SUPERIOR COURT
OF THE
STATE OF DELAWARE

T. HENLEY GRAVES
RESIDENT JUDGE

SUSSEX COUNTY COURTHOUSE
1 THE CIRCLE, SUITE 2
GEORGETOWN, DE 19947
(302) 856-5257

September 17, 2015

Caroline Brittingham, Esquire
Department of Justice
114 E. Market Street
Georgetown, DE 19947

Jerome Capone, Esquire
Office of the Public Defender
14 The Circle, 2nd Floor
Georgetown, DE 19947

RE: **State vs. Richard Roundtree**
Case No: 1412017602

Dear Counsel:

This is the Court's written decision following its bench ruling issued on September 14, 2015, that granted the State's Motion to allow hypergeometric sampling of suspected drugs when a large quantity is involved. The Court held a *Daubert* hearing over the course of two days.[1] The issue before the Court is narrow: whether hypergeometric sampling may be used by the Division of Safety and Homeland Security, Division of Forensic Science (hereinafter, "DFS") to test only a portion of seized drugs in large volume cases.[2]

On September 11, 2015, the State presented two experts, John Mario, a forensic scientist

[1] *See Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 597 (1993) (holding the rules of evidence assign to a trial judge "the task of ensuring that an expert's testimony both rests on a reliable foundation and is relevant to the task at hand."). As will be discussed, *infra*, this case ultimately did not involve a *Daubert* issue.

[2] When a population contains nine or fewer items, the hypergeometric sampling plan does not apply. *See Hypergeometric Sampling Table*, attached hereto as Exhibit A.

formerly with the Suffolk County Crime Laboratory of New York, and Dr. Bradley Venner, a statistician with the Environmental Protection Agency. On September 14, 2015, the State presented the testimony of Robyn Quinn, DFS' forensic testing supervisor, and Melissa Newell, the chemist who tested the drugs in this particular case. The defense argued that hypergeometric testing was not as reliable as testing to weight but did not offer any witness testimony to support its argument.

After hearing the evidence, the Court concludes the matter before it is not a typical *Daubert* issue, in that the issue is not whether to accept or reject a new technology or scientific theory. This matter concerns the day-to-day operations in drug laboratories and the subsequent use of evidence in a criminal trial. The question before the Court is: Does the hypergeometric method of sampling in drug cases permit an inference upon which the jury can reasonably rely to satisfy the State's burden of proof? Thus, this issue is really a sufficiency of the evidence argument.

This case does not pertain to the chemical analysis of suspected drug evidence. Rather, the question is how much of the seized drug evidence must be actually tested by the chemist.

Mr. Mario, a chemical forensic scientist, provided the Court with a brief overview of the field of forensic drug testing. He testified that the laboratory with which he had been affiliated from 1981 through his retirement in 2013 uses hypergeometric testing. Mr. Mario was a member of the Core Committee of the Scientific Working Group for the Analysis of Seized Drugs ("SWGDRUG") from 1998 until he retired in 2013. He continues to consult with the Springfield Massachusetts Police Department in a drug evidence audit.

Mr. Mario testified that SWGDRUG cannot publish standards, per se, but can make recommendations to the international forensic community. SWGDRUG endorses statistical sampling and supports the hypergeometric approach. The American Society for Testing and

Materials ("ASTM") publishes standards. Their standards are reviewed every five years and updated as needed. ASTM has adopted SWGDRUG's recommendation on sampling. The International Organization for Standardization/International Electrotechnical Commission ("IOS/IEC") is, according to Mr. Mario and not refuted by the defense, the leading standard for testing laboratories and provides that laboratories must have a sampling plan and procedures in place.

Mr. Mario told the Court that a review of seventeen sampling plans from around the United States, including two federal laboratories, revealed that all of them employ the hypergeometric probability distribution approach when they conduct sampling.[3] Among these laboratories are the New York State Police Forensic Center, the Virginia Department of Forensic Science, the Texas Department of Public Safety, the Massachusetts State Police, and the United States Drug Enforcement Administration. The State presented ample evidence that the hypergeometric sampling model is well entrenched in drug testing laboratories.

Dr. Venner testified that hypergeometric sampling is a reasonably relied upon probability model that is used not only in testing drug samples, but also for all sorts of commercial sampling. It is based upon solid mathematical and statistical grounds and was recognized centuries ago and has since been refined.

To a degree this is much ado about nothing, or perhaps *deja vu* all over again because we learned that the hypergeometric model was used in Delaware by the Office of the Chief Medical Examiner ("OCME") prior to its closure. I suspect it was such an imbedded practice, issues as to its use never arose. The current notoriety of the method seems to stem from the objection to the policy of the Pennsylvanian laboratory, NMS, of only testing nine or ten samples, regardless of the

[3] One of the laboratories reviewed was Delaware's DFS.

population of items seized.[4] This is an acceptable procedure in Pennsylvania, but its drug laws are different and, in fact, currently under revision. In Pennsylvania and some other jurisdictions, it is permissible to make a general or arbitrary inference argument to the jury that, if all ten (10) samples tested positive for heroin, it can infer the balance of the seized items would test positive for heroin. In this case, the Court rejected this general inference approach by way of a bench ruling on August 12, 2015. The Court was not satisfied that a general inference satisfied a sufficiency of the evidence threshold. Interestingly, having lost this initial battle, the State acknowledged in its written submission to the Court that there are problems with the arbitrary inference approach.

The polar opposite of permitting a general or arbitrary inference would be to require the prosecution actually test that amount of drugs required for conviction under the criminal statutes, *i.e.*, that DFS test to the weight. This Court could only locate one jurisdiction, Illinois, that requires the prosecution meet this strict standard.

The hypergeometric sampling methodology allows the testing laboratory to test a portion of the seized drugs, and, based upon those test results, infer certain conclusions about the balance of the untested seized drugs. It is a statistical model based upon a mathematical formula that produces a statistical inference that, if a certain number of randomly selected samples are tested and all test positive, then it is probable that most of the remaining items would likewise test positive if actually tested.

The number of samples that must be tested has a direct statistical relationship as to the conclusion on probability. In the drug testing world, the standard confidence and probability percentages requires that the number of samples tested produce a 95% confidence level that at least

[4] The drugs in this case were initially sent to NMS for testing.

90% of the remaining population is of the same composition as what was tested.

At the hearing, the Court also learned that a major driver for the use of hypergeometric sampling model is not only the reliability of its probability inference, but also its practicality. Testing to the weight requires much more time and State resources. The evidence showed that, in Delaware, it would be impractical, if not impossible, to test to the weight without a huge influx of money and resources into DFS.

Ms. Quinn, DFS' laboratory manager, testified DFS is licensed by the American National Standards Institute-American Society for Quality National Accreditation Board ("ANSI-ASQ"). DFS also has ISO/IEC 17025 accreditation, which is issued by the ANSI-ASQ. As noted, *supra*, the ISO/IEC 17025 standards require the laboratory have a sampling plan and procedures for sampling. Ms. Quinn's responsibilities include ensuring DFS' forensic chemistry unit is in compliance with ISO/IEC 17025.

Ms. Quinn was a laboratory manager at OCME and has been the laboratory manager since DFS reopened under its new incarnation in January of 2015. When Ms. Quinn took her position, she testified that she made changes to the sampling model to make it "more conservative." In so doing, she relied upon SWGDRUG's recommendations and other laboratories' policies. All of the laboratories from which she sought input use hypergeometric testing.

Ms. Quinn testified that there are five chemists at the Delaware lab. There are only three Gas Chromatography-Mass Spectrometry instruments ("GC-MS"), the machines utilized to identify substances in a test sample. Two are currently "on line" and available for use.

In the present case, DFS received 389 bags of suspected heroin.[5] The table for determining the number of samples to be tested under the hypergeometric model requires 28 randomly selected samples to be tested.[6] Ms. Quinn testified that, if all 389 bags had to be tested, it would take approximately thirty (30) hours of prep time plus ninety-seven (97) hours of machine time to complete the GC-MS analysis. Although the instrument is programed to run on its own, when a machine is in use it is not available for other testing.

The impracticality of testing to weight increases as the tier level for a drug offense increases. For example, a tier five heroin offense requires that a defendant have five (5) grams or more of heroin. Ms. Quinn testified that, based upon the average amount of heroin found in a bag of heroin in this case (.004 grams), five (5) grams of heroin could be contained in as many as 1250 bags of heroin. Ms. Quinn opined it would take one chemist close to 390 hours to test 1250 bags.

With this said, practicality and limited resources should not dictate the Court's acceptance of shortcuts. Thus, this Court did not accept the general or arbitrary inference theory first proposed by the State.

The hypergeometric model for sampling may be a time saver, but it is a statistically and mathematically sound method of providing the jury a statistically based and probability based inference as to the untested items. It allows for a reasonable inference based upon a mathematical and statistical model. Ultimately, the jury must decide whether the inference supports a conviction or whether the State's evidence falls short of its burden. For purposes of this motion, the Court finds

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[5] In point of fact, there were originally 399 bags in this case. However, ten of those were tested by NMS. The remaining 389 bags were sent to DFS for testing.

[6] *See* Exhibit A.

that the hypergeometric methodology of sampling provides sufficient evidence for the State to get to the jury.[7]

The Court notes that the State's expert witness, Mr. Mario, reviewed the State's hypergeometric testing protocol. That protocol tracks the standard operating procedure for the other laboratories and agencies that use hypergeometric sampling.

In each future case where the State relies upon the laboratory's sampling table attached to this decision, the State must still satisfy the requirements for proper hypergeometrical sampling; to wit, the State must show how a determination as to the homogeneity of the tested population was made and how the tested samples were randomly selected. Homogeneity requires the chemist to inspect visually each seized item to determine if the items are so similar in physical appearance that they would be included in a single population. In the present case, Ms. Newell visually inspected the exterior of all 389 bags (also known as bindles). Ms. Newell testified the bags were all of similar appearance; in same size, blue bags; and stamped with the notation "Erruption" in the same color ink. Ms. Newell stated that, had she found any bags that were not similar in appearance, she would have segregated the dissimilar bags into a different population pool.

After the population has been determined, the samples to be tested must be randomly selected. In this case, after counting the bags and making a homogeneity determination, Ms. Newell placed the bags back into a common container and randomly selected the requisite twenty-eight, per the hypergeometric sampling table. Dr. Venner testified that, in his expert opinion, this method of

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[7] *See Ohio v. Gartrell*, 24 N.E.3d 680, 707 (Ohio 2014) (holding evidence of hypergeometric sampling is "sufficient as a matter of law to support a determination that the entire substance recovered together and similarly packaged is the same controlled substance as that tested") (citation and internal quotation marks omitted).

random selection is an accepted practice. The twenty-eight samples were weighed and tested. All tested positive for heroin. Therefore, the chemist concluded with 95% confidence the probability was that 90% of the entire population of bags contained heroin. In conclusion, the hypergeometric model provided September 17, 2015 a statistical probability inference as to what was in the bags; *i.e.*, heroin.

The Court notes Dr. Venner testified that, had one or two samples tested negative, the hypergeometric model could still be used, but a different mathematical formula would be utilized, presumably creating a different table. The Court's decision only addresses the mathematical formula used when all the tested samples test positive.[8]

In this decision, the Court accepts the validity of hypergeometric sampling. The Court recognizes that if protocol is followed and all of the samples test positive, there exists a statistical probability permitting an inference with a 95% confidence level that 90% of the population contains the same substance as the tested samples. The Court will not require this statistical probability to be proven again and again with expert testimony in the future.

The Court will, of course, permit the attorneys to argue their respective positions as to the inferences that may be made from the use of hypergeometric testing because the jury ultimately decides whether it is satisfied the State has met its burden of proof.

Hypergeometric sampling is used only for determining the probability of the entire population containing the same substance. It tests each sample to determine one of two things: positive for controlled substance or negative. Hypergeometric sampling is not used to determine the total weight;

[8] As an aside, Ms. Quinn seemed baffled when the Court inquired about the potential effect a negative result in the sampled group would have; in her experience, she had never encountered such a scenario.

weight is determined by another process. The current lab does exactly what the OCME with regard to making a total weight determination. In this case, Ms. Newell weighed the contents of the opened and tested bags. She took an average of those twenty-eight bags and extrapolated the total weight of the 389 bindles. Using this averaging process, a chemist does not open all 389 bags. The Court suspects there are other methods of determining weight; for example, taking the total weight of all 389 bags and contents, then weighing out the average of the bag alone, which should be consistent, and then subtracting the weight of 389 bags only from the total. Again, this method was not the focus of the hearing because the hypergeometric model is only used to determine the probability inference of identifying the substance.

The Motion to permit the use of hypergeometric sampling is granted.

IT IS SO ORDERED.

Very truly yours,

/s/ T. Henley Graves

T. Henley Graves

THG/ymp

pc: Prothonotary
Valerie Dunkle, Esquire

STATE OF DELAWARE
DEPARTMENT OF SAFETY AND HOMELAND SECURITY
DIVISION OF FORENSIC SCIENCE
200 South Adams Street
Wilmington, Delaware 19801
Phone: 302-577-3420
Fax: 302-577-3416

The Honorable Jack A. Markell
Governor

The Honorable Lewis D. Schiliro
Cabinet Secretary

MEMO:

October 6, 2014

Division of Forensic Science – Controlled Substances Unit

To: Quality Manual

Re: Statistically Based Sampling Plan (Hypergeometric Distribution)

The Hypergeometric Sampling Table included in this Memo is effective as of October 6, 2014.

Hypergeometric sampling is a statistically-based model involving a defined confidence level with an associated probability of finding failures in a population. It is used to find the lowest sample size that requires analysis such that the minimum proportion of positives is met. The appropriate sample size within the population will be randomly selected to give a 95% level of confidence that at least 90% of the population contains a controlled substance. When an item contains 9 or fewer exhibits, the hypergeometric sampling plan is not applicable. The hypergeometric sampling plan requires a population size of 10 or greater to calculate the appropriate sample size needed to give a 95% confidence level that 90% of the population contains a controlled substance.

Hypergeometric Sampling Table

Population (N)	Proportion of Positives = 90% Confidence Level=95%
1 – 10	ALL
11 – 13	10
14	11
15 – 16	12
17	13
18	14
19 - 24	15
25 – 26	16
27	17
28 - 35	18
36 - 37	19
38 - 46	20
47 - 48	21
49 - 58	22
59 - 77	23
78 - 88	24
89 - 118	25
119 - 178	26
179 - 298	27
299 - 939	28
940 +	29

Table derived from European Network of Forensic Science Institutes Drug Working Group (ENFSI DWG) "Hypergeometric Sampling Tool (version 2012) Background of Calculation and Validation", DWG-SGL-002, Issued December 17, 2012

A. Robyn Quinn, M.S.
Laboratory Manager II