Intoxilyzer? 9000 in Texas

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However, Texas is currently transitioning to the Intoxilyzer 9000 and training breath test operators through local technical supervisors. Implementation of the Intoxilyzer 9000 was scheduled for Summer 2015, but due to software issues and bugs, the 9000 has not been approved for evidential use. While we can only speculate on the actual software that will eventually be approved, much is already known about the Intoxilyzer 9000 from use in other states. Georgia, Colorado, and parts of New York State use the Intoxilyzer 9000 for forensic evidential purposes.

By understanding the information and studies from other states regarding inherent shortcomings, a Texas criminal defense lawyer can prepare to attack the Intoxilyzer 9000 regardless of the final software. This article will equip the DWI trial attorney with the science of infrared spectroscopy and an intimate knowledge of the Intoxilyzer 9000 needed to effectively represent clients.

How Breath Contains Alcohol
All humans must breathe to stay alive. Breathing involves the absorption of oxygen from the environment and the elimination of carbon dioxide from the bloodstream. We breathe through our mouth or nose and the air is transported by the trachea or windpipe into the lungs. In the lungs, the trachea branches into smaller air tubes called bronchi, which continue to branch and eventually terminate in small air sacs called alveoli. These alveoli are surrounded by capillaries that are elastic in nature. It is in these pulmonary alveoli that blood is able, by diffusion, to release carbon dioxide and absorb oxygen for use throughout the body. If alcohol is present in the blood, it will also diffuse across the alveolar membrane into the breath in a fixed proportion to the alveolar blood alcohol concentration and the core body temperature.

The chemical principle that governs the diffusion of gases between the blood and the breath in the pulmonary alveoli is Henry's Law. Henry's Law states that the concentration of a material in the gaseous state above a liquid containing the dissolved material will be proportional to the concentration of the material in the liquid state. Henry's Law applies to alcohol vapor (gas) in the lung in contact with blood (liquid) containing alcohol. Alcohol continuously diffuses across the one-cell-thick semi-permeable membrane of the capillaries into the air of the lung in proportion to its concentration in the blood. Ultimately, if given enough time, the breath alcohol concentration (BrAC) will reach a defined balance with the blood alcohol concentration (BAC) in accordance with Henry's Law. This balance is called equilibrium. At equilibrium, the relationship between the concentration of alcohol in the blood and the breath can be described by the blood:breath ethanol partition ratio. At 34 degrees Celsius, the alleged average temperature of human breath, this blood:air ethanol partition ratio has been experimentally determined to be approximately 2100:1. Theoretically, at 34 degrees Celsius there is the same amount of alcohol in 100 mL of blood as there is in 210 L of air in contact with that blood in a closed container. This assumes that the air within the container has had sufficient time to reach equilibrium with the liquid state. Thus, it is necessary to try to obtain an air sample from a defendant that has reached sufficient equilibrium between the air in the lungs and the pulmonary blood to satisfy accuracy and reliability.

**Infrared Spectroscopy**

Before attacking the specific problems with the Intoxilyzer 9000, a brief overview of Infrared Spectroscopy (IR) is needed. Depending on their atomic and electronic structure, molecules absorb energy (light) of well-defined wavelengths. For molecules, the relative intensity of infrared light absorption at different wavelengths functions as a molecular fingerprint specific to a given molecule. Thus, by evaluating the relative intensity of absorption at specific wavelengths of infrared light, one can specifically identify ethyl alcohol and hopefully differentiate its infrared response from that of other volatile compounds. Additionally, by measuring the amount of infrared light absorption at specific wavelengths, one can use a standard differential absorption technique to determine the amount of a given molecule in a sample. The Beer-Lambert Law dictates that the quantity of light absorbed will always be proportional to the concentration of the molecule in the solution. This is the physical principle the Intoxilyzer 9000 uses to determine the amount of alcohol in a breath sample.

**The Intoxilyzer? 9000**

The heart of the Intoxilyzer 9000 is its optical or analytical bench (see diagram on page following). At one end of the bench (left side), an infrared source generates light in the infrared region of the spectrum, which is pulsed through the sample chamber at a defined frequency (10 Hz). In the sample chamber, the infrared light is allowed to interact with a breath sample. If the breath is alcohol free, the infrared light should pass through the sample chamber freely; however, if alcohol is present, specific frequencies or wavelengths of infrared light will be absorbed. At the opposite end of the sample chamber (right side), a lens focuses the energy (light) onto a detector, made up of four crystalline detectors that generate electrical signals proportional to the incident radiation. Prior to it reaching the detector, the infrared light is filtered by four single wavelength filters that are integrated into the detector unit. Once the light passes through the filter...
and strikes the detector, the detector generates an electric signal proportional to the amount of light striking it. This signal is then transmitted to a processing unit that interprets the electrical signal.

Prior to the delivery of a breath sample, the instrument allegedly establishes a zero reference point by measuring the amount of energy (light) striking the detector when the sample chamber is filled with ambient/room air. During a breath test, as the amount of alcohol vapor in the sample chamber rises, the amount of infrared energy (light) reaching the detector falls relative to the zero point measurement. By determining the difference in the amount of energy (light) striking the detector between the two measurements, the instrument is able to mathematically calculate the breath alcohol concentration in the test sample. The instrument then analyzes the relative response at each of the four detectors to confirm the identity of ethyl alcohol to the exclusion of other substances, if possible.

In summary, the Intoxilyzer 9000 looks for the presence and amount of alcohol in a breath sample. It uses infrared light to both identify and quantify ethyl alcohol because ethyl alcohol absorbs infrared light in a unique way. The pattern of absorption is used to identify alcohol, and the amount of absorption is used to quantify alcohol in a breath sample. The Intoxilyzer 9000 then prints the analytical result in grams of alcohol per 210 liters of breath, as required by Texas law.

**Inherent Problems in the Intoxilyzer 9000**

1. **Nonspecificity for Alcohol.** The main difference between the Intoxilyzer 5000-EN and 9000 is the ethanol “fingerprint.” Where the 5000 measured the carbon-hydrogen (C-H) bond vibrations in the 3 micron region of ethanol’s molecular fingerprint, the 9000 is measuring the carbon-oxygen (C-O) vibration in the 8.9 micron region. The problem exists that other molecules are commonly found in the human body with this same C-O stretching. Specifically, other organic molecules, which can potentially contaminate breath samples, also absorb IR radiation at 9 microns. These include other alcohol, esters, and ethers that contain both the methyl group and carbon-oxygen bonds in their molecular structures. Dimethyl sulfoxide (DMSO) exhibits IR absorption in both the 3.4 and 9.4 micron regions. DMSO is a common solvent for organic compounds and is also used in the treatment of interstitial cystitis (aka painful bladder syndrome) and scleroderma, with rapid absorption occurring through the skin and mucous membranes. Additionally, diethyl ether has been found to produce false ethanol readings at 3.4 and 9.5 microns, the latter overlapping absorption at 9.4 microns. Diethyl ether is widely used as a solvent for waxes, fats, oils, perfumes, alkaloids, and gums. Exposure to ether vapor is highly problematic because of its high tissue solubility and its low partition ratio in humans. Among the numerous esters that can contaminate breath samples, ethyl formate, methyl butanoate, propyl acetate, and pentyl acetate are noteworthy because they are synthetic flavoring agents that allow many products including...
ice cream, soft drinks, candy, and other foods?to taste natural in flavor. Furthermore, the GBI cited problems with the lack of sensitivity to compounds other than alcohol when evaluating the 9000. The 9000 actually scored the lowest of any competitor on the GBI survey to a list supplied by CMI to rate the specificity/selectivity for ethanol. Clearly breath-alcohol analysis via IR at 3.4 and 9.4 microns is not entirely ethanol specific, and any subject?s employment, medical, or eating history can and should be ascertained through appropriate evaluation of the subjects and the compounds.

Similarly, acetone may be found on the breath of individuals in a state of ketosis from untreated diabetes, prolonged fast, or a low-carb diet. Acetone impairment may resemble alcohol intoxication. However, the Intoxilyzer 9000 does not subtract the effect of acetone from the results. Texas recognizes the need to evaluate whether acetone testing will need to be a necessary part of official inspection in the future.

2. **Texas Won?t Produce the Histogram.** The 9000 produces a graphical representation of the breath flow, breath volume, blow duration, and breath alcohol concentration for every subject test. Georgia and Colorado both produce variations of the histogram/graph. From this graph, the skilled defense attorney or expert witnesses can find answers to critical, potentially exonerating, questions: Was the breath flow continual or spiked? Did the breath sample achieve sufficient slope to be considered a valid test? Was the slope indicative of mouth alcohol? Was the exhalation time sufficient to create a level slope? Likewise, the histogram would reveal what the breath alcohol concentration was at any given point during the exhalation. Texas Department of Public Safety (DPS) has chosen not to save or include the histogram next to the sample result. Why wouldn?t Texas DPS provide all the information possible? The 9000 is absolutely capable and does produce a histogram with every breath test, but the software determines what is printed. In fact, the entire report format of the breath test results is configurable by CMI technical personnel per customer requirements.

In an email dated April 28, 2014, from Scott Brown with Texas DPS Tyler to Larry Smith, Regional Manager of North Texas Breath BAL, Mr. Brown states that by providing more information on an Analytical Report/Breath Test slip would just give ?most jurors ?rope and a tree? with this extra information in a closed jury room. Additionally, Mr. Brown notes that jurors ?are not even allowed to have calculators in there. Why would we want them trying to subtract and add tolerances and temperatures without some kind of guidance (i.e., not the defense attorney suggesting they ?do the Math!?). Furthermore, Mr. Brown does ?not like the actual temperatures printed on any of the Reports . . . [O]ur testimony should be ?within tolerance, or notified otherwise? . . . It is already confusing enough when we tell a jury that the instruments do not ?care? about breath temperature. I believe printed simulator temperature information will cloud the issue even more on the stand.

Apparently, Mr. Brown failed to read Fox and Hayward, who found that there is an 8.62% increase in breath-alcohol concentration over blood-alcohol concentration for each degree Centigrade in-crease in core body temperature. However, Mr. Brown and DPS have chosen to only include basic information in the Analytical Report/Breath Slip so jurors can?t hang themselves with reasonable doubt.

3. **DPS Refuses to Produce Even More Information.** According to the Texas 9000 breath test slip obtained by the author, Texas will also not produce the following information:

a. the observation period start time;
b. when the observation period ended;
c. the last instrument calibration date;
d. whether the observation period was conducted by a cer-tified Breath Test Operator (BTO);
e. the last BTO certification date;
f. if the BTO had the subject remove any foreign material from the mouth cavity;
g. if the subject was deprived access to foreign material dur-ing the observation period;
h. that the subject did not belch, regurgitate, or intake any foreign material into the mouth during the observation period; and
i. the uncertainty measurement for the result.
All of this information is readily accessible and capable of being produced if Texas wanted it to be. The skilled trial lawyer will bring this to the jury's attention and ask them to demand more open and honest forensic science. If there is nothing to hide, then why not provide all of the information possible?

4. Four Filters with No Zero Set. The original 5000 used a tungsten filament light source that provided continuous IR and visible radiation to a five-filter chopper/filter wheel that rotated in front of the detector. The 9000 uses a grey body infrared light that pulses the energy through the sample chamber to a stationary detector that contains four filters, each for a specific wavelength of IR radiation. Where the 5000 had a blank or a zero filter in the wheel, the 9000 does not have a detector for a true zero. Instead, the machine assumes or is programmed to read zero if the filters do not detect other samples besides alcohol. Additionally, the Intoxilyzer 9000 ?masks? all results less than 0.007 and instead reports it as 0.000. How can the machine be sure that it didn't miss one of the contaminants listed above? If the detector has never been programmed or tested with the contaminants listed above, how can it truly be a zero? The answer is that it assumes that it is a zero. That's not good enough for forensics.

5. Common Problems Between the 5000 and 9000. Luckily for the defense attorney, the 9000 still maintains several similar problems that juries have been responsive to (1). Both Colorado and Georgia still use a 20-minute deprivation or observation period. Presumably, this is because CMI suggests this, but until CMI publishes its own operator manual, we will not actually know for sure. Texas still only requires a 15-minute waiting period. Further, Texas Breath Alcohol Testing Regulations are in the process of being changed to: ?An Operator shall remain in the continuous presence of the subject at least 15 minutes immediately before the test and should exercise reasonable care to ensure that the subject does not place any substances in the mouth. And while Texas recognizes that direct observation is not necessary, Texas addresses increased scrutiny of the continuity requirement by stating that ?clearly the ?best practice? is for the Waiting Period to be conducted entirely at the testing site? (2). The CMI warranty is only valid for one year from the date of invoice to the initial purchaser. The warranty extends only to the original purchaser and does not include abuse, misuse, cables, switches, or use of the product for other than its intended purpose. Additionally, the warranty does not apply if the product is in any way tampered with or modified without express written permission from CMI, Inc. CMI sells an extension of the warranty for one year for $125. The warranty argument will come into play after the first year from purchase, which should be soon with the delayed implementation in Texas (3). CMI still won't sell the new source code or COBRA V5 software to the 9000 without a protective order and non-disclosure agreement. Any viewing of the source code must be done at CMI and may not be sent outside for independent analysis. CMI still won't sell private citizens their machine (5). The breath tests must still be within 0.02 of each other (6). There is still no ToxTrap requirement or way to save the breath sample for independent testing using gas chromatography. For the 9000, although capable of running a dry gas simulator, Texas has chosen a wet bath?compatible option like the 5000 simulator sample. As with any preparation of a simulator solution, human error is always a factor.

6. New 9000 Issues. First, as discussed above, the optical bench is the heart of the 9000. The optical bench is shielded by a metal case that allegedly protects it from ambient electromagnetic radiation. However, it also has a radio frequency detection circuit that will still cause it to read radio frequency interference detected if a source is sufficiently strong and in the vicinity during the breath test. Why have the antenna and prompt if the optical bench is absolutely protected by the metal case? Second, the new software has so many bugs and issues that the machines have been delayed for implementation until they can be ?solved.? Third, the sample chamber in the 9000 is only approximately 6 inches long, where the 5000? is 10 inches long. This is a lot less room and a smaller sample being analyzed; therefore, any mistake will have a conversely larger effect in the measurement. And lastly, regarding the valves that control the source of tested air: The 5000? s three-way mac valve has been replaced by a valve of least resistance in the 9000 that can actually go back and forth. Arguably, any valve that can go back and forth could allow contamination in from
previous samples, ambient air, or even the simulator solution.

7. **Why Is Texas Still with CMI?** In a comprehensive analysis of the Intoxilyzer 9000, the Swedish-made Evidenzer 240 Mobile, and the Datamaster, the Intoxilyzer scored last in the diagnostic criteria where each machine was tested to determine whether it possessed all necessary diagnostic elements to ensure accurate and reliable testing. Additionally, the evaluation clearly showed the users ranked the 9000 lowest in the specificity/selectivity of the machine to be completely specific for ethanol.

8. Does Texas have some sort of exclusivity contract with CMI? Did Texas conduct its own evaluation against other machines? Can we see that report?

Despite many remaining issues and questions, DPS chose the Intoxilyzer 9000, which will eventually make its way into the hands of Texas breath test operators. It’s not a good sign that the machine already has software issues that delayed implementation. However, the DWI trial attorney must be ready for the inevitable implementation. Like any machine, it is not perfect. It will not behave perfectly. The Intoxilyzer has certain inherent scientific issues that are ripe for cross-examination. Just as the State will always strive to bring out the best in forensic science, we as defense attorneys must always remind the State about the flaws in its method and instrumentation. And we must educate the public and juries about the limitations, unreliability, and inaccuracies in the State’s forensic testing. Only through these checks and balances will the citizens charged with DWI actually receive reliable and accurate forensic chemical testing.

**Notes**

1. Thank you to Frank Sellers and Matthew Malhiot for their editing. Also, thank you to Matthew Malhiot Forensic Alcohol Consulting & Training, LLC, 1353 Riverstone Parkway, Suite 120-382, Canton, GA 30114, [http://www.forensicalcoholconsulting.com](http://www.forensicalcoholconsulting.com), and Rhidian Orr, Galleria Office Towers, 720 S. Colorado Blvd #1110n, Denver, CO 80246, [http://www.orrlaw.com](http://www.orrlaw.com), for their tutelage.


3. Id.


7. Id.

8. Id.

9. Id.

10. Id.

11. Id.

12. Id.

13. Id.
42. Id.

43. Id.

44. Id.

45. Texas Penal Code §49.01(1)(a) (West 2001); GBI Operator Transition Training Manual 2015 Revision, p. 16.

46. GBI Intoxilyzer 9000 Operator Transition Training Manual 2014 Revision, p. 5; GBI Evaluation of Breath Alcohol Testing Instruments to Replace the Intoxilyzer 5000, pp. 6, 39, and 77 (September 2012).


48. Id.

49. Id.

50. Id.


52. Id.

53. Id.


55. GBI Evaluation of Breath Alcohol Testing Instruments to Replace the Intoxilyzer 5000, p. 65 (September 2012). Compounds that were analyzed by the 9000 for specificity included acetone, acetaldehyde, methanol, 2-propanol, toluene, ethyl acetate, 2-butanone, 2-butanol, 1-propanol, acetonitrile, methylene chloride, and 2-methyl propanol. Id. at 93.

56. GBI Evaluation of Breath Alcohol Testing Instruments to Replace the Intoxilyzer 5000, p. 64 (September 2012).


58. See "The Effect of Acetone on the Intoxilyzer 9000," PowerPoint presentation by Janeen Kubilus, Forensic Scientist, Breath Alcohol Laboratory, Law Enforcement Support-Crime Laboratory Service (432)386-0353, slide 6. Ms. Kubilus stopped replying to my emails after I sent her a copy of her presentation and I asked her for clarification of her research and findings.

59. Id.

60. See "The Effect of Acetone on the Intoxilyzer 9000," PowerPoint presentation by Janeen Kubilus, Forensic Scientist, Breath Alcohol Laboratory, Law Enforcement Support-Crime Laboratory Service (432)386-0353, slide 23. See also Breath Alcohol (BAL Advisory Board Meeting Minutes, p. 3 (05/2014); email from Heather Greco, Quality Assurance Specialist with Texas DPS to Larry Smith, et al., on May 26,
2014.

61. See Breath Alcohol (BAL Advisory Board Meeting Minutes, p. 3 (05/2014); email from Heather Greco, Quality Assurance Specialist with Texas DPS to Larry Smith, et al., on May 26, 2014.


64. See attached Texas Intoxilyzer 9000 breath test slip versus Colorado breath slip.

65. GBI Evaluation of Breath Alcohol Testing Instruments to Replace the Intoxilyzer 5000, pp. 54 and 56 (September 2012).

66. GBI Evaluation of Breath Alcohol Testing Instruments to Replace the Intoxilyzer 5000, p. 54 (September 2012).


68. Id.

69. Id.


73. Id.

74. GBI Operator Transition Training Manual 2015 Revision, p. 16.

75. See ?The Effect of Acetone on the Intoxilyzer 9000,? PowerPoint presentation by Janeen Kubilus, Forensic Scientist, Breath Alcohol Laboratory, Law Enforcement Support-Crime Laboratory Service (432)386-0353, slide 10.


78. See An Overview of the Training and Implementation of the Intoxilyzer 9000, pp. 3 and 6; emailed from Larry Smith, Regional Manager North Texas BAL to Kristina Aguirre on July 14, 2014.
79. See An Overview of the Training and Implementation of the Intoxilyzer 9000, p. 7; emailed from Larry Smith, Regional Manager North Texas BAL to Kristina Aguirre on July 14, 2014. See also Texas Depart of Public Safety Interoffice Memorandum from Randall Beaty, Deputy Scientific Director to Luis Gonzalez, Assistant Director THP on February 24, 2014.

80. GBI Evaluation of Breath Alcohol Testing Instruments to Replace the Intoxilyzer 5000, p. 73 (September 2012).

81. Id.

82. Id.

83. GBI Evaluation of Breath Alcohol Testing Instruments to Replace the Intoxilyzer 5000, p. 80 (September 2012).

84. GBI Evaluation of Breath Alcohol Testing Instruments to Replace the Intoxilyzer 5000, pp. 55, 76, and 80 (September 2012).

85. GBI Evaluation of Breath Alcohol Testing Instruments to Replace the Intoxilyzer 5000, p. 55 (September 2012).

86. GBI Evaluation of Breath Alcohol Testing Instruments to Replace the Intoxilyzer 5000, p. 70 (September 2012). Although no written policy exists on who can purchase or receive training, this author was denied the ability to purchase a machine when he submitted a request as a private citizen and not an attorney.

87. See An Overview of the Training and Implementation of the Intoxilyzer 9000, p. 6; emailed from Larry Smith, Regional Manager North Texas BAL to Kristina Aguirre on July 14, 2014.


90. Id.

91. CMI Manual, also according to Mathew Malhiot.

92. CMI Manual, also according to Mathew Malhiot.

93. GBI Evaluation of Breath Alcohol Testing Instruments to Replace the Intoxilyzer 5000, pp. 11?12 (September 2012).

94. GBI Evaluation of Breath Alcohol Testing Instruments to Replace the Intoxilyzer 5000, pp. 64?65 (September 2012).

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