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 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 also encouraged and supported scientific research in all aspects related to the problem of alcohol and transportation.

Numerous types of breath alcohol testing devices were developed. Utilizing these new scientific instruments, Texas became involved in breath alcohol testing with pilot programs in the late 1940’s and early 1950’s.

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. In 2015 Texas began using the Intoxilyzer 9000®. The biggest difference between the instruments as they have developed is not their accuracy, precision, or method of analysis, but their automation and ease of operation.

In 1960, the National Safety Council recommended that an alcohol concentration at or above 0.10 be considered evidence of intoxication. As research continued, the committee recommended in 1971 an even 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 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 state is divided into more than thirty Technical Supervisor areas. Technical Supervisors are trained forensic scientists charged with the responsibility of administering, regulating, and enforcing all aspects of breath alcohol testing within their assigned area.

Technical Supervision is provided for breath alcohol testing programs by several different sources. The largest single groups of Technical Supervisors are employed by the Department of Public Safety; however, several Technical Supervisors are employed by local agencies. Technical Supervisors, regardless of their 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.
The most current copy of the Texas Breath Alcohol Testing Program Operator Manual is available at: http://www.dps.texas.gov

## Preparer

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INTOXILYZER 9000 INSTRUMENTATION & ANALYSIS

INSTRUMENT REQUIREMENTS
The Texas Breath Alcohol Testing Regulations place requirements on any breath alcohol testing instrument that is to be certified for evidential purposes in Texas. These requirements are:

- Expired breath specimens shall be analyzed
- The instrument shall incorporate a reference system, the result of which must agree within plus or minus 0.01 g/210 L of the nominal value or such limits as set by the Scientific Director
- 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.
- 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.

There are various analytical methods that can be used to measure the alcohol concentration in a breath specimen. The Intoxilyzer 9000 meets the requirements set forth by the Regulations using infrared spectrometry.

INFRARED SPECTROMETRY
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 measures the absorption of radiant energy by a substance and is widely used in the scientific community.

DETERMINATION OF ALCOHOL CONCENTRATION
The Intoxilyzer 9000 uses a scientific law known as the Lambert-Beer Law to determine the alcohol concentration in a breath sample. The Lambert-Beer Law states that the amount of energy absorbed by a particular substance is proportional to the number of absorbing molecules in the sample. The amount of infrared energy absorbed in a breath sample is proportional to the amount of ethanol present in a breath sample introduced into the instrument sample chamber. The Intoxilyzer 9000 reports the measured alcohol concentration in grams of alcohol per 210 liters of breath, as specified by Texas statute.
SPECIFICITY
The Intoxilyzer 9000 uses multiple wavelengths of infrared energy. For any given molecule, such as ethanol, the absorption patterns of specific wavelengths are unique, similar to a fingerprint. Other substances, such as acetone, absorb wavelengths in patterns different from ethanol. When the Intoxilyzer 9000 detects differing absorption patterns, it stops the test.

SIMULATOR
The Texas Breath Alcohol Testing Regulations require the instrument to incorporate a reference system. The simulator is a device that meets the reference system requirement. The simulator delivers a known concentration of ethanol to the instrument to verify the accuracy and calibration of the instrument. Technical Supervisors prepare solutions for use in the simulator called reference sample solutions. The analysis of the reference sample solution is called a calibration verification. Two calibration verifications are conducted as a part of each Subject Test. The acceptable range for each calibration verification result is 0.070 - 0.090 g/210 L. If a calibration verification result falls outside of the acceptable range, the instrument will stop the test.

The proper operating temperature of the reference sample solution is 33.80 - 34.20°C. If the temperature of the solution is not within the acceptable range, the instrument will stop the test. The Operator may verify the solution temperature by observing the digital thermometer display on the front of the simulator. The temperature of the solution will also be printed on the Analytical Report. If the simulator displays a status code, it may be turned off and turned back on by the Operator. If the status code persists, the Operator should contact the Technical Supervisor.

15 MINUTE WAITING PERIOD
The Texas Breath Alcohol Testing Regulations states:

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.

The waiting period is the 15 minutes immediately prior to the test, not just any 15 minute period. The purpose of the waiting period is to ensure that there is no residual (mouth) alcohol present. Only certified breath test Operators may conduct the 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, the waiting period must be restarted.

The Texas Breath Alcohol Testing Program uses a three prong approach to ensure that the Subject’s breath alcohol results are not affected by residual alcohol. In addition to the 15 minute waiting period, the instrument has a residual alcohol detection system and the two subject tests must not differ by more than 0.020 g/210 L. Taken together these safeguards ensure that the Subject’s breath alcohol results are not affected by residual alcohol.
INTOXILYZER 9000 NAVIGATION
There are several different buttons displayed on the instrument that will be used to navigate through the touchscreens. Most buttons require a single tap. The Stop, Clear, and Refused buttons require a double tap.

<table>
<thead>
<tr>
<th>Button</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEYBOARD</td>
<td>GO FORWARD</td>
</tr>
<tr>
<td>DL MAGNETIC SWIPE</td>
<td>CLEAR SIGNATURE BOX (double tap)</td>
</tr>
<tr>
<td>DL 2D BARCODE</td>
<td>SUBJECT REFUSED (double tap)</td>
</tr>
<tr>
<td>START THE TEST</td>
<td>ACCEPT</td>
</tr>
<tr>
<td>STOP THE TEST (double tap)</td>
<td>OPTIONS MENU</td>
</tr>
<tr>
<td>EXIT TO START SCREEN</td>
<td>GO BACK</td>
</tr>
</tbody>
</table>
STARTING THE TEST
When the Intoxilyzer 9000 has not been used for 30 minutes, the instrument will go into standby mode and the touchscreen will be either blank or displaying one of several screensavers. To bring the instrument out of the standby mode, tap the touchscreen with your finger or the stylus. At the conclusion of a two minute countdown, the Start test button will then turn green and the instrument will be ready for testing. The Intoxilyzer 9000 is equipped with a keyboard, a magnetic card reader, a 2d barcode reader and a color touchscreen display for data entry. The instrument will prompt the Operator to choose the method of data entry. The Operator will have the opportunity to review all of the data entered before the test begins. If the instrument will not power up, the Operator should contact the Technical Supervisor.

CONDUCTING A SUBJECT BREATH ANALYSIS
Before beginning a subject test, the Operator should take a few moments to explain the testing procedure to the subject. The instrument will require the subject to provide two separate breath samples in order to complete the test. To deliver an acceptable sample, the subject should provide a steady flow of breath into the instrument. A tone will sound as long as the subject is providing an acceptable sample.

The subject must blow into the Intoxilyzer 9000 with sufficient pressure to sound the tone for a minimum amount of time and until the slope detector is satisfied. The slope detector monitors the rate of change in the alcohol concentration of the breath sample. When the rate of change slows, the slope detector will be satisfied. The Intoxilyzer 9000 allows approximately three minutes for the subject to deliver an adequate breath sample. If the subject does not satisfy all of the breath sample requirements within three minutes, the Intoxilyzer 9000 will stop the test.

To begin a test, 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 your DL number). Press the arrow pointing to the right to continue. The Operator will then select the type of test to be conducted. The instrument will prompt the Operator to choose the method of data input. The Subject’s information can be entered manually using a keyboard, electronically by swiping the magnetic stripe, or scanning the 2d barcode on the Subject’s DL. If the subject’s date of birth is unknown, enter the current date.

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 by typing the word YES in the box to confirm. The Operator should then place their signature in the box on the touchscreen. Never use a pen or pencil.
The instrument will begin the testing sequence by automatically conducting an electronic check of the instrument’s operating system called the Operational System Check. The Operational System Check will be conducted again at the conclusion of the testing sequence. If there is an error during the check, the instrument will stop the test. At various points during the testing sequence, the instrument will conduct an air blank. During the air blank the instrument will purge the sample chamber with room air. The result of the air blank analysis must be 0.000 or the instrument will stop the test.

When the testing sequence reaches the Subject Sample 1 and Subject Sample 2 portion of the test, the instrument will automatically instruct the Subject to “please blow long and steady” in English. A Spanish version can also be activated by tapping the green button on the touchscreen. A rectangular box on the touchscreen will fill from the left as the Subject blows into the instrument. A Subject test may be stopped at any time by double tapping the STOP button. If a subject refuses to provide a breath sample, by words or actions, double tap the REFUSED button. Once a subject begins to deliver a sample with sufficient pressure to sound the tone, the REFUSED button will become unavailable. In the event that the subject begins to deliver a breath sample and subsequently refuses to continue, the Operator should allow the instrument to stop the test as a deficient sample.
The calibration will be verified twice during each complete test sequence. The calibration verification results must not fall outside of the acceptable range (0.070 - 0.090 g/210 L) otherwise the instrument will stop the test. If the temperature of the reference sample solutions is outside of the acceptable range (33.80 - 34.20°C), the instrument will stop 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. All evidential tests are stored in the Intoxilyzer 9000 as individual tamper resistant pdf documents. An Analytical Report can be printed from the pdf at any time.

**Complete Test**
For a test to be considered properly completed, 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: 0.070 - 0.090 g/210 L
4. The reference sample solution temperature of both calibration verifications must be in the acceptable range: 33.80 - 34.20°C
5. “Test Complete” is printed in the Sequence of Analysis box
6. The signature of the Operator

**Incomplete Test**
The instrument has safeguards in place to ensure the integrity of the results. When a test is stopped, either by the Operator or the instrument, the Intoxilyzer 9000 will display the reason the test was stopped and instruct the Operator on how to proceed. If the instrument instructs the Operator to contact the Technical Supervisor, the Operator should do so as soon as possible. If possible, it is recommended that the Operator call the Technical Supervisor from the Intoxilyzer room so that they can respond promptly.

Regardless of the operational message displayed, the most important thing to remember is: **Read and follow the instructions displayed on the touchscreen.**

**Updating Operator Information**
If an Operator needs to change their information, they must log in using the Options button and tap the Operator Update Information button. The name may be changed only by scanning the 2d barcode or swiping the magnetic stripe on the Operator’s driver license (DL). The name on the DL is the Operator’s official name. If an Operator wants to change their name, they must first update the information on their DL.
TEXAS FORENSIC BREATH ALCOHOL ANALYTICAL REPORT

Report Number: 00061800001  Date: 05/19/2015
Analytical Instrument: Intoxilyzer 9000  Location: University PD
Serial Number: 90–000618  Technical Supervisor Area: 099

Subject Name: MORRIS, MICHAEL ROBERT JR

Date of Birth: 04/15/1981

Subject Result 1: 0.117 g/210 L
Subject Result 2: 0.119 g/210 L

Sequence of Analysis:

Operational System Check  OK  23:55 CDT
Air Blank  0.000  23:55 CDT
Cal Verification  0.079  23:56 CDT
Solution Temp.  34.09°C
Air Blank  0.000  23:56 CDT
SUBJECT RESULT 1  0.117  23:57 CDT
Air Blank  0.000  23:57 CDT
Air Blank  0.000  00:00 CDT
SUBJECT RESULT 2  0.119  00:01 CDT
Air Blank  0.000  00:01 CDT
Cal Verification  0.080  00:01 CDT
Solution Temp.  34.11°C
Air Blank  0.000  00:01 CDT
Operational System Check  OK  00:02 CDT

Test Complete 05/20/2015

Operator Signature: Larry Jordan

Fifteen minute waiting period completed – YES
Operator Name: JORDAN, LAWRENCE JACOB

Certificate Number: 01004

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
TEXAS FORENSIC BREATH ALCOHOL ANALYTICAL REPORT

Report Number: 000618000002  Date: 05/21/2015
Analytical Instrument: Intoxilyzer 9000  Location: University PD
Serial Number: 90-000618  Technical Supervisor Area: 099

Subject Name: Smith, John Patrick

Date of Birth: 02/18/1979

INCOMPLETE TEST: INTERFERENT DETECTED
Test stopped by instrument. An interferent was detected in the subject’s breath sample.

Do not attempt to conduct another breath test on this subject. It is recommended that a blood sample be obtained.

Sequence of Analysis:

| Operational System Check | 23:56 CDT |
| Air Blank                | 0.000     |
| Calibration Verification | 0.079     |
| Solution Temp.           | 34.09°C   |
| Air Blank                | 0.000     |
| SUBJECT RESULT 1         | *         |
| Air Blank                | 0.000     |
| Operational System Check | 23:56 CDT |

*Interferent Detected  23:57 CDT

Operator Signature: ____________________________
Larry Jordon

Fifteen minute waiting period completed – YES
Operator Name: Jordan, Lawrence Jacob

Certificate Number: 01004

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
TEXAS FORENSIC BREATH ALCOHOL ANALYTICAL REPORT

Report Number: 00061800003  Date: 05/22/2015
Analytical Instrument: Intoxilyzer 9000  Location: University PD
Serial Number: 90-000618  Technical Supervisor Area: 099

Subject Name: PRACTICE, TEST

Date of Birth: 05/22/2015

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

Sequence of Analysis:

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<th>Status</th>
<th>Date, Time</th>
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</thead>
<tbody>
<tr>
<td>Operational System Check</td>
<td>OK</td>
<td>23:55:50 CDT</td>
</tr>
<tr>
<td>Air Blank</td>
<td>0.000</td>
<td>23:55:50 CDT</td>
</tr>
<tr>
<td>Cal Verification</td>
<td>0.079</td>
<td>23:50:00 CDT</td>
</tr>
<tr>
<td>Solution Temp.</td>
<td>34.09°C</td>
<td></td>
</tr>
<tr>
<td>Air Blank</td>
<td>0.000</td>
<td>23:56:00 CDT</td>
</tr>
<tr>
<td>SUBJECT RESULT 1</td>
<td>0.000</td>
<td>23:57:00 CDT</td>
</tr>
<tr>
<td>Air Blank</td>
<td>0.000</td>
<td>23:57:00 CDT</td>
</tr>
<tr>
<td>Air Blank</td>
<td>0.000</td>
<td>00:00:00 CDT</td>
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<tr>
<td>SUBJECT RESULT 2</td>
<td>0.000</td>
<td>00:01:00 CDT</td>
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<tr>
<td>Air Blank</td>
<td>0.000</td>
<td>00:01:00 CDT</td>
</tr>
<tr>
<td>Cal Verification</td>
<td>0.080</td>
<td>00:01:00 CDT</td>
</tr>
<tr>
<td>Solution Temp.</td>
<td>34.11°C</td>
<td></td>
</tr>
<tr>
<td>Air Blank</td>
<td>0.000</td>
<td>00:02:00 CDT</td>
</tr>
<tr>
<td>Operational System Check</td>
<td>OK</td>
<td>00:02:00 CDT</td>
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</table>

Test Complete 05/23/2015

Operator Signature: Larry Jordan

Fifteen minute waiting period completed – YES
Operator Name: JORDAN, LAWRENCE JACOB

Certificate Number: 01004

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: 33.83 - 34.20°C
The most current copy of the Texas Breath Alcohol Testing Program Operator Manual is available at: http://www.dps.texas.gov

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ETHANOL

WHAT IS ETHANOL?

Ethanol is classified as an alcohol. At room temperature 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, spirits, or simply alcohol. Ethanol can be found in many different products such as solvents, antiseptics, fuels, medications, and mouthwashes. The terms alcohol, ethyl alcohol, and ethanol can be used interchangeably. Regardless of the term used, ethanol is a drug that affects human behavior and performance.

There are many different types of alcohol 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 toxic. Consumption of even small amounts of methyl alcohol or isopropyl alcohol can have life threatening implications. Although still toxic, ethyl alcohol is not as toxic as other alcohols.

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 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 concentration higher 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 the United States, the ethanol concentration of distilled 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% alcohol by volume. 50% alcohol is equal to 100 proof.

\[
\text{Proof} = 2 \times \% \text{ Alcohol by Volume}
\]

The alcohol content of beer and wine are usually reported in terms of percent volume of alcohol. Most beers have less than 5% alcohol by volume and wines typically have about 10-12% alcohol by volume.

The alcohol content varies depending on the drink. For this course, one "drink" equals one 12 ounce serving of regular beer, 5 ounces of wine or one and a quarter ounces of 80 proof distilled spirits. Each of these drinks contains approximately the same amount of alcohol. If any one of these is consumed in the same period of time, it will have about the same effect upon the body.

**FATE OF ALCOHOL IN THE BODY**

Ethanol can be considered a food, a drug, or a poison for the following reasons:

- It's a *food* because the body uses it to produce energy.
- It's a *drug* because of its *depressant* effect upon the central nervous system.
- It's a *poison* because even small amounts damage and irritate tissue. Larger doses can cause coma and death.

**ABSORPTION**

The most common way to get ethanol into the body is by ingestion via the mouth. The absorption of ethanol begins immediately following the introduction of the alcoholic beverage into the digestive system. It travels down the esophagus and into the stomach. It then passes through the *pyloric sphincter* (valve between the stomach and small intestine) and into the small intestine. Ethanol is readily absorbed through all mucosal surfaces, including the oral cavity and gastrointestinal tract. Ethanol is *not digested*, rather *absorbed by simple diffusion across the mucous membranes*. Some alcohol is absorbed in the stomach, but the majority of the ethanol is absorbed in the *small intestine*.

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. Proper testing procedures combined with current evidential breath alcohol testing instrumentation eliminate residual alcohol from affecting the test result.

The length of time that ethanol remains in the stomach can vary due to several factors such as the presence of food in the stomach and stomach emptying. The most significant factor to affect absorption is the amount of food in the stomach. **Food delays the emptying of the stomach, causing ethanol to remain in the stomach for a longer period of time. This results in slower absorption of ethanol.** Slowing the alcohol absorption decreases the peak alcohol concentration, may prolong the time to reach the peak concentration, and reduces the impact of that alcohol on the person.

The type of food may affect the absorption rate, but the amount of food is the most significant factor. Even on a full stomach, the peak alcohol concentration is usually reached within 30 to 40 minutes after the last drink.

**Absorption Rate: Empty vs. Full Stomach**

![Absorption Rate Graph](image-url)
DISTRIBUTION

Once absorbed, ethanol travels through the liver and is distributed throughout the body. Some of the ethanol quickly reaches the brain. The water content of organs and tissues determines the amount of alcohol absorbed in those locations. Since ethanol mixes with water, it will move from an area of high ethanol content to an area of low ethanol content.

BODY TYPE AND TOTAL BODY WATER

The total amount of water in the body can vary from one individual to another based upon the weight of the person. Assuming the same body type, a 200 pound man must consume more ethanol than a 100 pound man to reach the same alcohol concentration. This is because the 200 pound man has more body water to dilute the alcohol.

The amount of fat tissue also affects the total amount of body water. Since fat tissue has very little water it does not absorb ethyl alcohol. A 200 pound obese person will have less body water to dilute the alcohol, than a 200 pound lean person. Total body water tends to decrease with age.

GENDER DIFFERENCE

In general, women have a higher percentage of body fat and a lower percentage of body water. If a man and woman of the same weight and body build ingest the same amount of alcohol, the woman will most likely achieve a higher alcohol concentration.

THE ELIMINATION PROCESS

Ethanol is removed from the body through metabolism and excretion. The majority of ethanol is metabolized (oxidized) by the liver. A small amount of alcohol can be eliminated in the gastrointestinal tract, particularly the stomach. A small portion is also excreted through urine, sweat and breath.

An individual's rate of metabolism is fairly constant, but the elimination rate can vary from person to person. The range of reported elimination rates varies from about 0.01-0.03 g/210 L per hour. The higher rates usually occur in alcohol abusers or alcohol dependent persons. Hot coffee, a cold shower, or vigorous exercise cannot change the rate of elimination. The body needs a sufficient amount of time to metabolize and excrete the ethanol that was consumed.
The elimination of ethanol in the breath is the basis for the forensic breath alcohol test. The exchange of oxygen and carbon dioxide occurs in the small tissue sacs of the lungs called the alveoli. A portion of the alcohol will be eliminated in the breath because the ethanol can readily pass through the thin alveolar membrane and be exhaled in the breath. The concentration of alcohol in the breath is proportional to the amount of ethanol in the body.

PUTTING IT ALL TOGETHER

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

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.

THEORETICAL ALCOHOL CONCENTRATION CURVE

Theoretical Alcohol Concentration Curve
THE CENTRAL NERVOUS SYSTEM (CNS)

Ethanol is a CNS depressant. It depresses nerve transmission and reduces coordination between various nerve centers.

Alcohol affects the brain in the reverse order of how brain functions develop. For example, higher level brain functions, such as judgment, logic, and reason, are affected first. The lower involuntary brain functions, such as respiration and digestion, are affected last.

Research support 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. Some of the effects alcohol can have on driving skills are:

**Judgment**  Impairment of judgement begins at relatively low alcohol concentrations. As inhibitions are reduced, risky and unsafe behavior increases and may be manifested through poor decision making and improper choices.

**Vision**  Ethanol depresses the coordination between the muscles that control the eyes. This lack of muscle coordination leads to blurring and double vision. Intoxicated individuals tend to narrow their visual field. Ethanol decreases the field of peripheral vision so drivers fail to perceive important peripheral events. Impairment of vision has been measured at extremely low alcohol concentrations.

**Divided Attention**  The ability to divide attention between two or more sources of information is a basic requirement of safe driving. Steering an automobile is an example of a relatively difficult divided attention task. The driver must maintain the vehicle within the lane limits and in the correct direction, while monitoring the driving environment for other important information. The driver must be aware of the presence of other vehicles, traffic signals, and pedestrians. Because these tasks must be performed at the same time, they require the division of attention. Research has shown that the divided attention task is sensitive to the effects of alcohol.

**Psychomotor Skills**  Psychomotor skills demonstrate the relationship between mental functions and physical movement. The degree of impairment demonstrated by roadside tests, such as walking and balancing, can depend on the drinking experience of the driver.

**Perception**  The ability to interpret complex sensory information can be adversely affected by ethanol.

**Information Processing**  Ethanol slows the rate of information processing by the CNS. 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. Alcohol impaired drivers require more time to recognize and respond to traffic signals.

*Even small amounts of alcohol can affect a person’s ability to drive. The only safe advice is to avoid drinking any alcohol if you are driving.*
ETHANOL & TOLERANCE

Tolerance to alcohol occurs when a larger amount must be consumed in order to produce the same effect. Inexperienced drinkers generally have less tolerance to the effects of alcohol than more experienced drinkers. That is why inexperienced drinkers often look and act more intoxicated than experienced drinkers who have the same alcohol concentration.

Most people can increase their tolerance to the effects of alcohol by repeated drinking. People who reduce the amount of alcohol they drink usually see their tolerance to the effects of alcohol decrease. This is similar to weight lifting. When people lift weights regularly, they are able to increase the amount of weight they can lift. If they significantly decrease or stop lifting weights, the amount of weight they can lift is reduced. Drinkers with a high tolerance to the effects of alcohol may appear normal and show few obvious signs of intoxication. This is due partly to learned behavior and physical changes in their bodies that result from repeated consumption of alcohol.

In 1919, Dr. Edward Mellanby was the first scientist to publish a study that concluded a person is more impaired at a given alcohol concentration when their alcohol concentration is increasing than when it is decreasing. Simply stated, the “Mellanby Effect” explains why people feel more intoxicated when their alcohol concentration is rising than when it is falling.

Because of the many aspects of alcohol tolerance, judging a person’s intoxication can be very difficult based only on how they appear. It is the loss of their normal physical and mental faculties that is the most critical. A person may try to hide 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 is too impaired to drive safely.

ALCOHOL AND OTHER DRUGS

Combining ethanol with other drugs can produce two 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. A synergistic situation occurs when a drug is combined with ethanol and the end result is greater than the sum of the individual effects.

When ethanol is consumed along with other drugs, the symptoms of alcohol intoxication may be altered. This may explain the situation where an individual appears very intoxicated, but the alcohol test results are low.

IMPAIRMENT WITHOUT ETHANOL

Certain illnesses, diseases, or other drugs are able to produce symptoms similar to ethanol intoxication. Untreated diabetics or trauma victims may exhibit symptoms similar to ethanol intoxication.

Acetone, like ethanol, can cause impairment and may be mistaken for alcohol intoxication. Acetone can be present in an individual due to a prolonged fast, a low carbohydrate diet, or untreated diabetes. Modern evidential breath alcohol testing instruments can distinguish between acetone and ethyl alcohol, eliminating the possibility of acetone affecting the alcohol result.
Preparer

Heather Greco  Date: 9/24/2015
Quality Assurance Specialist

Concurrence

Forrest W. Davis  Date: 9/24/2015
Quality Assurance Coordinator

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RENEWAL OF CURRENT CERTIFICATION

The renewal procedure for a currently certified breath test Operator is covered in §19.4 of the Breath Alcohol Testing Regulations. All Operator Certificates expire after October 31st of each year. An Operator must have completed all of the requirements for certification renewal prior to November 1st. If all the requirements for certification are met, the Operator’s certificate will be renewed until October 31st of the following year. Annual Renewal requirements are:

**Every year:**

Each Operator must properly complete at least five subject and/or practice tests before November 1st. Any combination of properly completed subject and/or practice tests will meet the yearly requirement.

**During years that end in an odd number:**

In addition to the annual requirements, Operators must successfully complete a renewal course and pass a written exam. Course details and dates will be determined by the Technical Supervisor. The Operator is responsible for obtaining the training schedule. Failure to complete the renewal course and/or pass the written examination will result in inactivation of certification.

Recommendations for meeting the certification renewal requirements:

- You do not have to wait until September and October to run tests. Any complete subject and/or practice tests conducted between last issuance of certification and its expiration (typically from November 1st until October 31st of the following year) will be counted towards certification renewal.

- If you have any questions, contact your Technical Supervisor.
Renewal of Current Certification

Preparer

Heather Greco
Quality Assurance Specialist

Date: 9/24/2015

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Forrest W. Davis
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