



Issue Brief: **All Blood is not the Same: Whole Blood v. Serum/Plasma/Supernatant in BAC**

Issue Brief 5 All Blood is not the Same: Whole Blood v. Serum/Plasma/Supernatant in BAC Analysis (May 2015)

This Brief was produced by the Traffic Resource Center for Judges, an initiative of the National Center for State Courts (NCSC). The Traffic Resource Center is a cooperative effort between the Department of Transportation and the National Center for State Courts (NCSC) to establish a resource for judges, court administrators, court clerks, and other court staff on issues related to traffic adjudication.



About the Author: The Brief was prepared by Elizabeth Buner, Knowledge and Information Services Intern under the supervision of Senior Analyst Greg Hurley. Points of view or opinions expressed in the Brief are those of the author and do not represent the official position of the NCSC or NHTSA.



When it comes to BAC analysis in DUI cases, not all blood is the same. There is whole blood, sometimes referred to as “legal blood,” and then there is serum/plasma/supernatant, sometimes referred to as “medical blood.” Though many people may not know that there is a difference between these various blood samples, and if they do, not understand why it matters, that difference can be significant when it comes to DUI prosecutions. It is important for attorneys and judges to understand the difference and why it is important.

Legal Blood v. Medical Blood: What is the Difference?

“Legal blood” is blood that has not been broken down into its solid and liquid components—it is whole.

By contrast, “medical blood” is the result of separating whole blood into its solid and liquid components. When medical blood is tested, the testing is done on only a portion of the blood. Most commonly that testing is done on the serum or plasma. Serum comes from whole blood that has not been treated with an anticoagulant, and is the liquid that remains once the blood cells and other particulate matter have been



removed.¹ Plasma comes from whole blood that has been treated with an anticoagulant, and, like serum, is the liquid that remains once the blood cells have been removed.² Occasionally the testing is done on the supernatant, the clear liquid that results from having precipitated proteins from the blood sample and centrifuging it.³

Why the Blood Sample Matters in DUI Cases

While blood samples in DUI cases are generally analyzed as whole blood that is not always the case.⁴ Blood alcohol testing that is done in hospitals (usually on blood taken for medical purposes) is often performed on the serum or plasma. It is important to find out whether the whole blood or serum/plasma was tested, because the difference will impact the reported BAC.

Depending on whether whole blood or serum/plasma is tested can have a significant impact on the reported blood-alcohol concentration of an individual. The significance of the difference varies from study to study (and, frankly, from individual to individual),⁵ but generally blood-alcohol concentrations in plasma or serum are higher than that in whole blood. One study, “Distribution of Ethanol: Plasma to Whole Blood Ratios, [by] Hodgson and Shajani” concluded that “[b]lood-alcohol concentrations in plasma were approximately 11 percent higher than that of whole blood, and those in supernatant samples were about 5 percent higher.” Another study, “Blood Alcohol Testing in the Clinical Laboratories: Problems and

¹ “Alcohol Toxicology for Prosecutors: Targeting Hardcore Impaired Drivers,” American Prosecutors Research Institute, July 2003; *Commonwealth v. Newsome*, 787 A.2d 1045 (Pa. 2001).

² “Alcohol Toxicology for Prosecutors: Targeting Hardcore Impaired Drivers,” American Prosecutors Research Institute, July 2003.

³ Lawrence Taylor and Steven Oberman, “Drunk Defense Driving,” Wolters Kluwer Law & Business, 2010.

⁴ Lawrence Taylor and Steven Oberman, “Drunk Defense Driving,” Wolters Kluwer Law & Business, 2010.

⁵ Lawrence Taylor and Steven Oberman, “Drunk Defense Driving,” Wolters Kluwer Law & Business, 2010; “Challenges and Defenses II: Claims and Responses to Common Challenges and Defenses in Driving While Impaired Cases,” National Traffic Law Center, Mar. 2013.



Suggested Remedies” found that disparity can be even higher, up to 20 percent higher, in serum-alcohol concentration than in whole blood-alcohol concentration.

The reason for the difference in BAC results is that serum and plasma (which can be expected to have equivalent alcohol concentrations) contain more water than whole blood.⁶ Since alcohol has an affinity for water, the BAC in serum and plasma will be higher than the BAC in whole blood.⁷

Since there are different types of blood samples that may have been tested, it is important for attorneys and judges to know which one was used in a particular case so that, if necessary, the appropriate conversion factor can be applied.

How Courts Have Handled the Variation in Blood Samples

Though the term “blood,” as used in the statutes, is typically not defined, courts have generally accepted that it refers to whole blood.⁸ As such, for a defendant to be found guilty of DUI, the evidence must show that his whole blood BAC violates the statute. If whole blood was not tested, BAC results of a serum, plasma or supernatant analysis are admissible at trial; however, the State must convert the results of the serum/plasma/supernatant test into its whole blood equivalent.⁹ “Evidence offered of a reading based upon a test of blood serum [, plasma or supernatant] without conversion, will not suffice.”¹⁰

While there is no single mathematical formula for converting a plasma, serum or supernatant BAC reading into a whole blood BAC reading, “[m]ost experts agree that if one has a serum [or plasma] sample, a reliable estimate of the whole blood alcohol content can be obtained by dividing the serum [or plasma] alcohol concentration by 1.14 to 1.16.”¹¹ (There will

⁶ “Challenges and Defenses II: Claims and Responses to Common Challenges and Defenses in Driving While Impaired Cases,” National Traffic Law Center, Mar. 2013.

⁷ *People v. Thoman*, 770 N.E.2d 228 (Ill. App. 2002).

⁸ See e.g. *People v. Thoman*, 770 N.E.2d 228 (Ill. App. 2002).

⁹ *People v. Thoman*, 770 N.E.2d 228 (Ill. App. 2002).

¹⁰ *Commonwealth v. Haight*, 50 A.3d 137 (Pa. Super. 2012); *Commonwealth v. Hutchins*, 42 A.3d 302 (Pa. Super. 2012); *Commonwealth v. Bartolacci*, 598 A.2d 287 (Pa. Super. 1991).

¹¹ *Watson v. State*, 2013 Alas. App. LEXIS 133 (2013); “Challenges and Defenses II: Claims and Responses to Common Challenges and Defenses in Driving While Impaired Cases,” National



be some variance due to individual blood chemistry, i.e. differing ratios between serum and whole blood due to the water content of each sample.¹²) However, erring on the side of caution, it is not uncommon for experts to divide by a more conservative number of 1.20.¹³ Experts will also often introduce a high end conversion factor and a low end conversion factor “to get a range of potential whole blood alcohol levels from Defendant’s blood serum sample.”¹⁴ At least one state, Illinois, has done away with the guesswork by establishing a fixed value for the conversion factor. In Illinois, the concentration of alcohol in blood serum or blood plasma should be “divided by 1.18 to obtain a whole blood equivalent.”¹⁵

Online legal research provided by LexisNexis.



Traffic Law Center, Mar. 2013. Unlike the conversion rates for plasma or serum, the conversion rate for supernatant is less clear; however, it is generally accepted to be lower (one study said approximately 1.05) as supernatant is more similar to whole blood.

¹² *Commonwealth v. Newsome*, 787 A.2d 1045 (Pa. 2001); *see also Watson v. State*, 2013 Alas. App. LEXIS 133 (2013).

¹³ “Challenges and Defenses II: Claims and Responses to Common Challenges and Defenses in Driving While Impaired Cases,” National Traffic Law Center, Mar. 2013.

¹⁴ *Commonwealth v. Newsome*, [787 A.2d 1045, 1049 \(Pa. 2001\)](#).

¹⁵ [20 Ill. Admin. Code § 1286.40](#) (2012).