

Understanding Retrograde Extrapolation in DWI Prosecutions – Attempts at Time Travel without a Flux-Capacitor

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**Understanding Retrograde Extrapolation in DWI Prosecutions –
Attempts at Time Travel without a Flux-Capacitor**

Daniel J. Koewler & Charles A. Ramsay

INTRODUCTION

In June, the United States Supreme Court held that statutes that make it a crime to refuse to submit to blood alcohol tests are unconstitutional. *Birchfield v. North Dakota*, 136 S.Ct. 2160 (2016). Instead of threatening drivers with the crime of refusal, police that want to collect a blood sample must either obtain free and voluntary consent from the driver, hope that they can prove exigent circumstances in court, or obtain a search warrants. Consent is always judged on a case-by-case basis, and three years ago the United States Supreme Court reaffirmed that exigency too in determined case-by-case; the normal dissipation of alcohol does not in itself create an exigency. *Missouri v. McNeely*, 133 S.Ct. 1552 (2013).

While much has been made of these cases, few have discussed the practical ramifications of the holdings. One obvious consequence will be the inevitable delay in obtaining a blood sample from drivers, as law enforcement learn and utilize the warrant process. This built-in delay presents a basic question: will tests administered more than two hours after driving be admissible as evidence?

Depending on the facts known in each case, **Retrograde Extrapolation** – a forensic calculation used to determine alcohol concentration at an earlier time – determines whether an alcohol test based on a sample collected more than two hours after driving can be admitted into evidence.

WHAT IS RETROGRADE EXTRAPOLATION?

Retrograde extrapolation is a forensic calculation involving 1) multiplying a driver’s alcohol elimination rate by 2) the hours between the incident and 3) the blood test, then 4) adding that to the test result, before finally 5) subtracting any unabsorbed alcohol at the time of the incident. *State v. Wolf*, 605 N.W.2d 381, 385 (Minn. 2000). Such testimony is allowed in a DWI case – but only if the evidentiary proponent has sufficient foundation to conduct the calculations. *Id.*

DETERMINING WHEN A DRIVER BECAME “POST ABSORPTIVE”

In order to have a working knowledge of this topic, one must have a basic understanding of how the body absorbs and eliminates alcohol. As one drinks the body gradually absorbs alcohol. A small amount of alcohol is absorbed in the stomach, but bulk of absorption occurs in the small intestine. The pyloric sphincter at the base of the stomach controls the passage of stomach contents from the stomach into the small intestine. Delayed emptying slows the rate of absorption. Likewise, rapid emptying increases the rate of absorption.

Numerous factors affect the rate of gastric emptying. Variables that have the greatest impact on absorption include the type of alcohol consumed, the rate it is consumed, other substances in the stomach, along with the subject’s weight and gender.

At the point of post-absorption (when the consumed alcohol is fully absorbed) the alcohol concentration in the blood “peaks” and then begins to slowly decline (as the liver removes the alcohol from the blood).

Retrograde extrapolation is impossible unless an accurate determination can be made of the point at which the subject has fully absorbed all the alcohol consumed. Average times until “post absorption” have no basis in science given the variables that must be considered on a case by case basis – an accurate determination of when the driver became “post absorptive” is crucial in every attempt to utilize reverse extrapolation.

Published peer reviewed studies support the conclusion that the time from last drink to post-absorption varies greatly. Dr. A.W. Jones, widely recognized as the most prolific researcher and publisher of forensic alcohol studies has reported that the absorption period (the time it takes to reach the post-absorptive phase) can last *four hours*. Knowing as many variables that determine when a driver will become post absorptive is obviously crucial.

While the rate of absorption is highly variable, the elimination rate is relatively steady. Scientists agree that the normal rates of elimination range from 0.01 to 0.025 an hour, with an average eliminate rate of 0.015.

ADMISSIBILITY – CASE LAW

Retrograde extrapolation evidence requires expert testimony and Minnesota courts have broad discretion to exclude expert testimony. *State v. Lopez-Rios*, 669 N.W.2d 603, 612 (Minn.2003). Expert testimony is admissible only if (1) it assists the trier of fact, (2) it has a reasonable basis, (3) it is relevant, and (4) its probative value outweighs its potential for unfair prejudice. *State v. Schwartz*, 447 N.W.2d 422, 424 (Minn.1989). Reverse extrapolation testimony must meet the threshold of foundational reliability set out in Minn. R. Evid. 702 and cannot be speculative. Additionally, any minimal probative value from speculative evidence must outweigh the prejudicial effect such evidence will have in the minds of a jury.

Expert testimony must be based on something more than, “mere speculation or conjecture.” *State Farm Fire & Cas. Co. v. Wicka*, 474 N.W.2d 324, 332 (Minn.1991). Under that standard, the Minnesota Supreme Court has concluded that reverse extrapolation testimony is rightly excluded from evidence when basic foundational evidence is lacking, such as:

1. When the driver last consumed alcoholic beverages;
2. The amount and type of alcohol consumed;
3. The driver’s accurate height and weight at the time of arrest.

State v. Wolf, 605 N.W.2d 381, 385 (Minn.2000). The *Wolf* Court made it plain that reverse extrapolation evidence *can* be admissible, but *only* when sufficient foundation for such evidence is provided.

Wolf cited to a situation where sufficient foundational reliability was established by the party attempting to utilize reverse extrapolation. In *State v. Jensen*, 482 N.W.2d 238 (Minn.Ct.App.1992) *rev. denied* (Minn. May 15, 1992), both the state’s expert and the defense expert started from the position that, “retrograde extrapolation is unreliable when an expert has

insufficient information about variables.” *Id.* at 239. However, the Court of Appeals approved the use of retrograde extrapolation because there *was* “sufficient information about the variables” that can affect reverse extrapolation calculations. Specifically, the experts in *Jensen* “had information about Jensen’s height, weight, gender, amount and type of food eaten, the type of alcohol consumed, when he drank his last beer, the time between the accident and testing, and that he did not consume any alcohol after the accident.” *Id.* at 239-240. Both experts, utilizing this information, came to the independent conclusion that the driver “significantly exceed[ed] the .10 alcohol concentration required for a violation at the time of the accident.” *Id.*

PRACTICALITIES OF RETROGRADE EXTRAPOLATION – “FILLING IN THE GAPS”

In recent years we have seen state forensic scientists attempt to fill in foundational gaps by making assumptions of unknown quantities. While some assumptions may be made by using the recognized ranges of possibility (e.g., elimination rates of 0.009 to 0.25), other assumptions may not.

In a recent case the trial court suppressed a blood test administered about four hours after driving. In a comprehensive retrograde order (and an excellent primer on the subject) the court held:

The State’s proffered expert testimony regarding retrograde extrapolation lacks sufficient foundational reliability, and is therefore inadmissible. See Minn. R. Evid. 702. The record lacks the basic information necessary for an expert to reliably estimate when Defendant had substantially absorbed the alcohol in his system, as necessary to perform retrograde extrapolation, including variables such as: what type of alcohol Defendant drank, the total quantity of alcohol Defendant drank, how quickly Defendant consumed alcohol, and when Defendant stopped drinking. Defendant’s motion to exclude the testimony of forensic toxicology specialist Donna Zittel of the BCA, on the issue of retrograde extrapolation, is GRANTED.

Without the challenged expert testimony utilizing retrograde extrapolation, the State cannot prove Defendant’s blood alcohol concentration within two hours of the time of his driving offense, as required to establish probable cause for the offense of gross misdemeanor driving while impaired in violation of Minn. Stat. §§ 169A.20, subd. 1(5) and 169A.25, subd. 2. Therefore, Defendant’s motion to dismiss Count One of the complaint is GRANTED.

See Order of the Honorable Lois J. Lang, July 28, 2016 (included in these materials).

STATE OF MINNESOTA

IN DISTRICT COURT

COUNTY OF ITASCA

NINTH JUDICIAL DISTRICT

State of Minnesota,

File No. [REDACTED]

Plaintiff,

v.

ORDER

[REDACTED]

Defendant.

The above-entitled matter came on for contested omnibus hearing before the Honorable Lois J. Lang, Judge of District Court, at the Itasca County Courthouse, in the City of Grand Rapids, County of Itasca, State of Minnesota, on May 31, 2016.

Assistant Itasca County Attorney Todd S. Webb, 123 Northeast Fourth Street, Grand Rapids, Minnesota, 55744, appeared on behalf of the State of Minnesota. Defendant [REDACTED] [REDACTED] (hereinafter 'Defendant') appeared in person with his attorney, Charles A. Ramsay, 2780 Snelling Avenue North, Suite 330, Roseville, Minnesota, 55113.

By four-count complaint filed December 9, 2015, the State charged Defendant with: count one, gross misdemeanor driving while impaired in violation of Minn. Stat. §§ 169A.20, subd. 1(5) and 169A.25, subd. 2; count two, misdemeanor possession of marijuana in a motor vehicle in violation of Minn. Stat. § 152.027, subd. 3; count three, misdemeanor illegal transportation of a firearm in violation of Minn. Stat. § 97B.045; and count four, petty misdemeanor speeding in violation of Minn. Stat. §§ 169.14, subd. 2(a)(3) and 169.89, subd 1(1). Defendant moves for a court order excluding the State's proffered expert testimony of Donna Zittel, of the Minnesota Bureau of Criminal Apprehension (BCA), regarding the use of

retrograde extrapolation to calculate Defendant's blood alcohol level at the time of his driving while impaired (DWI) offense. Defendant argues, in part, that Zittel's opinion lacks foundational reliability pursuant to Minnesota Rule of Evidence 702. Defendant argues that count one of the complaint—charging Defendant with driving a motor vehicle with a blood alcohol concentration of 0.08 or more as measured within two hours of the time of driving—must be dismissed if Zittel's testimony regarding retrograde extrapolation is excluded. The State opposes Defendant's motion.

At the May 31, 2016 hearing, Exhibits One through Four were received in evidence by agreement of the parties. Donna Zittel of the BCA, a board certified forensic toxicology specialist, testified on behalf of the State. Thomas Burr, a self-employed consultant in the field of forensic toxicology, testified on behalf of Defendant. The parties agreed that Defendant be given until June 21, 2016 to submit written arguments, and that the State be given until June 28, 2016 to respond. Defendant filed a Memorandum of Law on June 21, 2016. The State filed a Letter Brief on June 28, 2016. The matter is deemed submitted June 28, 2016.

Based on the witnesses' testimony, the exhibits received, the arguments of counsel, and all of the files, records and proceedings herein, the Court makes the following:

ORDER

1. The State's proffered expert testimony regarding retrograde extrapolation lacks sufficient foundational reliability, and is therefore inadmissible. *See* Minn. R. Evid. 702. The record lacks the basic information necessary for an expert to reliably estimate when Defendant had substantially absorbed the alcohol in his system, as necessary to perform retrograde extrapolation, including variables such as: what type of alcohol Defendant drank, the total quantity of alcohol Defendant drank, how quickly Defendant consumed alcohol, and when Defendant stopped drinking. Defendant's motion to exclude the testimony of forensic toxicology specialist Donna Zittel of the BCA, on the issue of retrograde extrapolation, is GRANTED.
2. Without the challenged expert testimony utilizing retrograde extrapolation, the State cannot prove Defendant's blood alcohol concentration within two hours of the time of his driving offense, as required to establish probable cause for the offense of gross

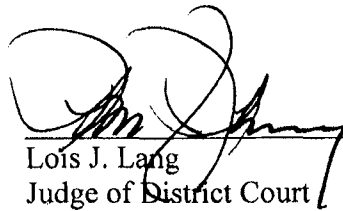
misdemeanor driving while impaired in violation of Minn. Stat. §§ 169A.20, subd. 1(5) and 169A.25, subd. 2. Therefore, Defendant's motion to dismiss Count One of the complaint is GRANTED.

3. Defendant shall appear on August 9, 2016 at 8:30 a.m., at the Itasca County Courthouse in Grand Rapids, Minnesota, in room 308, for a pre-trial conference.

The attached memorandum is incorporated herein and expressly made a part of this order.

DATE: July 28, 2016

BY THE COURT:


Lois J. Lang
Judge of District Court

FILED
JUL 28 2015
COURT ADMINISTRATOR
ITASCA COUNTY, MINN
BY _____

MEMORANDUM

I. Procedural Background

By four-count complaint filed December 9, 2015, the State charged Defendant [REDACTED] [hereinafter 'Defendant'] with: count one, gross misdemeanor driving while impaired in violation of Minn. Stat. §§ 169A.20, subd. 1(5) and 169A.25, subd. 2; count two, misdemeanor possession of marijuana in a motor vehicle in violation of Minn. Stat. § 152.027, subd. 3; count three, misdemeanor illegal transportation of a firearm in violation of Minn. Stat. § 97B.045; and count four, petty misdemeanor speeding in violation of Minn. Stat. §§ 169.14, subd. 2(a)(3) and 169.89, subd 1(1). Defendant moves for a court order excluding the State's proffered expert testimony of Donna Zittel, of the Minnesota Bureau of Criminal Apprehension, regarding the use of retrograde extrapolation to calculate Defendant's blood alcohol level at the time of his driving while impaired (DWI) offense. Defendant argues, in part, that Zittel's opinion lacks foundational reliability pursuant to Minnesota Rule of Evidence 702. Defendant's blood sample was collected approximately four hours after the time of his DWI offense; Defendant argues that his blood alcohol concentration within two hours of the time of his driving offense cannot be accurately calculated absent the challenged expert testimony regarding retrograde extrapolation. Therefore, Defendant argues that count one of the complaint—charging Defendant with driving a motor vehicle with a blood alcohol concentration of 0.08 or more as measured within two hours of the time of driving—must be dismissed if Zittel's testimony regarding retrograde extrapolation is excluded.

The State opposes Defendant's motion. The State argues, in part, that there is sufficient foundational reliability for Zittel's opinion to admit her testimony at trial, and that Defendant's

arguments pertain to the weight to be given to Zittel's testimony by the factfinder, rather than the admissibility of such testimony in the first instance.

II. Factual Background

The following statement of facts is for purposes of this order only and has no bearing on any subsequent factual or legal determinations in this matter.

Donna Zittel of the Minnesota Bureau of Criminal Apprehension (BCA) testified on behalf of the State. Zittel has been employed by the BCA for approximately 15 years. She is a board certified forensic toxicology specialist who works in the Toxicology Section of the BCA Forensic Science Laboratory. To maintain her board certification, Zittel teaches, maintains active membership in a scientific organization, does casework, performs toxicology, and makes court appearances. Zittel regularly performs retrograde extrapolation to calculate an individual's blood alcohol concentration at a time prior to testing. Zittel estimates that, at the time of the May 31, 2016 hearing, she had performed over 20 retrograde extrapolation analyses in calendar year 2016. The testimony of Zittel regarding her testing methods and the facts upon which she relied to perform retrograde extrapolation using Defendant's blood sample are credible and accepted. However, the issue of whether the facts in evidence are sufficient to provide foundational reliability for the admission of Zittel's retrograde extrapolation testimony in this case is an independent question of law, separate from the issue of Zittel's credibility.

Defendant was arrested at approximately 1:20 a.m. on December 6, 2015, on charges including driving while impaired (DWI). [*See* Application for Judicial Determination of Probable Cause to Detain, filed December 7, 2015, at p. 1-2.] The arresting officer obtained a search warrant authorizing a blood draw, and a sample of Defendant's blood was collected at 5:35 a.m. on December 6, 2015. [*See id.*; *see also* Exhibit 3, March 23, 2016 Letter of Donna

Zittel to Attorney Webb.] At the State’s request, Zittel performed retrograde extrapolation to determine the alcohol concentration of Defendant’s blood at the time of his DWI offense. [See Exhibit 3.] First, Zittel used “an approved gas chromatographic procedure” to test Defendant’s blood sample; analysis of the sample “revealed an ethyl alcohol concentration of 0.155± 0.007 grams per 100 milliliters of blood with a 99.73% level of confidence.” [Exhibit 2, BCA Report on the Examination of Physical Evidence, dated December 22, 2015; May 31, 2016 Testimony of Zittel.] Based on this result, Zittel then conducted retrograde extrapolation to “go backward in time” to calculate Defendant’s blood alcohol concentration at the time of his DWI offense. [Testimony of Zittel.]

To perform retrograde extrapolation in this case, Zittel utilized the following information, which she obtained from the results of the analysis of Defendant’s blood sample, as well as the reports of the arresting officer:

Gender:	Male
Time of blood draw:	12/06/2015 @ 5:35 a.m.
AC at the time of blood draw:	0.155 grams per 100 milliliters of blood
Encounter with deputy:	01:20 a.m. on 12/06/2015
Consumption scenario:	No alcohol consumption after 01:20 a.m. on 12/06/2015

[Ex. 3; Testimony of Zittel.] Based on Zittel’s retrograde extrapolation analysis, “it was [her] opinion, to a reasonable degree of scientific certainty, that [Defendant] would have obtained an ethanol concentration of approximately 0.193 – 0.261 grams per 100 milliliters of blood at 01:20 a.m. [the time of his DWI offense] on 12/06/2015.” [Ex. 3.] Zittel’s analysis relied upon the information above, as well as “the following assumptions: no alcohol consumption after 1:20 a.m. on 12/06/2015, substantial absorption of alcohol at 01:20 a.m. on 12/06/2015, and utilization of a normal burn-off range of 0.009-0.025 per hour.” [Id.]

At the May 31, 2016 hearing, Zittel testified that individuals metabolize alcohol at different rates, so she utilizes the lowest and highest possible burn off rates to calculate a range of estimates as to what a defendant's blood alcohol concentration might have been at the time of the DWI offense. [Testimony of Zittel.] Zittel acknowledged that the accuracy of retrograde extrapolation analysis is improved "the more information that can be obtained," and that it is "helpful" to understand how a defendant was drinking, the type of alcohol he was drinking, when he started drinking, when he stopped drinking, his weight, and whether he had consumed food; however, the BCA usually does not receive all of that information. [*Id.*]

Zittel further explained that the retrograde extrapolation analysis performed on Defendant's blood sample relied on the assumption that Defendant's "substantial absorption" of alcohol had occurred by the time of the DWI stop at 1:20 a.m. on December 6, 2015, meaning that the majority of alcohol Defendant had ingested was out of his stomach and into his small intestine. [Testimony of Zittel; *see also* Ex. 3.] Zittel clarified that a person who is drinking alcohol on an empty stomach typically reaches the point of "substantial absorption" within 30 minutes of consuming their final drink, assuming that the person is drinking socially rather than binge drinking or taking shots. [Testimony of Zittel.] On cross-examination, Zittel acknowledged that her conclusion that Defendant had substantially absorbed the alcohol in his system by the time of the DWI stop was based on the assumptions that Defendant was not binge drinking or taking shots, but rather was drinking socially; that Defendant was not drinking while driving; and that Defendant had been on the road for "some period of time" before he was stopped. [*Id.*] Zittel admitted that she did not know what type of alcohol Defendant had consumed, how much alcohol Defendant had consumed, the rate at which Defendant had consumed alcohol, when Defendant consumed his first or last drink, how long Defendant had

been on the road prior to the DWI stop, or what Defendant had eaten that day. [*Id.*] Zittel further admitted that—if Defendant had not been drinking socially, as she assumed—she would need to know when he had consumed his last drink in order to determine when he reached the point of substantial absorption. [*Id.*]

Thomas Burr, a self-employed consulting forensic scientist, testified on behalf of Defendant. He has been actively employed in the field of forensic toxicology for over 40 years. Earlier in his career, Burr worked in the St. Paul Police crime laboratory for over 20 years. He has testified in Minnesota state and federal courts, as well as in 21 other states and in Canada as an expert witness in forensic toxicology. Burr's testimony is credible and accepted.

Burr testified that the following factors are significant when conducting retrograde extrapolation analysis to determine a person's blood alcohol concentration at a time prior to testing: when the subject began drinking; when the subject stopped drinking; what the subject ate; what type of alcohol the subject drank; the subject's gender, height, and weight; the subject's rate and pattern of drinking; and the time of the relevant criminal event. [Testimony of Burr.] Burr testified that, while some assumptions can be made when performing a retrograde extrapolation analysis, in his opinion the minimum amount of information needed to conduct a valid retrograde extrapolation analysis includes knowledge of when the subject started drinking, when the subject stopped drinking, the rate at which he drank, and the type of alcohol he drank. [*Id.*]

Burr credibly testified that retrograde extrapolation requires a forensic scientist to make a reasonable calculation as to when a subject reached his peak absorption of alcohol; if a scientist incorrectly extrapolates back into the absorption phase (when the subject is still drinking or absorbing alcohol), then the scientist ends up calculating a high alcohol concentration at the time

of the offense, when there is actually a low alcohol concentration. Burr testified that, in his opinion, the information necessary to permit valid retrograde extrapolation was not present in the record in this case.

III. Analysis of Defendant's Motion

A. Legal Standard

“Evidentiary rulings, including the admission of expert testimony, are within the broad discretion of the district court.” *State v. Peterson*, 764 N.W.2d 816, 821 (Minn. 2009) (internal citation omitted). “Expert testimony generally is admissible if: (1) it assists the trier of fact; (2) it has a reasonable basis; (3) it is relevant; and (4) its probative value outweighs its potential for unfair prejudice.” *State v. Edstrom*, 792 N.W.2d 105, 111 (Minn. Ct. App. 2010) (internal quotation omitted). Minnesota Rule of Evidence 702, governing testimony by experts, provides in part 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. The opinion must have foundational reliability.” Minn. R. Evid. 702 (2015). As the Advisory Committee to the Minnesota rules of evidence has noted:

The trial judge should require that all expert testimony under rule 702 be based on a reliable foundation. The ... amendment does not purport to describe what that foundation must look like for all types of expert testimony. The required foundation will vary depending on the context of the opinion, but must lead to an opinion that will assist the trier of fact. If the opinion or evidence involves a scientific test, the case law requires that the judge assure that the proponent establish that “the test itself is reliable and that its admission in the particular instance conformed to the procedure necessary to ensure reliability.” *Goeb v. Tharaldson*, 615 N.W.2d 800, 814 (Minn.2000) (quoting *State v. Moore*, 458 N.W.2d 90, 98 (Minn. 1990)).

Minn. R. Evid. 702, 2006 comm. cmt. A reasonable basis for the admission of expert testimony exists “where an expert’s opinion is probably true; mathematical or absolute certainty is not

required.” *State v. Jensen*, 482 N.W.2d 238, 239 (Minn. Ct. App. 1992) (citing *Block v. Target Stores, Inc.*, 458 N.W.2d 705, 710-11 (Minn. Ct. App. 1990)).

In *State v. Jensen*, 482 N.W.2d 238, 239 (Minn. Ct. App. 1992), *review denied* (Minn. May 15, 1992), the Minnesota Court of Appeals considered, as a matter of first impression, whether expert testimony that relies on retrograde extrapolation is admissible to prove a defendant’s blood alcohol concentration at the time of the criminal offense. The court held that, under the facts of that case, retrograde extrapolation was admissible.

In the *Jensen* opinion, the court noted that retrograde extrapolation is a “mathematical formula” which involves “multiplying the alcohol elimination rate by the number of hours between the incident and testing, adding that to the test reading, and then subtracting any alcohol unabsorbed at the time of the accident.” *Jensen*, 482 N.W.2d at 239. In that case, two experts used retrograde extrapolation to calculate the defendant’s blood alcohol concentration at the time of his criminal offense. In making their calculations, the experts “had information about [the defendant’s] height, weight, gender, amount and type of food eaten, the type of alcohol consumed, when he drank his last beer, the time between the accident and testing, and that he did not consume any alcohol after the accident.” *Id.* at 240. However, “neither expert based his or her opinion on [the defendant’s] specific elimination rate.” *Id.* Both experts testified that they could calculate the defendant’s alcohol concentration at the time of his criminal offense “with a reasonable degree of scientific certainty.” *Id.* The Court of Appeals ultimately concluded that the trial court did not abuse its discretion in determining that the experts’ retrograde extrapolation calculations were “probably correct, and therefore had a reasonable basis,” and that the experts’ testimony “assisted the trier of fact, was relevant, and had probative value that outweighed any potential for unfair prejudice.” *Id.*

In reaching its conclusions, the *Jensen* court specifically noted that—according to both expert witnesses—“retrograde extrapolation is unreliable when an expert has insufficient information about variables.” *Jensen*, 482 N.W.2d at 239. The court also observed in a footnote that “[v]ariables affecting absorption and elimination rates would most likely go to the weight, rather than admissibility of retrograde extrapolation testimony.” *Id.* at 240, n.2 (internal citations omitted).

Since *Jensen*, only one Minnesota Supreme Court opinion—*State v. Wolf*, 605 N.W.2d 381 (Minn. 2000)—has considered the admissibility of retrograde extrapolation testimony. In *Wolf*, the defendant was arrested on charges of gross misdemeanor driving under the influence of alcohol and driving with a blood alcohol level over the statutory limits. *Id.* at 383. Ultimately, the defendant waived his right to a jury trial and submitted the case to the district court on stipulated facts, in accordance with *State v. Lothenbach*, 296 N.W.2d 854 (Minn. 1980). Based on the stipulated record, the trial court found the defendant guilty of the offenses charged. *Wolf*, 605 N.W.2d at 384. In reaching its decision, the district court disallowed the defendant’s proffered expert testimony on the issue of retrograde extrapolation, concluding that its potential for unfair prejudice outweighed its probative value. *Id.* at 383-84.

In considering whether the trial court abused its discretion by excluding the retrograde extrapolation testimony of the defendant’s expert witness, the *Wolf* Court noted that “[l]ower courts have allowed such [retrograde extrapolation] evidence when based on a proper foundation.” *Wolf*, 605 N.W.2d at 385. The Court concluded:

The record, as stipulated to by both parties at trial, does not contain all the information necessary to conduct retrograde blood alcohol level calculations. The record does not contain such basic information as when [the defendant] last consumed alcoholic beverages, the amount and type of alcohol consumed, or even his accurate height and weight at the time of the arrest....[O]n the stipulated

record, we cannot conclude that the district court's ruling was an abuse of its discretion concerning the admissibility of evidence.

Id. Thus, while the holding of *Wolf* is limited somewhat by the lack of information in the stipulated record, the Court's language suggests that a level of "basic information"—including when the defendant last consumed alcohol, the amount and type of alcohol consumed, and the defendant's height and weight—is "necessary to conduct retrograde blood alcohol level calculations."

The limited unpublished Minnesota case law¹ addressing the use of retrograde extrapolation evidence tends to corroborate the view that certain, basic information must be in evidence to support the admission of retrograde extrapolation testimony. For example, in *State v. Pettinelli*, 2014 WL 4388536, (Minn. Ct. App. 2014), *review denied* (Minn. Nov. 18, 2014), the Court of Appeals upheld the admission of retrograde extrapolation testimony. In that case, the expert testified that "she had information about [the defendant's] gender, height, weight, 'how many beers [he] drank between a specific amount of time,' and the fact that he did not consume more alcohol after driving." *Id.* at *10. However, the expert also testified that "she did not have information about [the defendant's] food consumption on the day at issue, what type of beer he consumed, whether he was an 'experienced drinker,' or whether he had any health conditions that might impact the dissipation of alcohol in his blood." *Id.* Based on these facts, the Court of Appeals concluded that "[t]he district court did not abuse its discretion by admitting [the expert's] testimony and permitting the jury to determine the weight to give to her approximation," noting that the expert had specifically "testified about the information that she lacked that may have affected her approximation." *Id.* at *11.

¹ Unpublished decisions of the Court of Appeals are not precedential but may be of persuasive value. Minn. Stat. § 480A.08, subd. 3(c); *Dynamic Air, Inc. v. Bloch*, 502 N.W.2d 796, 800 (Minn. Ct. App. 1993).

In *State v. Bestick*, 1997 WL 360579 (Minn. Ct. App. July 1, 1997), the defendant challenged the sufficiency of the evidence to support his conviction for criminal vehicular homicide. The defendant did not specifically challenge the admissibility of retrograde extrapolation evidence, but the Court of Appeals reviewed the use of retrograde extrapolation evidence as part of its overall review of the sufficiency of the evidence. In that case, the expert who completed retrograde extrapolation analysis was aware of the type of alcohol the defendant drank, the total amount he drank, and the approximate rate and timing of the defendant's drinking. The Court of Appeals ultimately upheld Defendant's conviction, relying—in part—on the retrograde extrapolation analysis. *Id.* at *1-2.

B. The State's proffered expert testimony regarding retrograde extrapolation lacks sufficient foundational reliability, and is therefore inadmissible.

In this case, the State's expert witness, Donna Zittel of the Toxicology Section of the BCA Forensic Science Laboratory, performed retrograde extrapolation to determine the alcohol concentration of Defendant's blood at the time of his DWI offense. In completing her calculations, Zittel knew: Defendant's gender, the time of Defendant's criminal offense, the time his blood sample was collected (approximately four hours after the offense), and Defendant's blood alcohol concentration at the time his sample was collected, as calculated using an approved gas chromatographic procedure. Notably, Zittel did not know Defendant's height or weight, what type of alcohol Defendant had consumed, how much alcohol Defendant had consumed, the rate at which Defendant had consumed alcohol, when Defendant consumed his first or last drink, how long Defendant had been on the road prior to the DWI stop, or what Defendant had eaten that day. Zittel admitted that her calculations were based on the assumptions that Defendant had been drinking socially, rather than binge drinking or taking shots, and that Defendant had substantially absorbed the alcohol in his system at the time of his

DWI arrest. Zittel further admitted that—if Defendant had not been drinking socially, as she assumed—she would need to know when he had consumed his last drink in order to determine when he reached the point of substantial absorption.

In *State v. Wolf*, the only Minnesota Supreme Court opinion to address the issue of retrograde extrapolation, the Court wrote:

The record, as stipulated to by both parties at trial, does not contain all the information necessary to conduct retrograde blood alcohol level calculations. The record does not contain such basic information as when [the defendant] last consumed alcoholic beverages, the amount and type of alcohol consumed, or even his accurate height and weight at the time of the arrest.

Wolf, 605 N.W.2d at 385. As in *Wolf*, the record in the current case also lacks the information “necessary to conduct retrograde blood alcohol level calculations.” The State’s expert did not know Defendant’s height or weight, what type of alcohol Defendant had consumed, how much alcohol Defendant had consumed, the rate at which Defendant had consumed alcohol, when Defendant consumed his first or last drink, or how long Defendant had been on the road prior to the DWI stop. There are no facts in the record to support Zittel’s assumption that Defendant had been drinking socially, as opposed to binge drinking or taking shots.

Defendant’s expert witness credibly testified that retrograde extrapolation requires a forensic scientist to make a reasonable calculation as to when a subject reached his peak absorption of alcohol; if a scientist incorrectly extrapolates back into the absorption phase (when the subject is still drinking or absorbing alcohol), then the scientist ends up calculating a high alcohol concentration at the time of the offense, when there is actually a low alcohol concentration. Because there are no facts in the record tending to establish when Defendant had reached the point of “substantial absorption” of alcohol, Zittel’s retrograde extrapolation testimony for the State lacks foundational reliability and must be excluded from evidence.

The State correctly notes the *Jensen* court's observation that "[v]ariables affecting absorption and elimination rates would most likely go to the weight, rather than admissibility of retrograde extrapolation testimony." *Jensen*, 482 N.W.2d at 240, n.2 (internal citations omitted). While this is true as a general rule, it is contradicted by the Minnesota Supreme Court's subsequent recognition that a certain amount of "basic information," including when the defendant last consumed alcohol, the amount and type of alcohol consumed, and the defendant's height and weight is "necessary to conduct retrograde blood alcohol level calculations." *Wolf*, 605 N.W.2d at 385. Such information is wholly lacking in this case. Indeed, based on a thorough review of Minnesota case law, this Court has been unable to locate any authority, published or unpublished, in which expert testimony pertaining to retrograde extrapolation was admitted into evidence on a factual record as sparse as that presented by the State in this case. In *Jensen*, the experts who completed retrograde extrapolation "had information about [the defendant's] height, weight, gender, amount and type of food eaten, the type of alcohol consumed, when he drank his last beer, the time between the accident and testing, and that he did not consume any alcohol after the accident." 482 N.W.2d at 239. In *Pettinelli*, the expert "had information about [the defendant's] gender, height, weight, 'how many beers [he] drank between a specific amount of time,' and the fact that he did not consume more alcohol after driving." 2014 WL 4388536 at *10. In *Bestick*, the expert was aware of the type of alcohol the defendant drank, the total amount he drank, and the approximate rate and timing of his drinking. 1997 WL 360579 at *1-2. In this case, by contrast, the State's expert did not have information about any of those variables.

The State's proffered expert testimony regarding retrograde extrapolation lacks sufficient foundational reliability, *see* Minn. R. Evid. 702; therefore, the expert testimony of Donna Zittel

is more prejudicial than probative, and must be excluded from evidence. *See* Minn. R. Evid. 403.

IV. Conclusion

The State's proffered expert testimony regarding retrograde extrapolation lacks sufficient foundational reliability, and is therefore inadmissible. Defendant's motion to exclude the expert testimony of forensic toxicology specialist Donna Zittel of the BCA, on the issue of retrograde extrapolation, is GRANTED. The State cannot prove Defendant's blood alcohol concentration within two hours of the time of his driving offense, as required to establish probable cause for the offense of gross misdemeanor driving while impaired in violation of Minn. Stat. §§ 169A.20, subd. 1(5) and 169A.25, subd. 2, absent the challenged expert testimony utilizing retrograde extrapolation. Therefore, Defendant's motion to dismiss Count One of the complaint is GRANTED.

L. J. L.