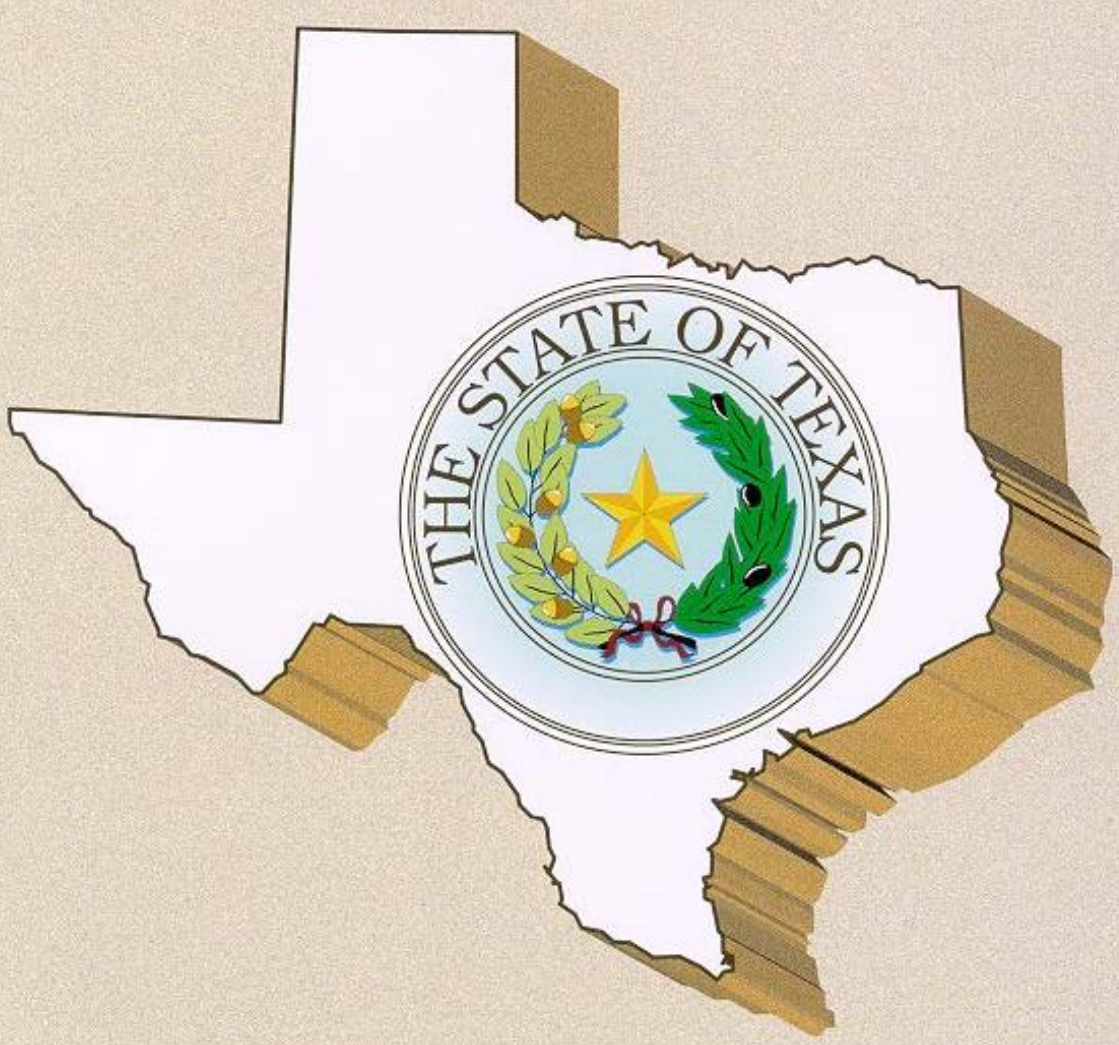
TEXAS BREATH ALCOHOL TESTING PROGRAM



OPERATOR MANUAL

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REVISION HISTORY

Effective Date	Brief Description of Change(s)
8/01/2022	Original Issue Previous revision history for individual chapters included in archived documents

01 INTRODUCTION

HISTORY OF ALCOHOL AND THE LAW

Ethyl alcohol has been a factor in motor vehicle crashes since the appearance of the automobile. Studies as early as 1904 have shown that drivers under the influence of alcohol are incapable of safely operating a motor vehicle.

In 1936, the National Safety Council (NSC) recognized the problem of alcohol impaired driving and established the Committee on Tests for Intoxication, now referred to as the Alcohol, Drugs and Impairment Division. This committee formalized the use of tests for physical signs of impairment and scientific tests for alcohol. The committee encourages and supports scientific research in all aspects related to the problem of alcohol and transportation. Numerous types of breath alcohol testing devices were developed from this research.

In 1960, the NSC recommended that an alcohol concentration at or above 0.10 be considered evidence of intoxication. As research continued, the committee recommended in 1971 a lower presumptive concentration of 0.08. Further research has shown that the ability of many individuals is impaired for driving and driving-related tasks at alcohol concentrations below 0.08, and that for some individuals, impairment occurs at alcohol concentrations below 0.05.

In 1975, the NSC and National Highway Safety Traffic Administration (NHSTA) approved a new definition for alcohol concentration as grams of alcohol per 210 liters of breath or grams of alcohol per 100 milliliters of blood.

Figure 1-1. The Breathalyzer was the first breath alcohol testing instrument used in Texas.

TEXAS BREATH ALCOHOL PROGRAM

Texas became involved in breath alcohol testing with pilot programs in the late 1940's and early 1950's. In 1969, the Texas Legislature passed the Implied Consent Law, which gave authority to the Texas Department of Public Safety, through its Office of the Scientific Director, to develop rules and regulations for breath alcohol testing throughout the state.

The Texas Breath Alcohol Testing Regulations establish the parameters within which breath alcohol testing is to be administered and regulated. The regulations may be found in Title 37, Part 1, Chapter 19 of the Texas Administrative Code. In this manual, references to the regulations will refer to the applicable Chapter 19 rule found in the Texas Administrative Code.

Texas began using the uniform definition of alcohol concentration in 1984. The Texas Penal Code, Chapter 49, defines alcohol concentration as the number of grams of alcohol per: 210 liters of breath, 100 milliliters of blood, or 67 milliliters of urine.

Texas began analyzing breath alcohol samples statewide in 1968 using the Breathalyzer. In 1980 the Intoxilyzer 4011AS-A was introduced in Texas, followed by the Intoxilyzer 5000 in 1988. The Intoxilyzer 5000 was the standard evidentiary breath alcohol testing instrument for law enforcement in Texas for more than 25 years.

Figure 1-2. The Intoxilyzer 5000 model instrument was in use in Texas from 1988 to 2016.

In 2015, Texas began transitioning to the Intoxilyzer 9000. The Intoxilyzer instruments utilize infrared analysis, while the Breathalyzer used wet chemical analysis. The biggest difference between the instruments as they have developed is their automation and ease of operation.

TECHNICAL SUPERVISORS

Technical supervisors are field agents for the Office of the Scientific Director. They are trained forensic scientists charged with the responsibility of administering, regulating, and enforcing all aspects of breath alcohol testing within their assigned area. The primary point of contact for operator training and instrument support is their technical supervisor. The State program is divided into more than thirty technical supervisor areas.

Several technical supervisors are employed by the Texas Department of Public Safety, but others are employed by local agencies. Technical supervisors, regardless of employer, supervise the breath alcohol testing activities of all the operators in their assigned area. The relationship and communication between certified operators and their technical supervisor is vital to the success of the program.

More information about the Texas Breath Alcohol Testing Program can be found on the DPS website at https://www.dps.texas.gov/BalLab. The most current version of this Operator Manual and the Breath Alcohol Testing Regulations may also be viewed from the website.

02 BREATH ALCOHOL INSTRUMENTATION, METHODS, AND TECHNIQUES

THE INTOXILYZER 9000 BREATH ALCOHOL TESTING INSTRUMENT

The Intoxilyzer 9000 is the only instrument currently in use in Texas for evidential breath alcohol analysis. The instrument is equipped with a keyboard, a magnetic card reader, a 2D barcode reader and a color touchscreen display for data entry. Subject testing is highly automated, providing instructions and audio-visual prompts to assist the operator to complete a test. The instrument reports a subject test on a document called the Analytical Report.

Intoxilyzer 9000 System Components:

1. Magnetic card reader
2. Disposable mouthpieces
3. Heated breath hose
4. Keyboard
5. Bar code scanner
6. Interactive touch screen
7. Reference sample device
8. External printer

Figure 2-1. The Intoxilyzer 9000 and associated equipment.

INFRARED SPECTROMETRY

There are various analytical methods that can be used to measure the alcohol concentration in a breath specimen. The Intoxilyzer 9000 uses a method of analysis called infrared spectrometry.

Energy that radiates from a source has the properties of a wave. Two common examples are the light from a lightbulb and the signal from a radio tower. Depending on the width of the energy wave, called the wavelength, various chemical molecules will react differently to the radiant energy. The basis of infrared (IR) breath analysis is the absorption of infrared energy by alcohol molecules in a breath specimen. IR spectrometry is an analytical method that is widely used in the scientific community.

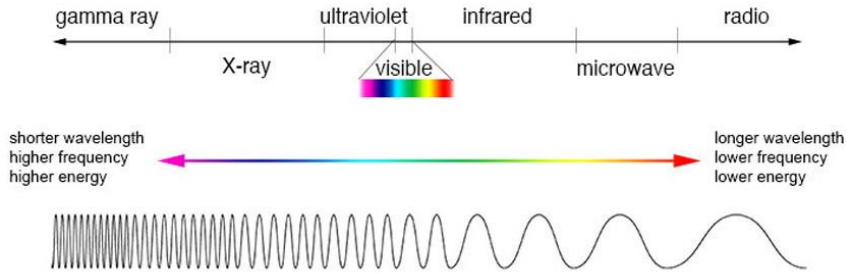


Figure 2-2. The electromagnetic spectrum shows a comparison of different types of radiant energy.

DETERMINATION OF ALCOHOL CONCENTRATION

The Intoxilyzer 9000 uses a scientific law known as the Beer-Lambert Law to determine the alcohol concentration in a breath sample. The Beer-Lambert Law states that the amount of energy absorbed by a particular substance is proportional to the number of absorbing molecules in the sample. By measuring the change in infrared energy when a breath sample is introduced, the Intoxilyzer 9000 can accurately determine the concentration of alcohol in the sample. The Intoxilyzer 9000 reports the measured alcohol concentration in grams of alcohol per 210 liters of breath (g/210 L), as specified by Texas statute.

ETHANOL SPECIFICITY

The Intoxilyzer 9000 is designed to measure a specific type of alcohol molecule called ethanol. This is the type of alcohol found in alcoholic beverages for human consumption. The instrument uses multiple wavelengths of infrared energy to analyze for ethanol. For any given molecule, the absorption patterns of specific wavelengths are unique, like a fingerprint. Other substances, such as acetone or other alcohols, absorb wavelengths in patterns different from ethanol. If the Intoxilyzer 9000 detects an absorption pattern different than ethanol it stops the test.

SIMULATOR REFERENCE SYSTEM

The Texas Breath Alcohol Testing Regulations require the instrument to incorporate a reference system. The reference system used with the Intoxilyzer 9000 in Texas is called a simulator or reference sample device. The simulator delivers a known concentration of ethanol to the instrument to verify the calibration of the instrument at the time of each test.

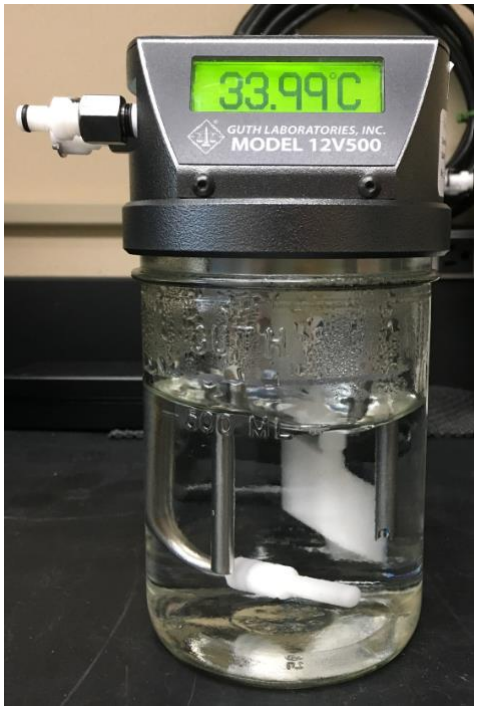


Figure 2-3. The Guth 12V500 simulator is equipped with a digital temperature display.

Technical supervisors prepare reference sample solutions for use in the simulator. The vapor above the solution is circulated into the instrument during analysis. The analysis of the reference sample solution vapor is called a *calibration verification*. Two calibration verifications are conducted during a complete subject test, and both results must be 0.080 ± 0.010 g/210 L. The accepted range for a calibration verification is 0.070 – 0.090 g/210 L as stated on the Analytical Report. If a calibration verification result falls outside of the acceptable range, the instrument will stop the test.

The simulator heats the solution to an operating temperature of 34.00 ± 0.20 °C. The acceptable temperature range for the solution is 33.80 – 34.20 °C as stated on the Analytical Report. The temperature of the solution does not need to be observed or recorded by the operator because it will be printed on the Analytical Report. If the temperature of the solution is not within the acceptable range, the instrument will stop the test.

Any malfunction of the simulator will cause a status code to be displayed on the simulator screen. The operator may attempt to reset the simulator by turning it off and back on again. The simulator may take a few minutes to heat up to 34 °C and be ready for testing. If the status code persists, the operator should contact the technical supervisor as soon as possible for instructions. If the simulator is displaying a status code the instrument will stop the test.

BREATH SAMPLING TECHNIQUES

The analysis of expired breath has been proven to accurately measure the alcohol concentration in the human body. However, alcohol introduced to the mouth a short time before a breath test could affect the results. For instance, alcohol consumed in a beverage or regurgitated from the stomach will be present in the mouth in higher concentrations than the rest of the body for a few minutes. This is called Residual or Mouth Alcohol. The Texas Breath Alcohol Testing Program uses three techniques to ensure that the subject's breath alcohol results are not affected by residual alcohol.

The 15-Minute Waiting Period

Residual alcohol dissipates in less than 15 minutes. Prior to testing the subject, the operator must complete a 15-minute waiting period. Only certified breath test operators may conduct the 15-minute waiting period. The operator should exercise reasonable care to ensure the subject does not place any substance in their mouth. If at any point during the 15-minute waiting period the subject places any substance in their mouth or leaves the presence of the operator, the waiting period must be restarted. It is only the 15 minutes immediately prior to testing that are considered a part of the required waiting period. This is a very important and effective technique to prevent the influence of residual alcohol.

Residual Alcohol Detection System

The Intoxilyzer 9000 has a system that can detect residual alcohol in a breath sample. As the subject delivers a breath sample, the alcohol concentration is continuously monitored. If an unacceptable change is detected in the concentration of the sample the instrument will stop the test.

Duplicate Breath Sampling

The introduction of residual alcohol in a sample can be detected by measuring for a wide concentration difference between subsequent samples from the same subject. Two separate breath samples are analyzed during each complete subject test, and the two alcohol concentration measurements are compared to each other. If the two results differ by more than 0.020 g/210 L the instrument will stop the test.

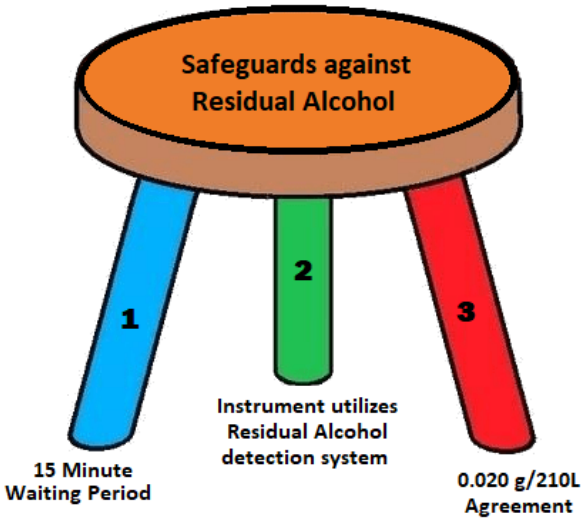


Figure 2-4. A three-legged stool illustrates how separate techniques work together to ensure that residual alcohol does not affect the test.

03 SUBJECT BREATH ANALYSIS

REQUIRED WAITING PERIOD

Conducting a 15-minute waiting period before starting the test is a requirement of the regulations. An operator must remain in the continuous presence of the subject for the entire 15-minute period immediately prior to the subject test. The operator must exercise reasonable care to ensure the subject does not place any substance in their mouth.

AUTOMATIC STANDBY MODE

When the Intoxilyzer 9000 has not been used for 30 minutes, the instrument will go into standby mode and the touchscreen will display a screensaver. To bring the instrument out of the standby mode, the touchscreen should be tapped with a finger or the stylus. At the conclusion of a 2-minute countdown, the START test button will then turn green and the instrument will be ready for testing.

PRIOR TO SUBJECT TESTING

Before beginning a subject test, the operator should explain the testing procedure to the subject. The operator should instruct the subject that a steady flow of breath with sufficient pressure to sound a tone will be required. The instrument will require the subject to provide two separate breath samples to complete the test.

Individually wrapped, disposable plastic mouth pieces are supplied at the testing location. A new disposable mouthpiece should be used for each subject for hygienic reasons. The mouthpiece may be removed or replaced after each breath sample if necessary, but it is not required. The breath alcohol concentration results will not be affected by using the same mouthpiece for subsequent breath samples from the same subject.

Figure 3-1. Disposable mouthpiece.

CONDUCTING A SUBJECT BREATH ALCOHOL TEST

Starting a Subject Test

To begin a test, the operator will tap the green START test button. The Intoxilyzer 9000 will prompt the operator to log in by entering their certificate number and a PIN (the last four digits of the operator's driver license number). Tapping the green arrow button will continue to the next screen. The operator will then select the type of test to be conducted. The instrument will prompt the operator to choose one of three methods for data entry. The subject's identifying information can be entered manually using the keyboard or electronically by swiping the magnetic strip or scanning the 2D barcode on the subject's driver license. The operator will have the opportunity to review the information before the test begins. When using the keyboard entry method, *if the subject's date of birth is unknown, the operator should enter the current date*.

Figure 3-2. The Intoxilyzer 9000 has three options to enter subject information.

15-Minute Waiting Period Confirmation

The instrument will display a statement asking the operator to confirm the completion of the 15-minute waiting period. To do this, the operator must check the blue button by tapping it and type the word **YES** in the box below the statement. Tapping the green arrow button will continue to the next screen.

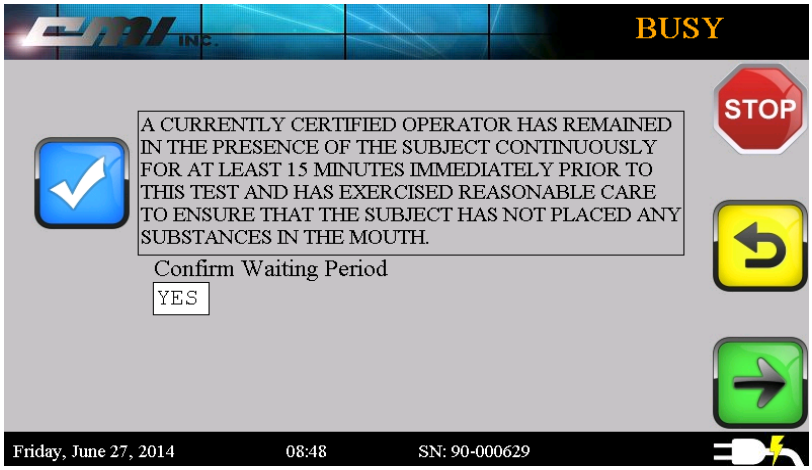


Figure 3-3. This screen requires the operator to verify that a 15-minute waiting period was completed.

On the next screen, the operator has the option to CONTINUE to subject testing or REVIEW to go back and review all data entries.

Providing Operator Signature

Once all data entries are complete, the operator will be required to provide their signature. The operator must sign in the box on the touchscreen using their finger or the provided stylus. *Pen or pencil should never be used on the digital display screen.* By double tapping the CLEAR button in the upper left-hand corner, an operator may erase and rewrite their signature as needed.

Tapping the green arrow button after signing will begin the testing sequence. This signature will be printed on the Analytical Report.

Figure 3-4. The operator provides an electronic signature that is printed on the Analytical Report.

Operational System Checks

The instrument will begin the analytical sequence by automatically conducting an Operational System Check. This step verifies that the instrument's internal components are working properly. The Operational System Check will be conducted again at the conclusion of the testing sequence.

Air Blanks

At various points during the testing sequence, the instrument will conduct air blanks. During the air blanks the instrument will purge the sample chamber with room air. The results of each air blank analysis must be 0.000.

Calibration Verifications

The instrument calibration will be verified twice during each complete subject test. The instrument verifies calibration by analyzing the vapor above the reference (simulator) solution. The calibration verification results must be within the acceptable range of 0.070 – 0.090 g/210 L.

During the calibration verifications, the solution temperature reading is transmitted from the simulator to the Intoxilyzer 9000. The temperature of the solution must be 34.00 ± 0.20 °C.

Subject Breath Samples

When the testing sequence reaches the Subject Sample 1 and Subject Sample 2 portions of the test, the instrument will audibly instruct the subject to "PLEASE BLOW LONG AND STEADY." A Spanish version of this audio message may be activated by tapping the green speaker button on the touchscreen.

A tone will sound and a rectangular box on the screen will fill in from the left as the subject blows into the instrument with sufficient pressure. The Intoxilyzer 9000 will monitor the rate of change in the alcohol concentration as the subject provides a breath sample. This monitoring system, commonly called a *slope detector*, ensures that the subject has reached the final phase of their exhalation.

Figure 3-5. An Intoxilyzer testing location with a locking cabinet.

Breath Sample Requirements

To provide an adequate sample for analysis, the subject must continually maintain pressure long enough to satisfy the minimal time and slope requirements. If the subject stops before providing an adequate sample, the operator should instruct the subject to take another breath and try again. The subject has 3 minutes to provide an adequate sample during each breath sample step.

Once the requirements for time, pressure, and slope have been met, the instrument will make distinct sounds to signify the end of the breath sample step and display SAMPLE ACCEPTED.

Completing the Test

After the testing sequence is complete, the subject test results will be displayed on the touchscreen and an Analytical Report will be printed. The operator must leave a copy of the Analytical Report for the technical supervisor in the Intoxilyzer cabinet.

REQUIREMENTS FOR A COMPLETE TEST

For a subject test to be considered complete, it must contain the following elements:

1. All air blanks must be 0.000.
2. Subject results 1 and 2 must not differ by more than 0.020 g/210 L.
3. Both calibration verification results must be in the acceptable range: 0.080 ± 0.010 g/210 L (0.070 – 0.090 g/210 L).
4. The reference sample solution temperature of both calibration verifications must be in the acceptable range: 34.00 ± 0.20 °C (33.80 – 34.20 °C).
5. “Test Complete” is printed in the Sequence of Analysis box.
6. The signature of the operator.

INCOMPLETE TESTS

The instrument has safeguards in place to stop a test to ensure the integrity of the results. When a test is stopped, either by the operator or the instrument, the Intoxilyzer 9000 will display a message that provides the reason the test was stopped and instruct the operator on how to proceed. If the instrument message instructs the operator to contact the technical supervisor, the operator should do so as soon as possible for instructions. The operator must leave a copy of every Analytical Report (both complete and incomplete tests) for the technical supervisor in the Intoxilyzer cabinet.

Tests Stopped by the Operator

INCOMPLETE TEST: TEST STOPPED BY OPERATOR will be printed on the Analytical Report if the operator stops the test by double tapping the **STOP** button. The operator should stop the test if any condition occurs that would require performing an additional 15-minute waiting period.

INCOMPLETE TEST: SUBJECT REFUSED will be printed on the Analytical Report if the operator stops the test because the subject refuses to continue. If a subject refuses to provide a breath sample by words or actions, the operator should double tap the REFUSED button to stop the test. Once a subject begins to deliver a sample with sufficient pressure to sound the tone, the REFUSED button will become unavailable. If the subject begins to deliver a breath sample and subsequently refuses to continue, the test will time out within 3 minutes and result in a deficient sample.

Tests Stopped Because of the Reference Sample

INCOMPLETE TEST: CAL VERIFICATION OUT OF TOLERANCE will be printed on the Analytical Report if the instrument stops the test because a calibration verification result is not within the acceptable range of 0.070 – 0.090 g/210 L.

INCOMPLETE TEST: SOLUTION TEMPERATURE OUT OF TOLERANCE will be printed on the Analytical Report if the instrument stops the test because the temperature of the simulator solution is not in the acceptable range of 34.00 ± 0.20 °C.

Tests Stopped by Environmental Conditions

INCOMPLETE TEST: RADIO FREQUENCY DETECTED will be printed on the Analytical Report if the instrument stops the test because radio frequency (RF) energy is detected above an established threshold. The Intoxilyzer 9000 is equipped with radio antennas and detection circuitry to ensure that transmitted energy from RF sources does not affect the test. Some devices that may stop a test by transmitting RF include two-way (walkie-talkie) radios, cell phones, and body worn cameras/mics.

INCOMPLETE TEST: AMBIENT FAILURE will be printed on the Analytical Report if the instrument stops the test because the result of an air blank analysis is not 0.000**.**

Tests Stopped Because of Breath Sampling Requirements

INCOMPLETE TEST: IMPROPER SAMPLE will be printed on the Analytical Report if the instrument stops the test because the subject was allowed to provide a breath sample at the wrong step in the analytical sequence.

INCOMPLETE TEST: DEFICIENT SAMPLE will be printed on the Analytical Report if the instrument stops the test because 3 minutes elapsed after the start of a subject breath analysis step. During each of the two breath analysis steps, the subject must provide an adequate sample that meets the time, pressure, and slope requirements of the instrument.

INCOMPLETE TEST: UNACCEPTABLE SAMPLE will be printed on the Analytical Report if the instrument stops the test because of an unacceptable change in the breath alcohol concentration. The Intoxilyzer 9000 requires a long and steady breath as the sample is delivered.

INCOMPLETE TEST: NO 0.020 AGREEMENT will be printed on the Analytical Report if the instrument stops the test because the two subject breath sample results differ by more than 0.020 g/210 L.

INCOMPLETE TEST: INTERFERENT DETECTED will be printed on the Analytical Report if the instrument stops the test because an IR absorption pattern is not specific for ethanol. The Intoxilyzer 9000 monitors multiple wavelengths of IR energy, and different chemical molecules create distinct absorption patterns like a fingerprint. ***An operator should not attempt to conduct another breath test on the subject after this message is displayed.*** It is recommended to collect a blood sample when an interferent is detected.

Regardless of the type of incomplete test, the operator should read and follow the instructions displayed on the touchscreen. If the instructions recommend to call the technical supervisor, the operator should make contact as soon as possible from the testing location. The operator must leave a copy of every Analytical Report (both complete and incomplete tests) for the technical supervisor in the Intoxilyzer cabinet.

CONDUCTING A PRACTICE TEST

An operator can conduct a practice test at any time. Practice tests can be used to maintain proficiency or to evaluate the functionality of the Intoxilyzer and associated equipment. Before beginning a practice test, the operator should take a few moments to review the practice test instructions. The operator will be required to provide the breath samples in place of the subject for practice tests. All elements of a complete test must be present for a practice test to be considered complete.

As with a subject test, the operator will tap the green **START** button and log in to the instrument using their operator certificate number and 4-digit PIN. The operator will then select PRACTICE TEST as the type of test to be conducted. The operator should *choose the manual keyboard option* for data entry when conducting a practice test. All practice test subject information will then be automatically filled by the instrument. **The operator should not make any changes or add to the information in the subject fields.**

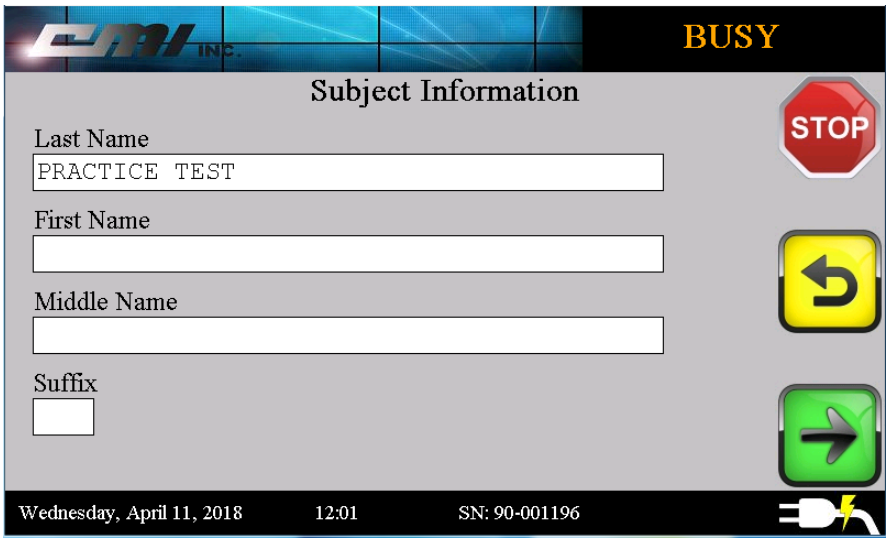


Figure 3-6. The subject information is automatically filled during a practice test.

The operator should tap the green arrow button to proceed through the screens until the 15-minute waiting period confirmation screen. The operator will confirm the completion of a 15-minute waiting period by checking the blue button and typing “YES” in the box below the message. Then, the operator will select “Continue” and provide their signature. Once an acceptable signature is completed, tapping the green arrow button will start the testing sequence. At the completion of the test, tapping the green check box will print the Analytical Report.

The operator must leave a copy of the Analytical Report for the technical supervisor in the Intoxilyzer cabinet.

04 ETHANOL

WHAT IS ETHANOL?

Ethanol is classified as an alcohol and considered to be *a food, a drug, and a poison*. At room temperature, pure ethanol is a clear, colorless liquid that has a slight odor and mixes completely with water.

Ethanol is the type of alcohol found in alcoholic beverages. It is also referred to as ethyl alcohol, grain alcohol, or spirits. Ethanol can be found in many different products such as solvents, antiseptics, fuels, medications, and mouthwashes.

The terms alcohol, ethyl alcohol, and ethanol are often used interchangeably. Regardless of the term used, ethanol is a drug that affects human behavior and performance.

There are many different types of alcohols and each has a unique molecular structure with specific chemical properties. Two other common alcohols are methanol (methyl alcohol) and isopropanol (isopropyl alcohol). All alcohols are poisonous. Consumption of even small amounts of methyl alcohol or isopropyl alcohol can have life threatening implications. The only type of alcohol that will be measured and reported by the Intoxilyzer 9000 is ethanol.

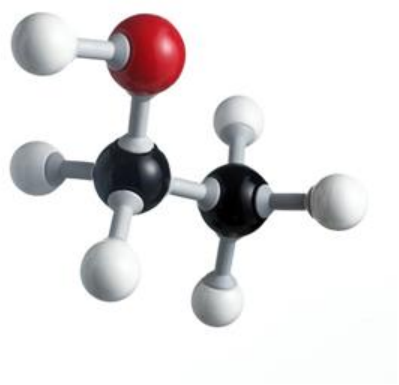


Figure 4-1. Ethanol has a unique molecular structure and contains two carbon atoms.

ALCOHOLIC BEVERAGES

Alcohol can be produced by various methods. By law, production of alcoholic beverages always begins with the process of fermentation. Fermentation is the procedure by which yeast microorganisms consume sugar or starch, and in turn excrete ethanol. Beer and wine are produced through this process. The maximum alcohol concentration produced by this method is about 12 – 15% because any higher alcohol concentration kills the yeast.

In order to manufacture a beverage with a higher alcohol content, such as rum, vodka, gin, or whiskey, the alcohol mixture produced from fermentation must be distilled. Distillation is a method of separating and collecting the ethanol from other compounds in a mixture. This process concentrates the ethanol so that the final product has a higher percentage of ethanol than the original fermented mixture. Depending on the fermented mixture used, the aging process, and type of flavorings added, different types of alcoholic beverages are produced.

HOW ALCOHOL IS MEASURED IN ALCOHOLIC BEVERAGES

The alcohol content of beer and wine are usually reported in terms of percent alcohol by volume (ABV). The average beer has approximately 5% ABV and wines typically have about 10 – 12% ABV.

In the United States, the ethanol concentration of distilled alcoholic beverages is designated by the proof system. Proof is twice the percentage of the alcohol content by volume. For example, 80 proof alcohol contains 40% ABV. 50% ABV is equal to 100 proof.

$$\textit{Proof} = 2 \times \%\ \textit{Alcohol by Volume}$$

The Standard Drink

The alcohol content per ounce varies depending on the type of beverage. According to the National Institute on Alcohol Abuse and Alcoholism, *one standard drink* (or one alcoholic drink equivalent) equals:

- 12 ounces of 5% beer
- 1.5 ounces of 80 proof (40%) distilled spirits
- 5 ounces of 12% wine

Each of these drinks contains approximately the same amount of pure alcohol.

Figure 4-2. A 'standard drink' contains an equivalent dose of alcohol regardless of the type of beverage.

RESIDUAL (MOUTH) ALCOHOL

Immediately after a sip of an alcoholic beverage, the breath would indicate a high alcohol concentration. This is sometimes referred to as residual alcohol or mouth alcohol. If analyzed, this breath sample would not be an accurate reflection of the alcohol concentration in a person's body.

Residual alcohol diminishes rapidly and disappears in less than 15 minutes. Completion of a proper 15-minute waiting period in combination with current evidential breath alcohol testing protocols on the Intoxilyzer 9000 will ensure that residual alcohol does not affect the test result.

THE FATE OF ALCOHOL IN THE BODY

The way alcohol moves through the body and is eventually removed is called alcohol pharmacokinetics. After consumption, alcohol is passed into the bloodstream from the digestive tract by the process of absorption. Once absorbed, alcohol travels via the bloodstream to all tissues in the body that contain water which is referred to as distribution. Alcohol is removed from the body at a steady rate by elimination, primarily through the metabolic pathways in the liver. Absorption, distribution, and elimination are all happening simultaneously within a few minutes after the first drink of ethanol and continue as long as ethanol is still present in the body.

Absorption

Ethanol is readily absorbed into the blood stream through all mucosal surfaces by simple diffusion, including the oral cavity and gastrointestinal tract. The absorption of ethanol begins immediately following the introduction of the alcoholic beverage into the digestive system.

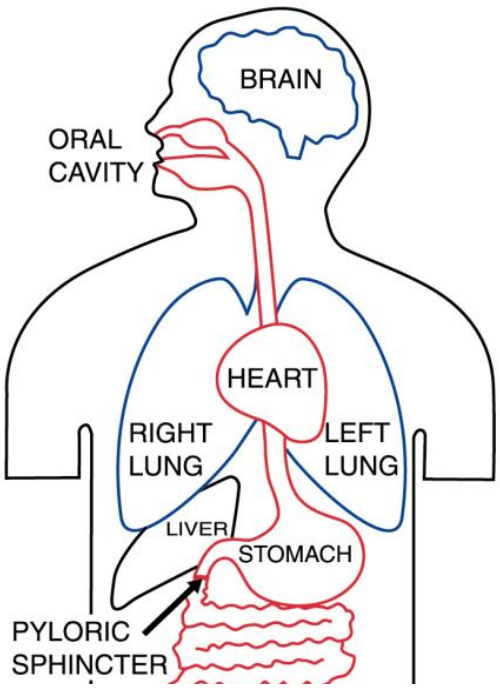


Figure 4-3. The pyloric sphincter controls the emptying of the stomach.

Ethanol is absorbed into the blood stream unchanged, as opposed to most food and drugs which must be broken down into smaller parts by digestion before being absorbed into the body. While some ethanol is absorbed in the stomach, the majority is absorbed in the small intestine.

The most common way to get ethanol into the body is by ingestion via the mouth. It travels down the esophagus and into the stomach. It then passes through a small valve between the stomach and the small intestine called the pyloric sphincter.

The length of time that ethanol remains in the stomach may vary. The most significant factor that affects absorption of ethanol in the body is the amount of food in the stomach. Food slows the rate that the pyloric sphincter opens. This causes the stomach contents, including ethanol to remain in the stomach for a longer period of time resulting in slower absorption. Slowing the absorption of alcohol will result in a longer time to reach highest (peak) alcohol concentration and lower the peak concentration.

While the type of food may affect absorption, the *amount of food is the most significant factor in delaying absorption* of alcohol in the human body. Even on a full stomach, the peak alcohol concentration is usually reached within 30 to 40 minutes after the last drink.

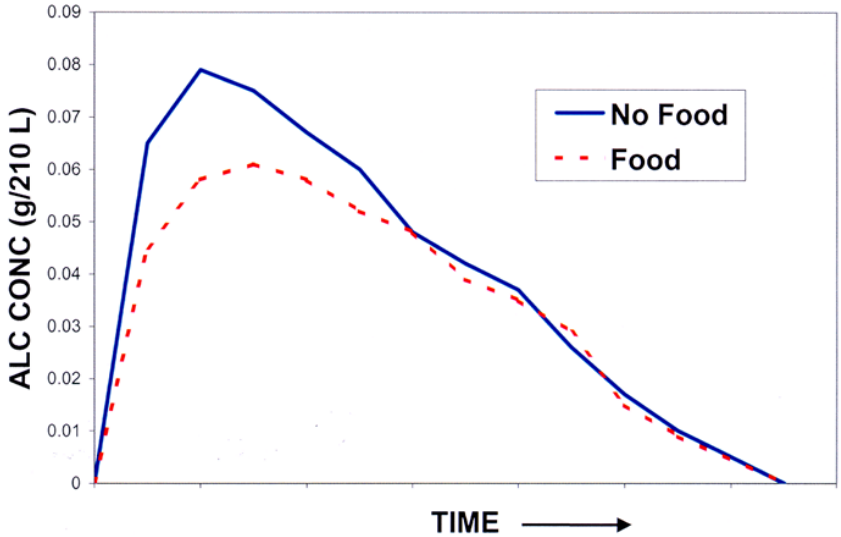


Figure 4-4. This graph illustrates how food may slow absorption and lower the peak alcohol concentration.

Distribution

Once absorbed, ethanol travels through the liver and is distributed throughout the body. Some of the ethanol quickly reaches the brain. Since ethanol mixes with water, the water content of organs and tissues determines the amount absorbed in those locations. Fat tissue has very little water and does not easily absorb ethanol.

Total body water (TBW) is the effective volume of water in the body available to mix with the ethanol. Smaller people usually have lower TBW than larger people, but body composition also plays a role. Females generally have lower TBW than males of the same height and weight. An obese person will have lower TBW than a lean person of the same weight.

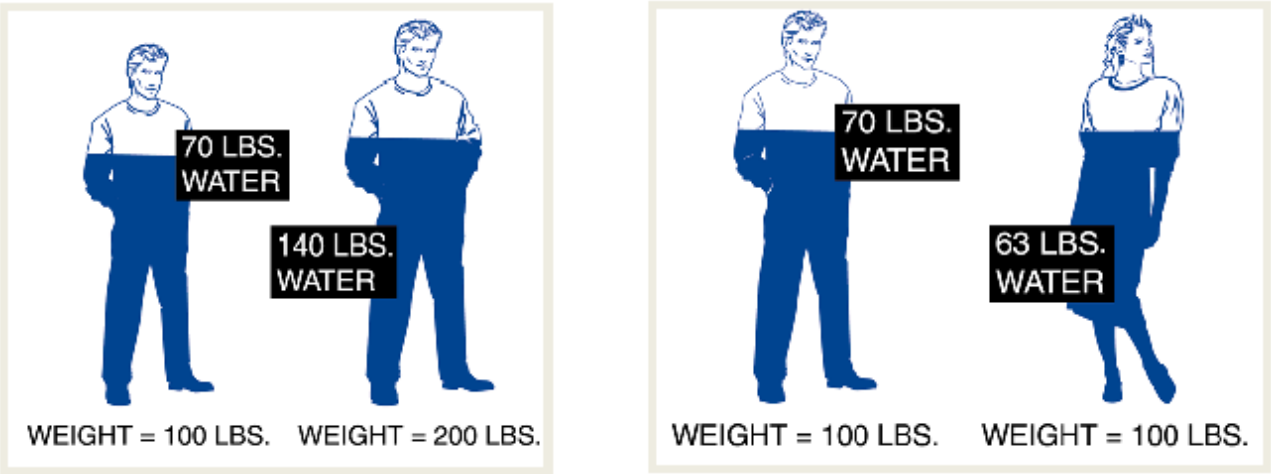


Figure 4-5. Weight and body composition determine the total amount of water for distribution.

Given the same dose of ethanol, *individuals with lower total body water will likely reach a higher alcohol concentration* because there is less water to dilute the ethanol. For example, a 200-pound obese male will likely have a higher alcohol concentration than a 200-pound lean male if they drink the same amount of ethanol at the same time.

Elimination

Ethanol is removed from the body through metabolism and excretion. The majority of ethanol is eliminated by metabolism in the liver. A small amount is eliminated by metabolism when in the stomach. Some ethanol is also excreted from the body in urine, sweat, and breath.

The exchange of oxygen and carbon dioxide occurs in the small tissue sacs of the lungs called the alveoli. Ethanol will be exhaled in breath because it can readily pass through the thin alveolar membrane. The concentration of ethanol in the breath is proportional to the amount of ethanol in the body. The elimination of ethanol in the breath is the basis for the breath alcohol test.

The reported range of elimination rates is between 0.01 – 0.03 g/210 L in ethanol concentration per hour. However, this rate of elimination is fairly constant for a given individual. For example, a person who eliminates at 0.02 g/210 L per hour and consumes enough ethanol to reach a 0.08 g/210 L concentration will eliminate most of their ethanol in approximately 4 hours.

Hot coffee, a cold shower, or vigorous exercise cannot speed up elimination. The body needs a sufficient amount of time to metabolize and excrete the ethanol that was consumed.

CHANGE IN ALCOHOL CONCENTRATION OVER TIME

Absorption of ethanol begins almost immediately after ingestion and elimination of ethanol begins soon thereafter. When the rate of alcohol consumption and absorption exceeds the rate of elimination, the alcohol concentration will increase. Ethanol concentration decreases when the rate of elimination exceeds absorption. Peak alcohol concentration occurs when the amount of alcohol being absorbed equals the amount being eliminated.

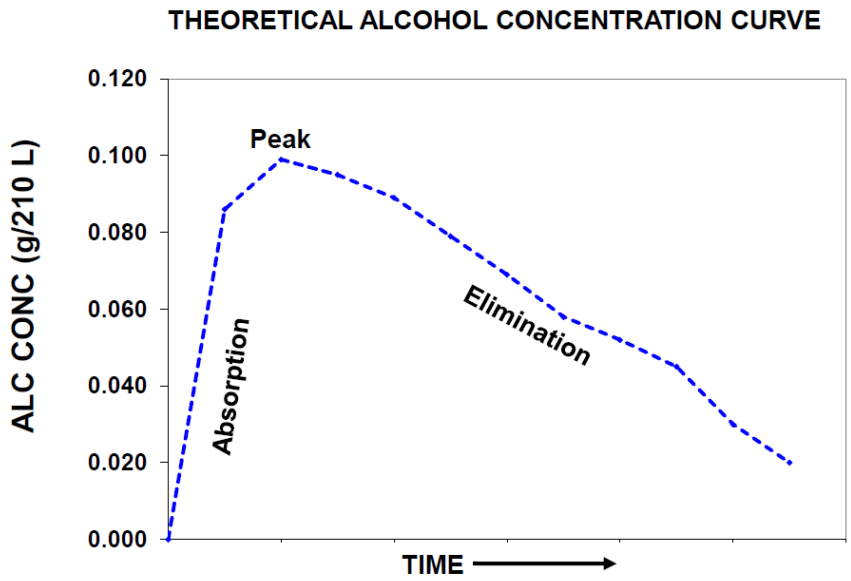


Figure 4-6. An alcohol concentration curve shows how the concentration changes over time.

SCIENTIFICALLY ESTIMATING ALCOHOL CONCENTRATION

Technical supervisors are asked to estimate a person's alcohol concentration at the time of driving. There are three possibilities when scientifically estimating the alcohol concentration at a time prior to the test. The alcohol concentration could be higher, the same, or lower, depending upon where the individual is on the alcohol concentration curve (absorption, peak, or elimination).

When scientifically estimating an individual's alcohol concentration at a time prior to the test, the most useful piece of information to consider is when the individual last consumed alcohol. Research indicates that the alcohol concentration at the time of the test is usually lower or the same compared to the time of driving.

IMPAIRMENT OF DRIVING SKILLS

The Central Nervous System (CNS) is composed of the brain and the spinal cord and is responsible for transmitting nerve impulses to the muscles and organs of the body. Ethanol is a *CNS depressant* that slows nerve transmission and reduces coordination between various nerve centers.

Impairment to some CNS functions are observable at low ethanol concentrations, and more abilities are impaired as the concentration increases. With a high enough ethanol concentration, even involuntary functions like breathing and digestion can be affected. Research supported by the National Safety Council and the American Medical Association has demonstrated that impairment of important driving skills can occur at ethanol concentrations well below 0.08 g/210 L. The only safe advice is to not drink any amount of alcohol before driving.

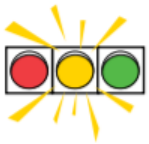
Judgment – As inhibitions are reduced, risky and unsafe behavior increases and may be manifested through poor decision making and improper choices.

Perception/Vision – Lack of muscle coordination leads to blurring and double vision. Intoxication decreases the field of peripheral vision. Impairment of vision has been measured at low alcohol concentrations.

Divided Attention – Drivers must be able to divide attention between tasks such as the presence of other vehicles, traffic signals, and pedestrians, in addition to handling in-car distractions such as passengers or electronic devices. Research has shown that ethanol impairs the performance of divided attention tasks.

Psychomotor Skills – The relationship between mental functions and physical movement is affected by ethanol. The degree of impairment observed during roadside testing, on actions such as walking and balancing, can depend on the drinking experience of the individual.

Tracking – The driver must maintain the vehicle within the lane and in the correct direction while monitoring the driving environment for other important information. The ability to steer is very susceptible to ethanol impairment.



Information Processing – If there are two or more stimuli and if several responses are possible, response times lengthen significantly and the likelihood of an incorrect response increases. Impaired drivers require more time to recognize and respond to traffic signals.

TOLERANCE TO ETHANOL

Tolerance is when a larger amount of a drug must be consumed in order to produce the same effect. It is also the ability to mask some of the outward signs of impairment. Some individuals have varying degrees of natural genetic tolerance to ethanol.

Tolerance can be learned by repeated use of a drug. Experienced drinkers that have developed a high tolerance to the effects of ethanol may appear normal and show few obvious signs of intoxication even at high concentrations.

Tolerance can also be developed during a single drinking event. The Mellanby Effect explains why a person may appear more intoxicated when their alcohol concentration is rising than when it is falling. Recent impairment at higher concentrations makes any lower concentration feel like an improvement to someone experiencing this effect.

Judging an individual's intoxication can be very difficult when based solely on visual observation. Regardless of how a person appears, it is the impairment of the individual's normal physical and mental faculties that is important. An individual may consciously or unconsciously attempt to disguise their intoxication, but this cannot change the fact that their judgment, vision, reactions, and coordination are impaired. Regardless of a person's tolerance to the effects of alcohol, everyone with an alcohol concentration of 0.08 or above is too impaired to drive safely.

ETHANOL AND OTHER DRUGS

When ethanol is ingested in combination with certain other drugs, the symptoms of alcohol intoxication may be increased. Combining ethanol with other drugs can produce two general types of effects, *additive or synergistic*. When one dose of a drug is combined with one dose of ethanol and the effect is equal to no more than the sum of the effects of the two drugs, the effect is said to be additive. When a drug is combined with ethanol and the end result is greater than the sum of the individual effects, the effect is said to be synergistic.

This may explain the situation when an individual appears very intoxicated, but the alcohol test results are low or zero. It is important to remember that intoxication may be from alcohol alone, alcohol in combination with other drugs, or from other drugs alone.

IMPAIRMENT WITHOUT INTOXICATION

Certain illnesses or diseases may produce symptoms similar to ethanol intoxication. Persons with untreated diabetes or trauma victims may appear to be intoxicated. Law enforcement officers and other first responders should be mindful of this possibility.

Acetone at certain levels has impairing effects which may be mistaken for alcohol intoxication. The three most common reasons that acetone is present is due to a prolonged fast, a low carbohydrate diet, or untreated diabetes. The Intoxilyzer 9000 can distinguish between acetone, ethyl alcohol, and other volatile chemicals present in human breath. If a substance other than ethanol is detected, the instrument will stop the test and indicate an interfering substance has been detected. This feature of the instrument eliminates the possibility of acetone or other substances affecting the alcohol result.

05 BREATH ALCOHOL TESTING REGULATIONS

TEXAS ADMINISTRATIVE CODE

The complete text of the Texas Breath Alcohol Testing Regulations can be found in the Texas Administrative Code in Title 37, Part 1, Chapter 19, Subchapter A.

Breath test operators must follow the regulations when conducting evidential subject tests and adhere to regulatory requirements for certification. This section highlights and explains key components of the regulations related to subject testing and operator certification.

DEFINITIONS (§19.1)

***Certified operator** – An individual meeting and maintaining the requirements stated in §19.4 of this title (relating to Operator Certification).*

An operator becomes certified by passing an initial course of instruction. Certification is maintained by meeting annual requirements specified in the regulations.

***Inactivation** – The voluntary or temporary discontinuance of certification.*

***Recertification** – A process to make certification current.*

***Scientific Director** – The individual or his designee responsible for the implementation, administration, and enforcement of the Texas Breath Alcohol Testing Regulations.*

The scientific director is the State's chief scientist in all matters related to the breath alcohol discipline. Technical supervisors are the field agents of the scientific director in an assigned area of the State.

***Suspension** – The termination or revocation of certification.*

INSTRUMENT CERTIFICATION (§19.2)

- ***(a) The Office of the Scientific Director, Breath Alcohol Testing Program, Texas Department of Public Safety (hereinafter referred to as the scientific director) shall approve and certify all breath alcohol testing instruments to be used for evidential purposes.***

Figure 5-1. The Intoxilyzer 9000 is approved and certified for evidential use by the scientific director.

There are certain criteria in the regulations for a breath alcohol testing instrument to be approved and certified:

- ***(b)(1) Expired breath specimens shall be analyzed.***

  The sample must be breath exhaled from the lungs directly into the instrument.

- ***(b)(2) The instrument shall incorporate a reference system, the result of which must agree within plus or minus 0.01g/210 L of the nominal value or such limits as set by the scientific director.***

  The reference sample device (simulator) and reference sample solution meet this requirement. The accuracy of the instrument is confirmed by measuring the known alcohol concentration of the solution two times during the test.

- ***(b)(3) The specificity of the procedure shall be adequate and appropriate for the analyses of breath specimens for the determination of alcohol concentration for law enforcement.***

  Specificity refers to the instrument's ability to differentiate between ethanol in a sample and any other volatile chemicals that may be present (i.e., acetone).

- ***(b)(4) Any other tests deemed necessary by the scientific director to correctly and adequately evaluate the instrument to give correct results in routine breath alcohol testing and be practical and reliable for law enforcement purposes.***

  The various safeguards built into the instrument that will stop a test if an improper condition for testing occurs ensure the reliability of the instrument and results.

The regulations prohibit demonstration or display of the instrument for purposes other than evidential subject breath analysis:

- ***(f) Certified evidential instruments should not ordinarily be used for public information programs. Individuals with appropriate breath alcohol testing technical expertise, such as a certified technical supervisor, should disseminate this type of public information.***

  An operator should not display or demonstrate the instrument for public information. The operator should contact the technical supervisor when receiving a request for public information or a request to view the Intoxilyzer.

TECHNIQUES AND METHODS (§19.3)

Required breath alcohol testing techniques and methods are detailed in the regulations:

- ***(a)(1) a period during which an operator is required to remain in the presence of the subject. 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. Direct observation is not necessary to ensure the accuracy of the test result;***

  A certified operator must perform the waiting period. This essential technique is to ensure there is no residual (mouth) alcohol present that could affect the results. The operator must restart the waiting period if they leave the presence of the subject prior to, or during the test. A 15-minute waiting period is required for a test to be considered complete.

Printed copy is uncontrolled. Refer to electronic copy for current version.

- ***(a)(2) the breath alcohol testing instrument must be operated by a certified operator or technical supervisor and only certified personnel will have access to the instrument;***

  Certified operators are responsible for both the security and operation of the instrument.

- Instrumentation will be used only ***(a)(7)(a) for testing subjects suspected of violating any statute or codified rule that defines intoxication in terms of alcohol concentration;***

  Since public intoxication (PI) is not defined in terms of alcohol concentration, subjects under arrest for PI should not be tested on an Intoxilyzer 9000.

OPERATOR CERTIFICATION (§19.4)

To be certified a person must meet specific requirements in the regulations:

- ***(a)(1) Prior to certification an applicant must establish proof of association, or pending association with: a law enforcement agency, or a laboratory, actively engaged in evidential breath alcohol testing, or a certified school of instruction in Texas or proof of pending association upon receipt of certification.***

- ***(a)(3) Prior to initial certification as a breath test operator, an applicant must successfully complete a course of instruction meeting the criteria set forth in §19.6 of this title (relating to Approval of Courses of Instruction).***

  In addition to the lecture component, the student establishes competency on the instrument by completing a laboratory component during the initial course and passes a written exam.

Figure 5-2. Breath test operators are issued a certificate after completing an initial course of instruction.

Persons meeting any of the following criteria are not eligible to be a certified operator:

- ***(a)(2)(A) persons convicted of a felony or a Class A misdemeanor […];***
- ***(a)(2)(B) persons convicted of a Class B misdemeanor within the last 10 years […];***
- ***(a)(2)(C) persons receiving a driver license suspension or a denial to issue a driver license for refusal to submit to the taking of a specimen per the provisions of Texas Transportation Code, Chapter 724 or Chapter 522 within the last 5 years […].***

INACTIVATION (§19.4)

- ***(d)(1) Inactivation may be initiated by the certified operator in case of voluntary surrender of certification or by anyone with the authority to suspend. The technical supervisor or operator shall, without delay, notify the office of the scientific director of any such inactivation. Challenges to involuntary inactivation will be resolved at the discretion of the scientific director.***

  Inactivation can be requested by the operator, due to transfer or promotion where certification is not needed. The operator should notify their technical supervisor.

  Inactivation can be initiated by the technical supervisor as needed.

SUSPENSION (§19.4)

- ***(d)(2) Suspension of certification will be utilized when the scientific director and/or a technical supervisor determines an operator intentionally or purposefully disregards or violates these regulations, or commits a violation of law relating to breath testing, or falsely or deceitfully obtains certification, or for malfeasance or noncompliance with any provision of these regulations, or when in the technical supervisor's judgment the operator's performance is unreliable or the operator is incompetent.***

  Suspension is utilized for intentional non-compliance with the regulations or when a technical supervisor believes an operator's performance is not reliable. The scientific director will decide if the suspension is sustained or set aside and will determine the effective dates for the suspension. After this decision is made, an operator may appeal the suspension as defined in the regulations.

APPEAL OF SUSPENSION (§19.4)

- ***(d)(3) An operator whose certification has been suspended may appeal such action in writing to the assistant director of the major division responsible for crime laboratory activities, Texas Department of Public Safety, who will determine if the action of the scientific director will be affirmed or set aside. The assistant director may reinstate the certification under such conditions as deemed necessary and notify the scientific director in writing.***

RECERTIFICATION (§19.4)

- ***(e) Certification that has been inactivated or suspended must be regained before evidential analyses may be administered. […]***

  The operator must pass a written exam.

  The operator will complete a competency requirement by properly completing practice tests on the instrument.

  An operator that is inactive for failing a written exam or for failing to establish competency must wait 30 days before applying to recertify.

  A subsequent failure of either criteria will require that the candidate attend and satisfactorily complete the initial course of instruction for certification of a breath test operator.

ANNUAL RENEWAL OF CERTIFICATION (§19.4)

A currently certified operator must complete specific requirements *each year* to remain certified:

- ***(b) In order to maintain current certification, the operator is required to renew certification prior to its expiration date. […]***

All operator certificates expire after October 31st of each year.

Annual renewal requirements vary, depending on the year.

An operator that does not meet the requirements for renewal prior to the expiration will be inactivated and will have to complete the recertification process before conducting any additional subject tests.

Requirements for renewal:

- ***(b)(1) The proper completion of any combination of five subject and/or practice tests as defined in the Texas Breath Alcohol Testing Program Operator Manual since the last issuance of an operator certificate […]***

  An operator is required to complete at least 5 tests *every year*.

  Only complete subject tests and complete practice tests will be counted.

  Incomplete tests *do not* count towards the annual renewal requirements.

- ***(b)(2) The satisfactory biennial completion of a course of instruction […]***

  This course is required *every other year*, in years ending in an *odd* number.

  Technical supervisors will provide information about the annual renewal course to operators in their area of responsibility.

  A review of topics related to breath alcohol testing will be covered followed by a written exam.

  This course is in addition to the annual 5 subject and/or practice tests requirement.

- ***(b)(5) Upon successful completion of the requirements for renewal of certification, the scientific director will issue the individual an operator certificate for a period of time designated by the scientific director or until next examination for renewal unless inactivated or suspended.***

  The operator's certification will be renewed until October 31st of the following year.

  It is the responsibility of the operator to maintain proficiency by completing the annual renewal requirements.

NOTE: An operator should notify the technical supervisor of any change in duty station or contact details as soon as possible.

06 ANALYTICAL REPORT EXAMPLES

1. COMPLETE SUBJECT TEST

TEXAS FORENSIC BREATH ALCOHOL ANALYTICAL REPORT

Report Number: 9999000002
Analytical Instrument: Intoxilyzer 9000
Serial Number: 90-009999

Date: 05/05/2021
Location: TEXAS PD
Technical Supervisor Area: 099

Subject Name: SUBJECT, JANE

Date of Birth: 09/09/1999

Subject Result 1: 0.137 g/210 L
Subject Result 2: 0.143 g/210 L

Sequence of Analysis

Operational System Check	OK	23:45 CDT
Air Blank	0.000	23:45 CDT
Cal Verification	0.078	23:46 CDT
Solution Temp.	34.01°C	
Air Blank	0.000	23:47 CDT
SUBJECT RESULT 1	0.137	23:47 CDT
Air Blank	0.000	23:48 CDT
Air Blank	0.000	23:50 CDT
SUBJECT RESULT 2	0.143	23:50 CDT
Air Blank	0.000	23:51 CDT
Cal Verification	0.078	23:51 CDT
Solution Temp.	34.00°C	
Air Blank	0.000	23:52 CDT
Operational System Check	OK	23:52 CDT

Test Complete 05/05/2021

Operator Signature: Joe Operator

Fifteen minute waiting period completed - YES
Operator Name: OPERATOR, JOE

Certificate Number: 99999

All air blank results must be 0.000
Subject results 1 and 2 must not differ by more than 0.020 g/210L.
Calibration verification results acceptable range: 0.070 - 0.090 g/210L.
Reference sample solution temperature acceptable range: 33.80 - 34.20°C.

2. INCOMPLETE SUBJECT TEST

TEXAS FORENSIC BREATH ALCOHOL ANALYTICAL REPORT

Report Number: 9999000001
Analytical Instrument: Intoxilyzer 9000
Serial Number: 90-009999

Date: 05/05/2021
Location: TEXAS PD
Technical Supervisor Area: 099

Subject Name: SUBJECT, JANE

Date of Birth: 09/09/1999

INCOMPLETE TEST: RADIO FREQUENCY DETECTED
Test stopped by instrument. A radio frequency signal was detected.

Sequence of Analysis		
Operational System Check	OK	23:38 CDT
Air Blank	0.000	23:38 CDT
Cal Verification	0.077	23:39 CDT
Solution Temp.	34.00°C	
Air Blank	0.000	23:39 CDT
SUBJECT RESULT 1	0.130	23:41 CDT
Air Blank	0.000	23:41 CDT
Air Blank	*	23:43 CDT
Air Blank	0.000	23:43 CDT
Operational System Check	OK	23:43 CDT

*RADIO FREQUENCY DETECTED

Operator Signature: Joe Operator

Fifteen minute waiting period completed - YES
Operator Name: OPERATOR, JOE

Certificate Number: 99999

All air blank results must be 0.000
Subject results 1 and 2 must not differ by more than 0.020 g/210L.
Calibration verification results acceptable range: 0.070 - 0.090 g/210L.
Reference sample solution temperature acceptable range: 33.80 - 34.20°C.

3. COMPLETE PRACTICE TEST

TEXAS FORENSIC BREATH ALCOHOL ANALYTICAL REPORT

Report Number: 9999000003
Analytical Instrument: Intoxilyzer 9000
Serial Number: 90-009999

Date: 05/05/2021
Location: TEXAS PD
Technical Supervisor Area: 099

Subject Name: PRACTICE TEST,

Date of Birth: 05/05/2021

Subject Result 1: 0.000 g/210 L
Subject Result 2: 0.000 g/210 L

Sequence of Analysis

Operational System Check	OK	23:54 CDT
Air Blank	0.000	23:55 CDT
Cal Verification	0.077	23:55 CDT
Solution Temp.	34.00°C	
Air Blank	0.000	23:56 CDT
SUBJECT RESULT 1	0.000	23:58 CDT
Air Blank	0.000	23:58 CDT
Air Blank	0.000	00:00 CDT
SUBJECT RESULT 2	0.000	00:00 CDT
Air Blank	0.000	00:01 CDT
Cal Verification	0.076	00:01 CDT
Solution Temp.	34.01°C	
Air Blank	0.000	00:02 CDT
Operational System Check	OK	00:02 CDT

Test Complete 05/06/2021

Operator Signature: Joe Operator

Fifteen minute waiting period completed - YES
Operator Name: OPERATOR, JOE

Certificate Number: 99999

All air blank results must be 0.000
Subject results 1 and 2 must not differ by more than 0.020 g/210L.
Calibration verification results acceptable range: 0.070 - 0.090 g/210L.
Reference sample solution temperature acceptable range: 33.80 - 34.20°C.