Intoximeters Inc
World Leader in Breath Alcohol Testing for Over Fifty Years

TRAINING SUPPLEMENT
ALCOHOL IN THE HUMAN BODY

C2H5OH

This manual is intended to be used in conjunction with a training lecture by an approved Instructor or Trainer as certified by Intoximeters and APC Group.

Intoximeters and APC Group have developed this training program to ensure the proper and consistent use of its breath testing instruments. The user’s understanding of the procedure and equipment will help them realize proper sampling and accurate results.
ALCOHOL AND THE HUMAN BODY

Alcohol’s Properties

Alcohol is a term denoting a family of organic chemicals with common properties. Members of this family include ethanol, methanol, isopropanol and others.

The alcohol we consume is ethyl alcohol—a clear, volatile liquid that burns (oxidizes) easily. Most alcohols are highly poisonous to humans, but ethyl alcohol can be tolerated by the body in small amounts.

Alcohol is not digested like food—but approximately 20% passes from the stomach into the bloodstream through the walls of the small intestine. Within minutes of drinking, the circulation system begins distributing the alcohol to every part of the body. Because it is distributed so quickly and thoroughly, alcohol can affect the central nervous system even in small concentrations. In low concentrations alcohol reduces inhibitions. As the alcohol travels around the body via the bloodstream, it starts to slow down the operation of various sorts of cells. This causes the different stages of intoxication and drunkenness—relaxation, laughter, slurred speech, inability to walk straight and dangerous driving.

With very high concentrations of alcohol—greater than 0.35 grams/100 milliliters of blood (equivalent to 0.35 grams/210 litres of breath) - a person can become comatose and die. This has prompted television campaigns within New Zealand from ALAC ....“its not what we drink, - its how we drink”, in a effort to make young people more aware of the dangers of “binge” drinking.

Alcohol interferes with your brain activity. It slows your reflexes, impairs co-ordination, reduces visual sharpness and caution is often thrown to the wind. Alcohol makes it harder to concentrate, you can’t think as clearly or as quickly, or act as fast as you normally do. Even more of a problem is that you are unaware of these affects on you.

See chart overleaf
# ALCOHOL AND THE HUMAN BODY

<table>
<thead>
<tr>
<th>BAC (g/100 ml of blood or g/210 l of breath)</th>
<th>Stages of Alcohol Intoxication</th>
<th>Clinical Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01-0.05</td>
<td>Sub-Clinical</td>
<td>Behaviour nearly normal by ordinary observation</td>
</tr>
<tr>
<td>0.03—0.12</td>
<td>Euphoria</td>
<td>Mild euphoria, sociability, talkativeness, increased self confidence, decreased inhibitions, diminution of attention, judgement &amp; control, beginning of sensory-motor impairment</td>
</tr>
<tr>
<td>0.09-0.025</td>
<td>Excitement</td>
<td>Emotional instability; loss of critical judgement, impairment of perception, memory &amp; comprehension, decreased sensory response; increased reaction time, reduced visual acuity, peripheral vision, vision &amp; glare recovery, sensory-motor incoordination, impaired balance, Drowsiness</td>
</tr>
<tr>
<td>0.18-0.030</td>
<td>Confusion</td>
<td>Disorientation, mental confusion, dizziness, exaggerated emotional states, disturbances of vision &amp; perception of colour, form motion and dimensions</td>
</tr>
<tr>
<td>0-25-0.40</td>
<td>Stupor</td>
<td>General inertia; approaching loss of motor functions, markedly decreased response to stimuli</td>
</tr>
</tbody>
</table>

- Sub-Clinical: Behaviour nearly normal by ordinary observation
- Euphoria: Mild euphoria, sociability, talkativeness, increased self confidence, decreased inhibitions, diminution of attention, judgement & control, beginning of sensory-motor impairment
- Excitement: Emotional instability; loss of critical judgement, impairment of perception, memory & comprehension, decreased sensory response; increased reaction time, reduced visual acuity, peripheral vision, vision & glare recovery, sensory-motor incoordination, impaired balance, Drowsiness
- Confusion: Disorientation, mental confusion, dizziness, exaggerated emotional states, disturbances of vision & perception of colour, form motion and dimensions
- Stupor: General inertia; approaching loss of motor functions, markedly decreased response to stimuli
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### Absorption
Alcohol is absorbed from all parts of the gastrointestinal tract largely by simple diffusion into the blood. However, the small intestine is by far the most efficient region of the gastrointestinal tract for alcohol absorption because of its very large surface area.

### Distribution
Alcohol has a high affinity for water and is therefore found in the body tissue and fluids in as much as they contain water. Absorbed alcohol is rapidly carried throughout the body in the blood and once absorption of alcohol is complete, an equilibrium occurs such that the blood at all points in the system contains approximately the same concentration of alcohol.

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<th>Stages of Alcohol Intoxication</th>
<th>Clinical Symptoms</th>
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</thead>
<tbody>
<tr>
<td>0.25-0.40</td>
<td>Stupor</td>
<td>Marked muscular in-coordination, inability to stand or walk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vomiting; incontinence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Impaired consciousness; sleep or stupor</td>
</tr>
<tr>
<td>0.35-0.050</td>
<td>Coma</td>
<td>Complete unconsciousness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Depressed or abolished reflexes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subnormal body temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Incontinence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Impairment of circulation &amp; respiration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Possible death</td>
</tr>
<tr>
<td>0.45+</td>
<td>DEATH</td>
<td>Death from respiratory arrest</td>
</tr>
</tbody>
</table>
ALCOHOL AND THE HUMAN BODY

Elimination
The liver is responsible for the elimination—through metabolism—of 95% of ingested alcohol from the body. The remainder of alcohol (5%) is eliminated through excretion of alcohol in breath, urine, sweat, faeces, milk and saliva. The body uses several different metabolic pathways in its oxidation of alcohol to acetaldehyde to acetic acid to carbon dioxide to water.

Healthy people metabolize alcohol at a fairly consistent rate. As a rule of thumb, a person will eliminate one average drink of 50z (15ml) of alcohol per hour. Several factors influence this rate. The rate of elimination tends to be higher when the blood alcohol concentration in the body is very high or very low. Also chronic alcoholics may (depending on liver health) metabolize alcohol at a significantly higher rate than average.

The body's ability to metabolize alcohol quickly also tends to diminish with age.

Body Weight and Body Type
In general, the less you weigh the more you will be affected by a given amount of alcohol. As detailed earlier alcohol has a high affinity for water. Basically, one's blood alcohol concentration is a function of the total amount of alcohol in one's system divided by the total body of water. Given this, then for two individuals with similar body compositions and different weights, the larger individual will achieve lower alcohol concentrations than the smaller one if ingesting the same amount of alcohol.

Rate of Consumption
Blood alcohol concentration depends on the amount of alcohol consumed and the rate at which the user's body metabolizes alcohol. Because the body metabolizes alcohol at a fairly constant rate (somewhat more quickly at higher and lower alcohol concentrations) ingesting alcohol at a rate higher than the rate of elimination results in a cumulative effect and an increasing blood alcohol concentration.
Alcohol Content
We are all aware, it's not what we drink but rather the way we drink or how much alcohol we consume, as you can see from the chart below.

### Alcohol Content of some Typical Drinks

<table>
<thead>
<tr>
<th>DRINK</th>
<th>ALCOHOL CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>330ml can of beer</td>
<td>10g pure alcohol</td>
</tr>
<tr>
<td>100ml glass of table wine</td>
<td>10g pure alcohol</td>
</tr>
<tr>
<td>30ml of straight spirits</td>
<td>10g pure alcohol</td>
</tr>
</tbody>
</table>

- **330ml can of beer @ 3% alcohol**
- **100ml glass of table wine @ 13% alcohol**
- **30ml of straight spirits @ 40% alcohol**

- **330ml can of beer @ 5% alcohol**
- **440ml can of beer @ 4.2% alcohol**
- **750ml bottle of beer @ 4% alcohol**

- **750ml bottle of sparkling wine @ 12% alcohol**
- **750ml bottle of wine @ 14% alcohol**
Alcohol Content of some Typical Drinks

<table>
<thead>
<tr>
<th>Volume</th>
<th>Type</th>
<th>Alcohol Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 litre cask of wine</td>
<td>37.5%</td>
<td></td>
</tr>
<tr>
<td>275ml bottle of RTD</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>335ml bottle of RTD</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>375ml bottle of spirits</td>
<td>37.5%</td>
<td></td>
</tr>
<tr>
<td>500ml bottle of spirits</td>
<td>37.5%</td>
<td></td>
</tr>
<tr>
<td>750ml bottle of spirits</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>1 litre bottle of spirits</td>
<td>47%</td>
<td></td>
</tr>
<tr>
<td>1125ml bottle of spirits</td>
<td>45%</td>
<td></td>
</tr>
</tbody>
</table>

Food
Food taken along with alcohol results in a lower, delayed blood concentration peak (the point of greatest intoxication)

Continued overleaf
ALCOHOL AND THE HUMAN BODY

Medication
Medication is known to increase the affects of alcohol. One should always consult their physician when drinking alcohol whilst on medication.

Fatigue
Fatigue causes many of the same symptoms that are caused by alcohol intoxication. These and other symptoms will be amplified if alcohol intoxication is concurrent with fatigue.

Tolerance
There are two types of tolerance at work with alcohol. The first is metabolic tolerance in which alcohol is metabolized at a higher rate (up to 72% more quickly in chronic users.) Because of the higher metabolic rate for alcohol, lower peak blood alcohol concentrations are achieved by chronic or conditioned drinkers than the average drinker when the same amount of alcohol is taken.

The second is functional tolerance in which there is an actual change in the organ or system’s sensitivity to the drug. Studies have shown that chronic alcohol users have twice the tolerance for alcohol as the average person. It is still important to note however, that even in light of these tolerance factors, it has been shown conclusively that even in heavy alcohol users functional impairment is clearly measurable at the blood alcohol concentration levels that are currently used for traffic law enforcement and safety sensitive job performance.

Gender Differences
In general, women tend to have a higher percentage of body fat and thus a lower percentage of body water. i.e. if a man and a woman of the same weight drink the same amount of alcohol the woman will tend to achieve a higher alcohol concentration. Total body water tends to decrease with age, so an older person will also be more affected by
the same amount of alcohol. According to the table below the differences in alcohol concentration due to average body composition differences based on gender would be between 16% and 10% depending on age.

<table>
<thead>
<tr>
<th>Age</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 to 40 years</td>
<td>61%</td>
<td>52%</td>
</tr>
<tr>
<td>Over 60 years</td>
<td>51%</td>
<td>46%</td>
</tr>
</tbody>
</table>

Another gender-based difference is in the elimination of alcohol. Although not explained, studies appear to show that women eliminate alcohol from their bodies at a rate 10% greater than that of men.

Alcohol in the Workplace
There are a number of reasons why monitoring for alcohol impairment needs to happen.

Cost to Industry
It is estimated that alcohol impairment in the workplace costs industry in New Zealand in excess of $670,000,000 in lowered productivity. This does NOT include the cost of workplace accidents and absenteeism.

Over 50 percent of New Zealand adults can be classified as “binge drinkers. Therefore, it is inevitable that in any organisation, regardless of size, there will be a proportion of individuals experiencing problem drinking and drug use, and they are just as likely to be in the boardroom as on the factory floor, in the office or the sales force. Workers who are either under the influence of alcohol, or suffering from the after-effects, have a heightened risk of injuring themselves or others in the workplace.
The workplace can also be a very important setting for programmes aimed at reducing alcohol-related harm. Because employees spend a lot of time at work, co-workers and supervisors may have the opportunity to notice a developing alcohol problem. In addition, employers can use their influence to motivate employees to get help for an alcohol problem.

Human Costs

On average, 1 person per day is killed and 12 people are injured in alcohol related motor vehicle accidents. Be mindful that although one person dies daily, the injured often suffer life changing injuries.

About 50% of road accident victims are impaired by alcohol at the time of the accident.

In total there are about 800 deaths every year due to heavy drinking, “binge” drinking and many time that number of injuries.

Fact

Almost 48% of all those in full-time employment in New Zealand are binge drinkers. Binge drinking and drug use (even if it occurs outside of working hours) can impact negatively in the workplace.

Employers have responsibility under the Health and Safety in Employment Act 1992 (HSE Act) to ensure the provision of a safe workplace. They must take all practicable steps to ensure the safety of their employees while at work. The Act also requires employees to eliminate, isolate and minimize, in that order of priority, all significant hazards. In this instance, a significant hazard could be the behaviour of an employee who was affected by alcohol or drugs. Workplace programmes to prevent and treat problem alcohol and drug use help employers fulfil these legal obligations.
Disclaimer

All information contained in this document has been obtained form the “public domain”. APC and Intoximeters Inc advise that the results that are generated are estimates of an average healthy person’s BAC assuming typical beverage sizes, recipes and alcohol content. The BAC estimates generated should not be used to infer anyone's fitness to work, drive or perform any other task or duty without comprehensive testing.

Sources:

ALAC New Zealand www.alac.org.nz
ACC New Zealand www.acc.co.nz
Intox.Com (USA) www.intox.com

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Yahoo Xtra Monday 8th June 2009

Boy in coma after drinking session

A 17-year-old boy is recovering in hospital after drinking a six-pack of lager in 30 minutes at a friend’s birthday party.

The boy started feeling unwell and collapsed at the top of a flight of stairs.

The amount is equivalent to 20 standard drinks.

The teenager was taken to hospital with a bottle of diorin from the bar at a beachside bar in a 15-year-old boy.

Could alcohol have been involved? the alcohol concentrations involved the young boy and the boy allegedly alone. Mardi after it was purchased to market only.

The boy was taken through to a coma in December hospital and died in a hospital condition.