STATE OF OKLAHOMA
BOARD OF TESTS FOR ALCOHOL AND DRUG INFLUENCE
Post Office Box 36307
Oklahoma City, Oklahoma 73136-2307
Phone: (405) 425-2460 Fax: (405) 425-2490
www.bot.ok.gov

Dr. Jarrad Wagner, Ph.D., F-ABFT
Chairman

Joshua Smith
Director

Evaluation and Comparison of the Intoxilyzer® 8000, Intoxilyzer® 9000, and the Alcotest® 9510 evidential breath alcohol measurement devices

Dr. Jarrad Wagner[1], Joshua Smith[2], Christopher Pape[2], David Cravens[2]

Overview

The Board of Tests for Alcohol and Drug Influence (BOT), a State of Oklahoma agency is statutorily authorized pursuant to 47 O.S. §759 to establish equipment and device standards and evaluation procedures for the evaluation of breath testing devices used in Oklahoma. The Intoxilyzer® 8000, Intoxilyzer® 9000, and Alcotest® 9510 were comparatively evaluated according to the Board of Tests evaluation procedures with results demonstrating that the instruments meet, or exceed, the requirements of the BOT on all criteria including alternative power sources, mobile and stationary testing environments, accuracy, linearity, precision, radio frequency interference (RFI), range exceed detection, ambient alcohol detection, and interference detection. Human subject testing completed provided additional comparison of correlating results with near-simultaneous breath test analysis from all instruments being evaluated. Two simple linear regression analyses were conducted to determine if Intoxilyzer® 8000 results could be predicted by the Intoxilyzer® 9000 and the Alcotest® 9510. Results indicated the two devices were strongly and positively associated with the Intoxilyzer® 8000: Intoxilyzer® 9000 and Intoxilyzer® 8000, r = .993; Alcotest® 9510 and Intoxilyzer® 8000, r = .996. According to the evaluation standards of the BOT, all instruments were found to be an accurate and reliable means of determining breath alcohol concentrations for evidential forensic measurement.

1. Dr. Jarrad Wagner Ph.D., F-ABFT (Chairman of the Board)
2. Supporting staff: Joshua Smith (Director of the Board); Christopher Pape (Breath Alcohol Testing Program Admin); David Cravens (Training Admin)

The following report was adopted by the Board *en banc* as official record of the agency at the Regular Meeting held November 14, 2023.

Introduction

The Board of Tests for Alcohol and Drug Influence (BOT) (*made up of a body of eight professionals and experts in the forensic science and law enforcement fields*) sets forensically approved standards and procedures for breath alcohol testing & training, maintains approved devices and equipment, and oversees the administration of the breath testing programs in Oklahoma.

The Intoxilyzer® 8000 (CMI Inc., Owensboro, Kentucky) is an automated evidentiary breath alcohol analyzer currently approved and maintained for use in the state of Oklahoma. The Intoxilyzer® 8000 is an infra-red (IR) breath alcohol analyzer that uses a pulsed infra-red source producing radiation across two wavelengths between 3 µm and 9 µm with pyroelectric IR detectors analyzing the breath. CMI Inc. notified BOT in November 2021 that the Intoxilyzer® 8000 would no longer be manufactured and some parts would still be available "new", while some parts would be "recertified" moving forward. Oklahoma has been using the Intoxilyzer® 8000 since 2007. With this information, the BOT took action to evaluate next generation IR evidential breath testing instrumentation for consideration to be used in Oklahoma. Oklahoma state statutes require the evidential instrument to be listed on the Department of Transportation National Highway Traffic Safety Administration (NHTSA) current or supplemented Conforming Products List of Evidential Breath Alcohol Measurement Devices (EBTs). The BOT identified two IR devices currently in production on the list. BOT completed comparative evaluations of the current state approved CMI Inc. Intoxilyzer® 8000 with the Draeger Alcotest® 9510 and the CMI Inc. Intoxilyzer® 9000.

BOT instrument evaluation procedures included evaluation of alternative power sources, mobile and stationary testing environments, accuracy, linearity, precision, radio frequency interference (RFI), range exceed detection, ambient alcohol detection, and interference detection. The Intoxilyzer® 8000, Alcotest® 9510, and Intoxilyzer® 9000 were evaluated according to the procedures at the time of evaluation. The objective of this document is to present the BOT evaluation data and findings for these instruments so the Board can make an informed decision and selection of the state's next generation IR evidential instrument.

Methods

General

In accordance with the BOT instrument and evaluation procedures, performance of the three instruments were evaluated using four different power sources. In addition, testing was completed in stationary and mobile environments. This report represents the data collected during the course of those evaluations performed.

External calibration checks of the instruments were conducted using calibrated wet-bath simulators approved by Oklahoma administrative code (*Guth Laboratories Model 2100, Harrisburg, Pennsylvania, USA*) operated at 34.0 ± 0.2 °C. A digital thermometer (*Alpha Technics, 5000 Series, PN:91-5443 calibrated by Guth Laboratories 06/29/2023*) was used throughout the evaluation to verify the displayed temperature of the wet-bath simulator. External calibration checks simulate breath alcohol vapors during testing at specified points in the evaluation using National Institute of Standards and Technology (NIST) traceable reference solutions of known concentration.

Commercial NIST reference standard solutions were used (*Guth Laboratories Harrisburg, Pennsylvania, USA*), the concentrations were verified by the agency using an Intoxilyzer® 8000 dedicated as the agency's "Alpha Unit" with simulators pursuant to the agency's maintenance procedures with exception to the "range exceed testing". Simulators were connected to the instrument using a closed loop, recirculating system to deliver simulator port samples. Simulator samples were also introduced via the instrument breath hose. A maximum of twenty (20) samples were analyzed for each 500 mL bottle of reference standard solution concentration commissioned.

Commercial reference dry gas standards were used (*ILMO Products, Jacksonville, Illinois, USA*), the concentrations in each canister utilized were verified by the agency using an Intoxilyzer® 8000 dedicated as the agency's "Alpha Unit" pursuant to the agency's maintenance procedures.

Ambient alcohol testing

The BOT evaluation policy requires ambient alcohol detection be tested to ensure that the instrument aborts, shows no change in measurement, or responds appropriately to any testing sequence in the presence of ambient alcohol.

Testing was completed by placing the instrument breath hose in the neck of a 500 mL reference solution bottle containing 125 mL of room temperature 0.100 g/210L reference standard solution during the first system blank test of an air blank-breath test–air blank testing sequence (ABA mode). Five (5) replicates of a breath test were performed.

Interference testing

The BOT evaluation policy requires interference detection or sensitivity be tested to ensure the instrument is capable of flagging the interference, aborting the test, or demonstrating no reaction by reporting a measurement equal to but not exceeding the known reference solution standard (+/-) 0.005 g/210L.

Testing was completed by performing five (5) replicates of an air blank-breath test–air blank testing sequence (ABA mode). A 0.020 g/210L reference standard solution was prepared with each of the following compounds individually at the specified concentration level(s).

Aqueous Mixture (vapor concentration)	**Max Result**
500 mL 0.020 g/210L Ethanol + 0.5 mL 99% or higher Acetone	0.020 g/210L +/- 0.005, or interference flag, test aborted
500 mL 0.020 g/210L Ethanol + 0.5 mL 99% or higher Isopropanol	0.020 g/210L +/- 0.005, or interference flag, test aborted

Mobile environment testing

The BOT evaluation policy requires instrument evaluation be conducted in mobile testing environments currently utilized in Oklahoma. The instruments have the ability to operate on alternating current (AC) or direct current (DC). The analytical and functional performance of the instruments were evaluated in an Oklahoma "ENDUI" van outfitted with a gasoline powered pure sine wave generator outputting AC power to the instrument.

The analytical and functional performance of the instruments were evaluated in an Oklahoma Highway Patrol SUV outfitted with a pure sine wave inverter outputting AC power to the instrument.

The mobile environment testing consists of verifying a maximum variation to the known traceable standard of (+/-) 5% or (+/-) 0.005 g/210L was demonstrated by the instrument when analyzing known reference standard solutions using air blank-breath test–air blank testing sequence (ABA mode) and using air blank-cal check–air blank testing sequence (ACA mode). A maximum variation to the known traceable standard of (+/-) 5% or (+/-) 0.005 g/210L was also required to be demonstrated by the instrument when analyzing a known dry gas standard using air blank-cal check–air blank testing sequence (ACA mode).

Twenty (20) samples total were analyzed for each aqueous solution mixture listed in the table below. Ten (10) samples were introduced through the instrument's simulator port, ten (10) samples were introduced through the instrument's breath hose. Ten (10) samples total were introduced into the instrument's simulator port for dry gas

standard measurement.

The following table below illustrates the acceptable measured ranges modeled from the published NHTSA Model Specifications for Devices to Measure Breath Alcohol:

Concentration	Range
500 mL 0.000 g/210L (distilled water)	0.000 – 0.000
500 mL 0.020 g/210L (Aqueous mixture)	0.015 – 0.025
500 mL 0.040 g/210L (Aqueous mixture)	0.035 – 0.045
500 mL 0.100 g/210L (Aqueous mixture)	0.095 – 0.105
500 mL 0.200 g/210L (Aqueous mixture)	0.190 – 0.210
0.080 g/210L (Dry Gas Standard)	0.075 – 0.085

Stationary environment testing

The BOT evaluation policy requires instrument evaluation be conducted in a stationary testing environment. The instruments have the ability to operate on alternating current (AC) or direct current (DC). The analytical and functional performance of the instruments were evaluated in the BOT administrative offices on AC and DC.

The stationary environment testing consists of verifying a maximum variation to the known traceable standard of (+/-) 5% or (+/-) 0.005 g/210L was demonstrated by the instrument when analyzing known reference standard solutions using air blank-breath test–air blank testing sequence (ABA mode) and using air blank-cal check–air blank testing sequence (ACA mode). A maximum variation to the known traceable standard of (+/-) 5% or (+/-) 0.005 g/210L was also required to be demonstrated by the instrument when analyzing a known dry gas standard using air blank-cal check–air blank testing sequence (ACA mode).

Twenty (20) samples total were analyzed for each aqueous solution mixture listed in the table below. Ten (10) samples were introduced through the instrument's simulator port, ten (10) samples were introduced through the instrument's breath hose. Ten (10) samples total were introduced into the instrument's simulator port for dry gas standard testing.

The following table below illustrates the acceptable measured ranges modeled from the published NHTSA Model Specifications for Devices to Measure Breath Alcohol:

Concentration	Range
500 mL 0.000 g/210L (distilled water)	0.000 – 0.000
500 mL 0.020 g/210L (Aqueous mixture)	0.015 – 0.025
500 mL 0.040 g/210L (Aqueous mixture)	0.035 – 0.045
500 mL 0.100 g/210L (Aqueous mixture)	0.095 – 0.105
500 mL 0.200 g/210L (Aqueous mixture)	0.190 – 0.210
0.080 g/210L (Dry Gas Standard)	0.075 – 0.085

Range exceed testing

The BOT evaluation policy requires instrument measurement range exceeded detection be tested to ensure that the instrument aborts or responds appropriately to any testing sequence exceeding the instrument's reported measurement range. This can also be termed the instrument's "highest limit of measurement".

Testing was completed by preparing 500 mL of an ethanol solution to deliver a vapor alcohol concentration of 0.05 g/210L or greater than the reported range of the instrument using a simulator operating at a temperature of 34.0 °C (+/- 2%). The wet-bath simulator containing the prepared ethanol solution was used to deliver the breath sample via the external breath hose during an air blank-breath test–air blank testing sequence (ABA mode). Five (5) replicates of a breath test were performed.

RFI testing

The BOT evaluation policy requires Radio Frequency Interference (RFI) detection be tested to ensure that the instrument aborts, shows no change in measurement, or responds appropriately to any testing sequence in the presence of RFI.

Testing was accomplished by performing an air blank-calibration check-air blank-calibration check–air blank testing sequence (ACACA mode). Five (5) series of tests were performed. On the first sample analysis, the instrument was allowed to complete a measurement of a known traceable reference standard without introducing RFI. On the second sample analysis, the instrument was allowed to measure a known traceable reference standard while introducing RFI from a 460 MHz FRS handheld radio.

Human subject testing

The BOT evaluation policy allows an optional evaluation consisting of three or more (3+) live volunteers. This evaluation is conducted in a stationary environment for increased safety of the volunteer drinkers. The goal of the optional evaluation is to comparatively evaluate each instrument with the Intoxilyzer® 8000 by analyzing the same live subject sample near-simultaneously on each device to identify measurement agreement and/or anomalies/disagreements for the report being prepared for the Board. "Near-simultaneous" was defined as samples collected over the span of ten (10) minutes.

Volunteers were evaluated by a Drug Recognition Expert (DRE) Instructor to ensure they were not impaired prior to dosing. An initial breath alcohol screening was administered on each volunteer prior to dosing to establish a zero-baseline using an agency calibrated and state approved portable breath testing device (CMI, Inc. Intoxilyzer® 800). All dosing guidelines were followed in accordance with NHTSA dosing guidelines and carried out by qualified authorized personnel (DRE Instructors). An identifiable letter (A,B,C…) was assigned to each volunteer making note of the sex (M, F). A minimum of two (2) breath samples on each device being evaluated spread over two (2) or more hours from each volunteer after the first hour of drinking was completed. Prior to initiating sample collection, a 15-minute deprivation period was completed. Each sample collected used the instrument configuration ACABA (Air Blank, Calibration Check, Air Blank, Breath Test, Air Blank). An approved dry gas standard was utilized for the Calibration Check.

Intoxilyzer® 9000 and Draeger Alcotest® 9510 breath alcohol results obtained from human subjects were compared against breath alcohol test results obtained on an agency maintained Intoxilyzer® 8000. The Intoxilyzer® 8000 is the current approved and maintained instrument in use in Oklahoma. It has been used since 2007 for the purposes of criminal and civil actions.

Results and findings

Ambient alcohol testing

Intoxilyzer® 8000
Findings concluded that the Intoxilyzer® 8000 detected the ambient alcohol interference and aborted the testing sequence resulting in an "ambient fail" exception message for all tests conducted with no reported measurement.

Alcotest® 9510
Findings concluded that the Alcotest® 9510 detected the ambient alcohol interference and aborted the testing sequence resulting in an "alcohol in amb. air" exception message for all tests conducted with no reported measurement.

Intoxilyzer® 9000
Findings concluded that the Intoxilyzer® 9000 detected the ambient alcohol interference and aborted the testing sequence resulting in an "ambient fail" exception message for all tests conducted with no reported measurement.

Interference testing

Intoxilyzer® 8000
The presence of acetone and isopropanol during simulated breath tests resulted in an "interferent detect" exception message for all tests conducted resulting in termination of the test sequence for the Intoxilyzer® 8000 with no measurement reported.

Alcotest® 9510
The presence of acetone during simulated breath tests resulted in acceptable measurement for all tests conducted for the Draeger Alcotest® 9510 verifying the instrument was not sensitive to acetone. The presence of isopropanol during simulated breath tests resulted in an "interferent detected" exception message for all tests conducted and resulted in termination of the test sequence for the Draeger Alcotest® 9510 with no measurement reported.

Intoxilyzer® 9000
The presence of acetone and isopropanol during simulated breath tests resulted in an "interferent detect" exception message for all tests conducted resulting in termination of the test sequence for the Intoxilyzer® 9000 with no measurement reported.

Range exceed testing

Intoxilyzer® 8000
The reported maximum measurement range of the Intoxilyzer® 8000 is 0.650 g/210L. An ethanol solution to deliver a vapor alcohol concentration of 0.700 g/210L was prepared using a simulator operating at a temperature of 34.0 °C (+/- 2%). The wet-bath simulator containing the prepared ethanol solution was used to deliver the breath sample via the external breath hose during an air blank-breath test–air blank testing sequence (ABA mode). The response from the Intoxilyzer® 8000 during simulated breath tests resulted in a "range exceeded" exception message for all tests conducted and termination of the test sequence with no measurement reported.

Alcotest® 9510
The reported maximum measurement range of the Alcotest® 9510 is 0.650 g/210L. An ethanol solution to deliver a vapor alcohol concentration of 0.700 g/210L was prepared using a simulator operating at a temperature of 34.0 °C (+/- 2%). The wet-bath simulator containing the prepared ethanol solution was used to deliver the breath sample via the external breath hose during an air blank-breath test–air blank testing sequence (ABA mode). The response from the Alcotest® 9510 during simulated breath tests resulted in a "range exceeded" exception message for all tests conducted and termination of the test sequence with no measurement reported.

Intoxilyzer® 9000
The reported maximum measurement range of the Intoxilyzer® 9000 is 0.650 g/210L. An ethanol solution to

deliver a vapor alcohol concentration of 0.700 g/210L was prepared using a simulator operating at a temperature of 34.0 °C (+/- 2%). The wet-bath simulator containing the prepared ethanol solution was used to deliver the breath sample via the external breath hose during an air blank-breath test–air blank testing sequence (ABA mode). The response from the Intoxilyzer® 9000 during simulated breath tests resulted in a "range exceeded" exception message for all tests conducted and termination of the test sequence with no measurement reported.

RFI testing

Intoxilyzer® 8000
Findings concluded that the Intoxilyzer® 8000 detected the RFI and aborted the testing sequence resulting in an "RFI Detect" exception message for all tests conducted with no reported measurement.

Alcotest® 9510
Findings concluded that the Alcotest® 9510 was unaffected by RFI for all tests conducted and no change in measurement was recorded.

Intoxilyzer® 9000
Findings concluded that the Intoxilyzer® 9000 detected the RFI and aborted the testing sequence resulting in an "RFI Detect" exception message for all tests conducted with no reported measurement.

Mobile environment testing

The analytical and functional performance of the instruments were evaluated in an Oklahoma "ENDUI" van outfitted with a gasoline powered pure sine wave generator outputting AC power to the instrument. An average of the twenty (20) collected samples for each known reference standard solution concentration and the standard deviation is reported in the table. An average of ten (10) collected samples is reported for the dry gas reference standard and the standard deviation is reported. Voltage measurements were recorded prior to commencing evaluations on each device and are reported in the Figure 1 table below.

The analytical and functional performance of the instruments were evaluated in an Oklahoma Highway Patrol SUV outfitted with a pure sine wave invertor outputting AC power to the instrument. An average of the twenty (20) collected samples for each known reference standard solution concentration and the standard deviation is reported in the table. An average of ten (10) collected samples for the dry gas reference standard and the standard deviation is reported in the table. Voltage measurements were recorded prior to commencing evaluations on each device and are reported in the Figure 2 table below.

ENDUI VAN Generator Results

Instrument		0.080 g/210L BrAC Dry Gas		Distilled Water		0.020 g/210L Solution		0.040 g/210L Solution		0.100 g/210L Solution		0.200 g/210L Solution	
		Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.
CMI Intoxilyzer® 8000 (118 VAC)		0.079	0.0005	0.000	0.0000	0.019	0.0006	0.040	0.0006	0.101	0.0010	0.204	0.0019
CMI Intoxilyzer® 9000 (118 VAC)		0.081	0.0005	0.000	0.0000	0.019	0.0005	0.041	0.0011	0.101	0.0015	0.200	0.0011
Drager Alcotest® 9510 (118 VAC)	IR	0.080	0.0000	0.000	0.0000	0.020	0.0003	0.041	0.0004	0.103	0.0009	0.205	0.0016
	EC	0.076	0.0005	0.000	0.0000	0.021	0.0006	0.039	0.0004	0.101	0.0017	0.197	0.0029

Figure 1. represents the analytical performance and findings of the devices in the "ENDUI" van outfitted with a gasoline powered pure sine wave generator outputting AC power.

OHP SUV Inverter Results

Instrument		0.080 g/210L BrAC Dry Gas		Distilled Water		0.020 g/210L Solution		0.040 g/210L Solution		0.100 g/210L Solution		0.200 g/210L Solution	
		Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.
CMI Intoxilyzer® 8000 (120.1 VAC)		0.078	0.0005	0.000	0.0000	0.018	0.0006	0.038	0.0005	0.100	0.0010	0.204	0.0020
CMI Intoxilyzer® 9000 (120.1 VAC)		0.081	0.0003	0.000	0.0000	0.020	0.0007	0.042	0.0009	0.102	0.0016	0.198	0.0006
Drager Alcotest® 9510 (120.1 VAC)	IR	0.080	0.0000	0.000	0.0000	0.020	0.0004	0.042	0.0005	0.102	0.0012	0.204	0.0012
	EC	0.076	0.0003	0.000	0.0000	0.020	0.0006	0.040	0.0008	0.095	0.0014	0.199	0.0016

Figure 2. represents the analytical performance and findings of the devices in the "OHP SUV" outfitted with a pure sine wave invertor outputting AC power.

Stationary environment testing

The analytical and functional performance of the instruments were evaluated in the Oklahoma Board of Tests administrative offices outfitted with AC power to the instrument. An average of the twenty (20) collected samples for each known reference standard solution concentration and the standard deviation is reported in the table. An average of ten (10) collected samples for the dry gas reference standard and the standard deviation is reported. Voltage measurements were recorded prior to commencing evaluations on each device and are reported in the Figure 3 table below.

The analytical and functional performance of the instruments were evaluated in the Oklahoma Board of Tests administrative offices outfitted with DC power to the instrument. An average of the twenty (20) collected samples for each known reference standard solution concentration and the standard deviation is reported in the table. An average of ten (10) collected samples for the dry gas reference standard and the standard deviation is reported. Voltage measurements were recorded prior to commencing evaluations on each device and are reported in the Figure 4 table below.

110 VAC Results													
Instrument		0.080 g/210L BrAC Dry Gas		Distilled Water		0.020 g/210L Solution		0.040 g/210L Solution		0.100 g/210L Solution		0.200 g/210L Solution	
		Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.
CMI Intoxilyzer® 8000 (120.1 VAC)		0.078	0.0003	0.000	0.0000	0.018	0.0012	0.040	0.0012	0.098	0.0019	0.196	0.0044
CMI Intoxilyzer® 9000 (119.6 VAC)		0.081	0.0005	0.000	0.0000	0.019	0.0008	0.039	0.0006	0.099	0.0007	0.198	0.0013
Drager Alcotest® 9510 (120.1 VAC)	IR	0.080	0.0000	0.000	0.0000	0.019	0.0002	0.040	0.0009	0.102	0.0004	0.204	0.0013
	EC	0.077	0.0005	0.000	0.0000	0.019	0.0004	0.038	0.0008	0.096	0.0010	0.198	0.0018

Figure 3. represents the analytical performance and findings of the devices in the Oklahoma Board of Tests administrative offices outfitted with AC power.

12 VDC Results													
Instrument		0.080 g/210L BrAC Dry Gas		Distilled Water		0.020 g/210L Solution		0.040 g/210L Solution		0.100 g/210L Solution		0.200 g/210L Solution	
		Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.	Average	Std. Dev.
CMI Intoxilyzer® 8000 (12.04 VDC)		0.078	0.0006	0.000	0.0000	0.018	0.0012	0.038	0.0011	0.098	0.0029	0.199	0.0036
CMI Intoxilyzer® 9000 (12.04 VDC)		0.081	0.0006	0.000	0.0000	0.019	0.0005	0.039	0.0004	0.098	0.0010	0.197	0.0011
Drager Alcotest® 9510 (12.08 VDC)	IR	0.079	0.0000	0.000	0.0000	0.020	0.0007	0.040	0.0016	0.099	0.0028	0.204	0.0013
	EC	0.076	0.0004	0.000	0.0000	0.020	0.0004	0.040	0.0007	0.097	0.0012	0.200	0.0019

Figure 4. represents the analytical performance and findings of the devices in the Oklahoma Board of Tests administrative offices outfitted with DC power.

Human subject testing

Three simple linear regression analyses were conducted to determine if Intoxilyzer® 8000 results could be predicted by the Intoxilyzer® 9000 and the Alcotest® 9510 IR/EC. Results indicated the two devices were strongly and positively associated with the Intoxilyzer® 8000: Intoxilyzer® 9000 and Intoxilyzer® 8000, $r = 0.993$; Alcotest® 9510 IR and Intoxilyzer® 8000, $r = 0.996$; Alcotest® 9510 EC and Intoxilyzer® 8000, $r = 0.955$.

Further, results indicated that all devices significantly predicted results obtained from the Intoxilyzer® 8000: 1) Intoxilyzer® 9000 and Intoxilyzer® 8000, $t = 33.098$, $p < .001$; 2) 9510 IR and Intoxilyzer® 8000, $t = 41.487$, $p < .001$; and 3) 9510 EC and Intoxilyzer® 8000, $t = 38.736$, $p < .001$). The sample prediction models can be found in Table 1.

Instrumentation	**Sample Prediction models**
Intoxilyzer® 9000 vs. Intoxilyzer® 8000	Y' = .981(X) + .002
Alcotest® 9510 (IR) vs. Intoxilyzer® 8000	Y' = .939(X) + .006
Alcotest® 9510 (EC) vs. Intoxilyzer® 8000	Y' = 1.001(X) + .005

Table 1. represents the Sample Prediction models

Paired sample *t* tests were conducted to further examine differences between the two devices and the Intoxilyzer® 8000. Descriptive statistics are shown in Table 2. There was no statistically significant mean difference between the Intoxilyzer® 9000 and the Intoxilyzer® 8000, $t = -1.079$, $p = .297$. However, analyses revealed a significant mean difference between the Alcotest® 9510 IR and the Intoxilyzer® 8000, $t = -2.759$, $p = .014$; and a significant mean difference between the Alcotest® 9510 EC and the Intoxilyzer® 8000, $t = -9.168$, $p < .001$.

Effect sizes (Cohen's *d*) were calculated for each of the paired differences, Intoxilyzer® 9000 and Intoxilyzer® 8000 ($d = .03$); Alcotest® 9510 and Intoxilyzer® 8000 ($d = .073$). According to Cohen's guidelines, all effect sizes are considered negligible. In other words, large discrepancies were not found between the Intoxilyzer® 8000 and the two devices.

	M	**SD**
Intoxilyzer® 8000	.07565	.021006
Intoxilyzer® 9000	.07500	.021260
Alcotest® 9510 IR	.07406	.022264
Alcotest® 9510 EC	.07100	.020887

Table 2. represents the descriptive statistics examining differences between the two devices and the Intoxilyzer® 8000

Breath alcohol measurements for six (6) drinking subjects obtained using the Intoxilyzer® 9000 and Alcotest® 9510 were compared to breath alcohol samples obtained from an Intoxilyzer® 8000 from the same drinking subjects. The results of 17 near-simultaneous, subject tests are shown in Figure 5, Figure 6, and Figure 7.

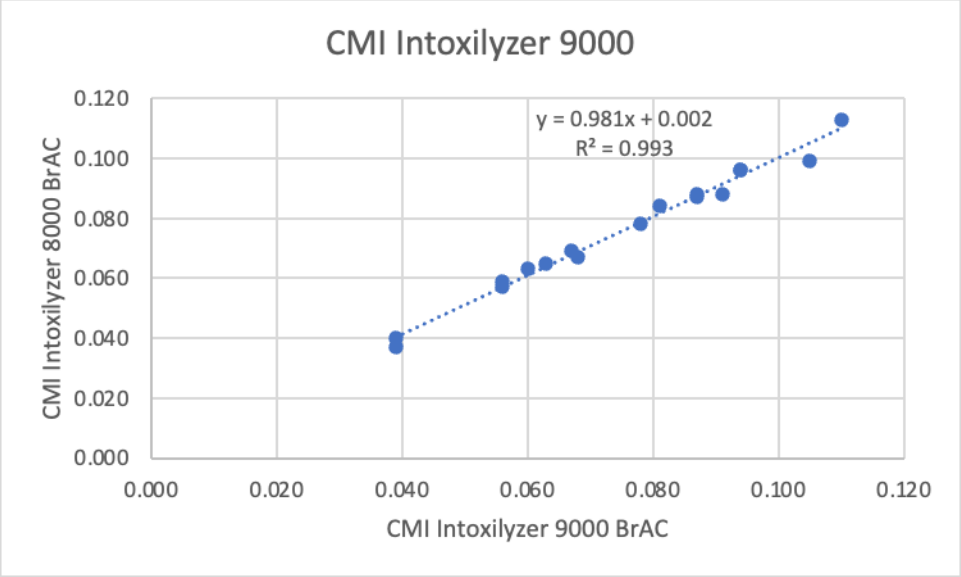

Figure 5. Regression relationship for near-simultaneous Intoxilyzer® 8000 samples compared to the Intoxilyzer® 9000 breath alcohol test results for human subjects (n = 17). the data are described by the linear model Y' = 0.981(X) + .002 (r = 0.993).

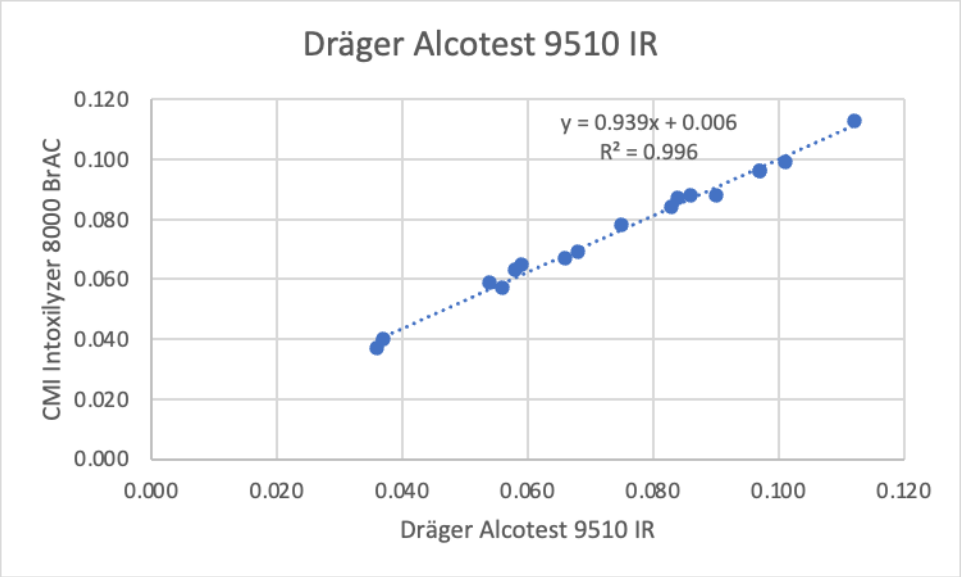

Figure 6. Regression relationship for near-simultaneous Intoxilyzer® 8000 samples compared to the Alcotest® 9510 (IR) breath alcohol test results for human subjects (n = 17). the data are described by the linear model Y' = 0.939(X) + .006 (r = 0.996).

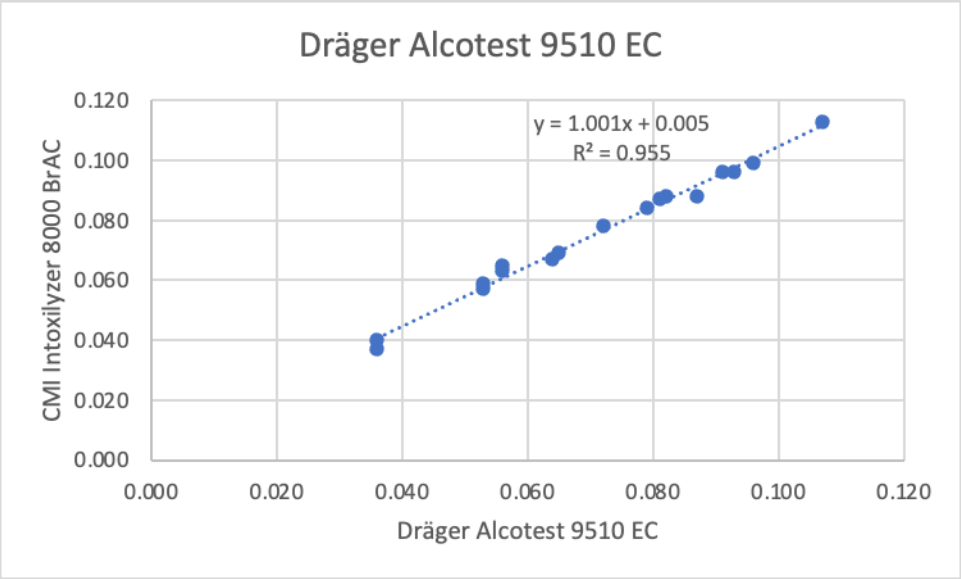

Figure 7. Regression relationship for near-simultaneous Intoxilyzer® 8000 samples compared to the Alcotest® 9510 (EC) breath alcohol test results for human subjects (n = 17). the data are described by the linear model Y' = 1.001(X) + .005 (r = 0.955).

Software Overview

CMI, Inc. reported that the software for the Intoxilyzer® 9000 is fully customizable including form printouts, and they also offer the COBRA management software solution for interfacing with and managing the devices. Draeger, Inc. reported the software for the Alcotest® 9510 is fully customizable including form printouts, and they also offer an interface solution for managing the devices. Both companies reported that they have partnered with Caliber Public Safety to operate with the Forensic Advantage LIMS program "FA-BrAD".

From the Caliber Public Safety website:

The Forensic Advantage® Breath Alcohol Database application (BrAD) tracks and stores records from multiple types of instruments that measure a subject's breath alcohol level. This solution can run in standalone mode or seamlessly integrate with the Forensic Advantage® LIMS platform to help organizations collect and manage test results from their breath alcohol testing devices. BrAD also tracks related information, including maintenance history and certifications for instruments and operators. BrAD handles subpoena duces tecum requests for all collected information, rendering responses in Adobe® PDF for return to attorneys and courts via e-mail, fax, or certified mail.

Conclusion

A thorough evaluation of the instrumentation was completed. By meeting the BOT Evaluation Procedures, the Intoxilyzer® 8000, the Intoxilyzer® 9000, and the Alcotest® 9510 have proven to be a scientifically valid means of determining breath alcohol concentration and are all suitable for use in Oklahoma with a high degree of forensic precision and accuracy.

Note

1. The unmodified term 'alcohol' refers to ethanol.

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