feb.9, 2021)
12T (Feb. 25, 2021)
13T (March 16, 2021)
14T (April 14, 2021)
15T (April 27, 2021)
16T (May 4, 2021)
17T (Aug. 18, 2021)
18T (Sept. 2, 2021)

Hearing:

19T (Sept. 20, 2021)
20T (Sept. 27, 2021)
21T (Sept. 28, 2021)
22T (Sept. 29, 2021)
23T (Sept. 30, 2021)
24T (Oct. 4, 2021)
25T (Oct. 5, 2021)
26T (Oct. 6, 2021)
27T (Oct. 7, 2021)
28T (Oct. 12, 2021)
29T (Oct. 13, 2021)
30T (Oct. 14, 2021)
31T (Oct. 18, 2021)
32T (Oct. 19, 2021)
33T (Oct. 20, 2021)

34T (Oct. 21, 2021)
35T (Oct. 25, 2021)
36T (Oct. 26, 2021)
37T (Oct. 27, 2021)
38T (Oct. 28, 2021)
39T (Nov. 1, 2021)
40T (Nov. 3, 2021)
41T (Nov. 4, 2021)
42T (Nov. 9, 2021)
43T (Nov. 15, 2021)
44T (Nov. 16, 2021)
45T (Nov. 17, 2021)
46T (Nov. 18, 2021)
47T (Nov. 29, 2021)
48T (Nov. 30, 2021)
49T (Dec. 1, 2021)
50T (Dec. 6, 2021)
51T (Dec. 7, 2021)
52T (Dec. 15, 2021)
53T (Dec. 20, 2021)
54T (Dec. 21, 2021)
55T (Dec. 22, 2021)
56T (Jan. 4, 2022)
57T (Jan. 5, 2022)
58T (Jan. 6, 2022)
59T (Jan. 11, 2022)
60T (Jan. 12, 2022)
61T (Jan 18, 2022)

Appendix C

	STATE V. OLENOWSKI **Supreme Court of New Jersey** **A-56 September Term 2018, 082253** # FINAL EXHIBIT LIST		
Exhibit Number	**Description**	**Identified**	**Admitted**
STATE EXHIBITS			
S-2	1985 DRE Study 1 Bigelow Johns Hopkins	9/27/21	9/27/21 (also D-23)
S-3	1986 NHTSA field evaluation – Compton	9/27/21	9/27/21
S-4	Adler 1994 DRE Validation study	9/27/21	9/27/21
S-5	MN DRE Corroboration study	9/27/21	9/27/21
S-7	Taplins et al., DRE Monograph 2018	9/27/21	9/27/21
S-12	Preusser, Evaluation of the impact of DEC program on enforcement and adjudication	9/27/21	9/27/21
S-15	Page CV, 2/2020	9/27/21	9/27/21
S-18	Azagba, positive drug trends in fatally injured drivers in the US from 2007 to 2017	9/27/21	9/27/21
S-19	Burns and Moskowitz, Psychophysical Tests for DWI Arrest, 1977	9/27/21	9/27/21
S-20	Tharp, Burns, Moskowitz, Development and Field Test of Psychophysical Tests for DWI Arrest, 1981	9/27/21	9/27/21
S-21	Anderson, NHTSA Field Evaluation of Behavioral Test Battery for DWI, 1983	9/27/21	9/27/21
S-22	Bierness, The Accuracy of Evaluations by DRE's in Canada – studies, 2009	9/27/21	9/27/21
S-25	Gibson resume	10/6/21	10/6/21
S-29	2020 DECP annual report	10/6/21	10/6/21
S-30	ARIDE instructor manual	10/6/21	10/6/21
S-31	ARIDE participant manual	10/6/21	10/6/21
S-32	Guide for course managers of DRE course	10/6/21	10/6/21
S-33	DRE 7-day course instructor manual	10/6/21	10/6/21
S-34	DRE 7-day course participant manual	10/6/21	10/6/21
S-36	DRE Matrix Rev 04-2018	11/9/21	11/9/21 (also S-44)
S-39	Facesheet & Narrative for DREs	10/6/21	10/6/21
S-42	International Standards of the DECP April 2020	10/6/21	10/6/21
S-43	Letters requesting more stringent standards	10/6/21	10/6/21
S-44	Matrix 2018	9/27/21	9/27/21 (also S-36)
S-45	Drug category examples used in MN training	10/6/21	10/6/21
S-47	DRE preliminary school instructor manual	10/6/21	10/6/21

S-48	DRE preliminary school participant manual	10/6/21	10/6/21
S-49	SFST instructor manual 2018	10/6/21	10/6/21
S-50	SFST participant manual 2018	10/6/21	10/6/21
S-51	SOP F26 2016	10/6/21	10/6/21
S-52	Field matrix card	10/6/21	10/6/21
S-55	GHSA Drug-Impaired Driving	9/27/21	9/27/21
S-56	DSM - substance intox characteristics	9/27/21	9/27/21
S-57	Heishman Lab Validation Study 1996	9/27/21	9/27/21 (also D-436)
S-58	Heishman Lab Validation Study 1998	9/27/21	9/27/21
S-59	Video of PCP suspect – 7.PCP-DPS Griego 1	10/6/21	10/6/21
S-62	Photo of burn 1	10/6/21	10/6/21
S-64	Photo of burn 3	10/6/21	10/6/21
S-67	Photo Cannabis Green Coating	10/7/21	10/7/21
S-69	Photo Dark Room UV Light Pic	10/7/21	10/7/21
S-72	Video Eyelid Tremors Green Lab Colorado	10/7/21	10/7/21
S-73	Video of eyes all categories (limited purpose)	10/7/21	10/7/21
S-74	Video finger to nose test (limited purpose)	10/7/21	10/7/21
S-78	Video of person nodding off	10/6/21	10/6/21
S-79	Video one-leg stand test Camden	10/7/21	10/7/21
S-80	Video of Patterson stimulant training	10/6/21	10/6/21
S-81	Video NHTSA PCP training, without audio and with PCP reference redacted	10/6/21	10/20/21
S-87	Photo of unequal pupil size	10/6/21	10/6/21
S-88	Photo UV Light Pic 1	10/7/21	10/7/21
S-89	Video of VGN signs	10/7/21	10/7/21
S-91	Video Walk and Turn Test	10/7/21	10/7/21
S-92	2019 NJ Stats OEM NJSP	10/6/21	10/6/21
S-97	Video of in-court DRE demonstration	10/7/21	10/7/21
S-100	Verdino CV	10/12/21/21	10/12/21/21
S-101	NJ State Police Toxicology Procedures Manual 2018b Version	10/12/21/21	10/12/21/21
S-102	Spreadsheet prepared by State (Martin report Attachment 1), REDACTED	10/13/21	10/13/21** (also D-58)
S-104	DRE initial report	10/13/21	10/13/21
S-105	Leigh, Excerpts from 2015 eye movement text, The Neurology of Eye Movements	10/19/21	10/19/21
S-106	Sarvananthan, The Prevalence of Nystagmus—Leicestershire Nystagmus Survey, 2009	10/19/21	10/19/21
S-108	Hartman, DRE Examination Characteristics of Cannabis Impairment, 2016	10/19/21	10/19/21 (also D-435)
S-109	Bramness, Impairment article from Addition Journal, 2010	10/19/21	10/19/21
S-112	Photo – Red Eye 1	10/20/21	10/20/21
S-113	Photo – Red Eye 2	10/20/21	10/20/21
S-114	Photo – Red Eye 3	10/20/21	10/20/21

S-115	Photo – Red Eye 4	10/20/21	10/20/21
S-116	Goldfrank, Toxicologic Emergencies, Part C, Ch. 74 Cannabinoids	10/20/21	10/20/21
S-117	Kosnoski, The Drug Evaluation Classification Program: Using Ocular and Other Signs to Detect Drug Intoxication	10/20/21	10/20/21
S-119	Fraunfelder, Drug-Induced Ocular Side Effects - Marijuana	10/20/21	10/20/21
S-120	Fraunfelder, Drug-Induced Ocular Side Effects - Heroin	10/20/21	10/20/21
S-121	Goldfrank, Toxicologic Emergencies - Cocaine	10/20/21	10/20/21
S-122	Goldfrank, Toxicologic Emergencies - Amphetamines	10/20/21	10/20/21
S-123	Goldfrank, Toxicologic Emergencies - Hallucinogens	10/20/21	10/20/21
S-124	Goldfrank, Toxicologic Emergencies - Opiods	10/20/21	10/20/21
S-125	Goldfrank, Toxicologic Emergencies, Ch. 83 - Phencyclidine & Ketamine	10/20/21	10/20/21
S-126	Goldfrank, Toxicologic Emergencies - Inhalants	10/20/21	10/20/21
S-127	Goldfrank, Toxicologic Emergencies, Ch. 826 – benzodiazepines	11/9/21	11/9/21
S-128	Fraunfelder, Drug Induced Ocular Side Effects - Cocaine	10/20/21	10/20/21
S-129	Dhingra, Illicit Drugs: Effects on Eye, 2019	10/20/21	10/20/21
S-130	Cecil Textbook of Medicine, 1988, Drug Abuse and Dependence chapter	10/20/21	10/20/21
S-131	Fraunfelder, Drug-Induced Ocular Side Effects - CNS Depressants	10/20/21	10/20/21
S-132	McKnight, Sobriety Tests for Low Blood Alcohol Concentrations, 2002	10/19/21	10/19/21
S-133	Good and Augsburger, Use of HGN as a Part of Roadside Sobriety testing	10/19/21	10/19/21
S-134	Citek, Nystagmus Testing in Intoxicated Individuals	10/19/21	10/19/21
S-135	Wood, Pupil Dilation Does Affect Some Aspects of Daytime Driving Performance	10/20/21	10/20/21 (also A-41)
S-136	Citek, Sleep Deprivation Does Not Mimic Alcohol Intoxication of Field Sobriety Testing, article 2011	10/19/21	10/19/21 (also D-424)
S-137	TAP Goals and Membership Responsibilities, 9/20	10/21/21	10/21/21 (also D-409)
S-140	Porath-Waller and Beirness, An Examination of the Validity of the SFSTs in Detecting Drug Impairment Using Data from the DEC Program	10/20/21	11/3/21
S-143	Citek, GEN is not HGN, published letter to the editor of Investigative Ophthalmology & Visual Science, re S-153	10/21/21	10/21/21

S-144	Richman, An Evaluation of Pupil Size Standards Used by Police Officers for Detecting Drug Impairment	10/20/21	10/20/21
S-145	Stuster, Validation of the Standarized Field Sobriety Test Battery at 0.08% blood Alcohol Concentration	10/21/21	10/21/21
S-146	American Optometric Association Resolution #1975 Endorsement of the DRE Program	10/21/21	10/21/21
S-147	NJSOP Resolution	10/21/21	10/21/21
S-148	Hawaii Medical Association DRE Program Endorsement	10/21/21	10/21/21
S-149	Vermont Medical Society DRE Endorsement 2017	10/21/21	10/21/21
S-150	Dade County Medical Association DRE Program Endorsement 1994	10/21/21	10/21/21
S-151	Broward County Medical Association DRE Program Endorsement 1994	10/21/21	10/21/21
S-152	Broward County Psychiatric Society DRE Program Endorsement 1994	10/21/21	10/21/21
S-153	Whyte, Occurrence of Physiologic Gaze-Evoked Nystagmus at Small Angles of Gaze, 2010	10/21/21	10/21/21
S-155	Rett, Gaze-Evoked Nystagmus: A Case Report & Literature Review, 2007	10/20/21	10/20/21
S-156	Rubenzer, Standardized Field Sobriety Tests: A Review of Scientific and Legal Issues	10/21/21	10/21/21
S-157	Papafotiou, An Evaluation of the Sensitivity of the SFSTs to Detect Impairment Due to Marijuana Intoxication, 2005	10/21/21	10/21/21
S-158	Rubenzer, Horizontal Gaze Nystagmus: A Review of Vision Science and Application Issues	10/21/21	10/21/21
S-160	Stapleton, Effects of Alcohol and Other Psychotropic Drugs on Eye Movements: Relevance to Traffic Safety, 1986	10/20/21	10/20/21
S-163	Smith and Citek, DRE Evaluations Made Using Limited Data, 2002	10/21/21	10/21/21 (also D-401)
S-165	Citek and Richman, Review of Experiment One of the Robustness of the HGN Test, 2017 memo	10/28/21	10/28/21
S-166	Hartman study (S-108) screenshot of calculator of eyelid tremors	10/28/21	10/28/21
S-167	Hartman study (S-108) screenshot of calculator of lack of convergence	10/28/21	10/28/21
S-168	San Diego calculator figure 4	10/28/21	10/28/21
S-170	Schalte, Laypersons Can Successfully Place Supraglottic Airways with Three Minutes of Training, 2011	11/3/21	11/3/21

S-171	Tocco-Tussardi, Want Correct Percentage of TBSA Burned? Let a Layman Do the Assessment, 2018	11/3/21	11/3/21
S-172	Girardi, Superiority of a Cognitive Education with Photographs Over ABCD Criteria in the Education of the General Population to the Early Detection of Melanoma, 2006	11/3/21	11/4/21
S-174	Slattery, Common Ocular Effects Reported to a Poison Control Center After Systemic Absorption of Drugs in Therapeutic and Toxic Doses, 2014	11/3/21	11/3/21
S-177	Fraunfelder and Riordan-Eva, Vaughn General Ophthalmology, Chapter re eye side effects	11/3/21	11/3/21
S-178	Firth, Ocular Sequelae from Illicit Use of Class A Drugs, 2004	11/3/21	11/3/21
S-181	Husain, Police AED Programs: A Systemic Review and Meta-analysis, 2013	11/3/21	11/3/21
S-183	Rothschild, Effects of Tactical Emergency Casualty Care Training for Law Enforcement Agencies, 2018	11/3/21	11/3/21
S-184	Implementation & Evaluation of First Responder Bleeding Control training program	11/3/21	11/3/21
S-185	Richman, The Competency and Accuracy of Police Academy Recruits in the Use of the HGN Test for Detection Alcohol Impairment, 1994	11/3/21	11/3/21
S-187	Rolling Log 17-01 – Roushinko	11/4/21	UNDER SEAL, 1/20/22
S-188	Rolling Log 17-05 – Lyons	11/4/21	UNDER SEAL, 1/20/22
S-189	Rolling log 18-10 – Guild	11/4/21	UNDER SEAL, 1/20/22
S-190	Rolling Log 18-06 – Silva, witness O'Hara	11/4/21	UNDER SEAL, 1/20/22
S-191	Rolling Log 17-11 – Gonzalez; witness Altimari	11/4/21	UNDER SEAL, 1/20/22
S-192	Training 17-02 – Vega, Gonzalez witness	11/4/21	UNDER SEAL, 1/20/22
S-193	Training Rolling log 17-4 – Bruton	11/4/21	UNDER SEAL, 1/20/22
S-194	Rolling log 18-03 Rodriguez, witness Gavilanes	11/4/21	UNDER SEAL, 1/20/22
S-195	Training Rolling log 2017-04 -- Ellis	11/4/21	UNDER SEAL, 1/20/22
S-196	Training 17-12 – Kotora, witness Alvarez	11/4/21	UNDER SEAL, 1/20/22
S-197	Training 18-04 – Carletta	11/4/21	UNDER SEAL, 1/20/22

S-198	Training 18-07 – Widener, witness Flanagan	11/4/21	UNDER SEAL, 1/20/22
S-199	Training 17-07 – Martin	11/4/21	UNDER SEAL, 1/20/22
S-200	Training 17-05 – Hassmiller	11/4/21	UNDER SEAL, 1/20/22
S-201	Training 17-07 – Martin, witness Trapani	11/4/21	UNDER SEAL, 1/20/22
S-202	Training 18-02 – Weil	11/4/21	UNDER SEAL, 1/20/22
S-203	Training 18-02 – Weil, witness Cantoni	11/4/21	UNDER SEAL, 1/20/22
S-204	Training 18-04 – Dickson, witness Lawler	11/4/21	UNDER SEAL, 1/20/22
S-205	Training 18-04 – Dickson	11/4/21	UNDER SEAL, 1/20/22
S-206	Training 18-10 – Rigby	11/4/21	UNDER SEAL, 1/20/22
S-207	Training 18-01 – Waterson	11/4/21	UNDER SEAL, 1/20/22
S-208	Training 18-01 – Backmann	11/4/21	UNDER SEAL, 1/20/22
S-209	Training 18-01 – Tardio	11/4/21	UNDER SEAL, 1/20/22
S-210	Training 18-04 – Cestare	11/4/21	UNDER SEAL, 1/20/22
S-211	Training 18-04 – Cestare, witness Caniano	11/4/21	UNDER SEAL, 1/20/22
S-213	Adams, Emergency Medicine-Clinical Essentials, Second Ed., Ch. 150 Hallucinogens & Drugs of Abuse	11/9/21	11/9/21
S-214	Adams, Emergency Medicine-Clinical Essentials, Second Ed, Ch. 154 Ethanol and Opioid Intoxication & Withdrawal	11/9/21	11/9/21
S-215	Adams, Emergency Medicine-Clinical Essentials, Second Ed, Ch. 155 Sedative-Hypnotic Agents	11/9/21	11/9/21
S-225	Brent, Critical Care Toxicology, 2d Edition, Ch. 2 Diagnostic Process in Medical Toxicology	11/18/21	11/18/21
S-231	Brent, Critical Care Toxicology, 2d Edition, Ch. 73 Arylcyclohexamines Ketamine, Phencyclidine & Analogues	11/9/21	11/9/21
S-235	Brent, Critical Care Toxicology, 2d Edition, Ch. 77 Hallucinogens	11/9/21	11/9/21
S-237	Nelson CV	11/9/21	11/9/21
S-240	Goldfrank, Toxicologic Emergencies, Ch. 3, Initial Evaluation of the Patient, Vital Signs & Toxic Syndromes	11/9/21	11/9/21

S-247	Goldfrank, Toxicologic Emergencies, Ch. 72, Sedative-Hypnotics	11/9/21	11/9/21
S-248	Goldfrank, Toxicologic Emergencies, Ch. 73, Amphetamines	11/9/21	11/9/21
S-268	Levine, Principles of Forensic Toxicology, Fifth Edition, Ch. 31, Inhalants	11/9/21	11/9/21
S-271	Report on the Toxic Chemical Syndrome. Definitions and Nomenclature Workshop, Dept. of Homeland Security	11/18/21	11/18/21
S-272	Rosen's Emergency Medicine, 9th Ed., Ch. 139 Approach to the Poisoned Patient	11/18/21	11/18/21
S-274	Rosen's Emergency Medicine, 9th Ed., Ch. 149 Cocaine and other Sympathomimetics	11/9/21	11/9/21
S-275	Rosen's Emergency Medicine, 9th Ed., Ch. 150 Hallucinogens	11/9/21	11/9/21
S-277	Rosen's Emergency Medicine, 9th Ed., Ch. 159 Sedative Hypnotics	11/9/21	11/9/21
S-281	Dong and Peng, Principled Missing Data Methods for Researchers, 2013	11/15/21	11/15/21
S-284	Spreadsheet prepared by State (Martin report Attachment 2), REDACTED	11/15/21	11/15/21**
S-286	Martin CV	11/15/21	11/15/21
S-287	Blomberg, Long Beach Fort Lauderdale Relative Risk Study	11/17/21	11/17/21
S-291	Tabachnick and Fidell, Using Multivariant Statistics, 2013, excerpts	11/15/21	11/15/21
S-293	Tables (Martin report tables 1,2. and 3)	11/15/21	11/15/21
S-295	Whiting, The Development of QUADAS: A Tool for the Quality Assessment of Studies of Diagnostic Accuracy Included in Systematic Reviews	11/17/21	12/1/21
S-302	Burns, Florida SFST Validation Study, 1997	11/30/210	11/30/21 (also D-16)
S-303	Burns, Overview of Field Sobriety Test Research, 2003	11/30/210	11/30/21 (also D-16)
S-312	Burns and Stuster, San Diego SFST Validation Study, 1998	11/29/21	11/29/21 (also D-17 and A-31)
S-317	Vaillancourt, Drugs & Driving Prior to Cannabis Legalization, 5 Year DRE Case Review, 2021	11/30/21	11/30/21
S-319	Fiorentino, Evans, and Page, The Usefulness of the SFSTs in Detecting Drugs Other than Alcohol, 2020	11/30/21	11/30/21
S-326	Fiorentino and Moskowitz, A Review of the Literature on the Effects of Low Doses of Alcohol on Driving-Related Skills, 2000	11/29/21	11/29/21

S-330	Porath and Bierness, Predicting Categories of Drugs Used by Suspected Drug Impaired Drivers, 2019	11/30/21	11/30/21
S-332	Porath-Waller, Beirness, and Beasley, Toward a More Parsimonious Approach to DRE Evaluations, 2009	12/1/21	12/1/21
S-333	Fiorentino CV	11/29/21	11/29/21
S-338	ANSI ASB Best Practice Recommendations	12/6/21	12/6/21
S-341	Cochems [Miles], Dextromethorphan in Wisconsin Drivers, 2007	12/6/21	12/6/21 (also D-522)
S-346	McCain, Impaired Driving Associated with the Synthetic Cannabinoid 5f-Adb, 2018	12/6/21	12/6/21
S-350	Strengthening Forensic Science in the United States - A Path Forward, 2009	12/6/21	12/6/21
S-351	Yeakel and Logan, Blood Synthetic Cannabinoid Concentrations in Cases of Suspected Impaired Driving, 2013	12/6/21	12/6/21
S-365	Porath-Waller and Beirness, Simplifying the Process for Identifying Drug Combinations, 2010	12/7/21	12/7/21
S-369	Truver, Oral Fluid and Drug Impairment – Pairing Toxicology with DRE Observations, 2019	12/7/21	12/7/21
S-370	Miles CV 2021	12/6/21	12/6/21
S-375	Levine, Chapter 22 Opiods, pp. 347, 366	12/7/21	12/7/21
S-377	Levine, Chapter 24 Cannabis, pp. 389, 440-42	12/6/21	12/7/21
S-378	Levine, Chapter 25 Amphetamines/ Sympathomimetic Amines, pp. 449, 452	12/7/21	12/7/21
S-382	Levine, Chapter 38 Oral Fluid Testing, pp. 629, 637-38	12/7/21	12/7/21
S-383	Session 24, "Drug Combinations" (section of DRE manual admitted at S-33)	12/6/21	12/6/21
S-387	Fares 2021 study	12/20/21	12/20/21
S-392	Earleywine, online High Times column, 7/2018	12/20/21	12/20/21
S-414	Individual DRE report Brett Paulas 540	12/22/21	UNDER SEAL, 1/20/22
S-415	Individual DRE report C. Williams 476	12/22/21	UNDER SEAL, 1/20/22
S-416	Individual DRE report 473	12/22/21	UNDER SEAL, 1/20/22
S-417	Individual DRE report David Lipari 7	12/22/21	UNDER SEAL, 1/20/22
S-429	Schisterman report Appendixes and Tables of Analysis	1/4/22	1/4/22
S-430	Schisterman, Principled Approaches to Missing Data in Epidemiologic Studies, American Journal of Epidemiology, 2018	1/4/22	1/4/22

S-431	Schisterman, Doubly Robust Estimation of the Area Under the Receiver Operating Characteristic Curve in the Presence of Verification Bias, 2006	1/4/22	1/4/22
S-432	Schisterman, A Method to Visualize a Complete Sensitivity Analysis for Loss to Follow Up in Clinical Trials, 2020	1/4/22	1/4/22
S-435	Schisterman, Confounding Causality and Confusion: The Role of Intermediate Variables Interpreting Observational Studies in Obstetrics, 2017	1/4/22	1/5/22
S-439	Schisterman CV	1/4/22	1/4/22
S-440	Schisterman, Multiple Imputation for Incomplete Data in Epidemiologic Studies, 2018	1/4/22	1/4/22
S-448	Hand drawn chart, Example Multiple Imputation – School Age Children	1/4/22	1/4/22
S-450	Hand drawn chart, Gold Standard 2x2 table	1/5/22	1/5/22
S-451	Hand drawn chart, Gold Standard 3x2 table	1/5/22	1/5/22
S-453	Albert and Jakobiec, Principles and Practice of Ophthalmology, 3rd Ed., Ch. 297	1/18/22	1/18/22
S-454	Albert and Jakobiec, Principles and Practice of Ophthalmology, 3rd Ed., Ch. 312	1/18/22	1/18/22
S-461	Walsh and Hoyt, Ch. 23 Nystagmus and Related Ocular Motility Disorders	1/18/22	1/18/22
OPD EXHIBITS			
D-4	DRE 2018 instructor training manual	9/28/21	9/28/21
D-7	Instructor guide for DWI detection SFST 2018	9/28/21	9/30/21
D-8	DRE 2018 participant manual	9/28/21	9/28/21
D-9	International standards SFST 2019	9/28/21	9/28/21
D-10	IACP international standards for drug evaluation and classification program 2020	9/28/21	9/28/21
D-12	1977 SFST Study 1 Burns/Moskowitz	9/28/21	9/28/21
D-13	1981 SFST Study 2 Tharp/Burns/Moskowitz	9/28/21	9/28/21
D-15	1995 SFST Study 4 Burns/Anderson Colorado	9/29/21	9/29/21
D-16	Burns, Florida SFST Validation Study, 1997	9/29/21	9/29/21 (also S-302)
D-17	Burns and Stuster, San Diego SFST Validation Study, 1998	9/29/21	9/29/21 (also S-312 and A-31)
D-18	2018 SFST participant manual	9/28/21	9/30/21
D-20	Transcript of Burns 1998 testimony (excerpts)	9/29/21	9/29/21
D-21	1993 DRE Student Manual	9/29/21	9/29/21
D-22	Signs and symptoms checklist	9/30/21	9/30/21
D-23	1985 DRE Study 1 Bigelow Johns Hopkins	9/29/21	9/29/21

			(also S-2)
D-24	1986 DRE Study 2 Compton LAPD 173	9/29/21	9/29/21 (also S-3)
D-25	1994 DRE Study 3 Adler/Burns Arizona	9/29/21	9/29/21 (also S-4)
D-28	Monograph, Drug Recognition Program, Bureau of Justice Assistance, 1989	9/30/21	9/30/21
D-29	Kane, Methodological Quality of Three Foundational Law Enforcement Drug Influence Evaluation Validation Studies	10/4/21	10/4/21
D-30	2011 DRE student manual	9/30/21	9/30/21
D-34	PDR.net pages re secobarbital	10/4/21	10/4/21
D-35	2009 PDR excerpts	9/30/21	9/30/21
D-38	DRE 2012 Page Internet posting	9/30/21	9/30/21
D-39	PDR.net pages re psychostimulants / amphetamines	9/30/21	9/30/21
D-40	TAP 2020 mid-year meeting minutes	10/25/21	10/25/21
D-42	DRE expert school text, January 2007	10/26/21	10/26/21
D-46	Users Guide to Medical Literature text	10/26/21	10/26/21
D-47	Page, DREs: Indispensable Tool for ID of Drug-Impaired Drivers, Clinical and Forensic Toxicology News, 2005	10/4/21	10/4/21
D-50	Page transcript in Klawitter, 4/19/1993, pp. cover, 47-48	10/4/21	10/4/21
D-51	DRE Matric drug category examples	10/4/21	10/4/21
D-52	Summary of SFST studies listed by year	10/5/21	10/5/21
D-53	Citations for DECP validation studies	10/5/21	10/5/21
D-54	Handwritten chart re Compton study	10/6/21	10/6/21
D-55	Rolling log form	10/12/21/21	10/12/21/21
D-56	DIE written by Jason Columbo, REDACTED	10/12/21/21	UNDER SEAL, 1/20/22
D-57	NJSP evidence field manual 2021	10/13/21	10/13/21
D-58	Spreadsheet prepared by State, REDACTED	10/14/21	10/14/21** (also S-102)
D-59	Officer Gannon rolling log	10/14/21	UNDER SEAL, 1/20/22
D-61	Rolling log of J. Abrusci	10/14/21	UNDER SEAL, 1/20/22
D-91	17-012-0012 DIE from training	10/14/21	UNDER SEAL, 1/20/22
D-92	Union Beach DIE training	10/14/21	UNDER SEAL, 1/20/22
D-93	Copy of officer Angelo trainings	10/14/21	UNDER SEAL, 1/20/22
D-94	Face sheets and trainings Maldonado	10/14/21	UNDER SEAL, 1/20/22

D-95	Officer Howard trainings from Hillsboro	10/14/21	UNDER SEAL, 1/20/22
D-96	Officer Cornine from White Plains	10/14/21	UNDER SEAL, 1/20/22
D-97	Spreadsheet created by OPD with training duplicates, REDACTED	10/14/21	10/14/21
D-98	17-25 from Officer Columbo rolling log	10/14/21	UNDER SEAL, 1/20/22
D-99	Lab report for D-98 evaluation	10/14/21	UNDER SEAL, 1/20/22
D-100	Facesheet indicating urine sample provided	10/14/21	UNDER SEAL, 1/20/22
D-101	Facesheet and narrative for Moore, 18-08	10/14/21	UNDER SEAL, 1/20/22
D-102	Facesheet and narrative for Moore, 18-08	10/14/21	UNDER SEAL, 1/20/22
D-103	DIE indicating insufficient urine to test	10/14/21	UNDER SEAL, 1/20/22
D-104	Facesheet 17-46 McNichol	10/14/21	UNDER SEAL, 1/20/22
D-105	17-03 English	10/14/21	UNDER SEAL, 1/20/22
D-106	18-007 Coster	10/14/21	UNDER SEAL, 1/20/22
D-107	17-38 Molino	10/14/21	UNDER SEAL, 1/20/22
D-108	18-2 Brenner	10/14/21	UNDER SEAL, 1/20/22
D-109	18-01 Tripano	10/14/21	UNDER SEAL, 1/20/22
D-110	Duplicate of D-109, except for step 12	10/14/21	UNDER SEAL, 1/20/22
D-111	18-03 Tripani	10/14/21	UNDER SEAL, 1/20/22
D-112	Drinking and driving report	10/14/21	UNDER SEAL, 1/20/22
D-114	17-11 Pavlosky	10/14/21	UNDER SEAL, 1/20/22
D-115	17-14 Suarez	10/14/21	UNDER SEAL, 1/20/22
D-116	Drinking driving report same person as D-112	10/14/21	UNDER SEAL, 1/20/22
D-117	17-23 Wanders	10/14/21	UNDER SEAL, 1/20/22
D-119	18-04 Wanders	10/14/21	UNDER SEAL, 1/20/22

D-120	18-02 Deligicomo	10/14/21	UNDER SEAL, 1/20/22
D-121	17-02 Lee	10/14/21	UNDER SEAL, 1/20/22
D-122	17-8 Bobo	10/14/21	UNDER SEAL, 1/20/22
D-123	17-11 Bobo	10/14/21	UNDER SEAL, 1/20/22
D-125	17-02 Keenan	10/14/21	UNDER SEAL, 1/20/22
D-128	17-04 DiRosa	10/14/21	UNDER SEAL, 1/20/22
D-129	17-3 Larocca	10/14/21	UNDER SEAL, 1/20/22
D-130	18-17 Conover	10/14/21	UNDER SEAL, 1/20/22
D-131	18-07 Chute	10/14/21	UNDER SEAL, 1/20/22
D-132	18-04 Dorward	10/14/21	UNDER SEAL, 1/20/22
D-134	Report 18-02 Kotora	10/18	UNDER SEAL, 1/20/22
D-135	17-05 DiAmolla	10/18	UNDER SEAL, 1/20/22
D-136	17-22 Tacopino	10/18	UNDER SEAL, 1/20/22
D-138	17-2 Goelz	10/18	UNDER SEAL, 1/20/22
D-151	18-01 Poletis	10/18	UNDER SEAL, 1/20/22
D-152	18-21 Pelaez	10/18	UNDER SEAL, 1/20/22
D-153	18-06 Cilento	10/18	UNDER SEAL, 1/20/22
D-154	18-12 Sanstrum	10/18	UNDER SEAL, 1/20/22
D-155	18-70 Pokovics	10/18	UNDER SEAL, 1/20/22
D-156	17-16 Demauro	10/18	UNDER SEAL, 1/20/22
D-157	18-15 Cantoni	10/18	UNDER SEAL, 1/20/22
D-158	18-16 Cestare	10/18	UNDER SEAL, 1/20/22
D-159	18-06 Dorward	10/18	UNDER SEAL, 1/20/22

D-160	18-07 Dorward	10/18	UNDER SEAL, 1/20/22
D-161	17-10 Hinman	10/18	UNDER SEAL, 1/20/22
D-162	18-36 Abrusci	10/18	UNDER SEAL, 1/20/22
D-163	17-132 Abrusci	10/18	UNDER SEAL, 1/20/22
D-164	18-32 Alasio	10/18	UNDER SEAL, 1/20/22
D-165	18-01 Locilento	10/18	UNDER SEAL, 1/20/22
D-166	17-19 Geddis	10/18	UNDER SEAL, 1/20/22
D-167	18-02 Santillo	10/18	UNDER SEAL, 1/20/22
D-168	17-03 Wuelfing	10/18	UNDER SEAL, 1/20/22
D-169	17-06 Keleshian	10/18	UNDER SEAL, 1/20/22
D-170	17-05 Keleshian	10/18	UNDER SEAL, 1/20/22
D-171	18-03 Reuter	10/18	UNDER SEAL, 1/20/22
D-172	17-07 VanSchaack	10/18	UNDER SEAL, 1/20/22
D-173	17-16 O'Connor	10/18	UNDER SEAL, 1/20/22
D-174	17-6 O'Connor	10/18	UNDER SEAL, 1/20/22
D-175	17-06 Septer	10/18	UNDER SEAL, 1/20/22
D-176	17-14 Morley	10/18	UNDER SEAL, 1/20/22
D-177	18-13 Cantoni	10/18	UNDER SEAL, 1/20/22
D-178	17-18 Morley	10/18	UNDER SEAL, 1/20/22
D-179	17-19 Fittin	10/18	UNDER SEAL, 1/20/22
D-181	18-05 Torello	10/18	UNDER SEAL, 1/20/22
D-182	17-06 Ghanim	10/18	UNDER SEAL, 1/20/22
D-183	18-05 McLaverty	10/18	UNDER SEAL, 1/20/22

D-184	18-01 McLaverty	10/18	UNDER SEAL, 1/20/22
D-185	17-11 Lott	10/18	UNDER SEAL, 1/20/22
D-186	17-01 Kerney	10/18	UNDER SEAL, 1/20/22
D-187	17-168 Abrusci	10/18	UNDER SEAL, 1/20/22
D-188	17-141 Abrusci	10/18	UNDER SEAL, 1/20/22
D-189	18-21 Umba	10/18	UNDER SEAL, 1/20/22
D-190	18-03 Abrusci	10/18	UNDER SEAL, 1/20/22
D-191	18-67 Abrusci	10/18	UNDER SEAL, 1/20/22
D-192	18-63 Abrusci	10/18	UNDER SEAL, 1/20/22
D-193	17-167 Abrusci	10/18	UNDER SEAL, 1/20/22
D-194	17-08 Phillips	10/18	UNDER SEAL, 1/20/22
D-195	2018-05 Geoline	10/18	UNDER SEAL, 1/20/22
D-196	18-02 Geddis	10/18	UNDER SEAL, 1/20/22
D-197	18-13 Geddis	10/18	UNDER SEAL, 1/20/22
D-198	18-01 Locilento	10/18	UNDER SEAL, 1/20/22
D-199	17-19 Geddis	10/18	UNDER SEAL, 1/20/22
D-200	17-14 DiCamillo	10/18	UNDER SEAL, 1/20/22
D-201	17-01 Gretkowski	10/18	UNDER SEAL, 1/20/22
D-202	17-04 Marvel	10/18	UNDER SEAL, 1/20/22
D-203	18-05 Marvel	10/18	UNDER SEAL, 1/20/22
D-204	18-13 Zezotarski	10/18	UNDER SEAL, 1/20/22
D-205	18-18 Lawler	10/18	UNDER SEAL, 1/20/22
D-206	18-31 Lawler	10/18	UNDER SEAL, 1/20/22

D-207	18-32 Lawler	10/18	UNDER SEAL, 1/20/22
D-208	17-03 Moore	10/18	UNDER SEAL, 1/20/22
D-209	18-22 Lawler	10/18	UNDER SEAL, 1/20/22
D-210	18-21 Lawler	10/18	UNDER SEAL, 1/20/22
D-211	18-34 Lawler	10/18	UNDER SEAL, 1/20/22
D-212	18-14 Lawler	10/18	UNDER SEAL, 1/20/22
D-213	18-03 Tracey	10/18	UNDER SEAL, 1/20/22
D-214	18-08 Moore	10/18	UNDER SEAL, 1/20/22
D-215	18-18 Kerney	10/18	UNDER SEAL, 1/20/22
D-216	17-07 Yurgel	10/18	UNDER SEAL, 1/20/22
D-217	18-06 Moore	10/18	UNDER SEAL, 1/20/22
D-218	17-3 Kerney	10/18	UNDER SEAL, 1/20/22
D-219	18-19 Kerney	10/18	UNDER SEAL, 1/20/22
D-220	17-07 Moore	10/18	UNDER SEAL, 1/20/22
D-221	18-08 Cilento	10/18	UNDER SEAL, 1/20/22
D-222	18-06 Medina	10/18	UNDER SEAL, 1/20/22
D-223	17-05 Cilento	10/18	UNDER SEAL, 1/20/22
D-224	17-3 Sanwith	10/18	UNDER SEAL, 1/20/22
D-225	17-13 Hasmiller	10/18	UNDER SEAL, 1/20/22
D-226	18-12 Sanstrum	10/18	UNDER SEAL, 1/20/22
D-227	18-19 Ehrenberg	10/18	UNDER SEAL, 1/20/22
D-228	18-02 Chung	10/18	UNDER SEAL, 1/20/22
D-229	17-31 Briggs	10/18	UNDER SEAL, 1/20/22

D-230	17-30 Briggs	10/18	UNDER SEAL, 1/20/22
D-231	17-22 Briggs	10/18	UNDER SEAL, 1/20/22
D-232	17-07 Colleshian	10/18	UNDER SEAL, 1/20/22
D-233	17-13 Briggs	10/18	UNDER SEAL, 1/20/22
D-234	17-14 Rettino	10/18	UNDER SEAL, 1/20/22
D-235	2017-15 Collins	10/18	UNDER SEAL, 1/20/22
D-236	18-8 Borino	10/18	UNDER SEAL, 1/20/22
D-237	18-02 Russo	10/18	UNDER SEAL, 1/20/22
D-238	18-36 McNichol	10/18	UNDER SEAL, 1/20/22
D-239	18-61 McNichol	10/18	UNDER SEAL, 1/20/22
D-240	18-62 McNichol	10/18	UNDER SEAL, 1/20/22
D-241	18-5 McNichol	10/18	UNDER SEAL, 1/20/22
D-242	17-33 McNichol	10/18	UNDER SEAL, 1/20/22
D-243	18-32 McNichol	10/18	UNDER SEAL, 1/20/22
D-244	18-14 McNichol	10/18	UNDER SEAL, 1/20/22
D-245	17-10 Murphy	10/18	UNDER SEAL, 1/20/22
D-246	17-06 Murphy	10/18	UNDER SEAL, 1/20/22
D-247	17-01 VanShaack	10/18	UNDER SEAL, 1/20/22
D-248	2017-11 Oczkos	10/18	UNDER SEAL, 1/20/22
D-249	17-13 Narkiewicz	10/18	UNDER SEAL, 1/20/22
D-250	18-2 Brennan	10/18	UNDER SEAL, 1/20/22
D-251	17-01 Sanderson	10/18	UNDER SEAL, 1/20/22
D-252	18-8 Brennan	10/18	UNDER SEAL, 1/20/22

D-253	18-26 Amin	10/18	UNDER SEAL, 1/20/22
D-254	18-47 Pakovics	10/18	UNDER SEAL, 1/20/22
D-255	17-04 Feldman	10/18	UNDER SEAL, 1/20/22
D-256	17-24 Pakovics	10/18	UNDER SEAL, 1/20/22
D-257	17-01 Karagias	10/18	UNDER SEAL, 1/20/22
D-258	18-05 Fisher	10/18	UNDER SEAL, 1/20/22
D-259	18-05 Witowski	10/18	UNDER SEAL, 1/20/22
D-260	17-10 Lawrence	10/18	UNDER SEAL, 1/20/22
D-261	17-09 Restreppo	10/18	UNDER SEAL, 1/20/22
D-262	17-12 Bobo	10/18	UNDER SEAL, 1/20/22
D-263	18-14 Ficke	10/18	UNDER SEAL, 1/20/22
D-264	18-1 Karpinski (12-09)	10/18	UNDER SEAL, 1/20/22
D-265	17-14 Karpinski (12-08)	10/18	UNDER SEAL, 1/20/22
D-266	17-01 Dye	10/18	UNDER SEAL, 1/20/22
D-267	17-07 Behnke	10/18	UNDER SEAL, 1/20/22
D-268	18-01 Krzywdzinski	10/18	UNDER SEAL, 1/20/22
D-269	18-13 Berger	10/18	UNDER SEAL, 1/20/22
D-270	PTL K 1713	11/1/21	UNDER SEAL, 1/20/22
D-271	Charles Quant 18-02	11/1/21	UNDER SEAL, 1/20/22
D-272	Weaver 17-07	11/1/21	UNDER SEAL, 1/20/22
D-273	Ptl. Dan Verdello	11/1/21	UNDER SEAL, 1/20/22
D-274	Ptl. Pasqual D? 18-03	11/1/21	UNDER SEAL, 1/20/22
D-275	Ptl Schaudar 18-04	11/1/21	UNDER SEAL, 1/20/22

D-276	Officer Chris Connors 2017-10	11/1/21	UNDER SEAL, 1/20/22
D-277	Officer M. Stralano 2018-06	11/1/21	UNDER SEAL, 1/20/22
D-278	Officer Sralano 2018- 04	11/1/21	UNDER SEAL, 1/20/22
D-279	PO J Simms 18-1	11/1/21	UNDER SEAL, 1/20/22
D-280	Ronald T. Morris 17-04	11/1/21	UNDER SEAL, 1/20/22
D-281	Sgt. James Katagan 17-04	11/1/21	UNDER SEAL, 1/20/22
D-282	Det. John Galgis 18-02	11/1/21	UNDER SEAL, 1/20/22
D-283	Ptl. Jeffrey Hanlon 17-02	11/1/21	UNDER SEAL, 1/20/22
D-284	Ptl. Jeffrey Hanlon 18-01	11/1/21	UNDER SEAL, 1/20/22
D-285	Ptl. Woodrow 17-14	11/1/21	UNDER SEAL, 1/20/22
D-286	Officer Dan Markman 18-01	11/1/21	UNDER SEAL, 1/20/22
D-287	Officer Daniel Markman 17-01	11/1/21	UNDER SEAL, 1/20/22
D-288	Officer Anthony M. Savarino 17-15	11/1/21	UNDER SEAL, 1/20/22
D-289	Lt. Shawn R. Mount 18-01	11/1/21	UNDER SEAL, 1/20/22
D-290	Officer Jeffrey Katora 17-13	11/1/21	UNDER SEAL, 1/20/22
D-291	Officer Jeffrey Katora 18-02	11/1/21	UNDER SEAL, 1/20/22
D-292	Officer Jeffrey Katora 18-09	11/1/21	UNDER SEAL, 1/20/22
D-293	Lab Report Bradley Beach PD 08202018	11/1/21	UNDER SEAL, 1/20/22
D-294	Lab Report (Berkley Twp. PD) January 2019	11/1/21	UNDER SEAL, 1/20/22
D-295	Lab Report Lindhurst PD 20217	11/1/21	UNDER SEAL, 1/20/22
D-296	Lab Report Fairlawn PD 2018	11/1/21	UNDER SEAL, 1/20/22
D-297	Officer Picow 18-01	11/1/21	UNDER SEAL, 1/20/22
D-298	Officer Picow 18-03	11/1/21	UNDER SEAL, 1/20/22

D-299	Lab Report Cranbury PD	11/1/21	UNDER SEAL, 1/20/22
D-300	Lab Report NJSP 2017	11/1/21	UNDER SEAL, 1/20/22
D-301	Officer Joseph Abrusi (16-71) 17-34	11/1/21	UNDER SEAL, 1/20/22
D-302	Lab Report NJSP 2018 (17-152)	11/1/21	UNDER SEAL, 1/20/22
D-303	Lab Report NJSP 2017 (17-89)	11/1/21	UNDER SEAL, 1/20/22
D-304	Officer J. Abrusi 18-303	11/1/21	UNDER SEAL, 1/20/22
D-305	Lab Report Westampton Twp. PD 2020 (18-39)	11/1/21	UNDER SEAL, 1/20/22
D-306	Officer J. Abrusi 17-134	11/1/21	UNDER SEAL, 1/20/22
D-307	Officer Michael Flowers 17-01	11/1/21	UNDER SEAL, 1/20/22
D-308	Lab Report East Brunswick Twp. 2017	11/1/21	UNDER SEAL, 1/20/22
D-309	Lab Report East Brunswick Twp. PD 2019	11/1/21	UNDER SEAL, 1/20/22
D-310	Officer David Owlesky 17-03	11/1/21	UNDER SEAL, 1/20/22
D-311	Sgt. W. Lardieri 18-03 (not used, no lab report)	11/1/21	UNDER SEAL, 1/20/22
D-312	Joel Phillips 18-13	11/1/21	UNDER SEAL, 1/20/22
D-313	R. Lyon 18-03	11/1/21	UNDER SEAL, 1/20/22
D-314	Lab Report Jefferson Twp. PD (17-22/18-03)	11/1/21	UNDER SEAL, 1/20/22
D-315	Sgt. Seamus Devis 18-17	11/1/21	UNDER SEAL, 1/20/22
D-316	Lab Report Freehold Twp. PD 2017 (17-03)	11/1/21	UNDER SEAL, 1/20/22
D-317	Lab Report Freehold Twp. PD 2018 (18-04)	11/1/21	UNDER SEAL, 1/20/22
D-318	Officer J. Tacopino 18-03	11/1/21	UNDER SEAL, 1/20/22
D-319	Officer J. Tacopino 18-01	11/1/21	UNDER SEAL, 1/20/22
D-320	Officer Tacopino 17-20	11/1/21	UNDER SEAL, 1/20/22
D-321	Officer N. Whelan 18-19	11/1/21	UNDER SEAL, 1/20/22

D-322	Sgt. Jason Ray 18-01	11/1/21	UNDER SEAL, 1/20/22
D-323	Sgt. Jason Ray 17-2	11/1/21	UNDER SEAL, 1/20/22
D-324	Officer Frank Pelaed 18-17	11/1/21	UNDER SEAL, 1/20/22
D-325	Lab Result Richfield Boro PD 2017	11/1/21	UNDER SEAL, 1/20/22
D-326	Lab Result Berkley Twp. PD 2018 (17-06)	11/1/21	UNDER SEAL, 1/20/22
D-327	Lab Result Elmwood Park PD 2019 (18-14)	11/1/21	UNDER SEAL, 1/20/22
D-328	Lab Result Hawthorne PD (18-01)	11/1/21	UNDER SEAL, 1/20/22
D-329	Officer William R. Marble 17-09	11/1/21	UNDER SEAL, 1/20/22
D-330	Officer William R. Marble 17-02	11/1/21	UNDER SEAL, 1/20/22
D-331	Officer David Soden 18-02	11/1/21	UNDER SEAL, 1/20/22
D-332	Sgt. Benjamin M. Miller 17-05	11/1/21	UNDER SEAL, 1/20/22
D-333	Sgt. Benjamin M. Miller 17-04	11/1/21	UNDER SEAL, 1/20/22
D-334	Officer Matthew Menowski	11/1/21	UNDER SEAL, 1/20/22
D-335	Officer Lawler 18-21	11/1/21	UNDER SEAL, 1/20/22
D-336	Ptl. Lawler 18-15	11/1/21	UNDER SEAL, 1/20/22
D-337	Officer Matthew Churney 18-19	11/1/21	UNDER SEAL, 1/20/22
D-338	Sgt. Yurgle 17-07	11/1/21	UNDER SEAL, 1/20/22
D-339	Ptl. J. Moore 17-1~~0~~	11/1/21	UNDER SEAL, 1/20/22
D-340	Michael S. Kelly 18-04 (18-05)	11/1/21	UNDER SEAL, 1/20/22
D-341	Drug Log Jackson Twp. PD 2018	11/1/21	UNDER SEAL, 1/20/22
D-342	Drug Log Jackson Twp. PD 2018	11/1/21	UNDER SEAL, 1/20/22
D-343	Officer Cillento 17-01	11/1/21	UNDER SEAL, 1/20/22
D-344	Officer Joseph Sanwood 17-3	11/1/21	UNDER SEAL, 1/20/22

D-345	Officer Joseph M. Sandstrom 18-11	11/1/21	UNDER SEAL, 1/20/22
D-346	Sgt. James Briggs 17-16	11/1/21	UNDER SEAL, 1/20/22
D-347	Officer Andrew Keleshien 18-02	11/1/21	UNDER SEAL, 1/20/22
D-348	Officer Daniel Petrone 18-2	11/1/21	UNDER SEAL, 1/20/22
D-349	Drug Log Little Falls PD 2018 (18-5)	11/1/21	UNDER SEAL, 1/20/22
D-350	Officer Geoffrey Regent 18-04	11/1/21	UNDER SEAL, 1/20/22
D-351	Officer Geoffrey Regent 18-01	11/1/21	UNDER SEAL, 1/20/22
D-352	Drug Log Upper Saddle PD 2019 (18-19 Regent)	11/1/21	UNDER SEAL, 1/20/22
D-353	Report Barnegat PD 2018	11/1/21	UNDER SEAL, 1/20/22
D-354	Report Woodbury Heights PD	11/1/21	UNDER SEAL, 1/20/22
D-355	Lab Result Middletown PD (Bruder)	11/1/21	UNDER SEAL, 1/20/22
D-356	Report Morris Plains PD (Sgt. Cornine)	11/1/21	UNDER SEAL, 1/20/22
D-357	Lab Report NJSP 2017 (17-02 O'Connor)	11/1/21	UNDER SEAL, 1/20/22
D-358	Report Winslow Twp. PD (Det. De 18-01)	11/1/21	UNDER SEAL, 1/20/22
D-359	Report NJSP 2017 (Det. O'Connor 17-09)	11/1/21	UNDER SEAL, 1/20/22
D-360	Sgt S. Lopez 18-03	11/1/21	UNDER SEAL, 1/20/22
D-361	Sgt. W. Fisher 17-01	11/1/21	UNDER SEAL, 1/20/22
D-362	Sgt. J.M. Wikowski 17-14	11/1/21	UNDER SEAL, 1/20/22
D-363	Report Pensville PD 2017 (Tarzani 17-15)	11/1/21	UNDER SEAL, 1/20/22
D-364	Drug Log Report NJSP 2018 (Mahoney 18-03)	11/1/21	UNDER SEAL, 1/20/22
D-365	Report NJSP 2017 (Trooper Gabone 17-18)	11/1/21	UNDER SEAL, 1/20/22
D-366	Report NJSP 2018 (Trooper Sherby 18-17)	11/1/21	UNDER SEAL, 1/20/22
D-367	Trooper J. Sherby 17-14	11/1/21	UNDER SEAL, 1/20/22

D-368	Report NJSP 2018 (Trooper Bobo18-)	11/1/21	UNDER SEAL, 1/20/22
D-369	Officer Det. K. Morley 2017-27	11/1/21	UNDER SEAL, 1/20/22
D-370	Trooper R. Keller 18-55	11/1/21	UNDER SEAL, 1/20/22
D-383	IACP DRE technical advisory panel mtg 9/12	10/25/21	10/25/21
D-384	DRE TAP meeting minutes 2019	10/25/21	10/25/21
D-386	DRE training manual 2013	10/25/21	10/25/21
D-387	Oregon statute re optometrists	10/25/21	10/25/21
D-389	TAP meeting minutes 10/19/21	10/25/21	10/25/21
D-391	ABCs of conformity assessment	10/25/21	10/25/21
D-392	MOA ANSI & NIST	10/25/21	10/25/21
D-394	May 2015 AOA Focus magazine	10/25/21	10/25/21
D-395	Z80 standards committee revisions	10/25/21	10/25/21
D-396	ARIDE instruction guide 2018	10/25/21	10/25/21
D-399	Z80 minutes August 2018	10/25/21	10/25/21
D-400	Wyngaarden and Smith, Cecil Textbook of Medicine, 18th Ed., Ch. 16 excerpts	10/27/21	10/27/21
D-401	Smith and Citek, DRE Evaluations Made Using Limited Data, 2002	10/26/21	10/26/21 (also S-163)
D-402	Citek, The Drug Evaluation Classification Program: Using Ocular and Other Signs to Detect Drug Intoxication, 1998	10/26/21	10/26/21
D-403	Reynolds, The Validity of a Screening Test, 1982	10/25/21	10/25/21
D-407	Listing of ICD-10 codes, opioid related disorders, F11 in general	10/25/21	10/25/21
D-408	ICD-10-CM Diagnosis Code F11.929	10/25/21	10/25/21
D-409	TAP Goals and Membership Responsibilities, 9/20	10/25/21	10/25/21 (also S-137)
D-410	Handwritten chart re statistics by Citek	10/25/21	10/25/21
D-411	Revised handwritten chart re statistics by Citek	10/25/21	10/25/21
D-412	Handwritten chart re release/arrest by Citek	10/25/21	10/25/21
D-413	Screenshot, WAT, chart/calculator	10/26/21	10/26/21
D-414	Screen shot of chart/calculator	10/26	10/26
D-415	Screenshot, HGN San Diego, chart/calculator	10/26/21	10/26/21
D-416	Glass, Beyond Diagnostic Accuracy: Applying and Extending Methods for Diagnostic Test Research	10/26/21	10/26/21
D-418	TAP minutes March 2006	10/27/21	10/27/21
D-419	TAP minutes October 2006	10/27/21	10/27/21
D-420	TAP minutes October 2007	10/27/21	10/27/21
D-421	TAP minutes March 2018	10/27/21	10/27/21
D-423	Burns, The Robustness of the Horizontal Gaze Nystagmus Test	10/26/21	10/26/21

D-424	Citek, Sleep Deprivation Does Not Mimic Alcohol Intoxication of Field Sobriety Testing, article 2011	10/26/21	10/26/21 (also S-136)
D-425	Citek, Convergence Testing in Intoxicated Individuals	10/26/21	10/26/21
D-428	Shinar, Drug Identification Performance on the Basis of Observable Signs and Symptoms, 2005 (Shinar study)	10/26/21	10/26/21
D-429	TAP minutes February 2009	10/27/21	10/27/21
D-430	Screenshot robustness table 10 – 2 second standard	10/26/21	10/26/21
D-431	Screenshot robustness table 10 – 1 second standard	10/26/21	10/26/21
D-432	Screenshot, Shinar likelihood	10/27/21	10/27/21
D-433	Screenshot, robustness experiment 3	10/27/21	10/27/21
D-434	IACP 2009 DRE annual report	10/27/21	10/27/21
D-435	Hartman, DRE Examination Characteristics of Cannabis Impairment, 2016	10/27/21	10/27/21 (also S-108)
D-436	Heishman Lab Validation Study 1996	10/27/21	10/27/21 (also S-57)
D-437	STARD (standards for reporting diagnostic accuracy)	11/15/21	11/15/21
D-438	QUADAS (quality assessment of diagnostic accuracy studies)	11/15/21	11/15/21
D-444	Spreadsheet created by OPD with evaluations coded "E", REDACTED	11/16/21	11/16/21**
D-446	Spreadsheet created by OPD with 3904 roadside evaluations, REDACTED	11/16/21	11/16/21**
D-447	Spreadsheet created by OPD with rate of missing labs by officer, REDACTED	11/16/21	11/16/21**
D-448	Spreadsheet created by OPD sorted with total roadside evaluations by toxicology, REDACTED	11/16/21	11/16/21**
D-460	Spreadsheet created by OPD sorted by statements, REDACTED	11/16/21	11/16/21**
D-461	Spreadsheets created by OPD with roadside statements, REDACTED	11/16/21	11/16/21**
D-464	Spreadsheet created by OPD sorted by no statements, REDACTED	11/16/21	11/16/21**
D-467	Spreadsheet created by OPD of CNS stimulant opinions, REDACTED	11/16/21	11/16/21**
D-468	Spreadsheet created by OPD of cases re hallucinogen only, REDACTED	11/16/21	11/16/21**
D-469	Spreadsheet created by OPD sorted inhalant, REDACTED	11/16/21	11/16/21**
D-470	Spreadsheet created by OPD of all 4293 reports with toxicology, REDACTED	11/16/21	11/16/21*

D-471	Spreadsheet created by OPD with 4293 entries, REDACTED	11/16/21	11/16/21**
D-472	Spreadsheet created by OPD, roadside with toxicology; general match compared with hypothetical, 2571 records, REDACTED	11/16/21	11/16/21**
D-474	Spreadsheet created by OPD, roadside with toxicology; narcotic and cannabis compared with hypothetical, 2571 entries, REDACTED	11/16/21	11/16/21**
D-475	Spreadsheet sorted narcotic and cannabis, REDACTED	11/16/21	11/16/21**
D-477	Spreadsheet created by OPD, sorted cannabis exact match, REDACTED	11/16/21	11/16/21**
D-479	Spreadsheet created by OPD, sorted CNS depressant exact match, REDACTED	11/16/21	11/16/21**
D-481	Spreadsheet created by OPD, sorted narcotic exact match, REDACTED	11/16/21	11/16/21**
D-482	Spreadsheet created by OPD, sorted CNS stimulant exact match, REDACTED	11/16/21	11/16/21**
D-484	Spreadsheet created by OPD, sorted CNS dissociative exact match, REDACTED	11/16/21	11/16/21**
D-499	Spreadsheet created by OPD, sorted not under the influence, REDACTED	11/16/21	11/16/21**
D-502	Consensus statement American Society of Addiction Medicine	11/18/21	11/18/21
D-504	Matrix	11/18/21	11/18/21
D-505	McLane, Ocular Manifestations	11/18/21	11/18/21
D-510	Homepage, Annals of emergency medicine website	11/18/21	11/18/21
D-511	Instruction for authors page, Annals of emergency medicine website	11/18/21	11/18/21
D-515	Goldfrank's Toxicological Emergencies, Ch. 24	11/18/21	11/18/21
D-517	Recommendations for Toxicological Investigation of Drug Impaired Driving and Motor Vehicle Fatalities, 2013	12/7/21	12/7/21
D-518	State v. Kerk opinion, Wisconsin Dist. 3 Court of Appeals, 2016	12/7/21	12/7/21
D-520	Transcript in State v. Sittlow, June 4, 2014	12/7/21	12/7/21
D-521	Miles, The Traffic Beat article	12/7/21	12/7/21
D-522	Cochems [Miles], Dextromethorphan in Wisconsin Drivers, 2007	12/7/21	12/7/21 (also S-341)
D-525	Miles CV, 1/2020	12/7/21	12/7/21
D-526	Miles testimony in Canada: Proceedings of the Standing Senate Committee on Legal and Constitutional Affairs, Issue No. 18, December 1, 2016	12/7/21	12/7/21
D-528	Brainerd CV	12/1/215	12/1/215
D-529	Earleywine CV	12/20/21	12/20/21

D-531	Arkell article in Traffic Injury Prevention Journal, 2021	12/20/21	12/20/21
D-533	Earleywine bell curve handwritten chart	12/20/21	12/20/21
D-534	Earleywine handwritten calculation chart	12/20/21	12/20/21
D-535	Taylor CV	12/21/21	12/21/21
D-536	Introduction, Standards for Educational and Psychological Testing, 2014	12/21/21	12/21/21
D-537	Chapter 1, Validity, Standards for Educational and Psychological Testing, 2014	12/21/21	12/21/21
D-539	Exhibit from Taylor's October 18, 2021, report	12/21/21	12/21/21
D-540	Table from Taylor's October 18, 2021, report	12/21/21	12/21/21
D-541	Table from Web of Science database	12/21/21	12/21/21
D-542	Spreadsheet, OPD data, REDACTED	12/21/21	12/21/21**
D-543	Exhibit 1 from Taylor's July 8, 2021, coding check report	12/21/21	12/21/21
D-544	Exhibit from Taylor's response to Martin's first report	12/21/21	12/21/21
D-546	Exhibit from Taylor's report, Focus on Field Assessment Records Where Suspect does not Admit Drug Use	12/21/21	12/21/21
D-547	Owusu-Bempah, Canadian Journal of Criminology article	12/21/21	12/21/21
D-548	Exhibit 2 from Taylor's October 18, 2021, report	12/21/21	12/21/21
D-549	Chu, Introduction to Sensitivity article	12/21/21	12/21/21
D-550	Jadschke, Journal of the AMA article, 1994	12/21/21	12/21/21
D-555	Exhibit from Taylor's response to Martin's first report – Assumption made in Martin's 2021 analysis	12/21/21	12/21/21
D-560	Figures from Taylor's October 18, 2021, report	12/21/21	12/21/21
D-564	Excerpts from Research Methods in Criminal Justice textbook, 1994	12/21/21	12/21/21
D-570	Modern Epidemiology, Ch. 2 on causal inference and scientific reasoning	1/5/22	1/5/22
D-574	Modern Epidemiology, Ch. 35 on clinical epidemiology	1/5/22	1/5/22
D-580	Schisterman, Imputations: Approaches for Potential Outcomes in Causal Inference, 2015	1/5/22	1/5/22
D-581	Schisterman, Monitoring Quality Control: Can We Get Better Data, 2008	1/5/22	1/5/22
D-584	Schisterman, Selecting Controls is Not Selecting 'Normals': Design and Analysis Issues for Studying the Etiology of Polycystic Ovary Syndrome, 2006	1/5/22	1/5/22
D-586	New Jersey DRE three-year license dated 12/18/19,	1/6/22	1/6/22
D-587	Bierness article, Traffic Injury Prevention, 2007	1/18/22	1/18/22

D-588	Rubenzer article, Behavioral Science and the Law, 2011	1/18/22	1/18/22
D-591	Adams CV	1/18/22	1/18/22
D-593	Fraunfelder, Drug Induced Ocular Side Effects, Preface	1/18/22	1/18/22
D-594	Truncated and annotated version of S-97 video	1/18/22	1/18/22
AMICUS EXHIBITS			
A-1	2018 SFST manual excerpts	10/5/21	10/5/21
A-2	1995 SFST student manual excerpts	10/5/21	10/5/21
A-3	2015 SFST participant manual excerpts	10/5/21	10/5/21
A-4	2006 SFST State Police student manual excerpts	10/5/21	10/5/21
A-19	Guzzardi, The Scientific Basis of Field Sobriety Tests and their Limitations in the Evaluation of Impairment from Alcohol and Other Drugs, Journal of PA Criminal Defense Lawyers Association, 2017	1/11/22	1/11/22
A-31	Burns and Stuster, San Diego SFST Validation Study, 1998	1/11/22	1/11/22 (also D-17 and S-312)
A-36	Mayo Clinic, What is a Normal Resting Hear Rate? Edward Laskowski, M.D. https://www.mayoclinic.org/healthy-lifestyle/fitness/expert-answers/heartrate/faq-20057979	1/11/22	1/11/22
A-37	Guzzardi CV	1/11/22	1/11/22
A-39	The Effect of Gender and Iris Color on the Dark-Adapted Pupil Diameter, Journal of Ocular Pharmacology and Therapeutics	10/27/21	10/27/21
A-40	Koch, Pupillary Size and Responsiveness: Implications for Selection of a Bifocal Intraocular Lens	10/27/21	10/27/21
A-41	Wood, Pupil Dilation Does Affect Some Aspects of Daytime Driving Performance	10/27/21	10/27/21 (also S-135)
A-43	2018 DRE Instructor Manual, Session 7	1/11/22	1/11/22 (part of S-33 and D-4)
A-44	2018 DRE Instructor Manual, Session 9	1/11/22	1/11/22 (part of S-33 and D-4)
A-45	2018 DRE Instructor Manual, Session 4	1/11/22	1/11/22 (part of S-33 and D-4)
A-46	ARIDE 2018 Participants Manual, 2018, Excerpt (Pages Session 5, pages 25-27)	1/11/22	1/11/22

A-47	Swartz, Toxicological Emergencies, Chapter 18	1/11/22	1/11/22
A-48	Goldfrank's Toxicologic Emergencies, Ch. SC-11, Assessment of Ethanol Induced Impairment	1/11/22	1/11/22
A-51	Cantor, Trends in Prescription Drug Use among Adults in the United States from 1999-2012	1/11/22	1/11/22
A-52	Excerpt from Gibson/Daab demonstration, S-97	1/11/22	1/11/22
A-56	McCartney, Are Blood and Oral Fluid Delta-9-Tetrahydrocannabinol and Metabolite Concentrations Related to Impairment? A Meta-Regression Analysis	1/12/22	1/12/22
A-62	Burkhardt, Critical Care Toxicology, Chapter 62	1/11/22	1/11/22
A-63	Video of demonstration of Guzzardi with Mr. Menzel	1/11/22	1/11/22
JOINT EXHIBIT			
J-1	Stipulation dated 11/4/21/21 Attachment A Attachment B Attachment C Attachment D	11/4/21	11/4/21

Appendix D

Witness	**Transcript Reference**
Karl Citek, O.D., Ph.D., FAAO	32T (Oct. 19, 2021) 33T (Oct. 20, 2021) 34T (Oct. 21, 2021) 35T (Oct. 25, 2021) 36T (Oct. 6, 2021) 37T (Oct. 27, 2021) 38T (Oct. 28, 2021)
Frederick W. Fraunfelder, M.D., M.B.A.	40T (Nov. 3, 2021)
Lewis Nelson, M.D.	42T (Nov. 9, 2021) 46T (Nov. 18, 2021)
Neal Adams, M.D.	61T (Jan. 18, 2022)
Lawrence J. Guzzardi, M.D.	59T (Jan. 11, 2022) 60T (Jan. 12, 2022)
Bridget D. Verdino, MS	28T (Oct. 12, 2021) 29T (Oct. 13, 2021)
Amy Miles	50T (Dec. 6, 2021) 51T (Dec. 7, 2021)
Michael Gibson, Sergeant, NJSP	26T (Oct. 6, 2021) 27T (Oct. 7, 2021) 28T (Oct. 12, 2021) 58T (Jan. 6, 2022)
Thomas E. Page	20T (Sept. 27, 2021) 21T (Sept. 28, 2021) 22T Sept. 29, 2021) 23T (Sept. 30, 2021) 24T (Oct. 4, 2021) 25T (Oct. 5, 2021) 26T (Oct. 6, 2021)
Brian D. Martin, Ph.D. JD	43T (Nov. 15, 2021) 44T (Nov. 16, 2021) 45T (Nov. 17, 2021)

Enrique F. Schisterman, Ph.D., MA	56T (Jan. 4, 2022) 57T (Jan. 5, 2022)
Nicholas Errico, Detective, DCJ	29T (Oct. 13, 2021) 30T (Oct. 14, 2021) 31T (Oct. 18, 2021) 39T (Nov. 1, 2021) 41T (Nov. 4, 2021)
Ralph B. Taylor	54T (Dec. 21, 2021) 55T (Dec. 22,2021)
Dary Fiorentino, Ph.D.	47T (Nov. 29, 2021) 48T (Nov. 30, 2021) 49T (Dec. 1, 2021)
Charles J. Brainerd	52T (Dec. 15, 2021)
Mitch Earleywine, Ph.D.	53T (Dec. 20, 2021)

Appendix E

NEW JERSEY STATE POLICE
DRUG RECOGNITION EXPERT PROGRAM

1 Breath A coho Screen ng Test
2 nterv ew of Arrest ng Off cer
3 Pre m nary Exam nat on
A F rst Pu se
4 Eye Exams (Equa Track ng/Equa Pup S ze)
A Hor zonta Gaze Nystagmus
- *Smooth Pursuit*
- *Maximum Deviation*
- *Angle of Onset*
B Vert ca Gaze Nystagmus
C Non-Convergence
5 D v ded Attent on Tests
A Romberg
- *Body Sway*
- *30 Seconds Internal Clock*
B Wa k and Turn
- 9 Steps/9 Steps
C One Leg Stand (30 Sec Each Leg)
- *Left Leg Then Right Leg*
D F nger to Nose
- *Left/Right/Left/Right/Right/Left*
6 V ta S gns & Second Pu se
7 Dark Room Checks of Pup S ze (Wa t 90 Seconds); Nasa & Ora Cav ty Exam
8 Check for Musc e Tone
9 Check for nject on Marks & Th rd Pu se
10 nterrogat on Statements & Other Observat on
11 Op n on of Eva uator
12 Tox co og ca Exam nat on

S P. 677 (Rev. 09/19)

NEW JERSEY STATE POLICE — DRUG EVALUATION & CLASSIFICATION

	CNS Depressant	CNS Stimulant	Hallucinogen	Dissociative Anesthetic	Narcotic Analgesic	Inhalant	Cannabis
Horizontal Gaze Nystagmus	Present	None	None	Present	None	Present	None
Vertical Gaze Nystagmus	Present (High Dose)*	None	None	Present	None	Present (High Dose)*	None
Lack of Convergence	Present	None	None	Present	None	Present	Present
Pupil Size	Normal (1)	Dilated	Dilated	Normal	Constricted	Normal (4)	Dilated (6)
Reaction to Light	Slow	Slow	Normal (3)	Normal	Little or None Visible	Slow	Normal
Pulse Rate	Down (2)	Up	Up	Up	Down	Up	Up
Blood Pressure	Down	Up	Up	Up	Down	Up/Down (5)	Up
Body Temperature	Normal	Up	Up	Up (PCP)	Down	Up/Down/ Normal	Normal
Normal Ranges	**Blood Pressure** SYSTOLIC 120 140 DIASTOLIC 70 90		**Pulse** 60 90 B.P.M.	**Temperature** 98.6 +/ 1°		**Pupil Diameters** RL 2.5 5.0 / NTD 5.0 8.5 DL 2.0 4.5	

* high dose for that particular individual.

1. Soma, Quaaludes and some anti depressants usually dilate pupils.
2. Quaaludes and ETOH and possibly some anti depressants may elevate.
3. Certain psychedelic amphetamines may cause slowing.
4. Normal, but may be dilated.
5. Down with anesthetic gases, up with volatile solvents & aerosols.
6. Pupil size possible normal.

RL Room Light
NTD Near Total Darkness
DL Direct Light

DCJ/Olenowski/009147

NEW JERSEY STATE POLICE
DRUG RECOGNITION EXPERT PROGRAM

1 Breath A coho Screen ng Test
2 nterv ew of Arrest ng Off cer
3 Pre m nary Exam nat on
A F rst Pu se
4 Eye Exams (Equa Track ng/Equa Pup S ze)
A Hor zonta Gaze Nystagmus
- *Smooth Pursuit*
- *Maximum Deviation*
- *Angle of Onset*
B Vert ca Gaze Nystagmus
C Non-Convergence
5 D v ded Attent on Tests
A Romberg
- *Body Sway*
- *30 Seconds Internal Clock*
B Wa k and Turn
- 9 Steps/9 Steps
C One Leg Stand (30 Sec Each Leg)
- *Left Leg Then Right Leg*
D F nger to Nose
- *Left/Right/Left/Right/Right/Left*
6 V ta S gns & Second Pu se
7 Dark Room Checks of Pup S ze (Wa t 90 Seconds); Nasa & Ora Cav ty Exam
8 Check for Musc e Tone
9 Check for nject on Marks & Th rd Pu se
10 nterrogat on Statements & Other Observat on
11 Op n on of Eva uator
12 Tox co og ca Exam nat on

S P. 677 (Rev. 09/19)

NEW JERSEY STATE POLICE — DRUG EVALUATION & CLASSIFICATION

	CNS Depressant	CNS Stimulant	Hallucinogen	Dissociative Anesthetic	Narcotic Analgesic	Inhalant	Cannabis
Horizontal Gaze Nystagmus	Present	None	None	Present	None	Present	None
Vertical Gaze Nystagmus	Present (High Dose)*	None	None	Present	None	Present (High Dose)*	None
Lack of Convergence	Present	None	None	Present	None	Present	Present
Pupil Size	Normal (1)	Dilated	Dilated	Normal	Constricted	Normal (4)	Dilated (6)
Reaction to Light	Slow	Slow	Normal (3)	Normal	Little or None Visible	Slow	Normal
Pulse Rate	Down (2)	Up	Up	Up	Down	Up	Up
Blood Pressure	Down	Up	Up	Up	Down	Up/Down (5)	Up
Body Temperature	Normal	Up	Up	Up (PCP)	Down	Up/Down/ Normal	Normal
Normal Ranges	**Blood Pressure** SYSTOLIC 120 140 DIASTOLIC 70 90		**Pulse** 60 90 B.P.M.	**Temperature** 98.6 +/ 1°		**Pupil Diameters** RL 2.5 5.0 / NTD 5.0 8.5 DL 2.0 4.5	

* high dose for that particular individual.

1. Soma, Quaaludes and some anti depressants usually dilate pupils.
2. Quaaludes and ETOH and possibly some anti depressants may elevate.
3. Certain psychedelic amphetamines may cause slowing.
4. Normal, but may be dilated.
5. Down with anesthetic gases, up with volatile solvents & aerosols.
6. Pupil size possible normal.

RL Room Light
NTD Near Total Darkness
DL Direct Light

Appendix F

Indicators Consistent with Drug Categories

	CNS Depressants	CNS Stimulants	Hallucinogens	Dissociative Anesthetics	Narcotic Analgesics	Inhalants	Cannabis
HGN	Present	None	None	Present	None	Present	None
Vertical Gaze Nystagmus	Present (High Dose)	None	None	Present	None	Present (High Dose)	None
Lack of Convergence	Present	None	None	Present	None	Present	Present
Pupil Size	Normal (1)	Dilated	Dilated	Normal	Constricted	Normal (4)	Dilated (6)
Reaction to Light	Slow	Slow	Normal (3)	Normal	Little or None Visible	Slow	Normal
Pulse Rate	Down (2)	Up	Up	Up	Down	Up	Up
Blood Pressure	Down	Up	Up	Up	Down	Up/Down (5)	Up
Body Temperature	Normal	Up	Up	Up	Down	Up/Down/ Normal	Normal
Muscle Tone	Flaccid	Rigid	Rigid	Rigid	Flaccid	Normal or Flaccid	Normal
General Indicators	Disorientation Droopy eyelids Drowsiness Drunk-like behavior Slow, sluggish reactions Thick, slurred speech Uncoordinated Unsteady walk	Anxiety Body tremors Dry mouth Euphoria Exaggerated reflexes Excited Eyelid tremors Grinding teeth Increased alertness Insomnia Irritability Redness to the nasal area Restlessness Runny nose Talkative	Body tremors Dazed appearance Difficulty with speech Flashbacks Hallucinations Memory loss Nausea Paranoia Perspiring Poor perception of time and distance Synesthesia Uncoordinated NOTE: With LSD, Piloerection may be observed (goose bumps, hair standing on end)	Blank stare Confusion Chemical odor (PCP) Cyclic behavior Difficulty with speech Disoriented Early HGN Onset Hallucinations Incomplete verbal responses Increased pain threshold "Moon Walking" Non-communicative Perspiring (PCP) Possibly violent Sensory distortions Slow, slurred speech Slowed responses Warm to touch (PCP)	Depressed reflexes Droopy eyelids Drowsiness Dry mouth Euphoria Facial itching Inability to concentrate Nausea "On the Nod" Puncture marks Slow, low, raspy speech Slow breathing Slow deliberate movements NOTE: Tolerant users exhibit relatively little psychomotor impairment.	Bloodshot eyes Confusion Disoriented Flushed face Intense headaches Lack of muscle control Non-communicative Odor of substance Possible nausea Residue of substance Slow, thick, slurred speech Watery eyes	Altered time/distance perception Alteration in thought formation Body tremors Bloodshot eyes Disoriented Drowsiness Eyelid tremors Euphoria Impaired memory Increased appetite Lack of concentration Mood changes Odor of Marijuana Rebound Dilation Relaxed inhibitions Sedation
Duration of Effects	Ultra-Short: A few minutes Short: Up to 5 hours Intermediate: 6-8 hours Long: 8-14 hours	Cocaine: 5-90 minutes Methamphetamine: Up to 12 hours	Duration varies widely from one hallucinogen to another: LSD: 10-12 hours Psilocybin: 2-3 hours	PCP Onset: 1-5 minutes Peak Effects: 15-30 minutes Exhibits effects up to 4-6 hours DXM: Onset 15-30 min. Effects 3-6 hours	Heroin: 4-6 hours Methadone: Up to 24 hours Others: Vary	6-8 hours for most volatile solvents Anesthetic gases and aerosols – very short duration	2-3 hours – exhibit and feel effects (Impairment may last up to 24 hours, without awareness of effects)
Usual Methods of Administration	Injected (occasionally) Insufflation Oral	Insufflation Injected Oral Smoked	Insufflation Oral Smoked Transdermal	Injected Insufflation Oral Smoked Transdermal	Injected Insufflation Oral Smoked Transdermal	Inhalation	Oral Smoked Transdermal
Overdose Signs	Clammy skin Coma Rapid, weak pulse Shallow breathing	Agitation Hallucinations	Intense bad "trip" Hyperthermia Convulsions	Deep coma Seizures and convulsions	Cold, clammy skin Coma Convulsions Slow, shallow breathing	Cardiac arrhythmia Possible psychosis Respiration ceases Severe nausea/vomiting Risk of death	Excessive vomiting Fatigue Acute anxiety attacks Paranoia Possible psychosis

FOOTNOTE: These indicators are the most consistent with the category, keep in mind that there may be variations due to individual reaction, dose taken and drug interactions.

1) Soma, Quaaludes and some antidepressants usually dilate pupils
2) Quaaludes, ETOH and some antidepressants may elevate
3) Certain psychedelic amphetamines may cause slowing
4) Normal, but may be dilated
5) Down with anesthetic gases, up with volatile solvents and aerosols
6) Pupil size possibly normal

Appendix G

DRUG EVALUATION AND CLASSIFICATION DRUG CATEGORY EXAMPLES

CNS DEPRESSANTS

ANTI-DEPRESSANTS
- Paroxetine (Paxil)
- Escitalopram (Lexapro)
- Bupropion (Wellbutrin)
- Citalopram (Celexa)
- Sertraline (Zoloft)
- Venlafaxine (Effexor)
- Phenelzine Sulfate (Nardil)
- Amitriptyline HydroChloride (Elavil)
- Fluoxetine (Prozac)
- Desipramine Hydrochloride (Norpramine)
- Doxepin Hydrochloride (Adapin)
- Impramine (Tofranil)
- Fluvoxamine (Luvox)
- Trazodone (Desyrel)
- Duloxetin (Cymbalta)

BARBITURATES
- Secobarbitol (Seconal)
- Amobarbital (Amytal)
- Pentobarbital (Nembutal)
- Amosecobarbital (Tuinal)
- Phenobarbital

COMBINATIONS
- Chlordiazepoxide-Amitriptyline (Limbitrol)
- Perphenazine-Amitriptyline HydroChloride (Triavil)
- Chlordiazepoxide HCL-Clidinium Bromide (Librax)

NON-BARBITURATE
- Carisoprodol (SOMA)
- Chloral Hydrate (Noctec, Fesule)
- Methaqualone (Quaalude)
- Methyprylon (Noludar)
- Ethchlorvynol (Placidyl)
- Diphenhydramine HydroChloride (Benadryl, Sominex)
- Eszopiclone (Lunesta)
- Zolpidem (Ambien)
- Paraldehyde (Paral)
- Diphenhylhydantoin Sodium (Dilantin)
- GammaHydroxybutyrate (GHB)

ANTI-PSYCHOTIC (MAJOR) TRANQUILIZERS
- Lithium Carbonate (Lithane)
- Haloperidol (Haldol)
- Droperidol (Inapsine)
- Chlorpromazine (Thorazine)

ANTI-ANXIETY (MINOR) TRANQUILIZERS
- Chlordiazepoxide (Librium)
- Diazepam (Valium)
- Flurazepam (Dalmane)
- Lorazepam (Ativan)
- Alprazolam (Xanax)
- Triazolam (Halcion)
- Clonazepam (Klonopin)
- Estazolam (ProSom)
- Temazepam (Restoril)
- Oxazepam (Serax)
- Flunitrazepam (Rohypnol)
- Meprobamate (Probate)

CNS STIMULANTS

- Dexedrine
- Methamphetamine
- Preludin
- Ritalin
- Adderall
- Amphetamine Sulphate
- Desoxyn
- Benzedrine
- Cocaine
- Amphetamine
- Methcathinone
- Caffeine
- Cathine/Cathinone
- Ephedrine

HALLUCINOGENS

- Peyote
- Psilocybin
- Methylenedioxyamphetamine(MDA)
- Lysergic Acid Diethylamide (LSD)
- Methylenedioxymethamphetamine MDMA, 'Ecstasy'
- STP (DOM)
- Trimethoxyamphetamine (TMA)
- Dimethyltryptamine (DMT)
- Salvia Divinorum
- Bufotenine
- Jimson Weed
- Nutmeg
- Morning Glory seeds
- Mescaline
- 2CB

NARCOTIC ANALGESICS

- Opium
- Morphine
- Heroin (Diacetyl Morphine)
- Lortab,Vicodin (Hydrocodone)
- Dilaudid (Hydromorphone HCL)
- Codeine
- Oxycontin, Percodan (Oxycodone)
- Demerol (Meperidine)
- MPPP
- Fentanyl
- Oxymorphone (Numorphan)
- Methadone
- Buprenorphine (Subutex)
- Thebaine

DISSOCIATIVE ANESTHETICS

- Phencyclidine (PCP)
- Dextromethorphan (DXM)
- Ketamine, Ketalar, Ketaject, Ketavet, Ketaset
- Sernyl
- Sernylan
- Vetalar, Vetamine
- Methoxetamine

INHALANTS

- Amyl Nitrate
- Butyl Nitrate (Isobutyl Nitrate)
- Toluene
- Acetone
- Hexane/Cyclohexane
- Benzene
- Nitrous Oxide
- Ether
- Freon
- Aliphatic Acetates

CANNABIS

- Marijuana
- Hashish/Hash Oil
- Marinol (Dronabinol)
- Tetrahydrocannabinol
- Synthetic cannabinoids