STATE OF MINNESOTA

DEPARTMENT OF PUBLIC SAFETY

CHEMICAL TEST TRAINING COURSE

Conducted By

BUREAU OF
CRIMINAL APPREHENSION LABORATORY

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CURRICULUM VITAE
of
Lowell C. Van Berkom

BORN: December 23, 1935, Powers Lake, North Dakota

EDUCATION:

North Dakota State University, Fargo, North Dakota, B.S. -1957, Pharmacy

North Dakota State University, Fargo, North Dakota, M.S. -1968, Department of Pharmacology and Toxicology, - major in Toxicology and minor in Biochemistry

EXPERIENCE:

Manager of Frank's Pharmacy , Powers Lake, North Dakota, 1957-1962

Owner-Manager of Van Berkom Pharmacy, Powers Lake, North Dakota, 1962-1966

Graduate Assistant, North Dakota State University, Fargo, North Dakota, Department of Zoology, 1966

Graduate Fellow in Toxicology, Office of the State Toxicologist, North Dakota State University, 1966-1968

Toxicologist, State of Minnesota, Department of Public Safety, Bureau of Criminal Apprehension Laboratory, St. Paul, Minnesota, 1968 - Present

Director, Chemical Testing Program, State of Minnesota, 1969 - Present

Continuing Legal Education Lecturer, University of Minnesota, General Extension Division, Minnesota State Bar Association

SOCIETIES:

International Association of Forensic Toxicologists
American Academy of Forensic Sciences (Fellow in Toxicology)
Midwestern Association of Forensic Scientists
National Association of Retail Druggists
American Pharmaceutical Association
Rho Chi, National Pharmacy Honor Society
National Safety Council, Committee on Alcohol and Other Drugs

- — Executive Board Member
- — Member of Ad Hoc Committee on Quantitative Breath-Alcohol Instrumentation - 1971
- — Member of Ad Hoc Committee on Breath-Alcohol Screening Tests - 1972
- — Member of Ad Hoc Committee on Review of 'A Performance Standard For Quantitative Breath Alcohol Measuring Instruments' proposed by the National Bureau of Standards - 1972
- — Member of Ad Hoc Committee on 'International Conference on Research Methodology for Roadside Surveys of Drinking Driving' - Paris, France 1974
- — Vice-Chairman - 1977-1979
- — Chairman - 1979-1981

Canadian Society of Forensic Science

- — Breath Test Committee - 1977-Present

CURRICULUM VITAE
of
James O. Rhoads

EDUCATION:

B.A. Degree - Chemistry - Westminster College - 1948 Fulton, Missouri

EXPERIENCE:

Chemist - Presstite Engineering Company - 1948, St. Louis, Missouri

Laboratory Analyst - Missouri Highway Patrol - 1948-1961 Laboratory Director - 1958-1961

Technical Consultant - Fisher Scientific Company - 1961-1962, St. Louis, Mo.

Laboratory Analyst - Minnesota Bureau of Criminal Apprehension - 1962-present, St. Paul, Minnesota, Laboratory Director - 1972-1979

SOCIETIES:

American Chemical Society
American Academy of Forensic Sciences
Midwestern Association of Forensic Scientists

CURRICULUM VITAE
of
Eldon L. Ukestad

EDUCATION:

Valley City State College, Valley City, North Dakota, B.S. - 1967, major Chemistry, minor Math - Speech

Breathalyzer Training Institute, Stephenson Corporation, Eatontown, New Jersey - 1968
Breath Examiner Specialist, Instructor Training Institute, Lansing Community College, Lansing, Michigan - 1971

Alert Maintenance School, Borg Warner Corporation, Chicago, Illinois - 1973

Intoximeter Maintenance School, Ft. Lauderdale, Florida - 1976

EXPERIENCE:

Chemistry Instructor, Lamoure Public High School, Lamoure, North Dakota 1967-68

Crime Laboratory Analyst, Department of Public Safety, Bureau of Criminal Apprehension Laboratory, St. Paul, Minnesota - 1968-present

SOCIETIES:

Minnesota Police and Peace Officers Association
Midwestern Association of Forensic Scientists
Certified Instructor - The Minnesota Peace Officers Training Board
National Safety Council, Committee on Alcohol & Other Drugs

CURRICULUM VITAE
of
James E. Nowell

EDUCATION:

University of Wisconsin - Oshkosh, Oshkosh, Wisconsin, B.S. - 1961 - major Medical Technology, minor Chemistry

University of Wisconsin - Milwaukee, Milwaukee, Wisconsin - 1961 - Certification, Use of Radioactive Isotopes in Medicine.

University of Indiana, Center for Studies of Law In Action, Bloomington, Indiana - Certified supervisor of Breath Tests for Alcohol - 1972

Police Officers Training Institute, College of St. Thomas, Management Center, St. Paul, Minnesota - Certification in Police Training Techniques - 1972

Alert Maintenance School, Borg Warner Corporation, Chicago, Illinois - 1973

Breathalyzer Training Institute, Stephenson Corporation, Eatontown, New Jersey -1973

EXPERIENCE:

Medical Technologist, Mercy Hospital, Oshkosh, Wisconsin - 1961-1963
Chief Technologist, Jensen Clinic, Inc., Menasha, Wisconsin - 1963-1964
Hematological Science Instructor, Medical Institute of Minnesota, Minneapolis, Minnesota - 1964-1972
Crime Laboratory Analyst, Department of Public Safety, Bureau of Criminal Apprehension Laboratory, St. Paul, Minnesota - 1972-present

SOCIETIES:

American Society of Clinical Pathologists
Minnesota Police and Peace Officers Association
Certified Instructor - Minnesota Peace Officers Standards and Training Board.
Midwestern Association of Forensic Scientists

CURRICULUM VITAE
of
Anne W. Rummel

EDUCATION:

Anderson College, Anderson, Indiana, B.A. — 1967, major Biology, minor Chemistry

Indiana University Medical School, Indianapolis, Indiana — 1968, post-graduate studies in Clinical Toxicology and in Analytical Methods.

Indiana University, Indianapolis, Indiana — 1971, post-graduate studies in Organic Chemistry.

EXPERIENCE:

Indiana University Medical School/Department of Toxicology — Indianapolis, Indiana, 1967-1969
Indiana State Police Laboratory, Indianapolis, Indiana, 1969-1975
Minnesota Bureau of Criminal Apprehension Laborabory, St. Paul, Minnesota, 1975-present
Instructor, Breathalyzer Training Class, Indiana State Department of Toxicology, Indianapolis, Indiana, 1968-1969
Certified Instructor — Drugs, Indiana Law Enforcement Academy, Indianapolis, Indiana
Instructor — Drugs/Alcohol, Indiana State Police Recruit School, Indianapolis, Indiana, 1969-1975
Instructor-Drugs, Indiana University Center for Criminal Justice Training, Bloomington, Indiana, 1972-1975

SOCIETIES:

American Academy of Forensic Sciences (member: Criminalistics Section)
Midwestern Association of Forensic Scientists

CURRICULUM VITAE
of
Robert Mooney

EDUCATION:

University of Minnesota, Minneapolis, Minnesota B.A. 1966
Major Zoology, Minor Chemistry

Drug Enforcement Administration - Forensic Chemist Seminar 1975

Federal Bureau of Investigation Academy - Laboratory Investigation in Arson matters.

EXPERIENCE:

Medical Research Scientist
University of Minnesota, Department of Surgery 1966-1969
Physiologist, Veterans Administration Hospital, Research Division, 1696-1972
Crime Laboratory Analyst, State of Minnesota, Bureau of Criminal Apprehension Laboratory 1974-present.

SOCIETIES:

Midwest Association of Forensic Scientists
American Chemical Society National and Minnesota Section Organization
International Association of Arson Investigators
Minnesota Peace and Police Officers Association

CURRICULUM VITAE
of
Richard E. Jensen

EDUCATION:

GrandView (Jr.) College, Des Moines, IA, Diploma — 1958

Iowa State University, Ames, IA, B.S. — 1960, major Chemistry, minor Physics and English

University of Iowa, Iowa City, IA, M.S. — 1964, major Analytical Chemistry

University of Iowa, Iowa City, IA, Ph.D. — 1965, major Analytical Chemistry, minor Inorganic Chemistry

EXPERIENCE:

Assistant Professor of Chemistry, Mankato State University, 1965-1966
Assistant Professor of Chemistry, Gustavus Adolphus College, 1966-1970
Teaching Postdoctoral Appointment, North Dakota State University, Fargo, ND, 1968-1969
Associate Professor of Chemistry, Gustavus Adolphus College, 1970-1979
Sabbatical Leave, Crime Laboratory, Bureau of Criminal Apprehensionn, 1979-80
Deputy Sheriff, Nicollet County, St. Peter, MN, 1968-1979
Assistant Director, Bureau of Criminal Apprehension, Forensic Science Laboratory, August, 1980-present

SOCIETIES:

American Chemical Society
Society of Sigma Xi — National Research Honorary
Ph. Lambda Upsilon — National Chemistry Scholastic Honorary
Midwestern Association of Forensic Scientists

NOTE TAKING

GOOD NOTES

1. Are a source of information.
2. Are a source of mental discipline.
3. Help to organize all points of a lecture.

GENERAL POINTERS

1. Don't try to write down everything the lecturer says.
2. Be sure to get the main points, the ideas and the principles the lecturer is trying to get across.
3. Try to distinguish the main points from those of lesser importance.
4. Don't take notes on introductions. Wait until the lecturer gets into his subject.
5. Stay a little behind the lecturer. Doing this will make the subject clearer to you. As the subject unfolds and develops, write it down.
6. Make your notes brief. Use your own words, as they will convey the meaning of your notes more clearly at some later date. Get the idea and write it down the way you understand it. This will help you to retain everything for an indefinite period of time.
7. Definitions are the exception to the above rule. When a definition is given to you, write it down word for word.
8. Use abbreviations as much as possible. Develop your own. Be sure to make them sensible so you know what they mean when you refer to them at some later date. Not much use in keeping notes if you won't be able to understand them.
9. Use a large size notebook. The best is letter size, which can be kept in a loose-leaf folder, with metal rings.
10. Keep notes of each subject together. Segregate them as you make them up.
11. There is no set rule for keeping or taking notes. Use the kind you find easiest to handle. The outline form or the narrative form. The outline form is the better kind, as it saves a lot of writing,and can always be expanded at a later date.
12. Check your notes at the end of the day. This serves as a refresher and helps to keep the subject in your mind.
13. Set up your notes based on the main points; add the secondary points. Use Roman numerals and capital letters; for subordinate parts of the secondary, use regular numerals and small letters.
14. Revise your notes before they become cold and add any new matter. The practice of touching up and rounding out notes will make them more valuable for later reference.
15. Apply your notes to practical problems. Whenever confronted by a difficult problem, consult your notes to find the solution. Then look in any books or references which were cited at the lecture, and which you have in your notes. Then, if you care to pursue it further or cannot find an answer, check with the instructor, or the director of the school, making reference to the particular subject.

    Note: Ask questions, but do not interrupt the instructor. If you did not get something, wait until the instructor reaches the end of the topic, and when he pauses, raise your hand. Please make this the practice.

Laboratory Rules

1. No smoking in laboratory area when instruments are on.
2. Replace all materials in proper storage areas.
3. Dispose of used ampoules in proper containers, and paper etc. in trash cans.
4. No horseplay in laboratory area at any time.
5. Wipe up any spilled liquids immediately. Use sodium bicarbonate solutions for spilled acid. Notify an instructor immediately of all spills.
6. Keep all working areas clean at all times. Neatness is a must in any laboratory environment. Clean materials and equipment will ensure accurate testing results.

DWI
THE
PROBLEM

CHAPTER II

THE ROLE OF THE DRINKING DRIVER IN TRAFFIC ACCIDENTS
BY

Robert F. Borkenstein
Richard F. Crowther

A SUMMARY
based on **'THE ROLE OF THE DRINKING DRIVER IN TRAFFIC ACCIDENTS'**

A Research Report
by
Robert F. Borkenstein
Richard F. Crowther
Robert P. Shumate
Walter B. Ziel
Richard Zylman

This investigation was supported by a Grant from the Licensed Beverage Industries, Inc., and Research Grant AC-16, from the Division of Accident Prevention, Bureau of State Services, Public Health Service.

THE ROLE OF THE DRINKING DRIVER IN TRAFFIC ACCIDENTS

Alcohol — a not-to-be-neglected factor in our society — has been the object of widespread study for many decades. Its effects on social institutions, such as the family and the community, have inspired the creation of organizations for its research, journals for communicating information between workers, and clinics and hospitals for care of its victims. Laws dealing with alcohol occupy more space in our statute books than those dealing with homicide.

Most efforts concerning control and research have been directed at the chronic alcoholic who is usually 'grounded' by his addiction, little at the acute alcoholic who moves about in society in a relatively normal pattern, but whose behavior is altered at times by his consuming alcohol in immoderate quantities.

People drive cars. We are a nation on wheels. The non-driver is either a youngster or an exception. With alcohol the part of our culture that it is, and with its power to alter attitude and behavior, it is inevitable that it be considered a factor in traffic safety.

The question is, 'How much of a factor?' Tabulations of the frequency of occurrence of alcohol in accident of fatality drivers usually yield startling results, ranging from 40% to 75%. This by itself is no evidence at all. During the First International Conference on Alcohol and Road Traffic in Stockholm in 1950, one delegate stated passionately that 42% of all road accidents are caused by drivers being drunk. Another delegate quickly retorted that, then, 58% must be caused by drivers being sober.

Tabulations of alcohol occurrence in accident drivers only answer the question, 'How many drivers involved in accidents have been drinking?'

Moreover, no single factor should be considered entirely out of context with other apparent accident causes. The sum of the roles of all causes in the accident total **must** be 100%. Each cause is subordinate to all the others. Yet, if the percentages usually ascribed to causes such as speed, alcohol, reckless acts, fatigue, drugs and narcotics, mechanical failures, weather conditions, etc., are added up, the total is several hundred percent.

Traffic accidents are the result of interactions among drivers, also the influence of the driving environment, including road, weather, vehicle, signs, and signals, etc. Thus, accidents become multiple-cause phenomena.

The motor age has been thrust upon us with a suddenness that has not given scientists and law-makers much time to cope with it effectively. It is only a half-century old, indeed its full brunt was not felt until after World War II. Yet, it has created problems greater and more difficult to solve than other social factors centuries old. It seems that there is a current awareness of the shortcomings of early and current approaches to accident prevention and that there exists a hunger for more facts on which to base action. Much research, both theoretical and applicable is currently in progress throughout the world. Enforcement intended to control the driver and engineering, intended to control environments, will undoubtedly undergo drastic changes as the result of this fact-searching.

Approaches to studying individual accident causes must be unemotional and designed to weave the cause into the entire fabric of traffic safety. In this light, a study, 'The Role of the Drinking Driver in Traffic Accidents,' was designed and executed by the Department of Police Administration of Indiana University.

Before this project was designed, a thorough search of the scientific literature was made. An enormous body of information was found, most of which was peripheral and not intended as 'action evidence.' This body of research provided isolated bits of information that when assembled became the foundation of our exhaustive study.

For instance, the effects of alcohol on the activity of the optic nerve of a frog's or tortoise's eye, or on the order of disappearance and reappearance of righting-reflexes in rabbits, or on standing-steadiness, flicker-fusion, pain sensitivity, or mathematical skill in man, these can hardly be translated **directly** into alcohol's effect on man in operating a motor vehicle.

However, evidence of this nature led to studies on the effects of alcohol on drivers operating vehicles on driving courses such as those used in licensing tests. This is about as far as experiments can go in studying experimental drivers in a 'real life' situation. It is unthinkable to consider sending such drivers into the actual traffic complex. Such tests made on driving courses have yielded valuable evidence; however, the psychological set is seriously different from the real-life situation

There have been continuing and serious efforts to design effective driving simulators that attempt to duplicate the real-life situation in the laboratory. Some of the best evidence to date has come from this source. But

even here, certain artifacts make difficult the translation of the results into action evidence.

The distilled essence that this enormous and multi-approach evidence yields is that the use of alcohol by human beings in some way alters their attitudes and behavior and that these changes cause deterioration of performance in these tasks incorporated in the research. It also yields strong evidence that, unlike most other drugs and narcotics, adaptation through experience in use of alcohol is of a very low order.

For a quarter of a century we have personally observed, tested and interviewed thousands of drinking drivers at accident scenes, in hospitals and in police stations, and have studied their records. We have also been involved in many controlled experiments concerned with studying the effects of alcohol on human beings. This experience made possible the direct observation of the alcohol-influenced driver **in situ** and **in context** with all other factors. This created in our minds the burning question, 'Can we isolate the alcohol factor in the real-life situation and determine what percentage of all accidents can be traced directly to alcohol?'

We believed that the answer to this question warranted searching for a method that would make the real-world traffic complex our controlled laboratory. Apropos of this, our mathematicians created an experimental design often used in laboratory experiments.

To determine the relationship between alcohol and all traffic accidents, it was necessary to sample not only the drivers actually involved in accidents, but also a representative group of the driving population-at-large, exposed to the same probability of being involved in accidents as the accident group.

At the same time, we studied other characteristics of the drivers, such as sex, age, race, education, occupation and socio-economic status, in order to keep them from obscuring the conclusions about the influence of alcohol all by itself.

Two groups were interviewed: drivers involved in accidents and drivers not involved in accidents. Each of these two groups was divided into drivers who had been drinking and drivers who had not been drinking. (See Fig. 1)* By comparing these two major groups and the subgroups in as many ways as possible, some interesting patterns emerged.

We hypothesized, on the basis of prior research, that we would find more drinkers in the accident than in the control sample. This hypothesis was shown valid; however, there were results that caught us completely unprepared.

Obviously, the validity of the study depended on the control sample. It had to be a sample of the non-accident driving population, and it had to be related to the times of day, night and locations within the city where accidents normally occurred.

In designing the method, we accepted the thesis that over long periods of time, accidents tend to repeat in approximately the same patterns, both as to time and location.

Grand Rapids, Michigan, was chosen as the city for study, on the basis of its being quite average in socio-economic and ethnic characteristics, and because of its excellent police department. In Grand Rapids, **every** accident is investigated and the results of the investigations are punched into **IBM** cards. During the three-year period prior to study, Grand Rapids experienced 27,000 accidents.

From the **IBM** cards resulting from these investigations, 2000 were selected at random. The sites of the accidents thus became the locations at which we collected our information.

Four drivers were stopped and interviewed at each site. These 'control' samples were taken at the same hour of day or night, the same day of the week, the same week of the month, the same month of the year and at the same location as the accident that occurred at that site. In this way, we duplicated the probability of accident involvement of the accident and control groups as nearly as possible.

Previous experience indicated that the 8,000 drivers interviewed at these sites would approach the anticipated total number of drivers who actually would be involved in accidents during the period of the study, July 1,1962 - June 30, 1963. In actuality, 7,590 drivers were interviewed at control sites and 5,985 drivers were interviewed at the scenes of accidents during this period.

Every effort was made to eliminate bias through a random selection of both sites for the control sample and the vehicles to be stopped at each site.

Our field date-collectors were very carefully trained in interview technique. They wore distinctive clothing, clearly identifying them as members of the research team. Upon arriving at one of the 'sites' a few minutes before the hour that the accident described on the card had occurred, they radioed police headquarters for assistance in stopping the drivers to be interviewed. A squad car was dispatched to the location and the officer directed traffic, stopping those vehicles designated by the investigator.

Each driver was asked to answer a series of questions and to give a sample of his breath to be analyzed for blood alcohol level.

Replies to the questions were recorded on a coded interview form, (See Fig. 2). This questionnaire was carefully designed to elicit the necessary information with adequate provision for internal cross-checks for validation. Breath specimens were collected in self-sealing mylar-polyethylene envelopes (See Fig. 3), numbered serially to correspond with the number on the interview form. These breath specimens were analyzed by research technicians at the police station using Breathalyzers designed especially for this project. The results were recorded on the interview form and on a cross-checking log book.

Results of breath tests made by police during their own investigation were given to the research investigators, but by previous agreement, the investigators did not reveal the results of the tests made by them or the information in the questionnaires to the police or anyone else.

Before the study was begun, the police and the prosecutor agreed to this nonreciprocal policy regarding the results of breath tests. We also agreed mutually that no one would be prosecuted on the basis of information he gave a member of the research team.

Wide publicity was given these and other agreements between our investigators and city officials. Preconditioning of the public undoubtedly played a big part in the willingness of motorists to cooperate — 97% of the control and 95% of the accident drivers answered questions and gave breath specimens.

The slightly lower response by the accident group may be attributed in part to the fact that many of the interviews at the scenes of accidents were taken by police officers after they completed their investigations, and part may be attributed to the fact that individuals seemed to be less inclined to cooperate after they had been involved in accidents.

A shorter form (See Fig. 4) was used at the scenes of accidents. Police officers were specially trained to use the interview forms and to obtain breath specimens.

Members of the research team covered as many accidents as possible.

Because of the nature of the experimental design, peaks in accident occurrence coincided with peaks in scheduled control interviews at the sampling sites. For this reason, our interviewers were very often engaged at

the control sites at the same time accidents were happening. Thus through necessity many accident scene interviews were conducted by the police. They did an outstanding job.

The interview forms, including the blood alcohol levels, were sent to Indiana University in Bloomington, Indiana, where they were punched into **IBM** cards.

The accident and non-accident groups were compared with each other on the basis of the following characteristics: 1. Blood Alcohol level,2. Age, 3. Estimated annual miles driven, 4. Completed years of education, 5. Race or nationality, 6. Marital status, 7. Occupation, 8. Reported average drinking frequency and 9. Sex.

A Chi-square test was made for each factor to determine whether or not any of the observed differences between the accident and control groups were significant.

Factors other than alcohol are associated with individual accident experience. In general, the classes with the worst accident experience were those that we anticipated. The frequency with which the young, the very old, the inexperienced and the uneducated were involved in accidents was out of proportion to their exposure to traffic. At the same time the identities of the safest groups seemed entirely logical. The most highly educated, those with the best employment and the middle-aged have the best records of low accident-involvement.

Figure 5 illustrates the accident involvement by alcohol level.

Since many factors other than alcohol are involved in accident experience, further control was necessary.

Tests of the data again showed that within all of the subclasses of the major factors, the accident rate mounted as the blood alcohol level rose. Then, just as in the preceding analysis, we found that above 0.08% blood alcohol level, factors other than alcohol became less and less significant and eventually seemed to disappear. In every case, the higher alcohol levels were associated with more frequent accident experience, and in general, accident involvement increased rapidly as the alcohol levels exceeded 0.05%. This association was so strong that other explanations of the excessive accident experience of drivers in the highest alcohol ranges were substantially ruled out.

The results for drivers in the 0.01% to 0.04% alcohol level class were unanticipated. To reach a 0.03% blood alcohol level, an average 150 pound man must consume three drinks, each containing one-half ounce of alcohol, in about two hours. Within most of the variables, the accident frequency of drivers in this class is lower than that of drivers with no alcohol. This result holds true in most of the subclasses of the major variables tested. There seem to be only two explanations; that drivers perform better at this alcohol level than they do on the average in the complete absence of alcohol; or that drivers who drink only enough to attain the 0.01% to 0.04% alcohol level are for some unconsidered reason better-than- average drivers.

Thus there seems to be no evidence that blood alcohol levels in the range of 0.01% to 0.04% are assocaited with excessive accident involvement.

Those between 0.04% and 0.08% tend to be associated with excessive accident involvement, but this excess is of the same order of magnitude as that associated with some of the socio-economic human factors we measured. These include such variables as age, education and marital status.

Three comments can be made concerning the excess accident involvement of drivers with blood alcohol levels over 0.08%. First, it cannot be explained by other factors or combination of factors considered in this project. Second, it is greater than that observed within any other variable. Third, not only does it increase as alcohol levels rise, but the rate of increase is greater at the higher levels.

This project was designed to show the relationship between alcohol and accident **involvement.**Being involved in an accident is not necessarily the same as **causing** it.

Obviously in multiple-vehicle accidents some drivers are causers and some are victims. What is the probability of a driver **causing** an accident at various blood alcohol levels? The research plan was not designed to estimate the probability of causing accidents. We considered the question and its answer important enough to make an individual effort to measure this probability by using the data in another way.

If all accidents involved only a single driver of a single vehicle colliding with a fixed object, then accident involvement would imply accident causation. However, most of the accidents observed in this study involved more than one vehicle. We obtained breath specimens from 5,366 drivers involved in multiple-vehicle accidents from 622 drivers involved in single-vehicle accidents.

To estimate the effect of alcohol on the probability of causing an accident as opposed to the probability of being involved, some assumptions had to be made. Multiple-vehicle accidents were assumed to consist of one driver who was at fault and a second driver who was innocently involved. Under this assumption, the 5,366 drivers involved in multiple-vehicle accidents and whose blood alcohols were measured, could be divided into two equal groups. One group comprised the set of accident-causing-drivers, the other-the set of drivers who were not at fault, but who were innocently involved by the driving errors of the accident-causing driver. Thus, the 'innocent' drivers became a sample from the same population as the control group. The distribution of blood alcohol levels within these two groups, the control and the innocently-involved, should have been the same, within the limits of sampling error. By using the control group data, the data for the drivers innocently-involved in accidents could be estimated and removed from the total multiple-vehicle accident group.

The remaining data represented an estimate of the blood alcohol levels in the group of drivers causing multiple-vehicle accidents. To these were added the data for the 622 drivers involved in single-vehicle accidents. The results represented an estimate of the blood alcohol levels in the total accident-causing driver group. These were combined with the control-group data to provide an estimate of the effect of alcohol level on the relative probability of causing accidents. This probability is relative to the probability of the drivers with no alcohol causing accidents. The results are presented in Figure 6.

The relative probability of causing an accident necessarily starts at 'one' for the no alcohol class. As the alcohol level increases, the curve falls until a low of about 0.6 is reached at the 0.03% alcohol level. Based on the data collected and the method of analysis used, subjects with blood alcohol levels of 0.03% are about one-third less likely to cause accidents than alcohol free drivers. As the blood alcohol level continues to increase beyond 0.03%, the relative probability of causing accidents starts to increase. The curve swings gently back to one, gradually moves about one and then suddenly skyrockets.

Subjects with blood alcohol levels close to 0.04% are about as likely to cause accidents as completely sober drivers. When an alcohol level of 0.06% is reached, the estimated probability of causing an accident is double that of a driver from the no alcohol level group. Drivers with a 0.10% blood alcohol level are more than six times as likely to cause an accident as one with no alcohol. When the 0.15% alcohol level is reached, the probability of causing an accident is increased to more than 25 times.

Beyond the 0.15% level, there is insufficient data for satisfactory estimates. However, the fact that 16 accident-involved drivers out of a sample of 5,985 were found to

have blood alcohol levels of 0.26% or higher indicates that the absolute probability of causing an accident in this range is very high indeed.

Figure 6 is based on strong assumptions. While the estimates should be used with caution, the shape of the curve is consistent with the accident involvement indices and with other data previously examined.

SUMMARY

This discussion is a summary and abstract of material contained in a 246 page report on 'The Role of the Drinking Driver in Traffic Accidents,' by R.F. Borkenstein, R.F. Crowther, R.P. Shumate, W.B. Ziel, and R. Zylman, edited by Allen Dale, Department of Police Administration, Indiana University, Bloomington, Indiana, 1964.

For the sake of brevity, many qualifications which must be made in the interpretation of this kind of data have been omitted. If the conclusions are to be used, the limitations should be examined in the original report.

Blood alcohol levels over 0.04% are definitely associated with an increased accident involvement. The probability of accident involvement increases rapidly at alcohol levels over 0.08%, and becomes extremely high at levels above 0.15%. When drivers with blood alcohol levels over 0.08% have accidents, they tend to have more singel vehicle accidents, more severe (in terms of injury and damage) accidents, and more expensive accidents than similar sober drivers. Blood alcohol levels 0.04% and below apparently are not inconsistent with traffic safety.

Many factors other than alcohol are related to the probability of accident involvement. The classes with the worst accident experience, in addition to the intoxicated, are the young or very old, the inexperienced and those with less formal education. Persons with the most education, those with better jobs and who are middle-aged, have relatively fewer accidents.

*Most figures and charts have been deleted to conserve space.

CHART XV

RELATIVE PROBABILITY OF CAUSING AN ACCIDENT

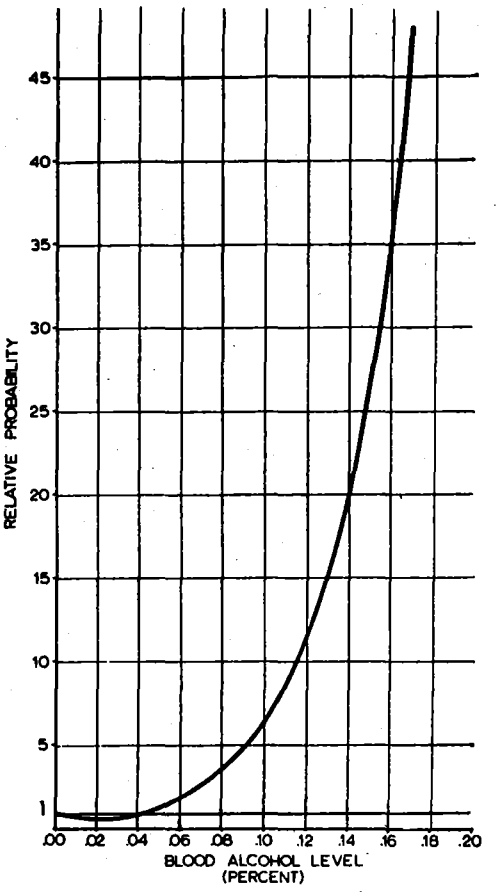
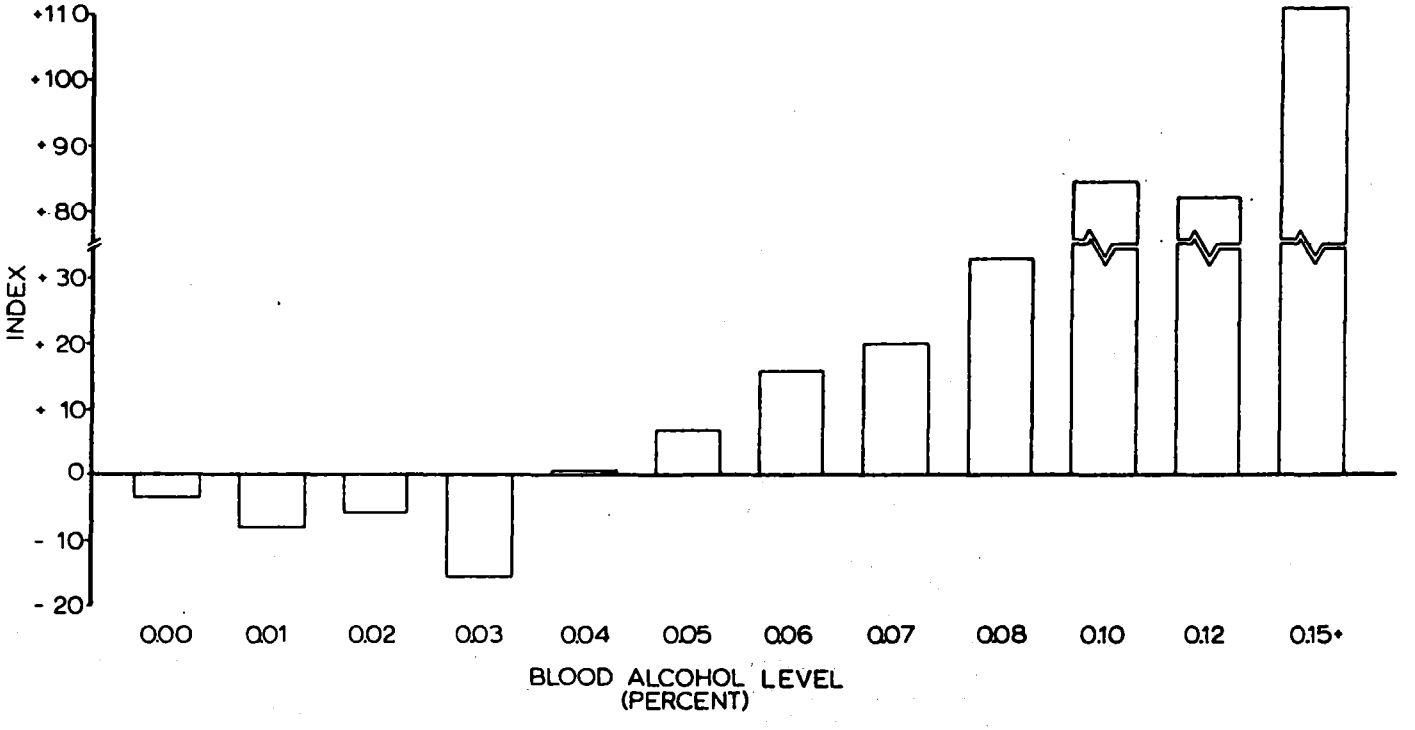


CHART IX

ACCIDENT INVOLVEMENT INDEX BY ALCOHOL LEVEL CLASSES



One in every 10 drivers alcoholic

THE NATION'S HIGHWAY KILLER

'. . .of the high violation, delinquent drivers who are involved in fatal auto accidents, fully 50 percent are alcoholic.'

Research findings in the 1950's established, beyond doubt, that a high proportion of automobile accidents, especially fatal accidents, involve alcohol. Since three-quarters of the adult population of the United States uses alcohol in greater or lesser quantities, it has readily come to be assumed that 'the majority of drinking accidents are caused by the majority of drinking drivers, namely, the social drinkers.'

On this basis, widespread and comparatively severe legislation has been enacted to discourage drinking while driving. Blood alcohol content levels, at which a driver was deemed technically intoxicated, were generally set at the fairly high level of 150 mg/100 ml. But there has been considerable pressure to lower these limits. It may be anticipated that this pressure will rise as the relatively low limits set by other nations become known.

The Department of Transportation standard establishes a limit of not more than 100 mg/100 ml, and several states have already followed suit. Recently Great Britain established a cut-off point as 80 mg/100 ml, a limit shared with Switzerland and Austria. Poland, Norway and Sweden have a fixed limit of 50 mg/100 ml.

The more totalitarian countries would appear to have even stricter limits: Czechoslovakia, Bulgaria, and the German Democratic Republic have a fixed blood alcohol limit set at 30 mg/100 ml; Bulgaria jails, for a minimum of ten years, drivers who have been drinking and cause a highway fatality.

Such legislation has not only been enacted , but is being enforced with considerable vigor. This, no doubt, reflects the judgment of law enforcement authorities and the public alike, that drinking is indeed a major cause of accidents, and one for which drivers must uniquely be held accountable. Where penalties are severe, however, there seems to be some reluctance to convict offenders of drunken driving; but, in a sense, this only confirms the general abhorrence of such behavior.

Problem for Generations

Drunkenness is a considerable problem in the United States, and has been for generations. Public intoxication is a criminal offense in most jurisdictions in the nation. The President's Commission On Law Enforcement and the Administration of Justice states 'enforcement is indeed intense.'

[1]In 1974 the FBI reported 1,458,821 arrests for public drunkenness by 3,977 agencies covering a population of 132,439,000. This figure accounted for over 31 percent of the total arrrests for all offenses and is almost twice the number of arrests for index crime offenses. If alcohol-related offenses (driving under the influence of alcohol, disorderly conduct and vagrancy) were added to this percentage, it would constitute from 40 to 49 percent of all reported arrests in 1964.

Only recently has it been recognized that, for a great many persons, the heavy use of alcohol, to the point of repeated intoxication, is less a matter of wrongdoing than of illness.

In the case of automobile accidents, society appears to be leaning toward a redefinition of this issue: what was once seen as a problem of public order is increasingly being defined as one of public health.

Estimates based on the Jellinek formula, which derives the proportion of persons with alcoholism in a population from statistics on cirrhosis of the liver deaths per annum, suggest that in 1960 there were about 4.5 million alcoholics in the United States. Since middle-aged males will be heavily overrepresented in such a group, it can be assumed with certainty that persons with alcoholism constitute quite a considerable proportion of the driver population and account for a still higher proportion of miles driven.

The Division of Alcoholism of the California Department of Public Health has estimated, by means of the Jellinek formula, that at least 650,000 persons with alcoholism drive, representing 6.5 percent of the 10 million drivers in the state and contributing 10.4 percent of the total mileage.

Pathological Drinking

The proposition that every tenth oncoming vehicle encountered on the highway is likely to be driven by an alcoholic is less than reassuring; but, on closer examination, the matter appears even more serious.

A second generation of alcoholic studies now begins to establish that a wholly disproportionate number of alcohol-related accidents involve, not just drinking drivers, but, in fact, alcoholic drivers.

Reports from Sweden, Germany, Canada, Australia and the United States increasingly converge on the probability that social drinking is nothing like the problem it has been thought to be, while pathological drinking is a very much greater one.

In testimony before the Committee, Dr. Julian A. Waller of California's Department of Public Health urged Americans to stop propagating the 'myth' that the social drinker is the major hazard in traffic accidents involving alcohol. He concludes California drivers with alcoholism are involved in, between 41 and 62 percent of known drinking accidents, with the likelihood that the true proportion is in the higher range.

Quite possibly, the pharmacological effect of alcohol on the central nervous system may be less important than the underlying personality of the individuals involved. Dr. Melvin L. Selzer of the University of Michigan has found that alcoholic drivers are 'significantly more paranoid, suicidal, depressed and violent than the non-alcoholic drivers responsible for fatal accidents.'

For the larger part of the driver population, it begins to emerge, that the issue is not alcohol as such, but the differential effect of alcohol on different persons. The perceived nature of that effect on persons with alcoholism is such as to warrant very little confidence in present methods of deterrence.

The essential fact about persons with alcoholism is: they are not in the least likely to be deterred from drinking-at least on any enduring basis-by the prospect of administrative sanctions, such as the loss of a driver's license.

Poor Are Afflicted

A social as well as a health issue is involved here. For some time, it has been apparent that automobile injuries are not evenly distributed across social and racial groups within the United States. Crashes are in significant measure an affliction of the poor, although no group escapes altogether. A similar situation most probably exists with respect to alcoholism and driving accidents.

The problem of alcoholic drivers is merely one aspect of the general problem of drivers with chronic medical

conditions which impair their ability to drive-albeit the most important one. Professor Ross A. McFarland (1962) has stated that 'at present there are no experimentally derived cut-off points or criteria to assist the physician in assessing the question of fitness to drive.'

Evidence is beginning to accumulate that medical conditions, including cardiovascular disease, epilepsy, diabetes and mental illness, do raise this question. Obviously, the Department of Health, Education and Welfare must now address itself with some vigor to the issue of alcoholism, which presents an unusually complex mixture of technical, ethical and practical questions.

Apart from its pre-eminence as a cause of crashes, two particular developments argue that priority be given to the problem of alcoholism and driving.

The first is that the heavy responsibility of alcoholics raises the possibility that a considerable reduction in crashes can be brought about by restricting driving by alcoholics. Recently Professor Nathaniel J. Ehrlich and Dr. Melvin L. Selzer of the University of Michigan Highway Safety Research Institute found, in a study of fatal accidents in Washtenaw County, Michigan, that 'of the high violation, delinquent drivers who are involved in fatal auto accidents, fully 50 percent are alcoholic.'

Simply by identifying such drivers and taking them off the roads, they estimated that between 15 percent and 20 percent of all fatal accidents would be avoided.

In the past, the presumption that the responsibility for alcohol-related accidents was spread throughout the drinking population has discouraged the belief that anything much could be done by taking such persons out of the driving population. This presumption still exists, and can be expected to obtain increasing popular support, the more so as popular attitudes toward alcoholics continue to be more or less traditionally punitive.

The second consideration is that, of itself, this development is likely to clash with the increasing recognition by the courts that alcoholism is a disease, and is, in effect, no more punishable than any other disease.

This point, once made, becomes increasingly cogent. Several recent federal cases have laid down this rule with great clarity. In Easter vs District of Columbia, Judge Charles Fahy declared:

> "This addiction-chronic alcoholism—is now almost universally accepted medically as a disease. The symptoms, as already noted, may appear as 'disorder of behavior.' Obviously this includes appearances in public . . .unwilled and ungovernable by the victim. When that is the conduct for which he is accused, there can be no judgement of criminal conviction passed upon him. To do so would affront the Eighth Amendment, as cruel and unusual punishment in branding him a criminal, irrespective of consequent detention or fine."

Professor Neil L. Chayet argues that while these cases continue to permit police to arrest drunken persons and remove them from the streets, once they have been identified as alcoholics they cannot be convicted of the crime of public drunkenness. 'The holdings of these cases,' he continues, 'are sure to be echoed in other courts throughout the country.' It is not to be supposed that traffic courts will be any exception.

Thus, just at the time when the public is likely to be demanding more stringent measures against alcoholic drivers, the courts are likely to be raising considerable obstacles to traditional forms of punishment and restrictions directed against such persons.

There are literally millions of licensed motor vehicle operators in the nation today who are alcoholics. A serious effort to revoke their licenses in significant numbers would surely produce a wave of counter moves by them, inundating the courts with highly insoluble questions, dependent on the testimony of the experts and the prejudice of the mass. On top of this would be the prospect of wrongful accusation.

If the problem of alcoholic-related accidents is to be attacked successfully, a wholly new approach is needed.

The Committee feels that here, in the problem of traffic safety, what is needed is a massive federal program to eradicate the disease of alcoholism.

Obviously, this is an immense undertaking. There is all the more reason to begin immediately since the etiology of alcoholism is not now understood, nor is there any apparent 'cure' for alcoholism. However, effective methods of treatment do exist in the nation.

The National Center for the Prevention and Control of Alcoholism should begin devising a strategy by which this goal might be achieved.

One of the most engaging aspects of American society has been its willingness and ability to organize itself to conquer the great infectious and diet deficiency diseases of the past. In one sense, alcoholism-again in a persisting parallel with traffic accidents—is a disease not of the rural past but of the urban present. The quest for long-term solutions to the immediate and pressing problems of drunken driving should not preclude the development of intermediate countermeasures by the National Highway Safety Bureau, much as the technique of quarantine preceding inoculation as a measure to control infectious diseases.

The National Highway Safety Bureau in the Department of Transportation must continue to concern itself with the enforcement, detection and research aspects of the role of alcohol in actual crashes and violation, and with the development and evaluation of countermeasures directed specifically at the problems of alcohol on the highway.

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[1] From a report submitted by the **HEW** Secretary's Advisory Committee on Traffic Safety chaired by Daniel P. Moynihan of the Harvard-MIT Joint Center for Urban Studies.

SCIENTIFIC CONCEPTS

CHAPTER III

THE METRIC SYSTEM

I.
Measurement of Length, Volume, and Weight

The metric system was developed in France near the end of the Eighteenth Century. It is used in scientific work throughout the world, and is in general use in practically all countries except the United States and those of the United Kingdom. It is based on a unit of length called the **Meter.** It is from this length measurement that the units of volume and weight are derived. In the metric system the unit of volume is the **Liter,** and the unit of mass or weight is the **Gram.**

The prefix centi-always indicates 1/100th and the prefix milli-always indicates 1/1000th—similar to the 'cent' and 'mill' divisions of the dollar. Thus, a **centimeter** is 1/100th of a **Meter,** and a **millimeter** is 1/1000th of a **Meter,** and a **milligram** is 1/1000th of a **Gram.**

The **Liter** was designed to be the volume of a cube measuring ten **centimeters** on a side. Such a cube will contain 1000 **cubic centimeters.** The **Liter** is subdivided into 1000 parts called **milliliters.** Thus, a **cubic centimeter** and a **milliliter** are the same for all practical purposes.

The mass of one **cubic centimeter** of water at its densest temperature (4° centigrade or 39.2° Fahrenheit) is one **Gram.** (Mass is measured in a vacuum—at a stated gravitational force—so that air pressure will not affect the result. For our purposes, however, mass and weight will be considered the same.)

1 KILOGRAM = The mass of the platinim-iridium standard

1 LITER = The volume of 1 kilogram of water at 4°C.

1 LITER = The volume of a cube 10 centimeters on a side or 1000 cubic centimeters (c.c.).

1000 CC = is the volume of 1 kilogram of water at 4°C.

1000 CC = 1 Liter of water at 4°C.

Expanded table of metric system measures and U.S. equivalents.

Length		1 millimeter	(mm)	=	0.0394	inch
10 millimeters	=	1 centimeter	(cm)	=	0.3937	inch
10 centimeters	=	1 decimeter	(dm)	=	3.937	inches
10 decimeters	=	1 meter	(m)	=	39.37	inches
					3.2808	feet = 1.0936 yards
10 meters	=	1 decameter	(dkm)	=	32.808	feet
10 decameters	=	1 hectometer	(hm)	=	328	feet 1 inch
10 hectometers	=	1 kilometer	(km)	=	0.62137	mile
Volume		1 milliliter	(ml)*	=	0.0338	fluid ounce
10 milliliters	=	1 centiliter	(cl)	=	0.338	fluid ounce
10 centiliters	=	1 deciliter	(dl)	=	6.1025	cubic inches
10 deciliters	=	1 liter	(l)	=	0.9081	dry quart = 1.0567 liquid quarts
10 liters	=	1 decaliter	(dkl)	=	2.6418	gallons
10 decaliters	=	1 hectoliter	(hl)	=	2.8378	bushels
10 hectoliters	=	1 kiloliter	(kl)	=	35.315	cubic feet
Weight		1 milligram	(mg)	=	0.0154	grain**
10 miligrams	=	1 centigram	(cg)	=	0.1543	grain
10 centigrams	=	1 decigram	(dg)	=	1.5432	grains
10 decigrams	=	1 gram	(g)	=	15.432	grains
10 grams	=	1 decagram	(dkg)	=	0.3527	ounce
10 decagrams	=	1 hectogram	(hg)	=	3.5274	ounces
10 hectograms	=	1 kilogram	(kg)	=	2.2046	pounds
1000 kilograms	=	1 metric ton		=	2204.622	pounds

* Because the standard liter in Paris could not be constructed with absolute perfection, it is slightly smaller than the intended volume of 1000 cubic centimeters. Thus, 1 ml = 1.000028 cc.

** One grain — 1/7000th avoidupois pound — 64.8 mg.

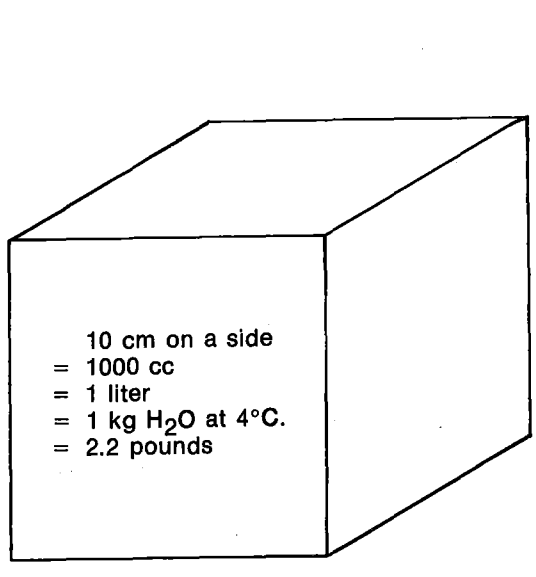
METRIC SYSTEM PREFIXES:

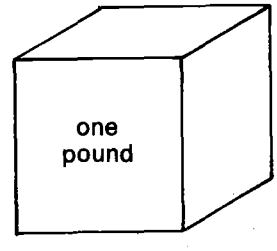
Deca	=	10 times	Deci	=	1/10th
Hecto	=	100 times	Centi	=	1/100th
Kilo	=	1000 times	Milli	=	1/1000th
Mega	=	1 million times	Micro	=	1/1 millionth

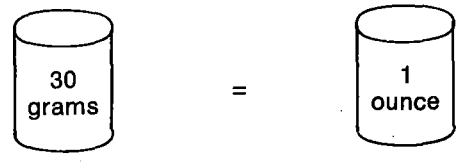
			METER LITER GRAM			
KILO	HECTO	DECA		DECI	CENTI	MILLI
1000	100	10	1	1/10	1/100	1/1000

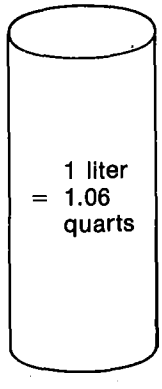
METER — Measures Length
LITER — Measures Volume
GRAM — Measures Weight

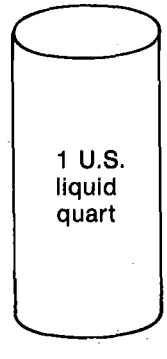
The following United States Customary equivalents to metric units should be memorized. These particular units are the ones that will be used most frequently in chemical test work. It will usually not be necessary to have the equivalents stated any more precisely.











II.
TEMPERATURE

A.Centigrade Temperature Scale

Scientific measurements of temperature are generally made on the centigrade scale. It is often referred to as the Celsius scale, after the man who devised it. Two fixed points, the freezing and boiling points of water, are used to graduate the scale. On the centigrade scale the two points are fixed as zero degrees (0°C.) and 100 degrees (100°C.). The intervening space is divided into 100 equal intervals or 100 centigrade degrees.

B. Temperature Conversion

In the Fahrenheit system there are 180 degrees between the freezing and boiling points of water. Thus, each degree centigrade is 1.8 times as large as each degree Fahrenheit.

$(C° \times 1.8) + 32 = F°$

$(F° - 32)/1.8 = C°$

OR

$(C° \times 9/5) + 32° = F°$

$(F° - 32°) \times 5/9 = C°$

III
CHARLES' LAW

Definition: The volume of a certain amount of dry gas varies directly with the Kelvin temperature, provided pressure remains constant.

All gases expand or contract at the same rate with changes in temperature, provided the pressure is unchanged.

The change in volume amounts to 1/273rd of the original volume at 0°C. for each centigrade degree the temperature is changed, since 0°C. is the equivalent of 273°K.

IV.
DENSITY DEFINED

The mass of a unit of volume of a material is called its density. Density may be expressed in terms of any consistent units of mass and volume as, for example, pounds per gallon, pounds per cubic foot, grams per cubic centimeter, or grams per milliliter. The most generally used unit is grams per milliliter.

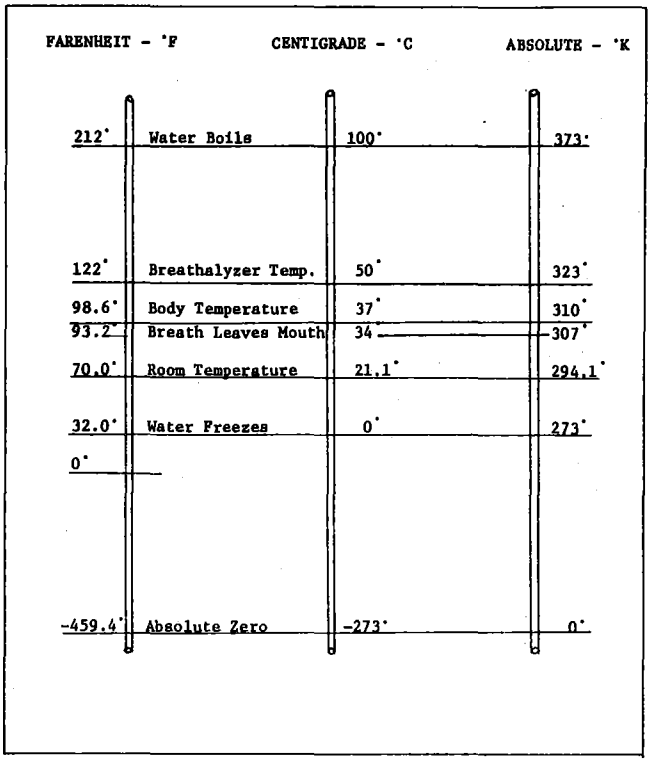
In general, an increase in temperature or a decrease in pressure results in a decrease in density. These effects are large for gases so that both the temperature and the pressure must be taken into account. The effect of moderate changes in pressure on the density of liquids or solids may be ignored, but the effect of temperature must always be taken into account.

V.
SPECIFIC GRAVITY

Specific gravity is the ratio between the density of a body and the density of some substance assumed as a standard. For liquids and solids the standard is distilled water at 4°C., the temperature at which water reaches its maximum density.

Blood, which is heavier than water, has for normal blood — a specific gravity of 1.055 at 20°C. Alcohol, which is lighter than water, has specific gravity of 0.79 at 20°C. (In nonscientific work, 0.8 is often used.)

Relationships among temperature scale



Since density can change with changes in temperature and pressure, as noted above, it is necessary to state these for complete accuracy. The standard pressure used is 760 mm. of mercury (29.92 inches barometric pressure), the average atmospheric pressure at sea level. In most cases the pressure makes so little difference that it is disregarded. Temperature can have a greater effect, however. The temperature of the standard (water) is constant at 4°C., and the ratio is stated differently as the temperature of the substance being compared is changed.

VI.
WATER AS A STANDARD

As already noted, water is used as a standard in a number of ways. For convenience, several of the more important uses are grouped below.

1. **Calorie:**
   The calorie is defined as the amount of heat energy that is needed to warm one gram of water one degree centigrade.
2. **Metric System:**
   For defining the relationship between volume and mass. One gram of water at 4°C occupies a space of 1cc. and has a volume of 1 ml.
3. **Centigrade Scale:**
   For establishing a zero and 100 — degree point of a temperature scale based on the freezing and boiling point of pure water.
4. **Specific Gravity:**
   For establishing a density standard for use with liquids and solids. Pure water at 4°C is defined to have a specific gravity of 1, all other substances are compared to this figure. (i.e. ethyl alcohol has a s.g. of .8 indicating that ethyl alcohol weighs less than water per equal units of volume.)

HISTORY AND CONCEPTS OF BREATH TESTING[1]

During the approximately 110 years since the first tests for alcohol in human body fluids and tissues were developed, their increasing frequency and importance have led to the development of a vast number of procedures. Alcohol determinations have been the most commonly performed forensic chemical examination for the past 50 years, the great majority being performed in order to establish the absence or presence and extent of alcoholic influence in drivers and victims of traffic accidents. More than 300 analytical methods for alcohol have been published.

Since this course is on the determination of alcohol in the breath, it is the breath alcohol techniques we will pursue. The first reported studies were in 1871 on breath alcohol in rabbits, and in 1874 on human breath-alcohol analyses. And so the research continued to the present, and will undoubtedly go on far into the future.

The breath test for alcohol when used for law enforcement purposes has several advantages and unfortunately some disadvantages as can be seen in this list.

Advantages:

1. The result can be obtained very quickly.
2. There is very little question as to the identity of the sample donor.
3. Collection and analyses of the breath sample requires less technical expertise than the collection and analysis of other body materials.
4. Breath test equipment and facilities cost less per test than performing alcohol tests in a laboratory.
5. The sample is easier to obtain.

Disadvantages and Limitations:

1. It is difficult to preserve the sample for later analysis.
2. The subject must cooperate in giving an adequate sample.
3. A sample cannot be taken from an unconcious subject.
4. The operator must observe the subject for 15 minutes to eliminate the possibility of mouth alcohol interference

Through the long history of breath testing, there is one assumption that was made in the beginning and by this point in time has been verified many times. That assumption is the basis of all breath testing and can most simply be stated:

> There is a determinable ratio between the alcohol concentration in blood (and hence the brain) and the alcohol concentration found in breath.

The ratio that is used in most modern day breath testing instrumentation is based on deep lung or alveolar air (deep lung air is in closest equilibrium with blood). It is the conclusion of the National Safety Council ad hoc Committee on Alcohol and Drugs and most experts in the field that 2100 parts of alveolar air contain the same amount of alcohol as 1 part of blood. Hence the ratio is:

2100 : 1

Devices now being used to determine the ethyl alcohol in breath, employ a variety of analytical techniques. The following is a list of the most common techniques and a short simplified explanation of the principals involved.

A. Chemical/Photoelectric Devices

These devices collect a sample of breath and bubble it through a solution containing a reagent of colored chemical substance (usually a chromic acid) that reacts with alcohol and in so doing loses an amount of original color. The color change, which is directly proportional to the amount of alcohol in the sample, is measured photoelectrically. A direct readout of BAC is provided.

A majority of the disposable screening devices (often called baggies) use the chromic acid technique. The colored chemical is placed on crystals in a glass tube. A breath sample is forced through the tube and a color change on the crystals is used to indicate the presence of ethyl alcohol.

B. Gas chromatographic Devices

These devices collect a sample of breath which is carried through a tubular column by a continuous flow of 'carrier gas' to a detector. Different substances in the breath move through the column at different rates and, therefore, arrive at the detector at different times. The detector transmits to a graphic recorder an amount of electrical current which is proportional to the concentration of each substance detected. The results are printed on a graphic recorder where the peak of the line indicates concentration and the time of the peak identifies the substance. AC can be determined from the graphic results or obtained directly from a digital readout. These devices can be valuable in identifying substances in the breath other than alcohol, clearly distinguishing them from alcohol. Gas chromatographic devices also can be used to analyze urine and blood for AC in addition to breath.

C. Infra Red Absorption

A breath sample is placed in a temperature and a volume controlled chamber. A beam of infra red light is passed through the chamber. When the light beam exits the sample chamber, it is filtered to remove all wave lengths other than 3.39 microns. The remaining 3.39 micron light energy is converted by a photosensor to an electrical signal directly proportional to the concentration of alcohol in the breath sample.

D. Catalytic Detector

An N type semi-conductor that changes conductance when a hydrocarbon comes into contact with it, is the heart of this type of system. A regulated voltage is placed across the detector, which is then heated to a very high temperature (300°C) to burn off any contaminants. When the detector is burned clean, it has a very high resistance, therefore allowing very little of the regulated voltage to pass through it. When a breath sample is blown across the detector, any alcohol in the sample attaches itself to the detector surface and decreases the resistance allowing an increase in voltage flow. The increase in voltage is proportional to the amount of alcohol blown across the detector surface.

E. Fuel Cell Device

An electrochemical device in which the alcohol in the breath sample is reacted chemically to produce electricity. The amount of electricity produced is proportional to the amount of alcohol in the sample

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[1] Factual information taken from **ALCOHOL AND THE IMPAIRED DRIVER,** American Medical Association and **BASIC TRAINING PROGRAM FOR BREATH EXAMINER SPECIALIST,** Duncan and Associates, Inc.

EXAMPLES OF U.S. BREATH SAMPLING AND TESTING DEVICES IN CURRENT USE

APPARATUS	DEVELOPER(S) YEAR DEVELOPED	MATERIAL ANALYZED	ALCOHOL EQUIVALENT OF ML BLOOD	METHOD FOR ALCOHOL QUANTITATION	TEST CATEGORY
Accutube	Hine, et al. 1968	Alveolar breath, 2 ml	2,100 ml	Laboratory Analysis	Screening and Remote sample testing device
Alco-Analyzer Gas Chromatograph	Luckey 1968	Alveolar breath, 10.5 ml	2,100 ml	Electronic thermistor detector	Breath, Blood or Urine
Alcolimiter	Energetics Science Inc. 1972	Alveolar breath, 20 ml	2,100 ml	Fuel Cell	Screening and/or Testing device
Alcometer	Greenberg and Keator 1941	Alveolar breath, 15 ml	2,100 ml	Iodic acid	Testing device
Alcosensor	Intoximeters Inc. 1972	Alveolar breath, 1 cc	2,100 ml	Fuel Cell	Screening
Alco-Tector	Jungman 1963	Alveolar breath, 52.5 ml	2,100 ml	Potassium dichromate and silver nitrate in sulfuric acid	Testing Device
Alert J2	Borg Warner 1972	Alveolar breath peak after six seconds continuous blowing	2,100 ml	Catalytic Detector	Screening
Alert J3A, +C	Borg Warner 1974	Same as above	2,100 ml	Same as above	Screening and/or Testing device
Breathalyzer	Borkenstein 1954	Alveolar breath, 52.5 ml	2,100 ml	Potassium dichromate and silver nitrate in sulfuric acid	Testing device
DPC Intoximeter	Forrester 1964	Alveolar breath, 250 ml	2,100 ml	Laboratory analysis	Screening and Remote Sample
Drunkometer	Harger and co-workers 1934	Rebreathed air, volume varies	2,100 ml	Potassium permanganate in sulfuric acid	Testing Device

EXAMPLES OF U.S. BREATH SAMPLING AND TESTING DEVICES IN CURRENT USE

APPARATUS	DEVELOPER(S) YEAR DEVELOPED	MATERIAL ANALYZED	ALCOHOL EQUIVALENT OF ML BLOOD	METHOD FOR ALCOHOL QUANTITATION	TEST CATEGORY
Gas chromatograph Intoximeter	Forrester and Associates 1968	Alveolar breath, 1/4 ml	2,100 ml	Electronic flame ionization detector	Testing Device
Gas chromatograph Intoximeter Field Sampling Kit	Forrester and Associates 1968	Alveolar breath 1/4 ml	2,100 ml	Gas chromatograph Intoximeter	Screening and Remote Sample
Intoxilyzer	Omicron Systems Corporation	Alveolar Breath, 600 ml	2,100 ml	Infrared Absorption	Test Device
Photo-Electric Intoximeter	Forrester 1960	Alveolar breath 105 ml	2,100 ml	Potassium dichromate in sulfuric acid	Testing Device
Portable Intoximeter	Forrester and co-workers 1941	Mixed expired breath, volume varies	Alcohol -- CO_2 ratio: 190 mg. CO_2	Laboratory analysis	Screening and Remote Sample
Sober-Meter-SM-2	Luckey 1960	Mixed expired breath, volume varies	Alcohol -- CO_2 ratio: 200 mg. CO_2	Laboratory analysis	Screening and Remote Sample
Sober-Meter-SM-7	Luckey 1968	Alveolar breath, 2,100 ml	2,100 ml	Gas chromatograph Alco-Analyzer or standard laboratory analysis	Screening and Remote Sample

ALCOHOL
CHAPTER IV

History and Chemistry Of Alcohol[1]

I. History of Alcohol

1. Origin:
   The term alcohol is of Arabic origin, from the word **AL-KOHL.** The twelfth century Irish called a strong alcoholic beverage they were drinking **'UISGE-BEATHA,'** which is Gaelic for 'Water of life.'

   The alcohol that we are concerned with is the one alcohol that can be used for beverage purposes, and that is ethyl alcohol. Ethyl alcohol is also known as ethanol, grain alcohol, neutral spirits, and spirit of wine.

2. Description:
   Ethyl alcohol is a transparent, colorless, mobile, volatile liquid with a slight, but characteristic odor and a burning taste. It boils at 78°C but volatilizes at even lower temperatures and is flammable. When pure it is neutral towards all indicators, The specific gravity of alcohol at 15.56°C is not above 0.816 (.7893@20°C) indicating not less than 92.3% of C_2H_5 OH by weight or 94.9% by volume.

3. Production:
   The production of ethyl alcohol depends upon the decomposition or fermentation of the saccharide dextrose into ethyl alcohol and carbon dioxide. This fermentation takes place in the presence of zymase, an enzyme that is present in yeast cells. Fermentation in grains and other substances rich in starch go through a two step process. First the starches are broken down into saccharides, then to ethyl alcohol and carbon dioxide.

4. Concentration:
   In normal fermentation processes the maximum alcohol content of the product will be 15% by volume. At 15% ethyl alcohol concentration the yeast cells are destroyed and the production of alcohol ceases. The following table states the sources and alcoholic content of some beverages.

5. Fortification:
   Some of the beverages in Table I have concentrations of alcohol that are higher than 15% by volume. Port wine is an example of fortified wine. Brandy is added to a wine to bring it to or above the 15% alcohol concentration.

6. Distillation:
   Most of the other beverages are brought to the higher alcohol concentrations by a process called distillation. Ethyl alcohol boils at 78°C and water boils at 100°C. An alcoholic beverage is heated, the steam is cooled and the resulting liquid may contain as high as 95% ethyl alcohol by volume.

7. Proof:
   In the United States, proof denotes the concentration of many alcoholic beverages. The proof is exactly twice the percentage concentration. For example, 200 proof would be 100% ethyl alcohol and 40% ethyl alcohol is an 80 proof beverage.

8. Fusel Oils:
   Proteins present in fermenting liquids produce alcohols other than ethyl alcohol. These alcohols (amyl, butyl, and propyl alcohol) are called fusel oils. The fusel oils are impurities in the alcoholic beverage and should be removed in the distillation process.

TABLE I: THE NAME, SOURCE AND APPROXIMATE ALCOHOLIC CONTENT OF VARIOUS BEVERAGES[1]

Beverage	Raw Material	Percent Weight by Volume
Light Beer	Cereals	2.0 - 4.0
Heavy Beer	Cereals	4.5 - 6.0
Ales	Cereals	6.0 - 8.0
Table Wines	Grapes	4.5 - 12.0
Ciders	Apples	8.0 - 10.0
Vintage Wines	Grapes	9.5 - 10.5
Champagne	Grapes	14.0 - 20.0
Sherry, Port	Grapes	30.0 - 50.0
Liqueur	Variety	40.0 - 55.0
Whiskey	Cereals	40.0 - 55.0
Rum	Molasses	40.0-55.0
Brandy	Grapes	40.0 - 55.0
Vodka	Neutral Spirits	40.0 - 55.0
Gin	Grain	35.0 - 40.0

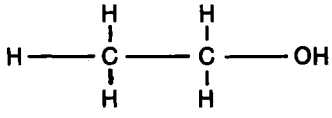
[1]**ALCOHOL AND THE IMPAIRED DRIVER, Committee on Medicolegal Problems - American Medical Association, 1970, p.3.**

II. Chemistry of Alcohol

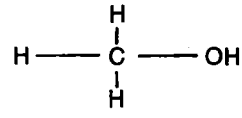
1. Ethyl alcohol is a simple organic compound. Its chemical formula is C_2H_5OH, where:
   C= Carhon
   H= Hydrogen
   O= Oxygen

   The chemical formula shows that ethanol is composed of two carbon atoms, five hydrogen atoms and a hydroxyl group. A hydroxyl group (OH) is an oxygen and a hydrogen atom bound together. A hydroxyl group is common to all alcohols.

   A structural formula shows how the atoms are bonded together to form a molecule. The structural formula for ethyl alcohol is:



Methyl alcohol, also called methanol or wood alcohol, has a simpler formula than ethyl alcohol. It only contains one carbon, 3 hydrogen atoms and a hydroxyl group. The chemical formula is CH_3OH. The structural formula is:



PHYSIOLOGY OF ALCOHOL

Endogenous Alcohol

Endogenous alcohol refers to alcohol that exists 'normally' in the body regardless of whether or not a person consumes alcoholic beverages. There is considerable disagreement among experts regarding the existence of 'normal' alcohol in the body; however, both 'normal' methyl and ethyl alcohol have been reported in the research literature. The values reported have not exceeded a BAC of 0.003% and generally are less than 0.001%. These values are about the same as those reported for 'normal' lead, arsenic, and mercury. They are generally too low to be of any medicolegal significance and are of academic interest only.

Physiology Overview

The course of alcohol in the human body is shown on page 27. A brief description of absorption, distribution and elimination of alcohol is given below.

Absorption. Alcohol is typically swallowed and travels from the mouth through the esophagus to the stomach. Here, part of the alcohol is absorbed directly into the blood stream by the process of diffusion; the remainder is absorbed in the small intestine. The rate of flow from the stomach to the small intestine is controlled by the pylorus, which opens and closes at the base of the stomach to permit or inhibit the passage of solids and liquids.

Distribution. The alcohol travels from the stomach and small intestine via the portal vein to the liver. From the liver, it travels to the heart, the lungs, and back to the heart from which it is pumped to all parts of the body. Alcohol has an affinity for water and is stored in the body tissues in proportion to their fluid content.

Elimination. Once absorbed into the blood stream, the body immediately starts to eliminate the alcohol. This is largely accomplished in the liver where the alcohol is oxidized to carbon dioxide and water. Some small portion (less than 10%) is eliminated directly through urine, breath, perspiration, tears and saliva.

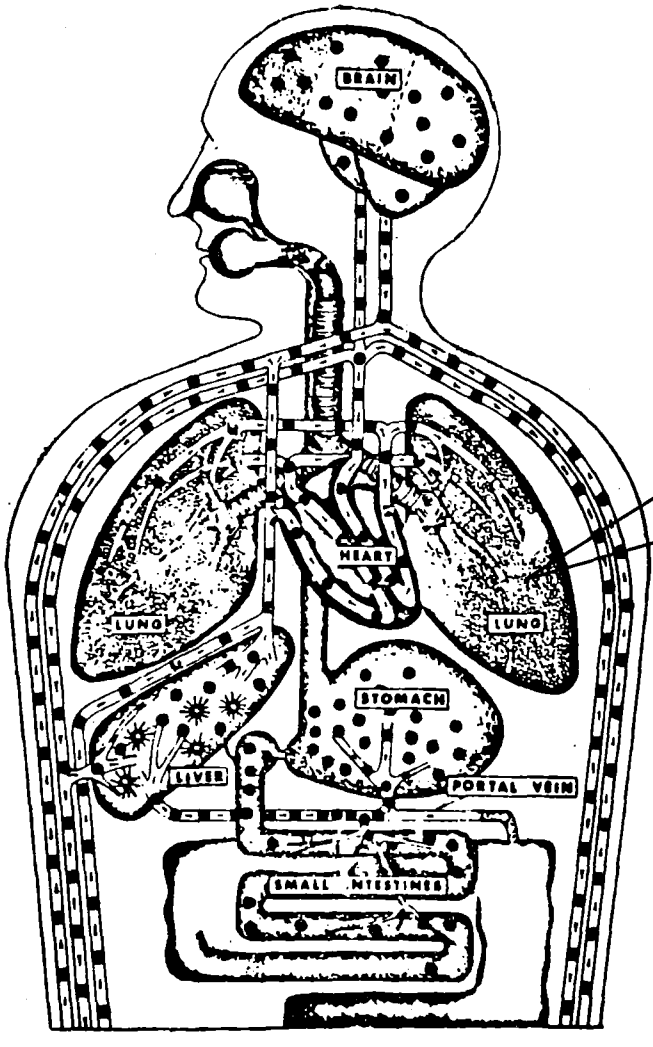
Alcohol in the Human Body

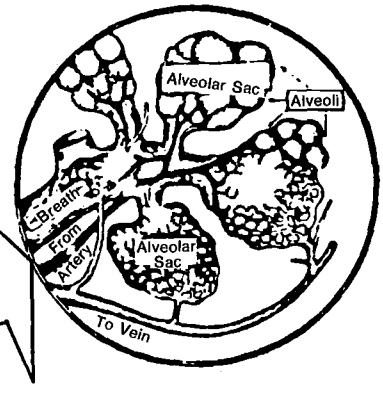
According to the concentration in the brain, alcohol first impairs judgment, then causes muscular incoordination, stupor and finally unconsciousness.

Course of Alcohol

Mouth
Esophagus
Stomach
Smaller Blood Vessels
Small Intestines
Portal Vein

To all parts of the body where it is stored in the water until returned by the blood to the liver to be oxidized.





Primary Lobule of the Lung
Diameter of circle = 1/50th inch

▲Direction of Flow
●Alcohol
✳Alcohol being Oxidized

Blood vessels in the lungs end in networks of capillaries in the walls of the alveoli.
Alcohol from the blood is imparted to the alveolar breath.
Alveolar breath contains 1/2100th as much alcohol as the blood.

Absorption

Routes. Alcohol is typically swallowed and the most common route of absorption is through the gastrointestinal tract. However, it may also be absorbed by inhalation, injection and direct insertion into the bladder or rectum. Whether or not absorption takes place by direct skin contact with alcohol is unknown.

* **Inhalation.** Ethyl alcohol is readily absorbed by lung tissue and both children and animals have become intoxicated by breathing alcohol fumes in confined spaces. Approximately 62% of the inhaled alcohol will be absorbed into the blood regardless of the concentration in the air or the rate of ventilation. However, a concentration of alcohol high enough to produce a significant rise in blood levels is very irritating. Investigators have shown that inhalation of a 0.9% alcohol-air mixture (about the highest tolerable limit) will produce a BAC of 0.045% only with forced respirations of 3 to 4 hours duration. Such conditions would not be obtained by industrial exposure to alcohol solvents.
* **Injection.** Alcohol is detectable in the blood within 5 to 15 minutes after injection into a muscle or skin.
* **Insertion.** When given as an enema, alcohol is readily absorbed by the large intestine (colon). Less than 10% of alcohol inserted in the bladder will be absorbed; alcohol passes more readily from the blood to the urine than from the urine to the blood.
* **Skin contact.** In experimental situations, no detectable blood levels have been obtained from alcohol rubs when care was taken that the subject did not inhale the alcohol. If absorbed via this route, apparently the rate of absorption is less than the rate of elimination.

Absorption from gastrointestinal tract. Alcohol is absorbed by various parts of the gastrointestinal tract as follows.

* **Mouth.** Alcohol can be absorbed through the mouth lining; however, the amount is normally insignificant since fluid leaves the mouth rapidly. The mouth of a non-drinker rinsed with liquor will be free of alcohol after about 15 to 20 minutes.
* **Stomach.** About 25% of the alcohol is absorbed directly into the blood stream through the stomach wall. The exact amount is variable and influenced by the emptying time of the stomach. In contrast, most other substances are not absorbed from the stomach.
* **Small Intestine.** The remainder is absorbed from the small intestine; very little gets past the duodenum (the first 8 to 10 inches of the small intestine).

Rate. The rate of absorption varies somewhat from person to person and for the same person at different times depending on the condition of his body. However, alcohol begins to pass into the blood stream within 1 to 2 minutes after it is consumed, most alcohol is absorbed within 15 minutes, nearly 90% is absorbed within 1 hour, and nearly all is absorbed in 1.5 hours.

* **Factors that Affect Rate of absorption.** Absorption through the stomach wall is slow and represents only a portion of total intake. Absorption through the small intestine is rapid. Therefore, anything that increases emptying time of the stomach increases absorption rate; anything that delays emptying time, slows absorption rate. Both dilution of the alcoholic beverage and food in the stomach affect rate of absorption.
* **Dilution.** Absorption is slow in dilute and strong beverages. It is fastest for a 20% alcohol solution. Apparently very strong solutions irritate the gastrointestinal walls and inhibit absorption.
* **Food in the Stomach.** Food in the stomach delays absorption. Absorption is slowed since stomach emptying time is delayed. This applies to eating **while** drinking and to eating **before** drinking.

Distribution

Route. Alcohol is absorbed into the blood through the walls of the stomach and small intestine, travels via the portal vein to the liver, and thence travels via the circulatory system to the heart, lungs and back to the heart. It is then pumped from the heart to all parts of the body.

Equilibrium. Alcohol has an affinity for water and distributes itself throughout the body organs and tissues in proportion to their fluid content. Blood circulates through the body at a rate of 3 to 4.5 liters/minute. Organs such as the brain, liver and kidney, which have a large blood supply, initially receive a disproportionately large quantity of circulating alcohol. When absorption and distribution are complete, equilibrium is achieved, that is, alcohol is proportional to fluid content.

Distribution ratios. The distribution ratios given below are for the amount of alcohol in tissues and body fluids compared to that in whole blood, which has been assigned a value of 1.00. The values given are averages; for example, the actual ratios between urine and blood have ranged from 1.12 to 1.51.

Breath	0.00047
Urine	1.35
Brain	0.85
Blood plasma	1.16
Saliva	1.12
Liver	0.91
Blood clot	0.77
Whole body - men	0.67
Whole body - women	0.55
Fat	0.019

Elimination

Method. Alcohol is eliminated from the body both by metabolism and by direct excretion.

* **Metabolism.** Most alcohol (between 90% and 98%) is oxidized to carbon dioxide and water. The oxidation process takes place in the liver. Since oxidation provides the body with calories, alcohol must be considered a food although it has no direct food value.
* **Excretion.** A small amount of alcohol is excreted directly through breath, urine, tears, saliva, perspiration, etc. The amount thus excreted is generally about 2% and rarely exceeds 8% of the quantity absorbed.

Rate of Elimination. As soon as alcohol is absorbed into the blood system and travels to the liver, the body immediately starts to eliminate it. After all the alcohol is absorbed the average rate of elimination is reported as 0.015 per hour and varies between 0.01 and 0.025 per hour. At very low AC's, the average rate of elimination is

about 0.01 per hour. For a man weighing 150 pounds, the quantity eliminated in one hour is about 7g or 2/3 oz. of 100-proof whiskey. Although there is some controversy in the literature, the preponderant evidence indicates that the rate of elimination is essentially linear; that is, for any given person at a given time, the rate of alcohol elimination per hour will be essentially constant.

Factors affecting rate of elimination. In general, the rate of elimination is not affected by stimulants, diseased state or exercise. Where changes in rates have been noted, they are too small to be of any practical value. Because of the small quantity excreted directly, any attemp aimed at eliminating alcohol through increasing breathing rate, urine or perspiration has little or no effect.

Factors Affecting Height And Shape of the AC Curve

Many factors affect the heights and shape of the AC curve. Some of these are discussed below.

Body Weight vs. Drinks consumed. In general, a heavier person can consume more alcoholic beverages than a lighter one to attain the same AC level. A chart of AC values for different body weights and drinks consumed is shown below.

The example in the exhibit uses an average elimination rate of 0.015 as a means of accounting for the factor of 'time since first drink' in estimating AC. It should be noted again that this rate of elimination is an average rate and, therefore, should be used with caution in making such estimates.

Empty Stomach vs. Full Stomach. Food in the stomach will delay absorption and result in a lower AC than would be obtained if the stomach were empty. Instead of decreasing immediately, a plateau at that AC will be maintained for a longer period of time than if the stomach were empty. The amounts of 80-proof liquor required to reach various AC's under conditions of both full and empty stomachs may be estimated from the charts on the following pages.

Rate of drinking and quantity consumed. The AC curve varies in height and shape depending on quantity of alcoholic beverages consumed and the rate of drinking. Variations in curve shape as a function of quantity consumed and time are shown on the following pages.

In general, it may be commented that maximum AC's are usually reached 20 to 30 minutes after consuming a single drink on an empty stomach. When drinks are consumed successively over time, the AC rises with each drink and starts to decline from this maximum. (See the following pages) When several drinks are consumed in a very short period of time, peak AC's may not appear until 45 minutes to 1-1/4 hours after ingestion of the last drink.

Alcohol Concentration chart of Body weight vs drinks consumed.

Showing estimated alcohol concentration in the blood by number of drinks in relation to body weight. This AC can be estimated by:

1. Count your drinks (1 drink equals 1 ounce of 100-proof liquor or 12-ounce bottle of beer).
2. Use the chart below and under number of 'drinks' and opposite 'body weight' find the Alcohol Concentration listed.
3. Subtract from this number the alcohol concentration 'burned up' during the time elapsed since your first drink. This figure is .015 per hour. Example: 180 lb. man - 8 drinks in 4 hours
   .167 minus (.015 × 4) = .10

DRINKS

Body Weight	1	2	3	4	5	6	7	8	9	10	11	12
100 lb.	.038	.075	.113	.150	.188	.225	.263	.300	.338	.375	.413	.450
110 lb.	.034	.066	.103	.137	.172	.207	.241	.275	.309	.344	.379	.412
120 lb.	.031	.063	.094	.125	.156	.188	.219	.250	.281	.313	.344	.375
130 lb.	.029	.058	.087	.116	.145	.174	.203	.232	.261	.290	.320	.348
140 lb.	.027	.054	.080	.107	.134	.161	.188	.214	.241	.268	.295	.321
150 lb.	.025	.050	.075	.100	.125	.151	.176	.201	.226	.251	.276	.301
160 lb.	.023	.047	.070	.094	.117	.141	.164	.188	.211	.234	.258	.281
170 lb.	.022	.045	.066	.088	.110	.132	.155	.178	.200	.221	.244	.265
180 lb.	.021	.042	.063	.083	.104	.125	.146	.167	.188	.208	.228	.250
190 lb.	.020	.040	.059	.079	.099	.119	.138	.158.	.179	.198	.217	.237
200 lb.	.019	.038	.056	.075	.094	.113	.131	.150	.169	.188	.206	.225
210 lb.	.018	.036	.053	.071	.090	.107	.125	.143	.161	.179	.197	.215
220 lb.	.017	.034	.051	.068	.085	.102	.119	.136	.153	.170	.188	.205
230 lb.	.016	.032	.049	.065	.081	.098	.115	.130	.147	.164	.180	.196
240 lb.	.016	.031	.047	.063	.078	.094	.109	.125	.141	.156	.172	.188

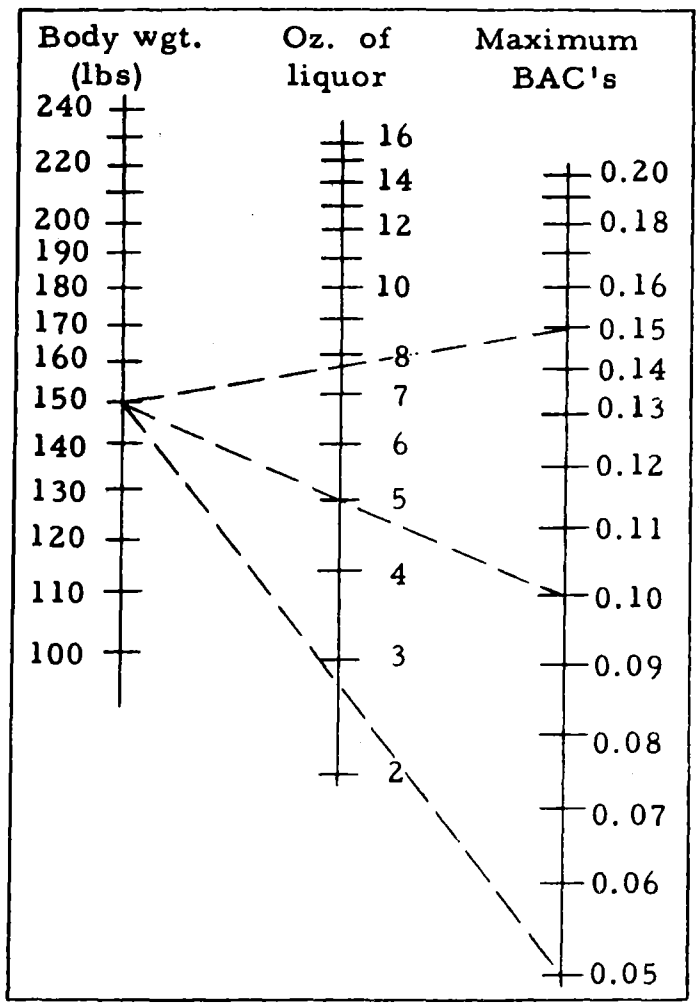
For clarification, if the 180 lb. person had all the alcohol from 12 ounces of 100 proof whiskey or 12 twelve-ounce bottles of beer in his body at one time, he would have an alcohol reading of 0.25 Alcohol Concentration by weight.

Body weight, drinks consumed and resultant AC levels for full and empty stomachs:

Estimated amount of 80-proof liquor consumed in one hour to reach given AC's

Empty stomach

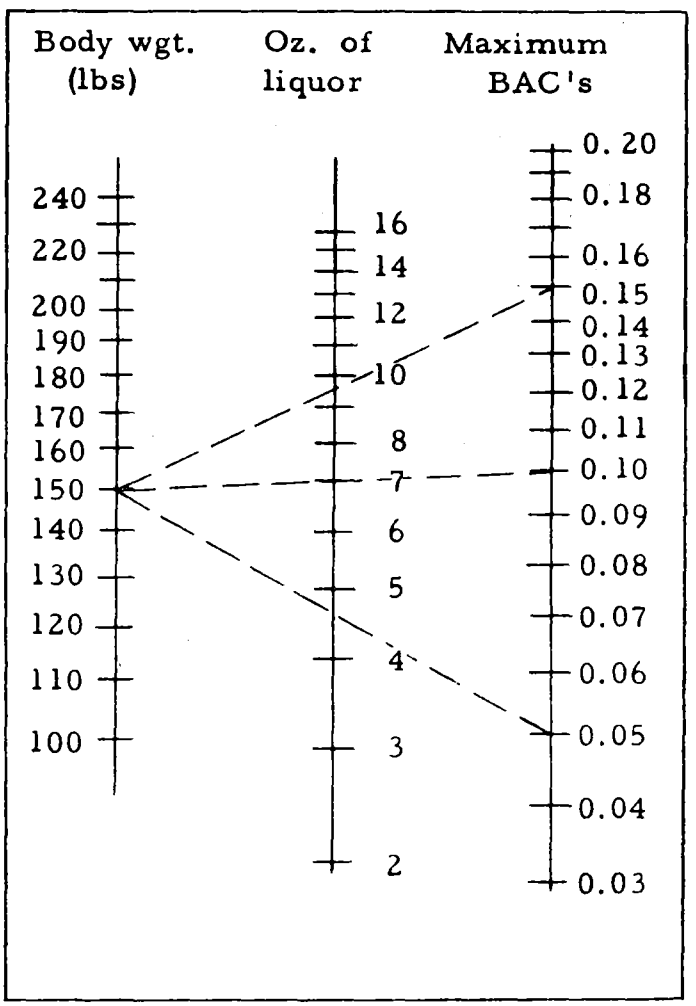
Little or no food prior to drinking



Adapted from a chart by U. S. Dept. of Health, Education and Welfare

Full stomach

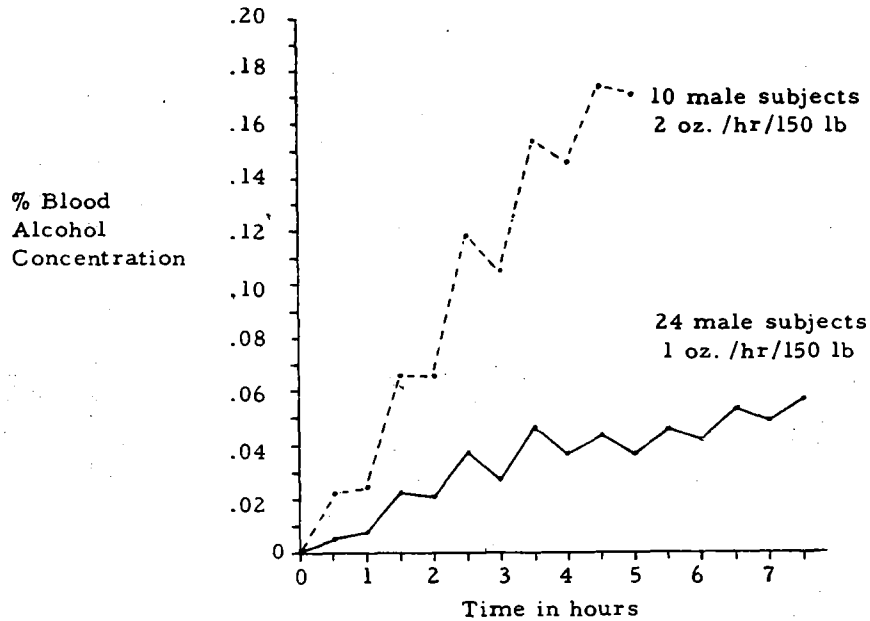
Between 1 and 2 hrs after average meal



Adapted from a chart by Royal Canadian Mounted Police

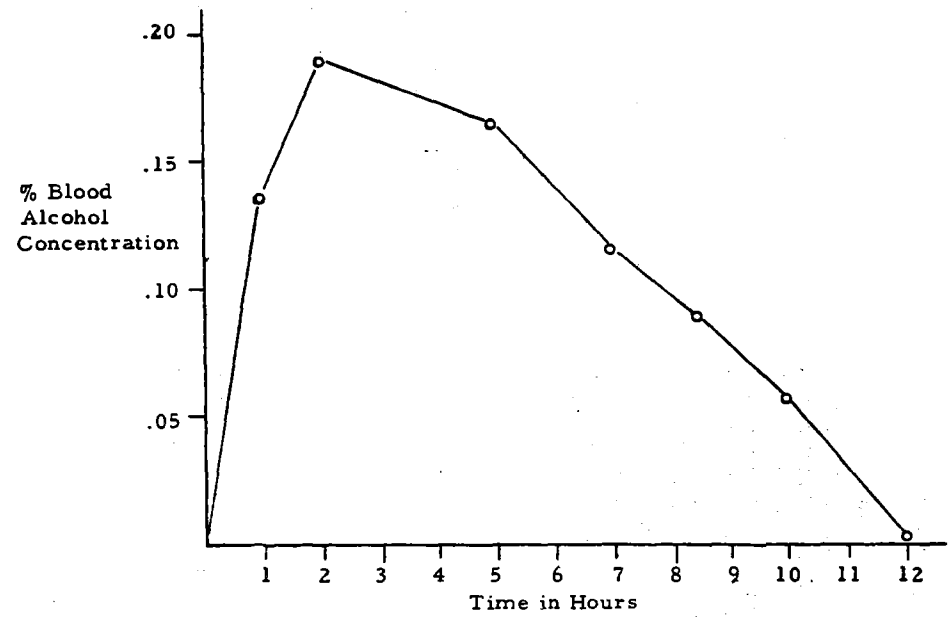
To determine the approximate average number of ounces of 80-proof liquor needed in a one-hour period to reach 0.10, draw a line from body weight to 0.10. The line will intersect the average number of ounces needed to produce 0.10. Follow the same procedure to determine the amount of liquor needed to reach other AC's. Charts show rough averages only, since many factors affect the rate of alcohol absorption into the bloodstream. The rate of elimination of alcohol from the bloodstream is approximately 0.015 per hour. Therefore, subtract 0.015 from the AC indicated on the charts for each hour after the start of drinking.

The AC curve when drinks are consumed successively over time



Mean blood alcohol levels in male subjects consuming 1 or 2 ounces of 100-proof whiskey per hour per 150 pounds of body weight. First drink at time 0 with 1 drink each hour thereafter. Adapted from a figure in Forney, R.N. and Hughes, F.W. **Combined Effects of Alcohol and Other Drugs.** Springfield, Illinois: Charles C. Thomas, 1968, p. 16. (Originally printed in **Clin. Pharmacol. Ther.**, 4:619, 621, 1963.)

The AC curve when several drinks are consumed in a short time period



Concentration of alcohol in the blood of a 150 lb man after drinking eight ounces of 100 proof whiskey. Hypothetical curve

WIDMARK CALCULATIONS

Widmark's R. E.M.P. Widmark, a Swedish scientist and pioneer in alcohol research, developed a formula for estimating the amount of alcohol in a person's body that would produce a given AC. It is based on the distribution of alcohol in the body as a whole compared to blood.

Formula. Based on the distribution ratio's, the amount of alcohol in the whole body of an adult male is 0.67 of the concentration found in the same person's blood. Turning it around a little; 0.67 of the adult male's total body weight will absorb alcohol. If we took an adult male weighing 150 lbs., we could determine that any alcohol he consumed would be evenly distributed through 100 lbs. of his body simply by multiplying.

```
   150   - Total body weight in lbs.
 × .67   - Distribution Ratio
------
  1050
  900
------
100.50   - Lbs. body weight that contain
           alcohol
```

If we had further facts telling us that this adult male was found to have an alcohol concentration of .15, we can compute the amount of alcohol in the 100 lbs. of his body that contain alcohol.

```
   100   - Lbs. containing alcohol
 × .0015 - AC converted for computation
------
   500
   100
------
0.1500   - Lb.s of alcohol in body
```

Since alcohol is not usually purchased by the pound, and we know that there are 16 ounces in one pound, we should convert the pounds of alcohol to ounces by multiplying by 16.

```
 .1500   - Lbs. ETOH
 × 16
------
  9000
  1500
------
2.4000   - Wt. oz. ETOH
```

We still have a problem, in that we have computed ounces of alcohol by weight, but most drinks are measured by volume. Thinking back on some of the basic facts, we learned about alcohol, we know that the specific gravity of ETOH is .8. This means that 1 fluid ounce weighs .8 ounces. If we divide the weight ounces of ETOH by .8, they would be converted to fluid ounces.

2.4000 wt. oz. ETOH ÷ .8 S.G. ETOH or

```
     3.000
.8 | 2.4000
     24
```

So our average 150 lb. adult male with an AC of .15 has 3.000 fluid ounces of pure ETOH in his system at the time of the test.

This process of computing the fluid ounces of pure ETOH in the body at the time of the test can be reduced to a simple algebraic formula.

$$A = \frac{W \times R \times AC \times 16}{S.G.}$$

Where: A = Fluid ounces pure **ETOH.**
W = Body Weight
AC = Alcohol Concentration
R = Widmark Factor
S.G. = Specific Gravity of **ETOH** (.8)

So the above problem would look like

$$A = \frac{150 \times .67 \times .0015 \times 16}{.8}$$

A = 3.000 fld. oz. pure **ETOH**

When solving this type of problem, we can take the answer (fluid ounces of pure ETOH) one step further and convert it to ounces of the beverage that the subject was drinking. It is a simple one step operation — divide the ounces of pure **ETOH** by the concentration of alcohol in the beverage consumed.

Example: 1 ounce pure **ETOH** converted to 100 proof

100 proof = 50% **ETOH.**
So divide 1 ounce by .50.

```
    2.
.50 | 1.00
```

1 ounce pure **ETOH** = 2 ounces 100 proof

Taking our previous problem with the 150 lb. man with an AC of .15, we found that he had 3.000 fluid ounces of pure **ETOH** in his body when the test was taken. Suppose we were told he had been drinking 86 proof whiskey, we know that 86 proof is 43%, so:

3.000 ÷ .43 = oz of 86 proof

```
     6.976
.43 | 3.000
```

The man had 6.976 ounces of 86 proof alcohol in his sytem at the time of the test, or if he was drinking normal drinks (not doubles) he consumed a minimum of seven drinks.

If the subject was drinking beer we can figure it the same as ounces of 100 proof **ETOH.** A 12 ounce bottle of strong beer contains about the same amount of pure **ETOH** as one ounce of 100 proof.

i.e.
Strong beer at 4.5% × 12 oz. = .54 ounces pure **ETOH**

= 100 proof 1 oz. × .50 = .5 ounces pure **ETOH**

As with any algebraic formula; if all the quantities are known except one, the formula can be manipulated to solve for the unknown. In other words, if we know a persons weight and the amount of alcohol he consumed, we can calculate his maximum AC. We have to say maximum because we have not yet learned to incorporate the rate of elimination into our calculations.

Let's work our previous problem in reverse to demonstrate the formula manipulation.

Given: 150 lb. man drinks 7.0 ounces of 86 proof

Find: AC

First we must convert the 7.0 ounces of 86 proof to pure **ETOH.** 86 proof is 43%

Using the formula:

$$\frac{\text{ounces of Pure ETOH}}{\%\text{Beverage}} = \text{ounces of Beverage}$$

We put in our facts

$$\frac{\textbf{ounces pure ETOH}}{43\%} = 7.0 \text{ ounces}$$

Multiply by .43

$$\frac{.43 \times \textbf{ounces pure ETOH}}{.43} = 7.0 \times .43$$

ounces of pure ETOH = 3.0

Then use the Widmark formula

$$A \quad \frac{\textbf{W x R x AC x 16}}{\text{S.G.}}$$

and put in our facts

$$3.0 = \frac{\textbf{150 x .67 x AC x 16}}{.8}$$

Multiply by .8

$$.8 \times 3.0 = \frac{\textbf{150 x .67 x AC x 16} \times .8}{.8}$$

Divided by 150

$$\frac{\textbf{.8 x 3.0}}{150} = \frac{\textbf{150 x .67 x AC x 16}}{150}$$

Divided by .67

$$\frac{\textbf{.8 x 3.0}}{150 \times .67} = \frac{\textbf{.67 x AC x 16}}{.67}$$

Divided by 16

$$\frac{\textbf{.8 x 3.0}}{150 \times .67 \times 16} = \frac{\textbf{AC x 16}}{16}$$

Carry out the math

.00149 = AC

Multiply by 100 to convert to AC as defined in the law.

.149 = AC

$$AC = \frac{\text{Fluid oz. pure ETOH} \times .8}{\text{Body wt.} \times .67 \times 16}$$

Caution. Widmark R is based on averages. It actually provides a means of estimating the amount of alcohol in the body at the time of chemical testing. It should not be considered as a means of specifying actual amount consumed.

Effects on the Central Nervous System

Alcohol is a depressant and not a stimulant. Many people think it is a stimulant since its first effect is to reduce tension and give a mild feeling of euphoria or well being. It affects the most recently developed part of the brain first — that part controlling a person's judgment and morals. It's last effect is on the oldest part of the brain — that part controlling a person's automatic body functions so that the individual completely loses control of himself, passes into a coma and ultimately can die if the respiratory center in the brain ceases functioning. In between, there is a progression of deterioration that affects a person's speech, vision and equilibrium.

Stages of intoxication. The stages of alcoholic influence are shown on the following pages. The AC ranges given in the Exhibit indicate that not all people are affected the same at the same AC. In addition, there are no precise AC's that define each stage. One merges into another as the effects of alcohol become more severe.

Effects on Vision. Pupils of the eye generally dilate (enlarge) and reaction to light becomes sluggish. At AC's of 0.10 people are unable to completely fuse the vision of each eye into a single image. Glare is more bothersome and distance judgment is impaired. The time to adjust from far to near vision may be increased from 0.10 to 0.20 seconds at the AC of 0.06.

Effects on Reaction Time and Coordination. Alcohol causes an impairment in muscular coordination; the threshold of impairment has been demonstrated to be as low as an AC of 0.02. Reaction time is increased. Each person appears to have a threshold AC at which impairment begins; then small additional doses of alcohol produce large losses in coordination. Motor tasks which require coordination or complex discrimination are impaired at AC's of 0.05.

Effects on Other Body Organs Systems and Tissues

Effects on Skin. Alcohol has antiseptic properties. It absorbs heat upon evaporation and, therefore, imparts a cool and soothing feeling when rubbed on fevered skin. Following absorption, alcohol enlarges the blood vessels of the skin and permits an increase in the amount of blood circulating in the skin; this accounts for the flushed face of the drinker.

Effects on Circulation. Low AC's have very little effect on circulation to enlarge blood vessels of the skin as discussed above. There is no evidence that alcohol improves circulation; on the contrary; it appears to impair circulation. At an AC of 0.45 or greater, death may result from respiratory or cardiac arrest.

Effects on Kidney. Aside from the fact that alcohol is a mild diuretic, that is, it increases urine output, moderate use of alcohol does not appear to cause any kidney damage.

Effects on Liver. Alcohol causes an accumulation of fat in the liver, a condition referred to as fatty liver. It may result in an inflammation of the liver, commonly called cirrhosis. However, cirrhosis appears to be more a result of the poor diet of the alcoholic rather than a direct result of alcohol. Moderate use of alcohol does not appear to have a harmful effect on the liver of healthy, well-nourished people.

Symptoms of Alcoholic Influence. Common symptoms of alcoholic influence are:

- Odor of alcoholic beverages on the breath
- Swaying or unsteadiness — staggering
- Poor muscular coordination
- Confusion
- Sleepiness
- Disorderly
- Speech impairment, such as slurred, confused, thick tongue
- Dizziness
- Nausea
- Unusual actions, such as very talkative
- Visual disorders — fixed stare - glassy eyes
- Flushed skin

The list is not all-inclusive nor does any one symptom or combination of symptoms mean that the person is intoxicated. Numerous illness/injuries can produce the same symptoms as alcoholic influence. Several of these are listed at the end of this section. The officer should, therefore, examine and question the suspect carefully in order that his possible need for medical attention will not be ignored.

It might be pointed out that a chemical test can protect both law enforcement groups and the public by providing an alert to the need for medical attention. An unusually low AC can serve to indicate that the suspect's abnormal behavior is due to some illness or injury other than alcohol, and appropriate procedures can be undertaken to assure that the suspect receives needed medical attention. An unusually high AC also indicates the need for medical attention in order that the danger of respiratory or cardiac arrest can be avoided.

Alcohol Combined With Other Drugs. Alcohol combined with other drugs can cause special problems. As stated previously, medical care should be obtained for any individual who has a low AC but appears to be markedly under the influence. The effects of alcohol combined with stimulants and other depressants, are discussed below.

* **Stimulants.** (Caffeine, amphetamine, etc.) Stimulants do not counteract the depressing effect of alcohol. They are only temporarily effective with regard to the grosser aspects of drunkenness. They may be used for temporary arousal in severe intoxication, but the arousal effect is brief.

* **Depressants.** (Analgesics, antihistamines, tranquilizers, etc.) The depressant effects of alcohol and other drugs will be added together and, in some instances, the resultant effect will be greater than the expected combined effect of the two drugs. Since such depressants are used widely and indiscriminately by the public, their use with alcohol could cause a serious problem for the driver.

* **Narcotics.** (opium, morphine, cocaine, marijuana, LSD, heroin, etc.) Animal studies have indicated additive and supra-additive effects of narcotics and alcohol; human studies are understandably lacking. In examining the drunk driver suspect, the officer should be alert to the possibility that the individual's behaviour may be due to a narcotic or to a combination of narcotic and alcohol.

Tolerance to Alcohol. It is well known that people

react differently to liquor, that is, some are better able to 'hold' their liquor than others. Different individuals at the same AC react differently. Although it may be said that the heavy drinker has learned to compensate for the effects of liquor (for example, by standing with his feet farther apart to minimize swaying), tolerance has been noted in the person with no previous exposure. Individuals with the same weight can attain different AC's from the same amount of alcohol. It is the opinion of most investigators that tolerance is limited and occurs most frequently at AC's of 0.10 or less.

The exact reasons for differences in tolerance to alcohol are unknown but the following reasons have been proposed:

- Delayed absorption
- Decreased penetration into the central nervous system
- Increased elimination
- Increased water content of the body
- Increased tissue tolerance
- Variation in the ability of individuals to respond to stress

Stages of acute alcoholic influence/intoxication [1]

ETHYL ALCOHOL LEVEL, Per cent by Weight Blood (Urine)	STAGE OF ALCOHOLIC INFLUENCE	CLINICAL SIGNS/SYMPTOMS
0.01-0.05 (0.01-0.07)	Sobriety	No apparent influence Behavior nearly normal by ordinary observation Slight changes detectable by special tests
0.03-0.12 (0.04-0.16)	Euphoria	Mild euphoria, sociability, talkativeness Increased self-confidence; decreased inhibitions Diminution of attention, judgment, and control Loss of efficiency in finer performance tests
0.09-0.25 (0.12-0.34)	Excitement	Emotional instability; decreased inhibitions Loss of critical judgment Impairment of memory and comprehension Decreased sensitory response; increased reaction time Some muscular incoordination
0.18-0.30 (0.24-0.41)	Confusion	Disorientation, mental confusion; dizziness Exaggerated emotional states (fear, anger, grief, etc.) Disturbance of sensation (diplopia, etc.) and of perception of color, form, motion, dimensions Decreased pain sense Impaired balance; muscular incoordination; staggering gait, slurred speech
0.27-0.40 (0.37-0.54)	Stupor	Apathy; general inertia, approaching paralysis Markedly decreased response to stimuli Marked muscular incoordination; inability to stand or walk Vomiting; incontinence of urine and feces Impaired consciousness; sleep or stupor
0.35-0.50 (0.47-0.67)	Coma	Complete unconsciousness; coma; anesthesia Depressed or abolished reflexes Subnormal temperature Incontinence of urine and feces Embarrassment of circulation and respiration Possible death
0.45 + (0.60 +)	Death	Death from respiratory paralysis

[1] Prepared by: Kurt M. Dubowski, Ph. D., FAIC, Director, Department of Clinical Chemistry and Toxicology, University of Oklahoma, School of Medicine, Oklahoma City, Oklahoma, Member, Committee on Alcohol and Drugs, National Safety Council

A list of Some Pathological Conditions Having Symptoms in Common With Those of Alcoholic Influence*

Acetone Odor of the Breath A fruity odor, which may be mistaken for the odor of alcoholic beverages):

- Concussion of brain
- Delirium tremens (form of acute insanity accompanied by trembling)
- Diabetes (disease of the pancreas (digestive gland) which prevents proper burning of blood sugar)
- Food poisoning
- Intestinal obstruction
- Severe migraine (headache)
- Starvation
- Stomach cancer
- Stomach ulcer
- Uremia (urine poisoning in the blood because of malfunctioning of the kidneys)
- Vomiting
- Wastings diseases such as cancer, malaria, syphilis, tuberculosis

Amnesia (loss of memory):

- Dementia (insanity which may be general paralytic, senile or toxic)
- Epilepsy (the epileptic usually has no memory of the convulsion which may have led to an accident and his subsequent arrest)
- Hysteria (a nervous disorder characterized by lack of control over acts and emotions)
- Korsakoff's Syndrome (peculiar mental disturbance, usually the result of alcoholism, characterized by disorientation, no appreciation of time or place. The victim talks freely and often plausibly about events that have never taken place)
- Toxemia (blood poisoning from microbic and other poisons, particularly encephalitis (inflammation of the brain)
- Trauma (an injury, particularly of the brain)

Ataxia (failure of muscular coordination, a condition characterized by imperfectly coordinated movements such as failure to 'walk the line' of 'touch the nose'):

- Ataxia due to chemicals, drugs, or gases, such as antihistamines, barbiturates, and other sedatives such as chloral hydrate; carbon monoxide; chemicals used in industry such as; aluminum, lead, manganese, or naphtha; opium derivatives; and tranquilizers
- Ataxia due to mental shock or fright
- Chorea (convulsive nervous disease manifested in irregular involuntary movement, 'St. Vitus dance')
- Chronic Progressive Chorea (Huntington's Chorea) characterized by muscular spasms, facial contortions, lurching gait)
- Hysterical Ataxia (failure of muscular coordination due to psychoneurosis (nervous disorder affecting the mind))
- Injury to nerves or muscles
- Labyrinthitis (infection of the inner ear)
- Peripheral Neuritis (inflammation of terminal nerves, usually the result of chronic alcoholism or diphtheria)
- Pernicious Anemia (improper development of red blood cells, usually with nerve conduction impairment)
- Spinal Cord Lesions:
  - Multiple Sclerosis (fibrous overgrowth of spinal cord)
  - Myasthenia Gravis (muscular weakness — head tends to fall forward)
  - Syringomyelia (degeneration of spinal cord caused by abnormal cavities filled with liquid in substance of the cord)
  - Tabes dorsalis (degeneration of the spinal cord and nerve-trunks, usually caused by syphilis)
  - Tumors of spinal cord
- Traumatic Ataxia (failure of muscular coordination due to injury, such as from auto accident, sudden changes of pressure in aviators, caisson workers, or divers)

Coma (unnatural, heavy, deep sleep sometimes ending in death):

- Cavernous Sinus Thrombosis (clotting of blood associated with infection in venous blood spaces in the skull)
- Diabetes
- Effect of chemicals
- Effect of extremes of temperature such as sunstroke, heat stroke, or excessive cold
- Excessive loss of blood from:
  - Ruptured aneurysm (a ballooned out, weakened arterial wall)
  - Ruptured gastric or duodenal ulcer (ulcer in stomach or first portion of small intestine)
  - Ruptured tubal pregnancy (abnormal pregnancy which is partly in the fallopian tube)
- Head Injuries:
  - Brain compression from hemorrhage
  - Concussion
  - Depressed fracture
- Embolism (usually blood clot or tumor cells lodging in brain)
- Hysterical trance (abnormal sleep due to hysteria during which sensibility and consciousness may remain)
- Insulin shock (due to overdose of insulin)
- Post epileptic state
- Sudden nervous shock
- Uremia

Delirium (mental disturbance marked by hallucinations, incoherence, illusions, etc.):

- Acidosis (depletion of alkali reserve of the body resulting in increased acidity, such as in cases of diabetes)
- Bites or stings of reptiles, insects, etc., such as bee, hornet, and wasp stings; jelly fish contacts; snake bites
- Blood loss
- Brain lesions, such as acute meningitis
- Delirium associated with stopping of a drug habit, e.g., alcohol, cocaine, heroin, morphine
- Drugs, such as aconite, atropin, camphor, cannabis indica, cocaine, hyoscyamus, marijuana, opium derivatives, stramonium; injections causing allergic reactions such as horse serum or penicillin

Fever from acute infections
Hysteria
Infection from animal bites, e.g., hydrophobia or rat bite fever
Poisonous foods, e.g., allergic food reactions, mushrooms, poisoning from spoiled foods
Sunstroke

Drowsiness:
Acute anemia
Concussion of brain
Diabetes
Drugs
Encephalitis lethargica (sleeping sickness)
Uremia

Eye Disorders (bloodshot eyes, pupils do not contract or do not dilate, etc.)**
Acute conjunctivitis (Pink Eye)
Foreign body in eye
Glaucoma (disease of eye marked by increased ocular pressure)
Hay fever and similar allergic disorders
Iritis (inflammation of the colored part of the eye)
Trachoma (a contagious disease marked by granular eyelids)

Contracted Pupils (pupils of eyes decreased in size, normally by bright light):
Brain hemorrhage in Pons (connecting organ in the brain)
Farsightness
Opium derivatives
Tabes Dorsalis (pupils occasionally large)
Uremia

Dilated Pupils (enlarged pupils of the eyes, normally caused by dim lights):
Acute Mania (insanity)
Anemia
Aneurysm (ballooning out of weakened arterial wall)
Apoplexy (sudden paralysis and coma due usually to blood escaping into brain or to clotting of blood in a blood vessel of the brain)
Asphyxia (deficiency of oxygen in the blood marked by suffocation)
Catalepsy (nervous disease marked by attacks of suspension of voluntary motion and sensibility)
Concussion of brain
Drugs, such as atropin, cocaine, epinephrin, eumydrin, homatropin, hyoscin
Dyspnea (difficult breathing)
Fright
Glaucoma
Mediastinal Tumor (tumor in the middle part of the chest)
Morphinism (during period of withdrawl of morphine from an addict)
Most comatose conditions (those affected with coma), except from opium or uremia
Nausea
Nearsightedness
Reflexly, from pain
Toxic Goiter (overactivity of the thyroid gland, usually resulting in swelling of the neck and causing a toxemia from the excess secretion of thyroxin)

Inequality of Pupils (difference in size of the two pupils):
Apoplexy
Artificial eye
Brain tumor
Cerebral Abscess (collection of pus in a cavity formed in the brain)
Multiple Sclerosis
Refraction unequal in both eyes
Skull fracture
Syringomyelia
Tabes Dorsalis

Flushed Face:
Acne Rosacea (chronic inflammation of the face and nose)
Aneurysm of Ascending Aorta (ballooning out of one of great arteries of the heart)
Apoplexy (stroke)
Arteriosclerosis (hardening of the arteries)
Cerebral Concussion (injury to the main part of the brain)
Chemical or Drug Poisoning (by amyl nitrite, belladonna, carbon monoxide, hyoscyamus, niotinic acid, or nitroglycerin)
Chlorosis (peculiar anemia causing greenish palor of the skin but marked also by occasional flushing of the face)
Chronic Pulmonary Tuberculosis (disease of the lungs)
Diabetes
Emotions (blushing)
Epilepsy
Exophthalmic Goiter (a goiter accompanied by protruding eyeballs)
Hysteria
Indigestion often with hypochlorhydria (insufficient hydrochloric acid in the gastric juice)
Lactation (period of secretion of milk in a female)
Menopausal hot flash (condition caused in female during change of life)
Mitral Stenosis (narrowing of the left valve to the heart)
Neurasthenia (nervous prostration)
Polycythemia Vera (disease characterized by great excess of red blood cells)
Sunstroke

Shock and Collapse:
Acute Appendicitis
Acute Intestinal Obstruction
Acute Pancreatitis (inflammation of the digestive gland which may be Fatal)
Acute Peritonitis (Inflammation of the membrane which lines the abdominal walls)
Preumothorax
Acute Pneumothorax (sudden, often spontaneous, rupture of lung)
Angina Pectoris (spasm of heart arteries)
Apoplexy (stroke; caused by ruptured blood vessel or blood vessel suddenly blocked by clotted blood)
Coronary Thrombosis (blood clot in heart artery)
Injury (particularly skull fracture)
Insulin Shock
Perforated gastric or duodenal ulcer
Poisoning
Psychic Trauma (emotional shock)
Ruptured Aortic Aneurysm
Ruptured Ectopic Pregnancy (development of the fertilized egg outside the walls of the womb. The fetus may develop in the fallopian tube causing rupture and sudden bleeding into the abdominal cavity)
Strangulated Hernia (protrusion of a tightly constricted loop of an organ of the body through an abnormal opening)

Speech Disorders:
- Adenoids
- Aphasia (impairment or loss of speech due to loss of memory commonly from apoplexy or cerebral thrombosis (blood clot in brain))
- Cleft Palate
- Chorea
- Dysarthria (disordered articulation usually due to paralysis or incoordination of certain groups of muscles in lips, tongue, palate, etc.)
- Facial Paralysis
- General Paralysis
- Hysteria
- Infection of tongue or mouth
- Jaw dislocation or fracture
- Lisping
- Mental Deficiency
- Migraine
- Multiple Sclerosis (results in slow 'scanning speech')
- Myasthenia Gravis (muscular weakness)
- Myxedema (a disease which is the result of a thyroid deficiency, marked by dullness of mental faculties, sluggishness of movement, unsteadiness of gait, and thick speech)
- Paralysis Agitans (Parkinson's disease), (shaking palsy)
- Stammering
- Toothlessness

Tremors (muscular twitching):
- Cerebellar Tumor (tumor on portion of brain which coordinates movements)
- Cerebral Tumor (tumor on the main partal brain)
- Chemical or Drug Poisoning (by absinthe, lead, manganese, mercury, narcotics, or tobacco)
- Encephalitis Lethargica (sleeping sickness)
- Exophthalmic Goiter
- General Paresis (softening of the brain marked by insanity and paralysis)
- Multiple Sclerosis
- Neurosis (functional disorder of the nervous system)
- Post-encephalic Parkinsonism (shaking palsy)
- Senility (old age)

Vertigo (dizziness):
- Anemia (deficiency in red blood corpuscles and/or iron)
- Aortic Regurgitation (leakage of valve to great artery of the heart)
- Arteriosclerosis of arteries of brain
- Cerebellar Tumor
- Cerebral Syphilis
- Cerebral Tumor
- Chronic Nephritis (chronic inflammation of the kidney)
- Eyestrain
- General Paresis
- Hemorrhage (external or internal bleeding)
- Injuries or infections of the brain
- Intoxications (due to substances other than alcohol, such as barbiturates, belladonna, carbon monoxide, marijuana, opium or quinine)
- Labyrinthitis (infection of the inner ear)
- Meniere's Disease (inflammation and congestion of the inner ear, characterized by dizziness, ringing of ears and some hearing loss)
- Motion Sickness
- Multiple Sclerosis
- Neurosis
- Paralysis of an eye muscle

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* Prepared by Doctor Herman A. Heise, Milwaukee, Wisconsin, one of the outstanding experts on chemical tests to determine alcoholic influence, who is a member of the American Medical Association and was formerly chairman of its Committee on Medicolegal Problems. He is also one of the charter members of the National Safety Council's Committee on Alcohol and Drugs, formerly the Committee on Tests for Intoxication. The designated symptoms are listed alphabetically, each followed by a group of pathological conditions which may cause the particular symptom. From Donigan, R.L. **Chemical Tests and the Law.** 2nd Ed. Evanston, Illinois. The Traffic Institute, Northwestern University, 1966, 300-307.

**Particular care should be given to examination of the eyes. Witnesses have been known to testify that a glass eye was 'bloodshot'.

STOPPING AND PROCESSING THE DWI SUSPECT

CHAPTER V

INITIAL CONTACT WITH THE DRINKING DRIVER

by Capt. Roger Lenz, MSP

INTRODUCTION

The drinking driver on Minnesota's streets and highways has been, is, and will continue to be a very serious problem. Over fifty percent of the drivers killed in motor vehicle accidents had been drinking. Every effort should be made on behalf of State, County, and Municipal law enforcement officers to curb this threat to humanity.

Recognizing, stopping and approaching the drinking driver are three essential segments of the overall law enforcement effort to combat the drinking driver problem. Each requires certain skills which will lend it to a successful apprehension. Successful in that it was done safely from the violator's and the officer's viewpoint, and successful that it lends itself to a conviction in court.

RECOGNITION

Probable cause that a driver is under the influence is normally determined by some type of unusual or abnormal driver behavior. This unusual or abnormal behavior will not necessarily constitute a violation. Driver behavior which may be indicative of an individual driving while under the influence is frequently indicated by the following:

1. Unreasonable speed — high or low
2. Driving in spurts, slow then fast, etc.
3. Frequent lane changing with excessive speed.
4. Improper passing with insufficient clearance; also taking too long or swerving too much in overtaking and passing (over control).
5. Overshooting or disregarding traffic control signals.
6. Approaching signals unreasonably fast or slow and stopping or attempting to stop with uneven motion.
7. Driving without lights when required.
8. Failure to dim headlights for oncoming traffic and when following.
9. Jerky starting or stopping.
10. Driving too close to shoulders or curbs.
11. Driving over center line, into wrong lane and/or off onto shoulder.
12. Driving with windows down and/or head partly or completely out of window.
13. Failure to start when green traffic signal appears.

STOPPING

Keep in mind when stopping the suspect that alcohol affects one's judgment and may result in sudden erratic behavior.

1. Select a suitable safe place to make the stop.
2. Be prepared for any sudden movement on behalf of the suspect vehicle.
3. Use adequate emergency warning devices to assure that the suspect recognizes your authority, understands your intent and that any other traffic is warned of your intended course of action.
4. Identify the driver where conditions permit.
5. Be aware of any evidence which may be thrown from the vehicle during the stop or unusual movement in the vehicle which may indicate the hiding of evidence.
6. Allow a sufficient distance between the patrol car and the suspect vehicle for ample safety. (recommended **minimum** — one car length)

APPROACH

Quite frequently a suspect is difficult to stop, or does not react in the manner you have indicated. Even though this can be an aggravating experience, **control yourself.** Do not allow your personal feelings to affect or influence your professional judgment.

1. Be alert, approach the suspect vehicle with due caution.
2. Upon your approach, check the car for location of driver and passengers and possible evidence which may be in open view.
3. Be courteous but firm, do not aggravate the driver or allow yourself to be drawn into an argument.
4. Assume command of the situation in a businesslike manner, do not project the feeling of uncertainty.
5. If more than one intoxicated person is in the car, try to isolate the driver, either out of his car and on the shoulder or in your squad car. Other occupants too often end up as a rooting section for a belligerent drinking driver.
6. Once you have the suspect stopped, do not allow him to drive unless you are assured he is not under the influence.

NATIONAL SAFETY COUNCIL
TRAFFIC SAFETY MEMO

TESTING THE DRINKING DRIVER

INTRODUCTION

Accident statistics for several years have reported from 25 to 30 percent of the drivers involved in fatal accidents as 'had been drinking' and seven to eight percent 'under the influence of intoxicating liquor.' These percentages may understate the problem. Studies of the problem in specific areas have shown them to be higher, varying from 40 to 70 percent involvement in fatal accidents. Without a doubt, the drinking driver is one of the major factors in the nation's traffic accident picture, and enforcement of statutory prohibitions against driving while under the influence of intoxicating liquor becomes a major weapon in the traffic accident prevention program. Present methods for handling drinking drivers are often inadequately administered, and many offenders are not arrested at all or are charged with lesser offenses.

Identification of the drinking driver is difficult. When an officer contacts a driver he suspects of being under the influence, he must assure himself that the suspect is actually under the influence to a degree that makes him a hazard on the highway. If the officer is so assured, he must obtain evidence to be presented in court which will convince the judge and jury, as the officer himself was convinced, that the driver was in fact under the influence of intoxicating liquor.

A number of factors make this identification difficult. First, the appearance and actions of the suspect must be different from those of a normal, sober person. When appearance and actions are clearly abnormal, it must be ascertained that alcohol is the cause. There are over 60 pathological conditions producing symptoms the same or similar to those of alcoholic intoxication. The officer must be certain that the suspect's condition is due to alcohol and not due to an illness, injury, or medication.

Another factor is the definition of 'under the influence.' The courts have held that any degree of impairment of physical or mental capabilities used to operate a motor vehicle should be considered as 'under the influence.' This poses some serious problems for an arresting officer. He is in a difficult position of not knowing a suspect's capabilities when sober, so that officer must practically guess that the suspect is under the influence from past observations of others, thusly impaired.

There is no rule of thumb test by which an officer, or any doctor, can look at a suspect and say positively in every case that the person was or was not under the influence of alcohol. This is the reason why chemical tests to determine alcoholic influence are so important. The tests determine the presence of alcohol and exclude the possibility of other influence causing impairment of a driver. The tests also tell to what degree alcohol has entered the bloodstream to give an idea of the extent of impairment.

TESTING METHODS

The methods for testing the drinking driver can be classified into two general groups: objective tests and chemical tests. The first group consists of the usual tests given drinking drivers by most police departments throughout the country. Within this group are also included other methods to indicate alcoholic influence, such as movies, voice recordings and handwriting analysis.

The principle of the objective test is to determine any deviation in normal behavior while a person is performing a particular task. Of course, it is also necessary to determine that alcohol is the cause of any such deviation. However, the objective test will show the state of the suspected drinking driver at the time he is apprehended and is necessary to show that the person's actions indicated impairment of normal abilities.

Chemical testing is the second group used to identify the drinking driver. There are over 200 different methods that can be used to identify alcohol in the human body. However, not all are considered adaptable to use in determining the presence and amount in drinking drivers. Chemical tests can be divided into two categories: those used in laboratory analysis and those used in immediate analysis, as in tests of exhaled breath. Laboratory analysis usually is concerned with specimens of blood and urine, although it can also include saliva.

Breath testing devices are available in two forms, the first is for preliminary screening and the second for quantitative analysis. The preliminary screening devices are portable and are used to confirm a police officer's suspicion that alcohol may be present. The officer is able to take a suspect in for further testing to determine the precise amount of alcohol present, whether by laboratory analysis or with another breath device for quantitative analysis.

It is an accepted fact that the amount of alcohol in the breath is a reliable index of the amount of alcohol in the blood, which in turn is an accurate index of the amount of alcohol in the brain affecting the judgment and abilities of the individual. All methods of determining breath alcohol, when properly conducted, provide accurate, comparable and reliable information on the presence and concentration of alcohol in the blood.

An enforcement agency's choice of which test method to employ will be dictated by what facilities are available in an area. If the police department has a good laboratory, it may easily conduct blood or urine tests itself. If competent personnel are available, a breath testing program may be used. If hospital, clinic, or health department laboratories can assist, the agency may make use of these facilities to help gather the information necessary for adequate prosecution of drinking drivers.

A chemical test by itself is not sufficient to bring about conviction of persons charged with driving while under the influence. Evidence must be presented that the suspect's physical abilities were impaired, in addition to the fact that the reason for impairment was the presence of alcohol in the blood. For this reason, both objective tests and chemical tests are essential to a good enforcement program against drinking drivers.

BLOOD ALCOHOL STANDARDS

The Uniform Vehicle Code contains the standards accepted as defining the alcoholic influence. The following interpretations have been given to these blood alcohol standards:

1. If there was at that time 0.05 percent or less by weight of alcohol in the defendant's blood, it shall be presumed that the defendant was **NOT** under the influence of intoxicating liquor;
2. If there was at that time in excess of 0.05 percent, but less than 0.10 percent by weight of alcohol in the defendant's blood, such fact shall not give rise to any presumption that the defendant was or was not under the influence of intoxicating liquor, but

such fact may be considered with other competent evidence in determining the guilt or innocence of the defendant;

3. If there was at that time 0.10 percent or more by weight of alcohol in the defendant's blood, it shall be presumed that the defendant was under the influence of intoxicating liquor.

Many states have enacted legislation that contain the above standards on alcoholic influence. Even in those states, without this legislation, there is usually case law setting a precedent for introduction of evidence based on these standards.

TESTING PROCEDURE

Many police agencies have regulations for proper handling of the drinking driver. The following paragraphs are intended to explain what elements are necessary to carry out a successful program and aid in the prosecution of drivers found under the influence.

For a driver to be charged with driving while under the influence of alcohol, it must be established that he was, in fact, driving a vehicle or in physical control of it at the time he was apprehended. To complete the charge, it must be ascertained that the suspect was under the influence of alcohol to such a degree that his driving abilities were impaired. All deviations from normal driving behavior should be noted, including extreme caution and all violations.

A complete examination of suspect is made easier through the use of the Alcoholic Influence Report Form. (See following page) This form is designed to give an officer a uniform guide in observing, testing and interviewing a suspect. It is intended to show impairment in coordination and judgment, and to assist an officer to arrive at a conclusion that the individual is normal or his driving abilities are impaired.

The questions asked of the suspect in the Interview Section are designed to eliminate any possibility that he is under the influence of something other than alcohol. It is also useful in blocking any later attempt by defense counsel to claim his client was ill, taking medicine, or some other possible explanation to account for his client's unusual behavior.

Each department may have specific instructions for filling out the Alcoholic Influence Report Form. In the discussion below, some general comments are made to aid in setting up these instructions. The identification and file information at the top of the form is self-explanatory.

1. The section entitled **OBSERVATIONS** is intended to show the physical appearance and actions of the suspect from the time he is brought in for examination. Most individuals act and appear quite different while under the influence of alcohol than is normally the case. If any additional space is needed for observation, the remarks section on the back of the form may be used, or a plain sheet of paper.

2. Each of the **PERFORMANCE TESTS** have special instructions which should be followed in each case. These instructions are as follows:

   BALANCE: Have a suspect stand with feet together, eyes closed, head tilted back. Allow him to use his arms for balance. Repeat test, but have him put arms to side.
   WALKING: Have suspect walk line on floor, heel to toe and return.
   TURNING: Specially not any difficulty when he turns around while performing the **walking** test.
   FINGER-TO-NOSE: Have suspect stand erect, feet together, eyes closed, extending both arms out to side with each index finger extended. Have him bring tip of one finger to end of nose. Repeat with other arm and finger.
   COINS: You arrange nine coins on floor, such as three pennies, three nickels and three dimes, in order, with the head or tails all up. Then you tell him each time what type of coin he is to pick up. Have him pick up each coin as you direct him, identify head or tail (which ever was up on the floor) and hand to you.

   The instructions for the performance tests should be put in a prominent place so that the person giving these tests can refer to them when needed.

3. The person making the observations and giving the performance tests should fill out the **OBSERVER's OPINION** Section. It should be noted that the Effects of Alcohol should be checked and the observer's opinion as to Ability to Drive should also be checked.

4. In the event blood or urine specimens are needed for a chemical analysis, these specimens can be obtained prior to beginning to use the Alcoholic Influence Report Form. If a Breath Test is given, it can follow the natural sequence of the sections in the form. No analysis result should be listed in the box provided, unless the test operator is also filling out the form.

   In those areas where written consent is needed to take a test, a separate form should be used to obtain this consent.

5. The **INTERVIEW** Section contains questions that provide information about a suspect's actions around the time of arrest and provide some of his personal history. The suspect's answers should be put down on the form as nearly the same as he says them.

   If he is unable or refuses to answer, record this fact in the space provided for the answer. No matter how silly an answer seems put it into the space provided.

   Have the suspect give a sample of his handwriting in the appropriate box. If reluctant, ask him to write 'I refuse to sign this form' or some other short sentence.

6. Information in the **SUPPLEMENTARY DATE** Section is useful to the prosecutor who will handle the case in court. It is necessary to have witnesses to prove driving and/or the suspect's condition. If a witness cannot attest to one of these facts, merely indicate Unknown or Not Known in the appropriate space.

Additional information required by a department in any DWI case should be put on separate forms or paper.

DRUGS AND DRIVING

Law enforcememt officers should be aware of the possibility of the presence of drugs in a suspect brought in for driving under the influence of alcohol.

If a suspect shows obvious signs of intoxication, but tests reveal little or no presence of alcohol, this should lead an officer to believe something other than alcohol is responsible for such behavior.

Indications are that too few law enforcement agencies are making further tests to learn if another agent is

responsible for apparent intoxication. When an original chemical test for alcohol shows a low blood alcohol level, or none at all, yet obvious intoxication is present, further specimens should be obtained and analysis made. Medical assistance should be obtained to determine if the suspect is suffering from some illness or injury. A concussion injury can easily produce the same symptoms as alcoholic intoxication, so it is best to leave no room for doubt as to cause of the condition.

THE PRE-ARREST SCREENING TEST

In 1971 the Minnesota legislature enacted a law allowing a police officer to request immediate breath test of any person suspected of DWI. The law further stated that the device used for such a test must be approved by the Commissioner of Public Safety. After extensive testing by the BCA Lab, only two instruments have been approved for pre-arrest testing.

The Breathalyzers, Models 900 and 900A, were first approved while testing and research was conducted on more portable units. Since the breathalyzer is not a truly portable instrument, the only way it could be used for an 'immediate' roadside test was to have the unit fitted into a specially equipped van. For this reason, the use of the Breathalyzer in pre-arrest testing was and is very limited.

The second and only other unit to gain approval is the A.L.E.R.T., Models J2A, J2-1000 and J3A. The A.L.E.R.T. was designed as a completely portable unit with a failsafe operation requiring a minimum of training. In 1973 the first A.L.E.R.T. units were used in Minnesota squad cars. The departments participating in the Hennepin County ASAP program and the State Patrol Metro districts introduced the units to their officers in an evaluation of the units and the concept of pre-arrest screening. Despite early problems with equipment durability and some officers reluctance to use the new tool, the unit and law proved to be an effective aid in dealing with the DWI problem.

The result of the above evaluation and studies conducted in other states show that without pre-arrest testing, as many as 50% of the drivers stopped with alcohol concentrations in excess of .10 would not be charged with DWI, and in fact would be allowed to drive. The A.L.E.R.T. can and is becoming the biggest single threat to the seasoned drinker, the drinker who is able to mask his physical symptoms of impairment. If the officer has any reason to believe that a driver has been drinking, the pre-arrest test can help even the most experienced officer make a correct decision on a 'borderline' subject. Even though the borderline 'Fail' result may not lead to a DWI conviction, it has assisted the officer in removing a potential hazard from the road.

Of the two problems experienced in the Minnesota evaluations, the equipment durability has been greatly increased with maintenance experience and design improvements with each new A.L.E.R.T. model. The problem of officer acceptance, despite the overwhelming evidence in its favor, still depends on the individual decision of each officer.

A third device that has been approved is the Alcosensor. It is a fuel cell device that also has the pass, warn, and fail lights to indicate the alcohol concentration.

(Check)	(Check)
☐ Driver	☐ Accident
☐ Pedestrian	☐ Violation
☐ Passenger	☐ Other

Date and time of Accident or Violation _____ am pm

ALCOHOLIC INFLUENCE REPORT FORM

Police Dept. _____
Arrest No. _____
Accident No. _____
Arresting Officer _____
Date and time in custody _____ am pm

Name _____ Address _____

Age _____ Sex _____ Race _____ Approx. Wt. _____ Operator Lic. No. _____ State _____

OBSERVATIONS:

CLOTHES	Describe: (Type & Color)	Hat or Cap _____ Jacket or Coat _____ Shirt or Dress _____ Pants or Skirt _____
	Condition:	☐ Disorderly ☐ Disarranged ☐ Soiled ☐ Mussed ☐ Orderly (Describe) _____
BREATH	Odor of Alcoholic Beverage:	☐ strong ☐ moderate ☐ faint ☐ none
ATTITUDE		☐ Excited ☐ Hilarious ☐ Talkative ☐ Carefree ☐ Sleepy ☐ Profanity ☐ Combative ☐ Indifferent ☐ Insulting ☐ Cocky ☐ Cooperative ☐ Polite
UNUSUAL ACTIONS		☐ Hiccoughing ☐ Belching ☐ Vomiting ☐ Fighting ☐ Crying ☐ Laughing
SPEECH		☐ Not Understandable ☐ Mumbled ☐ Slurred ☐ Mush Mouthed ☐ Confused ☐ Thick Tongued ☐ Stuttered ☐ Accent ☐ Fair ☐ Good

Indicate other unusual actions or statements, including when first observed: _____

Signs or complaint of illness or injury:

PERFORMANCE TESTS:

(Note—See departmental instructions for conducting these tests)

Check Squares If Not Made		Check appropriate square before word describing condition observed
☐	**BALANCE**	☐ Falling ☐ Needed Support ☐ Wobbling ☐ Swaying ☐ Unsure ☐ Sure
☐	**WALKING**	☐ Falling ☐ Staggering ☐ Stumbling ☐ Swaying ☐ Unsure ☐ Sure
☐	**TURNING**	☐ Falling ☐ Staggering ☐ Hesitant ☐ Swaying ☐ Unsure ☐ Sure
☐	**FINGER-TO-NOSE**	Right: ☐ Completely Missed ☐ Hesitant ☐ Sure Left: ☐ Completely Missed ☐ Hesitant ☐ Sure
☐	**COINS**	☐ Unable ☐ Fumbling ☐ Slow ☐ Sure ☐ (Other) _____ (Balance during coin test) _____

Ability to understand instructions: ☐ Poor ☐ Fair ☐ Good

Tests performed: Date _____ Time _____ am pm

OBSERVER'S OPINION:

Effects of alcohol: ☐ extreme ☐ obvious ☐ slight ☐ none

Ability to drive: ☐ unfit ☐ fit

Indicate briefly what first led you to suspect alcoholic influence: _____

Observed by: _____ Assignment: _____

Witnessed by: _____ Date _____ Time _____ am pm

CHEMICAL TEST DATA:

Specimen: ☐ Blood ☐ Breath ☐ Saliva ☐ Urine ☐ None
☐ Refused ☐ Unable

Analysis result:

If Breath, what instrument?

If refused, why? _____

INTERVIEW:

Were you operating a vehicle?_____ Where were you going?_____

What street or highway were you on?_____ Direction of travel?_____

Where did you start from?_____ What time did you start?_____

What time is it now?_____ What city (county) are you in now?_____

What is the date?_____ What day of the week is it?_____

INTERVIEWER TO FILL IN ACTUAL: _____ am/pm _____ _____ _____ _____

Time | Day | Date | Interviewer's Name

When did you last eat?_____ What did you eat?_____

What were you doing during the last three hours?_____

Have you been drinking?_____ What?_____ How much?_____

Where?_____ Started?_____ am/pm Stopped?_____ am/pm

Are you under the influence of an alcoholic beverage now?_____

What is your occupation?_____ When did you last work?_____

Do you have any physical defects?_____ If so, what?_____

Are you ill?_____ If so, what's wrong?_____

Do you limp?_____ Have you been injured lately?_____ If so, what's wrong?_____

Did you get a bump on the head?_____ Were you involved in an accident today?_____

Have you had any alcoholic beverage since the accident?_____ If so, what?_____

Where?_____ How much?_____ When?_____

Have you seen a doctor or dentist lately?_____ If so, who?_____ When?_____

What for?_____ Are you taking tranquilizers, pills or medicines of any kind?_____

If so, what kind? (Get sample)_____ Last dose?_____ am/pm Do you have epilepsy?_____

Diabetes?_____ Do you take insulin?_____ If so, last dose?_____ am/pm

Have you had any injections of any other drugs recently?_____ If so, what for?_____

What kind of drug?_____ Last dose?_____ am/pm When did you last sleep?_____

How much sleep did you have?_____ Are you wearing false teeth?_____ Do you have a glass eye?_____

HANDWRITING SPECIMEN Signature and/or anything he chooses	

REMARKS:_____

SUPPLEMENTARY DATA:

(Note—Get witnesses, including officers who observed, to prove driving)

WITNESSES			Was Suspect Driving or Operating	What Was His Condition	Where Observed
Name	Address	Tel. No.			

Passengers in Suspect's Vehicle	Name	Address	Condition

FORM 1812 (REV. 1-66)

MINNESOTA HIGHWAY PATROL

ALCOHOLIC INFLUENCE
Report Form

(check)	(check)
☐ Driver	☐ Accident
☐ Pedestrian	☐ Violation
☐ [illegible]senger	☐ Other

Arrest No._____
Date and time of Accident or Violation _____ A.M. P.M.
Date_____

NAME ADDRESS

AGE D.O.B. SEX APPROX. WEIGHT DISTRICT NUMBER

DR. LIC. NO. STATE DATE 19

CH. LIC. NO. STATE TIME OF TEST A.M. P.M.

OBSERVATIONS: (Draw circles around words describing observed conditions)

BREATH	Odor of alcoholic liquor	Apparently none	faint	moderate	strong	
COLOR OF FACE	Apparantly normal	Flushed	Pale	(Other)		
CLOTHES	Orderly	Mussed	Soiled	Disarranged	Disorderly (Describe)	
ATTITUDE	Polite Cooperative	Excited Indifferent	Hilarious Antagonistic	Talkative Cocky	Carefree Combative	Sleepy Insulting	(Other)
UNUSUAL ACTIONS	Profanity	Hiccough	Belching	Vomiting	Fighting	(Other)	
☐ SPEECH	Choice of words ☐ Fair	☐ Slurred	☐ Stuttering	Clearness and correctness of enunciation ☐ Confused	☐ Incoherent	(Other)	

INSTRUCTIONS FOR COORDINATION TESTS

Do not have suspect perform any test action unless he is willing. When tests are made, record results and check squares below. When tests are not made, record conditions from general observations but do not check the squares. A square is to be checked only if test is made.

EXAMINATION: (Draw circles around words describing test reactions)

☐ EYES	Apparently normal		Watery	Bloodshot			
☐ PUPILS	Apparently normal		Dilated	Contracted	Poor reaction to light		
☐ BALANCE	Sure	Fair	Swaying	Wobbling	Sagging Knees	Falling	(Other)
☐ WALK &	Sure	Fair	Swaying	Stumbling	Staggering	Falling	(Other)
☐ TURNING	Sure	Fair	Swaying	Uncertain	Staggering	Falling	(Other)
☐ FINGER-TO-NOSE TEST			Right-Sure	Uncertain	Left-Sure	Uncertain	(Other)
☐ PICKING UP COINS			Sure	Slow	Uncertain	Unable	(Other)

AFFIDAVIT OF CONSENT

DATE_____ HOUR_____ A.M. P.M.

I,_____, a resident of the state of_____, do hereby consent to the taking of a sample of blood, urine, breath or saliva from me personally for the purpose of determining by an acknowledged chemical test procedure, whether or not I am under the influence of an alcoholic beverage. I have been advised that I do not have to consent to the taking of a sample of blood, urine, breath, or saliva and that the results of any chemical test may be used as evidence either for or against my interests. I consent to this chemical test procedure voluntarily, without any influence or fear produced by threats, restraint coercion or by virtue of promises of any kind.

SIGNED_____

WITNESS_____

PHYSICIAN'S REPORT

E[illegible]ning physician,_____ A.M. P.M.
NAME ADDRESS TIME EXAMINED

Physician's Diagnosis_____

_____
SIGNATURE OF PHYSICIAN

QUESTIONS:

Were you operating this motor vehicle?_____ Where were you going?_____

What direction were you travelling?_____ Actual_____

Where did you start from?_____ What time did you leave?_____ A.M. P.M.

What Highway were you on?_____ Actual_____

What city are you in?_____ Actual_____

What time is it now?_____ A.M. P.M. Actual time_____

What date is it?_____ Actual date_____

Have you been drinking?_____ What?_____ Where?_____

How much?_____ Commenced?_____ a.m. p.m. Stopped?_____ A.M. P.M.

Are you ill?_____ Have you been injured recently?_____ Do you normally limp?_____

Are you hurt?_____ Did you get a bump on the head?_____

Have you been to a doctor or dentist recently?_____ Who?_____

If so, when?_____ what for?_____

Do you wear contact lenses or glasses?_____

Are you taking medicine?_____ If so, what?_____ Last date taken?_____

Are you taking tranquillizers or other pills?_____ Last time?_____

Do you have diabetes?_____ Are you taking insulin?_____

Have you had any shots or injections recently?_____ What for?_____ When?_____

Have you been exposed to ether recently?_____ If so, how long ago?_____

How much sleep did you get last night?_____ How much sleep today?_____

How long since you last worked?_____

When did you last eat?_____ What_____ (Meal, Sandwich, Etc.)

Have you consumed any alcholic beverages since eating?_____ What?_____ When?_____

Have you been drinking since the accident?_____ What?_____ How much?_____

What first led officer to suspect alcoholic influence?_____

Unusual actions or statements_____

Signs of illness or injury_____

Condition of vehicle steering mechanism_____

Indicate: Type of Road_____

Weather_____ Surface of Highway_____

CONCLUSION Effects of Alcohol– ☐ Apparently none ☐ Slight ☐ Obvious ☐ Extreme

Ability to drive– ☐ Apparently fit ☐ Ability impaired ☐ Greatly impaired

Witnesses to examination_____

REMARKS:_____

CHEMICAL TESTS

Sample No.	Material	Date and Time Collected	Taken In Presence Of	Sample Sealed by	Date and Time Analyzed	Percent Alcohol

Tests made by_____

Witnesses_____

DISPOSITION: Amount of fine_____ Costs_____ or Days_____

Other_____

OFFICER_____

SIGNATURE NO. STATION DATE TIME COMPLETED

IMPORTANT: This form must be forwarded to district office upon completion of case.

STATE OF MINNESOTA
DEPARTMENT OF PUBLIC SAFETY
DRIVER AND VEHICLE SERVICES DIVISION
IMPLIED CONSENT SECTION
108 TRANSPORTATION BUILDING
ST. PAUL, MN 55155

IMPLIED CONSENT ADVISORY

(TO BE USED TO REQUEST THE TEST AND TO RECORD THE INDIVIDUAL'S RESPONSES. CROSS OUT REFERENCES TO ANY TEST NOT OFFERED.)

_____, I believe that you have been driving, operating or controlling a motor vehicle while under the influence of alcohol or a controlled substance.

TIME STARTED: _____ LOCATION WHERE READ: _____

I request that you submit to a test of your

(CHECK ONE)
_____ Breath
_____ Urine
_____ Blood or Breath/Urine

To determine the presence of alcohol/controlled substance.

If you refuse the test, your right to drive will be revoked for six months.

If you take the test and the results indicate that you are under the influence of alcohol or a controlled substance, you will be subject to criminal penalties and your right to drive may be revoked for ninety days or more.

If you take the test, you have the right to have additional tests made by a person of your choosing.

Before making your decision about testing, you have the right to consult with an attorney. This right cannot unreasonably delay the test. If you can't reach an attorney, you will have to decide on your own.

If the test is unreasonably delayed or if you refuse to make a decision, you will be considered to have refused the test.

Do you understand what I've just explained? _____

Do you want to call an attorney? _____

Telephone Time: _____ (Start) _____ (Stop)

Will you give the test? _____

(If blood is offered:)
Would you rather give a _____ (Breath or Urine) test instead of a blood test? _____

(If driver refuses:)
What is your reason for refusing? _____

_____

_____

_____

TIME COMPLETED: _____

_____
(Printed name of officer requesting test)

IMPLIED CONSENT LAW
PEACE OFFICER'S CERTIFICATE

▶(PLEASE TYPE OR PRINT LEGIBLY, CROSS OUT REFERENCES TO INAPPLICABLE ITEMS.)

Name of Peace Officer	Name of Police Agency

I certify to the Commissioner of Public Safety, State of Minnesota, that I am a member of the above police agency and:

1. I am a "peace officer" within the meaning of Minnesota Statutes, Section 169.123, Subdivision 1.

2. On (Date) _____, I had reasonable and probable grounds to believe that the person named below had been driving, operating or in physical control of a motor vehicle within the State of Minnesota on _____ in the City or Township of _____ in _____ County. while under the influence of alcohol or a controlled substance, contrary to law.

Full Name		Date of Birth
Address	City, State, Zip	
Driver License Number		State of Issue

3. PEACE OFFICERS: You must complete each of the four statements below.

a. The ground(s) for the initial contact was:
___accident, ___moving violation, ___equipment violation,
___other (please explain) _____

b. The probable cause for DWI was, in addition to the above:
___odor of alcohol, ___slurred speech, ___staggering,
___bloodshot, watery eyes, ___other (describe) _____

c. The Implied Consent Advisory was read by: (name and agency)
_____
If not read, please explain _____

d. Other pertinent information: _____

4. The person was requested to submit to a chemical test to determine (alcohol concentration) (or) (presence of a controlled substance), pursuant to the provisions of Minnesota Statutes, Section 169.123, and was advised as indicated on the other side of this form.

5. The person: (X APPLICABLE BOX)
☐ Refused to provide a test sample to determine the presence of (alcohol) (or) (controlled substance).
☐ Provided a sample of (blood) (breath) (urine) for analysis.

The sample was submitted for analysis to:

Name of Agency, Analyst or Breathalyzer Operator
Address of Agency or Analyst
City, State, Zip
Sample Identification Number (Blood or Urine Tests Only)

The sample was analyzed and interpreted, and the test result indicated (an alcohol concentration of .___) (the presence of a controlled substance _____).

(ATTACH COPY OF BREATHALYZER CHECK LIST AND SCORE SHEET OR LABORATORY TEST REPORT.)

50

MEDICAL PERSONNEL CERTIFICATE

Pursuant to Minn. Stat. §634.15 (1982), at the request of the undersigned peace officer, I withdrew a sample of blood from:

NAME: _____

AT: _____
(Location)

I am authorized to draw blood samples pursuant to Minn. Stat. §169.123, subd. 3 (1982).

I withdrew the sample of blood at _____ A.M./P.M., after preparing the site of withdrawal with a non-alcohol substance.

I used a sterile needle and container in withdrawing and receiving the blood sample.

I gave the blood sample to the undersigned peace officer.

DATE: _____ _____
Signature

_____
Printed Name

_____
Occupation (M.D., R.N., M.T., L.T., etc.)

I requested and witnessed the drawing of the above blood sample, and received the blood sample from the above-named person.

_____
Signature of Peace Officer

SEND WITH COPY OF ALCOHOL INFLUENCE REPORT, ARREST OR ACCIDENT REPORT, OR MEMORANDUM OF CIRCUMSTANCES TO:

Department of Public Safety
Driver and Vehicle Services Division
Implied Consent Section
108 Transportation Building
St. Paul, MN 55155

Attach Notice of Revocation (Form PS-31123-02) if issued.

Signature of Peace Officer
Printed Name of Peace Officer
Badge Number
Business Telephone Number
Date

PS-01802-04 (Rev. 7/82)

131104

PS31123-02

STATE OF MINNESOTA
DEPARTMENT OF PUBLIC SAFETY
DRIVER & VEHICLE SERVICES DIVISION
SAINT PAUL 55155

→ *Date Issued _____
Enf. Agency _____
Ticket or Case # _____
DOB _____
Court _____

Name _____ (First) (Middle) (Last)

Address _____ D/L # _____

City _____ State _____ Zip _____

NOTICE AND ORDER OF REVOCATION

You are hereby notified that on the date shown above (*date issued) you were asked to submit to a chemical test to determine the alcohol concentration of your blood pursuant to M.S. 169.123, the Implied Consent Law.

☐ Because you refused to submit to testing, the Commissioner of Public Safety will revoke your Driver License and/or driving privileges for six months.

☐ Because you submitted to a breath test which disclosed an alcohol concentration of 0.10 or more, the Commissioner of Public Safety will revoke your driver license and/or driving privileges for 90 days. Results of breath test indicated _____ blood alcohol concentration.

☑ Your Driver License and/or privilege to drive in this state is hereby REVOKED. THIS IS YOUR OFFICIAL NOTICE OF REVOCATION. This revocation will take effect 7 days after the date shown above.

SURRENDER OF DRIVER LICENSE

By law, the officer is required to take all license certificates in your possession, and if you have a valid license, issue a temporary license effective only for 7 days.

☐ Yes ☐ No Driver License card surrendered and forwarded with this report.

TEMPORARY LICENSE

This entire notice is valid as a temporary license from the date shown above for 7 days. NOT VALID IF DETACHED. Temporary license valid only if record so indicates.

Licensee Height: _____ Weight: _____ Class: _____

Restriction: _____

☐ No temporary license issued because: _____

AFFIDAVIT OF LOST DRIVER LICENSE

I have lost or destroyed my license. I promise that if it is found I will immediately forward it to the Driver License Office, 108 Transportation Building, St. Paul, Mn. 55155. I fully realize that in making this affidavit, the license certificate is rendered null and void and may not be used for operating a motor vehicle.

_____ _____
Date Signature of Licensee

Signed: _____
Signature of Peace Officer

_____
Telephone Number

REQUEST FOR ADMINSTRATIVE REVIEW

The Commissioner of Public Safety will review your revocation only upon written request. The forms which are required to be completed to obtain this review are available from a Driver License Examining office, Clerk of District Court, or from the Driver and Vehicle Services Division office on the first floor of the Transportation Building in St. Paul. Request for Administrative Review forms are also available by mail. Send written request for the forms to: Chief Driver Evaluator, 108 Transportation Building, St. Paul, MN 55155. Telephone requests cannot be accepted.

PETITION FOR JUDICIAL REVIEW

You have the right to Petition for judicial review. Petitions must be filed in writing as outlined in M.S. 169.123, subd. 5C in the county in which the incident occurred. The hearing is limited to the issue specified in your Petition which may include:

a. Whether the Peace Officer had reasonable and probable grounds to believe that you were driving, operating, or in physical control of a motor vehicle while under the influence of alcohol or a controlled substance.

b. Whether you were lawfully placed under arrest for violation of Section 169.121, or were involved in a motor vehicle accident or collision resulting in property damage, personal injury or death, or refused to take the screening test provided in Section 169.121, or took the screening test and failed.

c. Whether you were advised of your rights and responsibilities under the law.

d. Whether you refused the test, or whether you submitted a reliable test which showed an alcohol concentration of 0.10 or more.

GENERAL INFORMATION

If your license is revoked, you may not drive again in Minnesota under any condition, including using a driver license from another jurisdiction until you have complied with Minnesota's requirements and received a notice of reinstatement.

IF YOU PLEAD GUILTY TO DWI

Because the revocation which follows a DWI conviction is often shorter than an implied consent revocation, the Commissioner will impose the lesser revocation period upon receipt of a certificate of conviction from the clerk of court.

REINSTATEMENT INFORMATION

You may not drive in Minnesota until:

a. The expiration of the period of time designated on the front side of this notice or expiration of additional period of time as indicated in correspondence from Driver & Vehicle Services Division, and

b. You have successfully completed a re-examination, and paid the $30.00 reinstatement fee, and

c. You have complied with any other requirements of Driver & Vehicle Services, if you have had any previous alcohol related offenses and

d. Prior to reinstatement of your privilege to drive in the State of Minnesota, you must submit proof of an alcohol problem assessment. This is an assessment interview relative to your use of alcohol. If this assessment was done by the Court (termed a presentence investigation) you can submit a copy of that assessment to this office. If no assessment was done by the Court, you must schedule an assessment interview with our office.

   Assessment Scheduling (612) 296-2040
   Assessment Information (612) 296-8599

e. You have made application for and received a new license, and

f. Received a notice of reinstatement.

g. If you are not a resident of Minnesota, you will receive a notice of reinstatement only.

LIMITED LICENSE INFORMATION

If this is the first time your license has been withdrawn, you may be eligible for a limited license.

▶ Any additional information may be obtained by writing Driver Evaluation Section, Driver & Vehicle Services Division, Room 108 Transportation Building, St. Paul, Minnesota 55155 or by telephone at (612) 296-2025.

EQUIPMENT OPERATION IN MINNESOTA

CHAPTER VI

BASICS OF BREATH TESTING

I. Obtaining the Sample of Breath

A. Potential Contaminating Substances in the Mouth

1. **Mouth Alcohol** - Some alcohol will remain for the first few minutes after placing it in the mouth. In addition to alcoholic beverages, alcohol is sometimes present in such products as breath freshners, cough syrups and medications. The operator must be assured that at least 15 minutes have elapsed since the intake of substances containing alcohol.
2. **Smoking** - The vapors and particles in the smoke can affect instrument performance. It can result in sluggish mechanical action of the Breathalyzer and in destroying the usefulness of the detector unit in the A.L.E.R.T. system. At least 5 minutes should be allowed for smoke to clear the breath.
3. **Acetone** - Acetone vapors may be present in the breath of persons with a diabetic condition. You have no control over this, but as an operator you should be aware that the Breathalyzer is not sensitive to acetone on the breath of a diabetic, while the A.L.E.R.T. SYSTEM is. In rare cases this might explain why a person could fail a screening test on the A.L.E.R.T system but be below 0.10 AC using a Breathalyzer.
4. **Other Substances in the Mouth** - To avoid problems such as blockage of the breath flow and possible damage to the instrument, it is recommended that no foreign matter be in the mouth during the test or for the observation period before the test is conducted. This would include gum, candy, cough drops, poultices or other medications, tobacco products, etc.

B. Collection of the Breath Sample

1. Deep lung air is needed to obtain a good correspondence between alcohol in the breath and in the blood. A shallow breath sample will produce an erroneously low reading. The A.L.E.R.T. system obtains a deep lung air sample by requiring a minimum of pressure for a time interval. The operator should stop the test promptly when the **TEST** and **READY** lamps go out. The Breathalyzer vents the shallower air, but depends upon the operator to require the subject to blow long and hard enough to obtain a deep lung air sample.

II. Surrounding Atmospheric Conditions

A. Temperature

1. This applies to use of the breath testing instruments in the field.
2. When subjected to below-freezing temperatures, the warm-up time may be lengthy. Because of this, it is not recommended that the instruments be stored in unheated vehicles or left there for long breaks. If they are left in the cold:
   a. Breathalyzer and simulators can be turned on to warm up.
   b. A.L.E.R.T. system — to avoid depleting the battery charge on heating, this instrument should be allowed to come up to above freezing temperatures before starting. It should not be stored or warmed up in a location too hot for the bare hand. It can be charged during this time if power is available.

B. Moisture

1. Breath condensation can result if the instrument is not up to normal operating temperature. This moisture can absorb some of the alcohol thus resulting in a lower than true reading.
2. Rain and snow — It is not recommended that the instruments be used where they are directly exposed to rain, snow, etc.

C. Contaminating Vapors

1. Breathalyzer — One purpose of conducting the Room-Air blank test is to determine that the test on the subject is not biased by such vapors in the test location.
2. **A.L.E.R.T. System** — The A.L.E.R.T. system is sensitive to some other vapors in addition to alcohol. Examples include automotive fuel vapors and exhaust fumes, if certain paint and solvent vapors are present it will be impossible to conduct a test because the A.L.E.R.T. unit will continue to purge and the **READY** lamp will not light. As operator, you can try moving to another location to conduct the test. For example, move upwind from the accident scene or vehicle exhaust.

A.L.E.R.T. SYSTEM

A. Operation:

The A.L.E.R.T. was designed as a portable, pre-arrest, breath testing unit. To meet these qualifications it was designed in such a manner as to make it easy to operate and require a minimum of training.

The operator should first assure himself that the subject has nothing in his mouth that will affect the test result, (see 'Basics of Breath Testing'). He then attaches a clean mouthpiece to the unit and pushes the switch to the on position. The 'on' light should come on. After a warm up and conditioning period the 'Ready' light will come on. At this point the operator will tell the subject: 'Take a deep breath and blow hard continuously until I tell you to stop.' When the subject starts to blow the 'Test' light will come on and the subject must continue blowing until both the 'Ready' and 'Test' lights go off. After the 'Test' and 'Ready' lights go off one of the 3 indicator lights should come on.

If the subject does not maintain sufficient pressure or does not blow until the 'Ready' and 'Test' lights go off, the operator should shut the unit off and start the test over. If the 'On' lights goes off or blinks before the subject starts blowing, it indicates that the unit does not have enough power to run the test and it should be recharged. If the 'on' light goes off or blinks after the subject starts blowing, there is sufficient power to complete the test but no more tests should be run until the unit has been recharged.

B. Theory:

The A.L.E.R.T. system is based on a catalytic detector of the N semi-conductor type. This detector is described in detail under 'Concepts of Breath Testing'.

C. Calibration:

One of the improvements in succesive models of the A.L.E.R.T. has been in the method of calibration. Calibration instruction sheets on the following pages cover both the units currently in use within the State of Minnesota. Both sheets are self-explanatory but care must be taken that the steps are followed carefully and in the proper sequence.

D. Batteries:

All A.L.E.R.T. units are powered by rechargeable nickel cadmium batteries. Approximately 90% of all operational problems found in the A.L.E.R.T. are caused by battery failure. The most effective preventative maintenance is to charge the unit properly and maintain that charge. When the unit is first put in service it should be charged for 16 hours; after that it **must** be charged for 8 hours in each 24 hour time period. If the unit is not going to be used for any length of time, it should be left on the charger. There is no limit as to how often or long the unit may be charged. On the newer model J3A, there will be an 'In Car' charger available so the units may be left in the car and charged continuously by those departments wishing to purchase this option.

E. Maintenance:

The A.L.E.R.T. unit is designed to require a minimum of maintenance. If service is required, contact the BCA Lab at (612) 296-2665 or send to:

BCA Laboratory
1246 University Avenue
St. Paul, MN 55104

Attach a note giving your name and phone number, the return address, the unit number and a description of the problem.

Save your original shipping carton in case you need to return the unit.

CALIBRATION PROCEDURE

A.L.E.R.T. J2A-1000

1. Prepare breath alcohol simulator containing .11% solution. (Simulator must be heated to 34 degrees C ± .2)
2. Using a miniature screwdriver, turn ALERT FAIL calibration screw approximately 1 turn clockwise. The screw is accessible through a small hole in the bottom end near the wrist strap.
3. Turn **Alert** unit on, obtain ready, and run a simulator test. Use a mouthpiece on simulator and blow, do not use rubber bulb. **Warn** light should come on. Turn **Alert** unit off. (Return to step 2 if **Fail** Light came on.)
4. Plug calibrator into **Alert** unit and flip calibrator toggle switch to **'SAM'** position.
5. Turn **Alert** unit on and obtain ready light.
6. Depress reset button on calibrator for 3 seconds. (Reset button must be depressed at this point for it may have picked up a false signal from the **Alert** pump.)
7. Connect **Alert** unit to simulator and blow into simulator. Be sure to blow continuously and to stop immediately when **Test** and **Ready** lamps go out.
8. Wait 15 seconds and then place calibrator toggle switch in **'CAL'** position. Turn calibration screw counterclockwise slowly until **Fail** light comes on. (Turning past point that **Fail** light comes on will cause the instrument to fail at lower levels.)
9. Disconnect **Alert** Unit from Calibrator.

NOTE: If Procedure is Temporarily Discontinued You Must Start at Step 2.

CALIBRATION OF 200 SERIES UNITS USES THE SAME PROCEDURE EXCEPT:

1 - In step 5 after ready light appears, wait 15 seconds before continuing.

2 - In steps 2 and 8, turn the calibration screw in the opposite direction.

INSPECTION AND CALIBRATION PROCEDURE

A.L.E.R.T. J3A

1. Prepare a breath alcohol simulator containing a .11% solution and allow it to heat to 34°C ± .2°C.
2. Turn the A.L.E.R.T. unit on.

BATTERY INSPECTION

3. Check to make sure the **On** Light is lit. (If it is not lit or is blinking, the unit must be charged before attempting to calibrate.)

LAMP INSPECTION

4. With a small screwdriver depress the **Reset** button. All lights must come on when **Reset** button is pushed. If all lights come on, release the **Reset** button and continue procedure. If all the lights do not come on, unit must be taken to **BCA** for repair.
5. With the switch **On** allow the unit to purge until **Ready** light comes on.
6. Connect unit to outlet of simulator. Blow one continuous sample through simulator, blow hard enough to cause test light to come on. Blow until both **Test** and **Ready** light go off (approximately 6.5").If the test was blown properly, when the **Ready** and **Test** lights go off, either the **Pass, Warn** or **Fail** light should come on.

Follow the appropriate action:

7A **Pass** or **Warn** light on -

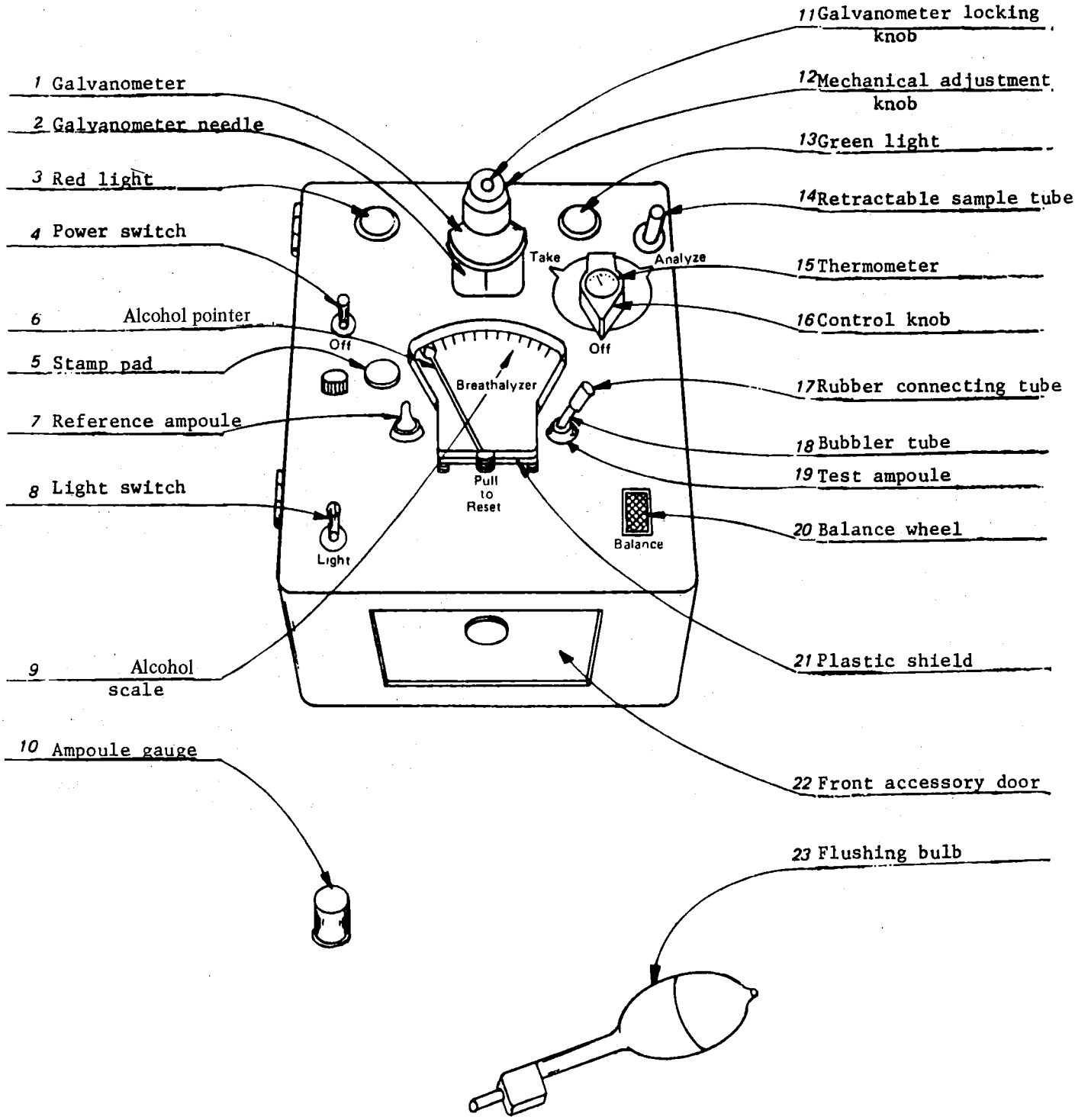
Turn the calibration screw slowly **clockwise.** Stop immediately when the **Fail** light comes on.

7B **Fail** light on -

Turn calibration screw **counterclockwise** two complete turns. Push and release **Reset** Button. If **Fail** light comes on again repeat until the **Warn** light comes on after the **Reset** button is released. Turn the unit off and start the procedure at Step 5.

BREATHALYZER COMPONENTS

Face Plate



BREATHALYZER OPERATION
TEST PROCEDURE

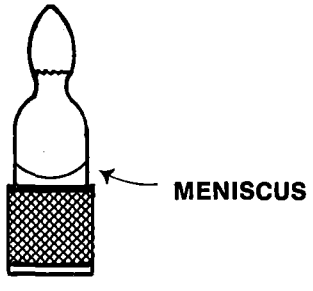
PREPARING THE SUBJECT

Before performing the test, the operator must establish that the subject has had nothing to eat, drink or smoke within 20 minutes prior to the collection of the breath sample. Smoking is not permitted by the operator or other personnel in the immediate area where the test is being conducted. Immediately before collecting the breath specimen from the subject, the operator will ask the following questions: **'Do You Have Any Food or Other Foreign Material in Your Mouth at This Time?'** and his response will be recorded. A physical check should be made at this time. Either the arresting officer or the operator will testify to this fact in court.

INSTRUMENT PREPARATION

Place the on-off switch to the 'on' position. Wait until the thermometer reads within the range marked on the thermometer (47° - 53°C). Record the operating temperature in the blank provided on the right side of the checklist. The thermometer should register within this temperature range indicating that the sample chamber and all breath carrying tubes are above body temperature. This prevents condensation of moisture from the breath that would cause loss of alcohol and also possible sticking or jamming of the piston. If the latter should occur, a brief pumping with the flushing bulb, with the control knob in the **'Take'** position, will dry the cylinder and free the piston. The temperature is thermostatically controlled within this range. While the instrument is warming up, the galvanometer can be checked for mechanical center. This is accomplished by turning the large gray knob on the top of the galvanometer until the needle rests on the center line. This adjustment is made with the power switch **'on'** and the light **'off'.**

To gauge the ampoules; a sealed ampoule is removed from the storage box and wiped clean. The ampoule should only be handled by the top portion, that part above the level of the liquid. Try the ampoule first in the small end of the gauge, which it should not fit, and then insert it in the large end of the gauge. Hold the gauge at eye level and check to see that the bottom of the meniscus of the liquid is level with or above the level of the gauge.



Touching only the top, place this ampoule in the left hand holder — the reference side of the instrument. Take another sealed ampoule and repeat the gauging procedure. If the bottom of the meniscus is above or at the gauge level, record the control number from the ampoule into the slot provided on the checklist. With the ampoule still in the gauge, carefully break off the top, and again check the liquid level to make sure none of the solution has spilled out. Take the rubber connecting tube from the sample outlet, carefully remove the ampoule from the gauge and gently place it in the right hand well — the test side of the instrument. Take one of the small plastic bags containing a mouthpiece and bubbler tube and push the large, or right angle end of the bubbler tube through the plastic. Holding onto the right angle portion of the bubbler tube, connect the rubber connecting tube to the end protruding from the plastic bag. Remove the connected bubbler tube and rubber connecting tube from the plastic bag, holding onto the rubber connecting tube. Insert the tapered end of the bubbler tube into the opened ampoule, and carefully connect the rubber connecting tube to the sample outlet. At this point, place a test record marked **'Room Air Blank'** onto the face of the instrument over the printed scale.

PURGE

Turn the control knob to the **'Take'** position. Take the flushing bulb and connect it to the retractable sample tube. The retractable sample tube does not need to be pulled out of the instrument for this operation. Pump the flushing bulb about 15 times. Check the green light to make sure the piston is at the top of the cylinder and turn the control knob directly to the **'Analyze'** position. At this time check the test ampoule to make sure air is bubbling through it. When the red light comes on, indicating the piston has reached the bottom of the cylinder, start timing 1-1/2 minutes. At the end of the 1-1/2 minutes hold the light switch down and adjust the **'Balance'** wheel until the galvanometer needle is in the center.

ROOM AIR BLANK

Release the light switch. Pull back gently on the Alcohol Pointer and position it over the stamp pad. Tap it lightly with the finger and reposition it over the true or righthand zero. Release the pointer and press gently on the plastic shield to stamp the test record.

Turn the control knob back to the **'Take'** position and repeat the flushing procedure. Making sure the green light is on, turn again to the **'Analyze'** position and record the time in the space provided. When the red light comes on, wait 1-1/2 minutes and rebalance the instrument by turning on the light and adjusting the balance wheel until the galvanometer is centered. Press lightly on the plastic shield to stamp the test record and position the pointer over the stamp pad. Remove the test record and read it to three (3) places, and record the answer on the checklist. If the reading is equal to or exceeds .010, remove the test ampoule and start a new checklist.

ANALYSIS

Place a new test record containing the name of the subject onto the instrument. Pull back on the Alcohol Pointer and position it over the subject start line (the left index line on the scale). Press gently on the plastic shield to stamp the test record. Turn the control knob to the **'Take'** position, pull the retractable sample tube from the instrument and insert the clean plastic mouthpiece. Have the subject take a deep breath and blow one **continuous-long** breath into the instrument. It is the operators responsibility to make sure the sample is adequate. An inadequate sample will give a low reading and should not be analyzed. If it is felt the sample was insufficient, have the subject blow again into the mouthpiece. When a good sample has been obtained, make sure the green light is on, push the retractable sample tube back into the instrument and turn the control knob to the **'Analyze'** position. Record the time on the checklist in the blank provided. After the red light comes on, wait 1-1/2 minutes, then turn on the light and balance the instrument. Stamp the test record, observe the reading, pull back the pointer and position it over the stamp pad. Remove the test record and read it to two (2) places, record this reading on the checklist.

SIMULATOR TEST

Insert a new test record, marked with the simulator solution number onto the instrument. Turn the control knob to the **'Take'** position and repeat the flushing procedure. Making sure the green light is on, turn the control knob to the **'Analyze'** position. When the red light comes on, wait 1-1/2 minutes and balance the instrument. Pull back on the Alcohol Pointer and position it over the true zero or right hand zero, press on the plastic shield to stamp the test record. Collect a simulator sample by removing the retractable sample tube from the instrument and connecting it to the simulator outlet. Connect the flushing bulb to the simulator inlet, check the simulator temperature, making sure it is in the proper range, and squeeze the bulb gently 5 or 6 times. Making sure the green light stays on, disconnect the retractable sample tube and replace it in the instrument. Turn the control knob to the **'Analyze'** position recording the time and the simulator solution control number on the checklist. When the red light comes on, wait 1-1/2 minutes and rebalance the instrument. Stamp the test record and read it to **three** (3) places. The simulator solutions sent out by the Minnesota BCA Laboratory are certified to simulate an AC reading of .11. A reading of .120 or above indicates that the subject analysis may not be valid. A reading below .100 indicates that the breathalyzer or the solution is running low. Any simulator reading below .100 or above .120 should be checked by running a simulator checklist. If the readings continue to be outside the allowable range, it should be reported to the BCA Laboratory.

DISCONNECTION

To clear the instrument, first turn the control knob to the **'Take'** position, repeat the flushing procedure and turn the control knob to the **'Analyze'** position. When the red light comes on, disconnect the rubber connecting tube from the sample outlet. Remove the test ampoule, bubbler tube and rubber assembly from the instrument, take the rubber connecting tube off the bubbler and replace it on the sample outlet. Dispose of the ampoule and bubbler tube. **Note:** The ampoule contains a 50% sulfuric acid solution and should be disposed of accordingly. Take the reference ampoule from the instrument and put it back in the ampoule storage container. Turn the control knob to the **'Off'** position and cover the instrument. Go over the completed checklist carefully making sure all blanks have been checked or filled in with appropriate information. Transfer the recorded times on the checklist onto the appropriate test record and staple all test records to the checklist in the lower left hand corner.

STORAGE

When the instrument is not in use, the control knob **must** be left in the **'Off'** position and all ampoules **must** be removed from the holders. The galvanometer need not be locked down unless the instrument is being transported. It is best to leave the instrument in a locked cabinet with only certified operators having access to the breathalyzer.

In some cases, it may be desirable to have the breathlayzer warmed up during a period of high DWI incidence. When the instrument is left on for any length of time, the front accessory door should be left open and the cover propped open an inch or two to permit air circulation. Extended operation of the breathalyzer will cause deterioration of the photocells — an expensive component of the instrument. It is therefore recommended that the breathalyzer not be left on for more than 8 hours at a time.

MAINTENANCE

All maintenance and breathalyzer certification is performed by the Minnesota BCA Laboratory. Any repairs done by other than authorized personnel will not qualify in court and will invalidate all subject tests until the instrument can be recertified by the proper authorities. Any instrument malfunction should be brought to the immediate attention of an authorized breathalyzer maintenance person.

THE ALCOHOLIC BREATH SIMULATOR

The Alcoholic Breath Simulator is a specially designed constant temperature water-alcohol solution instrument devised for the purpose of providing a standard alcohol-air mixture. The solution is maintained at a temperature of 34°C (mouth temperature) with a variation of plus or minus 0.2°C. This temperature variation will not result in noticeable error. The temperature should be monitored by the operator to be certain it stays within this range (33.8°C - 34.2°C). On the newer Mark II simulators this is done by means of a thermometer calibrated in tenths of a degree C. The older models are checked for correct temperature by noting the length of the mercury column in the thermostat.

SIMULATOR SOLUTIONS

Solutions to be used in the simulator for breathalyzers monitored by BCA personnel are prepared each month by the BCA. Each solution is tested with a minimum of two analytical techniques and certified to contain alcohol equivalent to a .110 ± .003 alcohol reading when used in a breath alcohol simulator at proper temperature. A solution certified to be within this range, when run on a properly calibrated breathalyzer must give a reading between .100 and .120.

Because of varying conditions and frequency of use within different departments, the period of time a solution may be used to give an accurate reading will change. Under extreme conditions the solution will still give accurate results for 45 days after the date it is received in the department. The solutions received in the departments will be stamped with an expiration date, and must be changed prior to that date. A subject test that is followed

with a test on an expired simulator solution may cause considerable problems in court and will not be validated by BCA personnel.

INSTRUCTION FOR USE OF SIMULATOR SOLUTION

1. Remove top of simulator by unscrewing from jar.
2. Throw away old solution in simulator jar.
3. Wipe simulator and simulator jar dry with a clean, dry towel.
4. Pour entire contents of new container into simulator jar.
5. Replace simulator top and seal.
6. Record date of change and solution control number in log book.
7. Remove the label from the shipping bottle and place it on the simulator jar.
8. Save plastic bottle and mailing box, return them to the BCA Lab, Breath Test Unit.
9. Run a monthly Laboratory Simulator Checklist on the new solution.

SIMULATOR RESULTS

A proper simulator reading (.100-.120) on an unexpired certified solution, when run immediately after the subject test, is the operator's confirmation that the subject results are valid. When run according to the Breathalyzer Operational Checklist (BCA form 05-019) the operator is performing his own certification of the instrument, ampoules and operational technique used on the subject.

An improper simulator test result will invalidate the subject test. In this case, the operator may attempt to obtain a second **voluntary** sample (blood or urine) from the subject. The operator should eliminate the simulator as the cause of the improper results by running a simulator checklist (BCA form 05-022). If the results are consistently out of range, the operator should contact the BCA Lab Breath Test Unit.

OPERATOR REQUIREMENTS

1. To operate a Breathalyzer in Minnesota, it is required that the applicant attend and satisfactorily complete a BCA Chemical Test School, consisting of a minimum of 56 hours. During the seven days, the student will be required to run a minimum of 45 Breathalyzer tests, learn to prepare chemical test documentation for court, and understand the theory and background of chemical testing sufficiently for competent court testimony as a chemical test specialist. Completing the course satisfactorily, means that a student must have a final average of 75% or above and achieve a minimum score of 70% in the lab test and written final.

   The students average is made up of three parts:

   A. Quiz Scores — One third of the final average is composed of an average of the quiz grades.

   B. Lab Grade — The lab grade constitutes another one-third of the final average. The student will run Subject Checklists on subjects with an unknown alcohol concentration. The grade will be figured in two parts.

      1. Accuracy — The result that the student obtains on the unknown must be within a range of ± .01 of the actual concentration. The lab percentage is determined by dividing the number of correct results by the number of tests; i.e., 4 correct results out of 4 tests would be 4/4 or 100% etc.
      2. Procedure — In the second part of the lab grade, a student will lose points for any error on the checklist or test record which could cause a breathalyzer test to be disallowed in court. Example of such errors are, not filling in, or improperly filling in any portion of the checklist, or test record, and misreading a test result by more than .003. For each error of this type, one point will be subtracted from the lab percentage.

         In addition, a point will be taken off for any operator induced malfunction and for any instrument malfunction that is not properly noted by the student and brought to the attention of an instructor.

   C. Final Examination — The last third of the final average is the score on the written final examination.

   Each of these three grades have a maximum of 100 points. They are added together and divided by three to obtain the students final average.

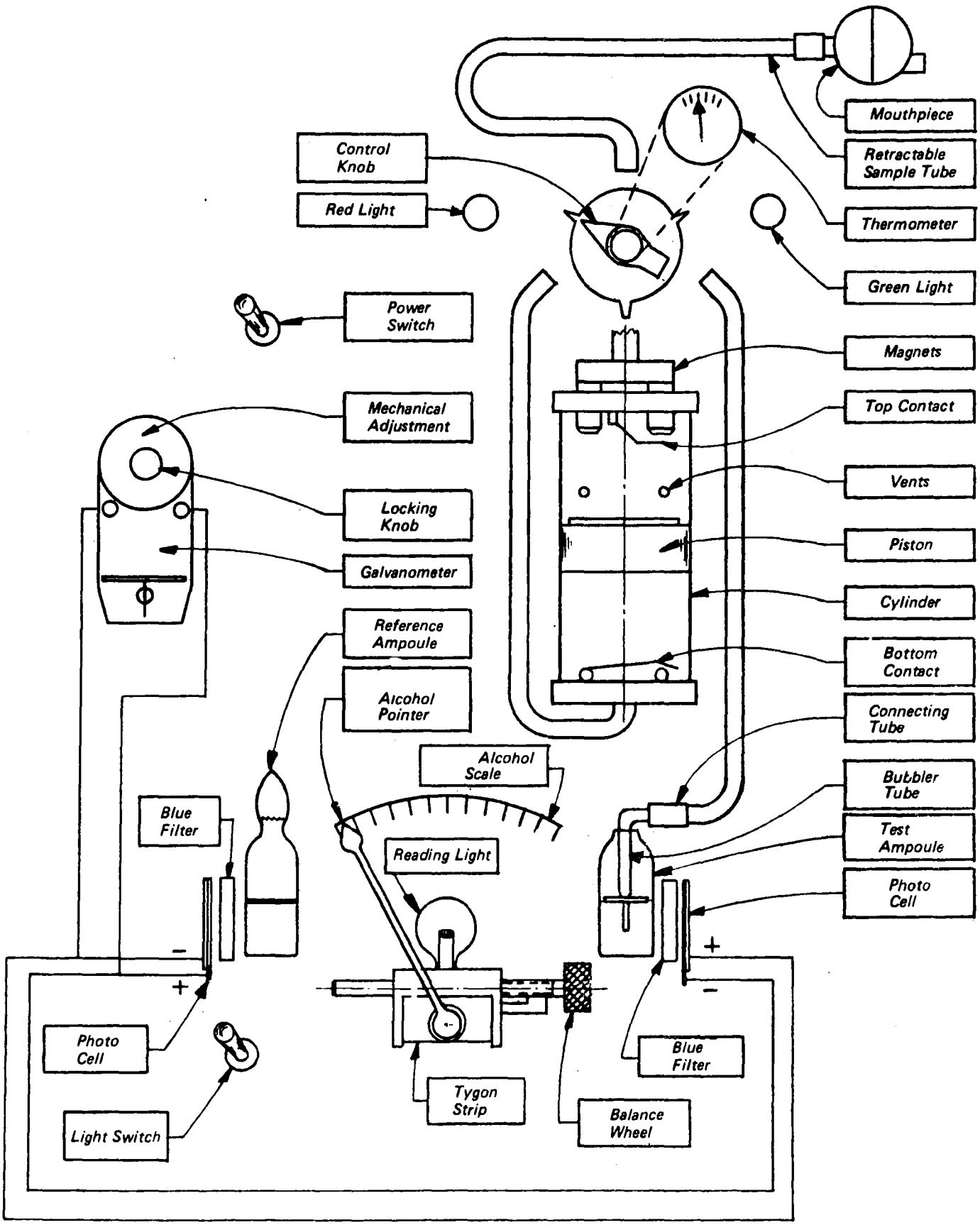
2. To maintain an active certification, an operator must attend an 8 hour refresher school periodically and again pass both written and practical tests.
3. During the period of active certification, it is recommended that an operator run a minimum of three (3) tests per month. This recommendation is fulfilled by running one (1) full 21 step checklist on a drinking subject or running one (1) pink checklist titled **"Monthly Laboratory Simulator Test."**

SUMMARY

The Chemical Test training program has been developed and constantly updated to better deal with today's DWI problem. The checklists and operator requirements are the result of our experiences and recommendations of the National Safety Council's Committee on Alcohol and Drugs.

The high standards placed on operators and instruments in this state have established the Breathalyzer as an accurate and impartial test for alcohol. It is imperative that this quality be maintained.

BREATHALYZER COMPONENTS



BREATHALYZER THEORY

The method consists of three principle phases as follows: In the **first** phase, a known amount (52.5 ml) of alveolar breath (deep lung air) is trapped in the metal cylinder. This is accomplished by having the subject blow into the instrument through the retractable sample tube, to which a sterile plastic mouthpiece has been attached to prevent the passage of solid or liquid materials into the instrument. With the control valve in the **'Take'** position, pressure of the subject's breath raises a metal piston to a level above vents at the top of the cylinder, which permits the first expired breath to escape from the machine, and only the last portion of the expired air is collected. In the **second** phase, the control valve is turned to the **'Analyze'** position. The breath specimen, previously collected, is forced into the test ampoule, which contains an alcohol-sensitive solution, (potassium dichromate and sulfuric acid) and the piston falls to the bottom of the cylinder by means of gravity. When the cylinder is full, a green light on the face of the instrument comes on, indicating to the operator that the cylinder is full and the proper amount of breath has been collected. When the piston reaches the bottom of the cylinder, a red light on the face of the instrument comes on, indicating that the cylinder is empty. In the **third** phase, the change in intensity of color of the alcohol-sensitive solution in the test ampoule is measured. This is accomplished by using balanced photocells mounted one in back of the test ampoule and the other in back of the 'reference' ampoule, with the necessary light being supplied by an incandescent bulb located between the two ampoules on a moveable track. Before the breath specimen is collected, the light is positioned between the two ampoules in such a manner that the amount of light transmitted through each of the two solutions is the same. This is indicated to the operator by observing that the needle of the galvanometer (null meter) is at the zero position. When alcohol is present in the breath of the subject, the color of the solution in the test ampoule will fade due to a chemical reaction between alcohol and the reagents contained in the test solution. Since the color of the solution in the test ampoule is now less intense than that of the 'reference' ampoule, the light must be moved in the direction of the standard ampoule to re-establish a zero reading on the galvanometer. The distance through which the light carriage must be moved, is a direct indication of the amount of alcohol present which is reflected by the scale pointer on the calibrated scale on the face of the instrument as alcohol concentration.

THE BREATHALYZER SOLUTION

INTRODUCTION

The use of a sulfuric acid solution of potassium dichromate for quantitatively analyzing for ethyl alcohol has a history of more than a hundred years. Most alcohol methods use this reagent. Its characteristics are well known.

THE BREATHALYZER INSTRUMENT

The Breathalyzer has taken advantage of this long history. This instrument has gone one step further in its use. By the use of a specially designed photoelectric measuring device (Breathalyzer patents) the need for exact potassium dichromate content has been eliminated.

THE BREATHALYZER SOLUTION

The formula for this solution is 50% sulfuric acid by volume in water containing 0.25 mg of potassium dichromate per milliliter, and a catalyst ($AgNO_3$.)

THE SULFURIC ACID CONCENTRATION

There is no effect on results produced by varying the sulfuric acid concentration betwen the specified limits — 1.50-1.54 specific gravity.

THE POTASSIUM DICHROMATE CONCENTRATION

The potassium dichromate strength was chosen because it is capable of giving a reading on the instrument up to .70%, a reasonable excess over any anticipated answer. Since the Breathalyzer measures only the amount of potassium dichromate used by the alcohol, this concentration is not that critical. Too strong a solution would cut down the sensitivity of the instrument without changing the answer. (This is a condition much like changing from postal scales to bathroom scales. The weight is the same, but the sensitivity is different.) A weaker than normal solution will give accurate answers, unless it is too weak to measure all the alcohol in the breath sample. (For instance, if there is only enough potassium dichromate in the solution to measure .25% and the subject is at .35%, the instrument will then show only .25%). The only requirement for correct answers is that the solution be yellow before and after the test.

EFFECTS OF IMPURITIES OF CONTAMINATION

Contamination of the ampoule contents by introduction of impurities during manufacture may result in reduction of the potassium dichromate concentration. If this is extreme, then insufficient dichromate is left for the test and the result would be low. Another source of contamination that must be carefully avoided, is that of introduction of impurities into the ampoule after opening, either from the atmosphere (dirt, dust or other organic debris) or by using a bubbler tube that is contaminated by improper handling. Since the Breathalyzer solution is not absolutely specific for ethyl alcohol, some other organic material (contaminants) can react with the solution, resulting in a decrease in the potassium dichromate concentration. This is the reason that is important to purge the instrument prior to the collection and analysis of a breath sample. Since some organic materials that could conceivably be introduced as contaminants require longer than 90 seconds to react with the Breathalyzer solution, it is necessary to purge and to run a room air to insure that no further change in the potassium dichromate concentration will take place. If this is not done and if reactive contaminants are present, then the final result obtained in the breath test could be erroneously high (reading due to alcohol in breath plus reading due to contaminants).

THE AMOUNT OF SOLUTION

The major critical feature of the solution is its volume, which must be 3 ml. A tolerance of plus 0.1 ml and minus

nothing is given the manufacturer. This volume is checked in a special gauge that measures the height of the solution in the ampoule before each test. If the solution passes the gauge check, it is satisfactory. The result is inversely proportional to the amount of solution. Too little solution will produce high results and vice versa.

AMPOULES

The diameter of the ampoules is important within limits. If the ampoule passes the gauge test (performed by the operator for each test) it is satisfactory. Ampoule diameters are controlled during manufacture and checked by the Breathalyzer operator to limits between .625" and .650". Other than this, there is no problem with the ampoules. It is impossible to fit an ampoule that is much too large into the instrument because of the bore of the holder. An ampoule much too small in diameter would result in slightly high results.

KEEPING QUALITIES

Once the ampoules are sealed, the volume of the solution and the concentration and strength of the sulfuric acid solution will remain unchanged for decades. The concentration of potassium dichromate may or may not weaken during this time. Loss of potassium dichromate is hastened by exposure to daylight over long periods of time. Therefore, ampoules should be stored in their original containers. Such deterioration would give low results.

SPECIFICITY

The Breathalyzer solution is used under controlled conditions. The time for complete oxidation of ethyl alcohol under these conditions is less than two minutes (from the beginning of the bubbling of the breath through the solution). Under these conditions, the breath of a diabetic in extreme acidosis will not affect the reagent. Onion, garlic, halitosis, smelly foods, etc. on the breath will have no effect.

SUMMARY

The Breathalyzer solution is composed of sulfuric acid, water, and potassium dichromate. These may be varied in concentration within described limits without affecting the results. The normal outcome of excessive variations are low results.

The volume is critical and must be checked carefully. Ampoule diameter must be controlled within prescribed limits. Used according to instructions, this solution is not sensitive to acetone, onions, garlic, halitosis, etc.

PS-22031-01

DO NOT USE FOR SUBJECT TESTS

Sample

Department of Public Safety
State of Minnesota BCA Lab

MONTHLY LABORATORY SIMULATOR TEST

Solution No. 79011 Serial No. 123456 Date 012279

Operator PTLM Ketchem Department Price Co S.O.

OPERATING STEPS

PREPARATION

- ☒ 1. Throw SWITCH to ON. Wait until THERMOMETER shows 50 ± 3°C. Record temperature. — 50 °C
- ☒ 2. Gauge AMPOULE and insert in left hand holder.
- ☒ 3. Gauge AMPOULE, record AMPOULE CONTROL NUMBER, open, regauge solution level, insert in right hand holder. Insert bubbler and connect to outlet. (Control No.) — 39

(INSERT TEST RECORD)

PURGE

- ☒ 4. Turn to TAKE, flush out, turn to ANALYZE.
- ☒ 5. When RED empty signal appears, wait 1½ min., turn on LIGHT and BALANCE.

ROOM AIR BLANK

- ☒ 6. Disengage ALCOHOL POINTER and set on ZERO line. Stamp Record.
- ☒ 7. Turn to TAKE, collect ROOM AIR sample, turn to ANALYZE. Record time. — 1403
- ☒ 8. When RED empty signal appears, wait 1½ min. Turn on LIGHT and BALANCE. Stamp Test Record.
- ☒ 9. Record ROOM AIR READING (if reading is greater than 0.01 discard test ampoule and repeat procedure). — 0. 000

(INSERT TEST RECORD)

SIMULATOR TEST I

- ☒ 10. Check SIMULATOR temperature.
- ☒ 11. Disengage POINTER, set on ZERO line. Stamp Test Record.
- ☒ 12. Turn to TAKE and collect SIMULATOR sample, turn to ANALYZE. Record time. — 1407
- ☒ 13. When RED empty signal appears, wait 1½ min. Turn on LIGHT and BALANCE. Stamp Test Record. Record SIMULATOR SOLUTION READING. — 0. 104

(INSERT TEST RECORD)

SIMULATOR TEST II

- ☒ 14. Check SIMULATOR temperature.
- ☒ 15. Turn to TAKE, flush out, turn to ANALYZE.
- ☒ 16. When RED empty signal appears, wait 1½ min. Turn on LIGHT and BALANCE.
- ☒ 17. Disengage POINTER, set on ZERO line. Stamp Test Record.
- ☒ 18. Turn to TAKE and collect SIMULATOR sample, turn to ANALYZE. Record time. — 1415
- ☒ 19. When RED empty signal appears, wait 1½ min. Turn on LIGHT and BALANCE. Stamp Test Record. Record SIMULATOR SOLUTION READING — 0. 109

(INSERT TEST RECORD)

SIMULATOR TEST III

- ☒ 20. Check SIMULATOR temperature.
- ☒ 21. Turn to TAKE, flush out, turn to ANALYZE
- ☒ 22. When RED empty signal appears, wait 1½ min. Turn on LIGHT and BALANCE.
- ☒ 23. Disengage POINTER, set on ZERO line. Stamp Test Record.
- ☒ 24. Turn to TAKE and collect SIMULATOR sample, turn to ANALYZE. Record time. — 1421
- ☒ 25. When RED empty signal appears wait 1½ min. Turn on LIGHT and BALANCE. Stamp Test Record. Record SIMULATOR SOLUTION READING — 0. ~~.113~~ J.K. .107

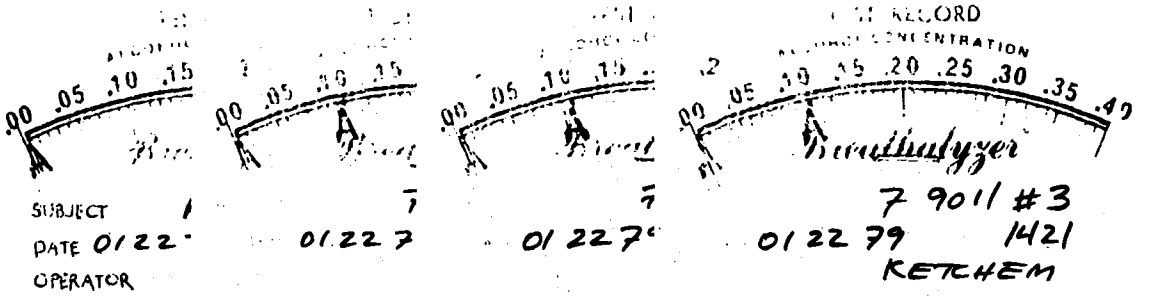
DISCONNECT

- ☒ 26. Turn to TAKE, flush out, turn to ANALYZE. Record Breathalyzer temperature. — 50 °C
- ☒ 27. When RED empty signal appears, dispose of TEST AMPOULE, BUBBLER and MOUTHPIECE. Remove REFERENCE AMPOULE. Turn CONTROL KNOB to OFF and cover instrument.

Staple Test Records Below

J. Ketchem
Operator Signature

Room Air Test #1 #2 #3



SUBJECT 7 7 7 7901 #3
DATE 0122 01227 01227 01227 9 1421
OPERATOR KETCHEM

BCA-05-019 (REV. 8-78)

SAMPLE

State of Minnesota
Bureau of Criminal Apprehension Laboratory
BREATHALYZER OPERATIONAL CHECK LIST

75177

Subject: JAMES S DRUNK

Operator: PTLM I. KETCHEM

DOB: 08 14 39 Sex: (M) F Date: 01 16 79

Dept: PRICE Co. S.O.

Arresting Officer: TRP. D. SMOKE # 523

Certificate Number: 007

Dept: MSP

Instrument S/N 1012

Arrest Location: RURAL (CITY) PRICE (COUNTY)

Instrument Location: PRICE Co. L.E.C.

PREPARATION

1. Throw SWITCH to ON. Wait until THERMOMETER shows 50 ± 3°C. Record temperature. 49 °C
2. Gauge AMPOULE and insert in left hand holder (REFERENCE AMPOULE).
3. Gauge AMPOULE, record AMPOULE CONTROL NUMBER, open, regauge solution level. Insert in right hand holder (TEST AMPOULE). Insert bubbler and connect to outlet. (Control No.) 39

(INSERT TEST RECORD)

PURGE

4. Turn to TAKE, flush out, turn to ANALYZE.
5. When RED empty signal appears, wait 1-1 2 min., turn on LIGHT and BALANCE.

ROOM AIR BLANK

6. Disengage ALCOHOL POINTER and set on ZERO line. Stamp Record.
7. Turn to TAKE, collect ROOM AIR sample, turn to ANALYZE. Record time. 2042
8. When RED empty signal appears, wait 1-1 2 min. Turn on LIGHT and BALANCE. Stamp Test Record.
9. Record ROOM AIR ALCOHOL READING (If reading is greater than 0.01 discard test ampoule and repeat procedure). 0. 002

(INSERT TEST RECORD)

ANALYSIS

10. Subject has been under observation for 15 – 20 minutes. 0.2.
11. Disengage POINTER and set on LEFT (ZERO) INDEX. Stamp Test Record.
12. Turn to TAKE, collect BREATH sample, turn to ANALYZE. Record time. 2051
13. When RED empty signal appears, wait 1-1 2 min. Turn on LIGHT and BALANCE. Stamp Test Record. Record SUBJECT'S ALCOHOL CONCENTRATION (grams of alcohol per 210 liters of breath). 0. 16

(INSERT TEST RECORD)

SIMULATOR TEST

14. Turn to TAKE, flush out, turn to ANALYZE.
15. When RED empty signal appears, wait 1-1 2 min. Turn on LIGHT and BALANCE.
16. Disengage POINTER, set on ZERO line. Stamp Test Record. RECORD Certified Simulator Solution known Concentration. 0. 11
17. Check simulator temperature.
18. Turn to TAKE and collect SIMULATOR sample, turn to ANALYZE. Record time. 2058
    Record simulator solution number. No. 79011
19. When RED empty signal appears, wait 1-1 2 min. Turn on LIGHT and BALANCE. Stamp Test Record. Record SIMULATOR SOLUTION READING. 0. 111

DIS-CONNECTION

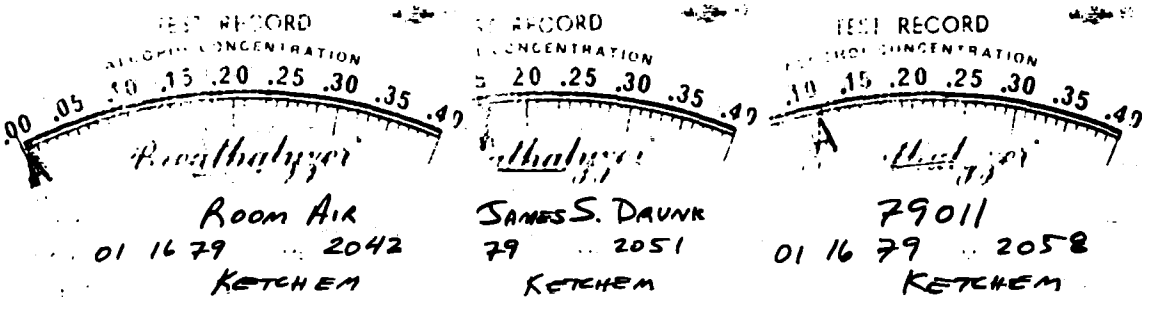
20. Turn to TAKE, flush out, turn to ANALYZE. Record Temperature. 50 °C
21. When RED empty signal appears, Dispose of TEST AMPOULE, BUBBLER and MOUTHPIECE. Remove REFERENCE AMPOULE. Turn CONTROL KNOB to OFF and cover instrument.

REMARKS:

D. Ketchem
OPERATOR'S SIGNATURE

D. Smoke #523
WITNESS

DEPARTMENT COPY



EXPLANATION OF BREATHALYZER OPERATIONAL CHECKLIST

1. Heat all tubing to 50° ± 3°C to prevent condensation from breath and maintain sample volume regardless of room temperature.
2. Make sure solution is high enough in ampoule to cover light path on reference side.
3. Same as above, plus diameter and depth measurement of solution is an indirect measurement of test solution volume. Too much solution would give low result, too little solution would give high result but would not pass gauge test.
4. Force room air through system to clean out any contaminants that may have been left from previous tests.
5. Allow time for contaminants (if any) to react, then position light so that photocell on each side is illuminated with equal intensity (indicated on galvanometer).
6. Set and stamp a permanent mark on the Alcohol Scale as a start point for measuring any contaminants in the instrument or room air in which the instrument is being operated.
7. Again force room air through the system and collect a sample to determine if any contaminants are present.
8. Allow sample to react in test ampoule. Reposition light to again achieve balance as described in Step 6. Any movement of the light is transmitted into movement of the pointer on the Alcohol Scale. After balance is attained, a second permanent mark is put on the Alcohol Scale. The distance between the two marks on the scale is reflective of any reaction that occurred in the test ampoule.
9. A reading of .01 or less, indicated that the entire system and its environment are free of any contaminants which would effect the accuracy of a subject analysis.
10. Observing the subject for 15 minutes, making sure s/he puts nothing in his mouth, will eliminate the possibility of getting a reading from **mouth** alcohol.
11. The start point on the Alcohol Scale for the human subject test is called the Left Index. This Index is .003% below the True Zero on the Alcohol Scale. Medical research has found that approximately one in ten thousand alcohol free subjects will give reading on a Breathalyzer of .003; so in effect, all subjects are given a benefit of .003%.
12. The subject is asked to blow a long-continuous breath through a sterile plastic mouthpiece into the instrument. The first part of the subject's exhalation is vented and only the very last part of deep lung air is trapped in a stainless steel cylinder. Anything other than deep lung air would give a false low result.
13. After the sample has been delivered to the test ampoule and allowed to react for 90 seconds, the light is moved to compensate for any of the yellow color which may have been used in the test ampoule (balanced), and a second mark is put on the Alcohol Scale. The distance between the two marks is measured and recorded as the subject's alcohol content.
14. The system is again flushed as in Step 4.
15. A new balance is obtained before running the Simulator Test.
16. The Alcohol Scale is stamped at the start point for running a simulated alcohol sample. The known concentration, as printed on the simulator solution label, is recorded at this time. The simulator solution is an alcohol and water mixture prepared by the BCA Laboratory. When heated to breath temperature, it will produce vapors of a known alcohol concentration.
17. The Simulator is a device used to heat the simulator solution to breath temperature (34°C). The solution must be maintained at 34° within a range of ±.2°C. The temperature is indicated by a thermometer located in the Simulator Control Head, and should be checked just prior to collecting a sample of simulator solution vapor.
18. If the temperature is within the allowable range, a sample of the simulator solution vapor is collected in the stainless steel cylinder. The batch number of the simulator solution is recorded for future cross reference with laboratory records as to its chemical content.
19. After the sample has been delivered to the test ampoule and the reaction time has elapsed, the light is moved to achieve balance and a second mark is placed on the Alcohol Scale. The distance between the two marks is read and recorded as the simulator result. If the result is within the ±.01 of the known concentration, it indicates that the entire system was working properly. The entire system includes the Breathalyzer, the ampoule, and the operator.
20. Room air is again forced through the system to insure that the instrument is not stored with contaminants. The temperature is checked and recorded to assure that the instrument stayed within the allowable temperature range during the test.
21. The test ampoule is disposed of properly and the reference ampoule stored for future use. The valve is left in the **'Off'** position to prevent damage to the valve and the instrument covered to prevent the accumulation of dust.

Minor Malfunction
Trouble Shooting

Most instrument malfunctions must be repaired by BCA personnel in order to maintain a valid instrument certification, however, certain operational procedures should be checked before reporting a malfunction to BCA.

PROBLEM	ACTION
1. Red Light does not come on.	A. Check for power to instrument by turning on tungsten reading light. 1. If no power. a. Check plug (instrument and wall) b. Check power switch 'on'. c. Check fuse (instrument and circuit) 2. If power OK a. Check bulb b. Check piston movement by turning control knob to 'take', flush, remove flushing bulb, turn to 'off'. If piston is working properly red light should come on almost immediately.
2. Green Light does not come on.	A. Check power same as above. B. Check bulb. C. Check flushing bulb for leaks.
3. Galvanometer will not balance or has irratic motion.	A. Check galvanometer locking knob for proper positioning. B. Both ampoules must be in position. C. Turning balance wheel the wrong direction. D. Check mechanical center with light switch off.
4. Sample will not deliver.	A. Bubbler against bottom of ampoule. B. Connecting tube not connected properly or blocked with plastic over mouth of bubbler.
5. Sample output too fast (red light comes on immediately after turning to 'Analyze')	A. Green light was not on when control knob was turned. B. Control knob was turned from take, to off, to analyze.
6. Reading too low.	A. Check 'sample output too fast' B. Insufficient sample (retest) C. Check for simulator leak D. Simulator temperature too low. E. Breathalyzer temperature too high. F. Ampoule used up — retest with new ampoule
7. Reading too high.	A. Simulator temperature too high B. Breathalyzer temperature low (35° - 47°C) C. Failure to flush and balance between samples D. Leak in Take — check for bubbling in ampoule when collecting sample.

THE LAW

CHAPTER VII

HIGHWAY TRAFFIC REGULATIONS — INTOXICATION

An Act relating to highway traffic regulations; providing for arrest without a warrant; defining admissible evidence; providing for alcohol problem assessments; providing alternative testing procedures; providing for administrative driving privilege revocations for failure to submit to chemical testing or exceeding prescribed alcohol concentration; authorizing revocations prior to judicial review; revising the procedure for hearings and appeals on administrative revocations; authorizating introduction into evidence certain peace officer records and repots; prescribing penalties; providing for detoxification of drivers; amending Minnesota Statutes 1980, Sections 3.736, Subdivision 3; 169.121, Subdivision 1, 2, 3, 4, and 6, and by adding subdivisions; 169.123; 171.19; 171.30, Subdivision 1; 466.03, by adding a subdivision; and 634.15; proposing new law coded in Minnesota Statutes, Chapter 169.

Be it enacted by the Legislature of the State of Minnesota:

Section 1. Minnesota Statutes 1976, Section 169.01, is amended by adding a subdivision to read:
Subd. 61. Alcohol concentration. "Alcohol concentration" means
(a) the number of grams of alcohol per 100 milliliters of blood, or
(b) the number of grams of alcohol per 210 liters of breath, of
(c) the number of grams of alcohol per 67 milliliters of urine.

169.121 MOTOR VEHICLE DRIVER UNDER INFLUENCE OF ALCOHOL OR CONTROLLED SUBSTANCE. Sec. 2. Minnesota Statutes 1980, Section 169.121, Subdivision 1, is amended to read:

Subdivision 1. Crime. It is a misdemeanor for any person to drive, operate or be in physical control of any motor vehicle within this state:

(a) When the person is under the influence of alcohol;

(b) When the person is under the influence of alcohol;

(c) When the person is under the influence of a combination of any two or more of the elements named in clauses (a) and (b); or

(d) When the person's alcohol concentration is 0.10 or more.

The provisions of this subdivision apply, but are not limited in application, to any person who drives, operates, or is in physical control of any motor vehicle in the manner prohibited by this subdivision upon the ice of any lake, stream, or river, including but not limited to the ice of any boundary water.

When an accident has occurred, a peace officer may lawfully arrest a person for violation of this section without a warrant upon probable cause, without regard to whether the violation was committed in the officer's presence.

Subd. 2. **Evidence.** Upon the trial of any prosecution arising out of acts alleged to have been committed by any person arrested for driving, operating, or being in physical control of a motor vehicle in violation of

subdivision 1, the court may admit evidence of the amount of alcohol or a controlled substance in the person's blood, breath, or urine as shown by a medical or chemical analysis thereof, if the test is taken voluntarily or pursuant to section 169.123.

For the purposes of this subdivision:

(a) evidence that there was at the time an alcohol concentration of 0.05 or less is prima facie evidence that the person was not under the influence of alcohol;

(b) evidence that there was at the time an alcohol concentration of more than 0.05 and less than 0.10 is relevant evidence in indicating whether or not the person was under the influence of alcohol.

Evidence of the absence of tests is admissible in a prosecution under this section without any comment and with a jury instruction, where applicable, that there shall be no speculation as to the reason for the absence and that no inference is to be drawn from the absence.

For purposes of this section and section 169.123, the result of an evidentiary test administered within two hours of the alleged violation is deemed to be the alcohol concentration at the time of the violation.

The foregoing provisions do not limit the introduction of any other competent evidence bearing upon the question whether or not the person was under the influence of alcohol or a controlled substance, including tests obtained more than two hours after the alleged violation.

Subd. 3. **Criminal penalties.** A person who violates this section or an ordinance in conformity therewith is guilty of a misdemeanor.

The following persons are guilty of a gross misdemeanor:

(a) A person who violates this section or an ordinance in conformity therewith within five years of a prior conviction under this section or an ordinance in conformity therewith; and

(b) A person who violates this section or an ordinance in conformity therewith within ten years of two or more prior convictions under this section or an ordinance in conformity therewith.

The attorney in the jurisdiction in which the violation occurred who is responsible for prosecution of misdemeanor violations of section 169.121 shall also be responsible for prosecution of gross misdemeanor violations of section 169.121.

Subd. 4. **Penalties.** A person convicted of violating this section shall have his driver's license or operating privileges revoked by the commissioner of public safety as follows:

(a) First offense: not less than 30 days;

(b) Second offense in less than five years; not less than 90 days and until the court has certified that treatment or rehabilitation has been successfully completed where prescribed in accordance with section 169.126;

(c) Third offenses in less than five years: not less than one year, together with denial under section 171.04, clause (8), until rehabilitation is established in accordance with standards established by the commissioner;

(d) Fourth or subsequent offense on the record; not less than two years, together with denial under section 171.04, clause (8), until rehabilitation is established in accordance with standards established by the commissioner.

Whenever department records show that the violation involved personal injury or death to any person, not less than 90 additional days shall be added to the base periods provided above.

Any person whose license has been revoked pursuant to section 169.123 as the result of the same incident is not subject to the mandatory revocation provisions of clause (a) or (b).

Subd. 6. **Preliminary screening test.** When a peace officer has reason to believe from the manner in which a person is driving, operating, controlling, or acting upon departure from a motor vehicle, or has driven, operated, or controlled a motor vehicle, that the driver may be violating or has violated subdivision 1, he may require the driver to provide a sample of his breath for a preliminary screening test using a device approved by the commissioner of public safety for this purpose. The results of this preliminary screening test shall be used for the purpose of deciding whether an arrest should be made and whether to require the chemical tests authorized in section 169.123, but shall not be used in any court action except to prove that a chemical test was properly required of a person pursuant to section 169.123, subdivision 2. Following the screening test additional tests may be required of the driver pursuant to the provisions of section 169.123.

The driver who refuses to furnish a sample of his breath is subject to

the provisions of section 69.123 unless, in compliance with section 169.123, he submits to a blood, breath or urine test to determine the presence of alcohol or a controlled substance.

Subd. 8. **Alcohol assessment.** When the evidentiary test shows an alcohol concentration of 0.07 or more, that result shall be reported to the commissioner of public safety. The commissioner shall record that fact on the driver's record. When the driver's record shows a second or subsequent report of an alcohol concentration of 0.07 or more with two years of a recorded report, the commissioner may require that the drive have an alcohol problem assessment meeting the commissioner's requirements. The assessment shall be at the driver's expense. In no event shall the commissioner deny the license of a person who refuses to take the assessment or to undertake treatment, if treatment is indicated by the assessment, for longer than 90 days. If an assessment is made pursuant to this section, the commissioner may waive the assessment required by section 169.126.

Sec. 8. Minnesota Statutes 1980, Section 169.121, is amended by adding a subdivision to read:

Subd. 9. **Immunity from liability.** (a) The state or political subdivision by which a peace officer making an arrest for violation of section 169.121 is employed shall have immunity from any liability, civil or criminal, for the care or custody of the motor vehicle being driven by, operated by, or in the physical control of the person arrested if the peace officer acts in good faith and exercises due care.

(b) For purposes of this subdivision, "political subdivision" means a county, statutory or home rule charter city, or town.

169.122 OPEN BOTTLE LAW; PENALTY. Subdivision 1. No person shall drink or consume intoxicating liquors or non-intoxicating malt liquors in any motor vehicle when such vehicle is upon a public highway.

Subd. 2. No person shall have in his possession on his person while in a private motor vehicle upon a public highway, any bottle or receptacle containing intoxicating liquor or non-intoxicating malt liquor which has been opened, or the seal broken, or the contents of which have been partially removed.

Subd. 3. It shall be unlawful for the owner of any private motor vehicle or the driver, if the owner be not then present in the motor vehicle, to keep or allow to be kept in a motor vehicle when such vehicle

is upon the public highway any bottle or receptacle containing intoxicating liquors or non-intoxicating malt liquors which has been opened, or the seal broken, or the contents of which have been partially removed except when such bottle or receptacle shall be kept in the trunk of the motor vehicle when such vehicle is equipped with a trunk, or kept in some other area of the vehicle not normally occupied by the driver or passengers, if the motor vehicle is not equipped with a trunk. A utility compartment or glove compartment shall be deemed to be within the area occupied by the driver and passengers.

169.123 CHEMICAL TESTS FOR INTOXICATION. Subdivision 1. **Peace officer defined.** For purposes of this section and section 169.121, the term peace officer means a state highway patrol officer, University of Minnesota peace officer, a constable as defined in section 367.40, subdivision 3, or police officer of any municipality, including towns having powers under section 368.01, or county.

Subd. 2. **Implied consent; conditions; election as to type of test.** (a) Any person who drives, operates, or is in physical control of a motor vehicle within this state consents, subject to the provisions of this section and section 169.121, to a chemical test of his blood, breath, or urine for the purpose of determining the presence of alcohol or a controlled substance. The test shall be administered at the direction of a peace officer. The test may be required of a person when an officer has reasonable and probable gounds to believe the person was driving, operating, or in physical control of a motor vehicle in violation of section 169.121 and one of the following conditions exist; (1) the person has been lawfully placed under arrest for violation of section 169.121, or an ordinance in conformity therewith; or (2) the person has been involved in a motor vehicle accident or collision resulting in property damage, personal injury, or death; or (3) the person has refused to take the screening test provided for by section 169.121, subdivision 6; or (4) the screening test was administered and recorded an alcohol concentration of 0.10 or more. No action may be taken against the person for declining to take a direct blood test, if offered, unless an alternative test was offered.

(b) At the time a chemical test specimen is requested, the person shall be informed:

(1) that if testing is refused, the person's right to drive will be revoked for a period of six months; and

(2) that if a test is taken and the results indicate that the person is un-

der the influence of alcohol or a controlled substance, the person will be subject to criminal penalties and the person's right to drive may be revoked for a period of 90 days; and

(3) that the person has a right to consult with an attorney but that this right is limited to the extent that it cannot unreasonably delay administration of the test or the person will be deemed to have refused the test; and

(4) that after submitting to testing, the person has the right to have additional tests made by a person of his own choosing.

Subd. 2a. **Requirement of urine test.** Notwithstanding subdivision 2, if there are reasonable and probable grounds to believe there is impairment by a controlled substance which is not subject to testing by a blood or breath test, a urine test may be required even after a blood or breath test has been administered.

Subd. 3. **Manner of making test; additional tests.** Only a physician, medical technician, physician's trained mobile intensive care paramedic, registered nurse, medical technologist or laboratory assistant acting at the request of a peace officer may withdraw blood for the purpose of determining the presence of alcohol or controlled substance. This limitation does not apply to the taking of a breath or urine specimen. The person tested has the right to have a person of his own choosing administer a chemical test or tests in addition to any administered at the direction of a peace officer; provided, that the additional test specimen on behalf of the person is obtained at the place where the person is in custody, after the test administered at the direction of a peace officer, and at no expense to the state. The failure or inability to obtain an additional test or tests by a person shall not preclude the admission in evidence of the test taken at the direction of a peace officer unless the additional test was prevented or denied by the peace officer. The physician, medical technician, physician's trained mobile intensive care paramedic, medical technologist, laboratory assistant or registered nurse drawing blood at the request of a peace officer for the purpose of determining alcohol concentration shall in no manner be liable in any civil or criminal action except for negligence in drawing the blood. The person administering a test at the request and direction of a peace officer shall be fully trained in the administration of the tests pursuant to standards promulgated by rule by the commissioner of public safety.

Subd. 4. **Refusal, consent to permit test; revocation of license.** If a person refuses to permit chemical testing, none shall be given, but the peace officer shall report the refusal to the commissioner of public safety and the authority having responsibility for prosecution of misdemeanor offenses for the jurisdiction in which the acts occurred. If a person submits to chemical testing and the test results indicate an alcohol concentration of 0.10 or more, the results of the test shall be reported to the commissioner of public safety and to the authority having responsibility for prosecution of misdemeanor offenses for the jurisdiction in which the acts occurred.

Upon certification by the peace officer that their existed reasonable and probable grounds to believe the person had been driving, operating, or in physical control of a motor vehicle while under the influence of alcohol or a control substance and that the person refused to submit to chemical testing, the commissioner of public safety shall revoke the person's license or permit to drive, or his nonresident operating privilege, for a period of six months. Upon certification by the peace officer that there existed reasonable and probable grounds to believe the person had been driving, operating or in physical control of a motor vehicle while under the influence of alcohol or a controlled substance and that the person submitted to chemical testing and the test results indicate an alcohol concentration of 0.10 or more, the commissioner of public safety shall revoke the person's license or permit to drive, or his nonresident operating privilege, for a period of 90 days.

If the person is a resident without a license or permit to operate a motor vehicle in this state, the commissioner of public safety shall deny to the person the issuance of a license or permit for the same period after the date of the alleged violation as provided herein for revocation, subject to review as hereinafter provided.

Subd. 5. **Notice of revocation or determination to deny; request for hearing.** A revocation under subdivision 4 becomes effective at the time the commissioner of public safety or a peace officer acting on his behalf notifies the person of the intention to revoke and of revocation. The notice shall advise the person of the right to obtain administrative and judicial review as provided in this section. If mailed, the notice and order of revocation is deemed received three days after mailing to the last known address of the person.

Subd. 5a. **Peace officer agent for notice of revocation.** On behalf of the commissioner of public safety a peace officer offering a chemical test or directing the administration of a chemical test shall serve immediate notice of intention to revoke and of revocation on a person whose refuses to permit chemical testing or on a person who submits to a chemical test the results of which indicate an alcohol concentration of 0.10 or more. The officer shall take the license or permit of the driver, if any, and issue a temporary license effective only for 7 days. The peace officer shall send the person's driver's license to the commissioner of public safety along with the certificate required by subdivision 4.

Subd. 5b. **Administrative review.** At any time during a period of revocation imposed under this section a person may request in writing a review of the order of revocation by the commissioner of public safety. Upon receiving a request the commissioner or his designee shall review the order, the evidence upon which the order was based, and any other material information brought to the attention of the commissioner, and determine whether sufficient cause exists to sustain the order. Within 15 days of receiving the request the commissioner shall report in writing the results of his review. The review provided in this subdivision is not subject to the contested case provisions of the administrative procedure act in sections 15.041 to 15.052.

The availability of administrative review for an order of revocation shall have no effect upon the availability of judicial review under this section.

Subd. 5c. **Petition for judicial review.** Within 30 days following receipt of a notice and order of revocation pursuant to this section, a person may petition the court for review. The petition shall be filed with the clerk of county or municipal court in the county where the alleged offense occurred, together with proof of service of a copy on the commissioner of public safety, and accompanied by the standard filing fee for civil actions. No responsive pleading shall be required of the commissioner of public safety, and no court fees shall be charged for his appearance in the matter.

The petition shall be captioned in the name of the person making the petition as petitioner and the commissioner of public safety as respondent. The petition shall state with specificity the grounds upon which the petitioner seeks rescission of the order of revocation or denial.

The filing of the petition shall not stay the revocation or denial. The reviewing court may order a stay of the balance of the revocation if the hearing has not been conducted within 60 days after filing of the petition upon terms the court deems proper. Judicial reviews shall be conducted according to the rules of civil procedure.

Subd. 6. **Hearing.** A hearing under this section shall be before a municipal or county judge, in any county in the judicial district where the alleged offense occurred. The hearing shall be to the court and may be conducted at the same time and in the same manner as hearings upon pretrial motions in the criminal prosecution under section 169.121, if any. The hearing shall be recorded. The commissioner of public safety may appear through his own attorney or, by agreement with the jurisdiction involved, through the prosecuting authority for that jurisdiction.

The hearing shall be held at the earliest practicable date, and in any event no later than 60 days following the filing of the petition or review. The judicial district administrator shall establish procedures to ensure efficient compliance with the provisions of this subdivision. To accomplish this, the administrator may, whenever possible, consolidate and transfer review hearings among the county courts within the judicial district.

The scope of the hearing shall be limited to the issues of:

(1) whether the peace officer had reasonable and probable grounds to believe the person was driving, operating, or in physical control of a motor vehicle while under the influence of alcohol or a controlled substance, and whether the person was lawfully placed under arrest for violation of section 169.121, or the person was involved in a motor vehicle accident or collision resulting in property damage, personal injury or death, or the person refused to take a screening test provided for by section 169.121, subdivision 6, or the screening test was administered and recorded an alcohol concentration of 0.10 or more; and

(2) whether at the time of the request for the test the peace officer informed the person of his rights and the consequences of taking or refusing the test as required by subdivision 2; and

(3) either (a) whether the person refused to permit the test, or (b) whether a test was taken and the test results indicated an alcohol concentration of 0.10 or more at the time of testing, and whether the testing method used was valid and reliable, and whether the test results were accurately evaluated.

It shall be an affirmative defense for the petitioner to prove that, at the time of the refusal, his refusal to permit the test was based upon reasonable grounds.

Certified or otherwise authenticated copies of laboratory or medical personnel reports, documents, licenses and certificates shall be admissible as substantive evidence.

The court shall order either that the revocation be rescinded or sustained and forward the order to the commissioner of public safety. The court shall file its order within 14 days following the hearing. If the revocation is sustained, the court shall also forward the person's driver's license or permit to the commissioner of public safety for his further action if the license or permit is not already in the commissioner's possession.

Subd. 7. **Review by district court.** Any part aggrieved by the decision of the reviewing court may appeal the decision to the district court as provided in sections 484.63 and 487.39.

Subd. 8. **Notice of action to other states.** When it has been finally determined that a nonresident's privilege to operate a motor vehicle in this state has been revoked or denied, the commissioner of public safety shall give information in writing of the action taken to the official in charge of traffic control or public safety of the state of the person's residence and of any state in which he has a license.

Subd. 9. **Limited license.** In any case in which a license has been revoked under this section, the commissioner may issue a limited license to the driver. The commissioner in issuing a limited license may impose the conditions and limitations which in his judgment are necessary to the interests of the public safety and welfare, including re-examination of the driver's qualifications, attendance at a driver improvement clinic, or attendance at counseling sessions. The license may be limited to the operation of particular vehicles and to particular classes and time of operation. The limited license issued by the commissioner shall clearly indicate the limitations imposed and the driver operating under a limited license shall have the license in his possession at all times when operating as a driver. In determining whether to issue a limited license, the commissioner shall consider the number and the seriousness of prior convictions and the entire driving record of the driver.

Subd. 10. **Termination of revocation period.** If the commissioner

receives notice of the driver's attendance at a driver improvement clinic, attendance at counseling sessions, or participation in treatment for an alcohol problem the commissioner may, 30 days prior to the time the revocation period would otherwise expire, terminate the revocation period. The commissioner shall not terminate the revocation period under this subdivision for a driver who has had a license revoked under section 169.121 or this section for another incident during the preceding three year peiod.

169.124. ALCOHOL SAFETY PROGRAM. Subdivision 1. The county board of every county having a population of more than 10,000 shall and the county board of every county having a population of less than 10,000 may establish an alcohol safety program designed to provide alcohol problem assessment and evaluation of persons convicted of one of the offenses enumerated in section 169.126, subdivision 1.

Subd. 2. The alcohol problem assessment shall be conducted under the direction of the court and by such persons or agencies as the court deems qualified to provide the alcohol problem assessment and assessment report as described in section 169.126. The alcohol problem assessment may be conducted by court services probation officers having the required knowledge and skills in the assessment of alcohol problems, by alcoholism counselors, by persons conducting court sponsored driver improvement clinics if in the judgment of the court such persons have the required knowledge and skills in the assessment of alcohol problems, by appropriate staff members of public or private alcohol treatment programs and agencies or mental health clinics, by court approved volunteer workers such as members of Alcoholics Anonymous, or by such other qualified persons as the court may direct. The commissioner of public safety shall provide the courts with information and assistance in establishing alcohol problem assessment programs suited to the needs of the area served by each court. The commissioner shall consult with the alcohol and other drug abuse section in the department of public welfare and with local community mental health boards in providing such information and assistance to the courts. The commissioner of public safety shall promulgate rules and standards, consistent with this subdivision, for reimbursement under the provisions of subdivision 3. The promulgation of such rules and standards shall not be subject to chapter 15.

Subd. 3. The cost of alcohol problem assessment outlined in this section shall be borne by the county. Upon application by the county to the commissioner of public safety, the commissioner shall reimburse the county up to 50 percent of the cost of each alcohol problem assessment not to exceed $25 in each case. Payments shall be made annually and prorated if insufficient funds are appropriated.

169.125 COUNTY COOPERATION. County boards may enter into an agreement to establish a regional alcohol problem assessment alcohol safety program. County boards may contract with other counties and agencies for alcohol problem assessment services.

169.126 ALCOHOL PROBLEM ASSESSMENT. Subdivision 1. An alcohol problem assessment shall be conducted in counties of more than 10,000 population and an assessment report submitted to the court by the county agency administering the alcohol safety counseling program when:

(a) The defendant is convicted of an offense described in section 169.121; or

(b) The defendant is arrested for committing an offense described in section 169.121, is not convicted therefor, but is convicted of another offense arising out of the circumstances surrounding such arrest.

Subd. 2. The assessment report shall contain an evaluation of the convicted defendant concerning his prior traffic record, characteristics and history of alcohol problems, and amenability to rehabilitation through the alcohol safety program. The assessment report shall include a recommendation as to a treatment or rehabilitation program for the defendant. The assessment report shall be classified as private data on individuals as defined in section 15.162, subdivision 5a.

Subd. 3. The assessment report required by this section shall be prepared by a person knowledgeable in diagnosis of chemical dependency.

Subd. 4. The court shall give due consideration to the agency's assessment report.

Subd. 5. Whenever a person is convicted of a second or subsequent offense described in subdivision 1 and the court is either provided with an appropriate treatment or rehabilitation recommendation from sources other than the alcohol problem assessment provided for in this section, or has sufficient knowledge both of the person's need for treatment and an appropriate treatment or rehabilitation plan, and the court finds that requiring alcohol problem assessment would not substantially aid the court in sentencing, such alcohol problem assessment need not be conducted.

Subd. 6. This section shall not apply to persons who are not residents of the state of Minnesota at the time of the offense and at the time of the alcohol problem assessment.

169.1261 REINSTATEMENT OF DRIVING PRIVILEGES; NOTICE. Upon expiration of any period of revocation under section 169.121 or section 169.123, the commissioner of public safety shall notify the person of the terms upon which his driving privileges can be reinstated,

which terms are: (1) successful completion of a driving test and proof of compliance with any terms of alcohol treatment or counseling previously prescribed, if any; and (2) any other requirements imposed by the commissioner and applicable to that particular case. The commissioner shall also notify the person that if driving is resumed without reinstatement of driving privileges, the person will be subject to criminal penalties.

169.128 RULES OF THE COMMISSIONER OF PUBLIC SAFETY. The commissioner of public safety may promulgate rules to carry out the provisions of sections 169.121 and 169.123. The rules may include forms for notice of intention to revoke, which shall describe clearly the right to a hearing, the procedure for requesting a hearing, and the consequences of failure to request a hearing; forms for revocation and notice of reinstatement of driving privileges as provided in section 7; and forms for temporary licenses.

Rules promulgated pursuant to this section are exempt from the procedure required by sections 15.0411 to 15.052.

169.129 AGGRAVATED VIOLATIONS; PENALTY. Any person who drives, operates, or is in physical control of a motor vehicle, the operation of which requires a driver's license, within this state in violation of section 169.121 or an ordinance in conformity therewith before his driver's license or driver's privilege has been reinstated following its cancellation, suspension or revocation (1) because he drove, operated, or was in physical control of a motor vehicle while under the influence of alcohol or a controlled substance or while he had an alcohol concentration of 0.10 or more or (2) because he refused to take a test which determines the presence of alcohol or a controlled substance when requested to do so by a proper authority, is guilty of a gross misdemeanor. Jurisdiction over prosecutions under this section is in the district court.

171.30 LIMITED LICENSE. Subdivision 1. In any case where a person's license has been suspended under section 171.18 or revoked under sections 169.121 or 171.17, if the driver's livelihood or attendance at a chemical dependency treatment or counseling program depends upon the use of his driver's license, the commissioner may at his own discretion issue a limited license to the driver. The commissioner in issuing a limited license may impose such conditions and limitations as in his judgment are necessary to the interests of the public safety and welfare including re-examination as to the driver's qualifications. The license may be limited to the operation of particular vehicles, to particular classes and times of operation and to particular conditions of traffic.

The limited license issued by the commissioner shall clearly indicate the limitations imposed and the driver operating under the limited license shall have the license in his possession at all times when operating as a driver.

In determining whether to issue a limited license, the commissioner shall consider the number and the seriousness of prior convictions and the entire driving record of the driver and shall consider the number of miles driven by the driver annually.

Subd. 2. A limited license shall not be issued for a period of 60 days to an individual who has had his license or privilege revoked or suspended for commission of the following offenses:

(a) Manslaughter or criminal negligence resulting from the operation of a motor vehicle.

(b) Any felony in the commission of which a motor vehicle was used.

(c) Failure to stop and disclose identity as required under the laws of this state, in the event of a motor vehicle accident resulting in the death or personal injury or another.

Subd. 3. The commissioner shall issue a limited license restricted to the vehicles whose operation is permitted only under a Class A or Class B license whenever a Class A or Class B license has been suspended under section 171.18, or revoked under section 171.17, for violation of the highway traffic regulation act committed in a private passenger motor vehicle. This subdivision shall not apply to any persons described in section 171.04, clauses (4), (5), (6) and (9).

DEPARTMENT OF PUBLIC SAFETY

SAFETY ADMINISTRATION DIVISION

Chapter Ten: 11 MCAR §§ 1.0096 - 1.0103 Standards of Training for Persons Administering and Interpreting Chemical Tests for Intoxication.

§ 1.0096 Purpose and scope. The purpose of these rules is to establish minimum standards of training for persons administering and interpreting a chemical test for intoxication at the direction of a peace officer, pursuant to the provisions of Minn. Stat. § 169.123 (1974), and Laws of 1976 ch. 341, § 2.

§ 1.0097 Definitions. For the purposes of these rules, the following terms shall have the meanings ascribed to them:

A. Administer. The collection of a specimen of blood, breath, or urine, from a person for the purpose of analyzing such specimen to determine the alcoholic content of the person's blood.

B. Commissioner. The Commissioner of Public Safety of the State of Minnesota.

C. Peace Officer. A person described by the provisions of Minn. Stat. § 169.123, subd. 1 (1974).

D. Interpret. To derive a blood-alcohol content reading from analysis of a sample of blood, breath, or urine.

§ 1.0098 Persons who administer blood tests. Only a person who has been trained and is employed in the capacity of a physician, registered nurse, medical technologist, medical technician, or laboratory assistant may administer a blood test.

§ 1.0099 Persons who administer breath tests. Any person, who has satisfactorily completed a course of formal classroom instruction in the use of an instrument specially manufactured to analyze a specimen of breath to determine the alcoholic content of the blood, may administer a breath test at the direction of a peace officer. The course of instruction must be approved by the Commissioner. After completion of the described course such person may be required to periodically demonstrate, to the Commissioner or his duly authorized and acting agents, his competence to satisfactorily operate such instrument.

§ 1.0100 Persons who administer urine tests. Any person may administer a urine test.

§ 1.0101 Prior regulation repealed. The provisions of Highway Regulation 2 previously adopted are hereby repealed.

§ **1.0102 Persons who interpret blood or urine tests.** Any person who meets the educational and occupational standards set forth below may interpret blood or urine tests:

A. Educational qualifications. A bachelor's or higher degree in chemistry, biochemistry, biology, biological sciences, pharmacology, criminalistics, toxicology or medical technology.

B. Occupational qualifications. Full-time employment or self-employment as a criminalist, crime laboratory analyst, toxicologist, pathologist, chemist, biochemist, medical technologist, medical laboratory technician or medical laboratory assistant.

§ **1.0103 Methods of analyzing blood or urine samples.** Blood and urine samples shall be tested for alcohol using only procedures approved and certified to be a valid and reliable testing procedure by the Laboratory Director, Forensic Toxicology Services, Bureau of Criminal Apprehension, Department of Public Safety, State of Minnesota, based upon one of the following quantitative methods:

A. Gas Chromatography

B. Alcohol Dehydrogenase Reaction

C. Micro-diffusion

D. Oxidation of distillate with potassium dichromate or other approved oxidizing agents.

THE TRIAL

CHAPTER VIII

SAMPLE QUESTIONS DESIGNED TO QUALIFY THE BREATHALYZER OPERATOR AS A WITNESS

1. What is your name?
2. What is your occupation; and by whom are you employed?
3. Are you a full-time employee?
4. How long have you been so employed?
5. What is your rank and what are your duties?
6. Have you attended any special school(s) connected with your work?
7. Where and when did you attend this specialized school(s)?
8. Who was in charge of this course(s)?
9. What was the duration of the course(s)?
10. What did the training consist of?
11. Were you required to operate chemical test instruments while in attendance at this school(s)?
12. Were you tested in any manner to determine your degree of proficiency in the operation of these instruments?
13. You mentioned running 'knowns', 'unknowns', and 'drinking subjects'. Please explain what you mean.
14. Did you successfully complete the course(s) of instruction?
15. Were you issued a certificate, diploma, or other evidence of your having successfully passed the Breathalyzer Operator Training Course? If so, by whom?
16. What is the Breathalyzer and how does it work?
17. How do you know that it is in good working order when you run a test?
18. How do you know that the chemicals are correct?
19. Since your completion of the course have you had occasion to operate chemical test instruments as a part of your police duties?
20. Can you advise the court as to approximately how many chemical tests you have administered since your completion of the course?
21. Did all of the tests indicate that the persons tested were under the influence of intoxicating beverages?
22. Have you testified previously in a court of record concerning your operation of chemical test instruments?
23. How many times?
24. Do you know the defendant in this case?
25. Do you see him in the courtroom?
26. Will you point him out?
27. Did you have an occasion to conduct a Breathalyzer test on this defendant?
28. On what date did you give the defendant a Breathalyzer Test?
29. Where and when did you give him this test?
30. How long was he under your observation before you gave him the test?
31. During this time did he have anything to eat, drink or smoke?
32. What kind of tests other than the Breathalyzer Test did you give him?

32a. Were you present when he performed the tests given by the arresting officer?

33. Describe these tests to the court. (Not used if 32a is applicable instead of 32).
34. Describe to the court how he performed these tests.
35. Did you ask him any questions? What were they? What did he answer?
36. Calling attention to the Breathalyzer Test you made in this case, do you recall what the reading of the chemical test on the Breathalyzer was?
37. Was the test given in strict conformity with the accepted instructions?
38. How do you know you performed all the steps in the right order? (Checklist can be introduced as evidence at this point).
39. Is this checklist a standard form used by your department in operating the breathalyzer?
40. What was the reading?
41. As a result of these tests do you have an opinion as to the condition of the defendant at the time you made these tests?
42. Will you state this opinion to the court.

SAMPLE OPERATOR TESTIMONY

JOE E. SMITH

a witness called on behalf of the plaintiff, being first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY PROSECUTOR

Q Would you state your full name please?
A Joe E. Smith
Q By whom are you employed? And in what capacity?
A Small County Sheriff's Department: Deputy Sheriff
Q How long have you been so employed?
A Two years — seven months
Q What type of training did you have for your employment?
A I have attended the Police Academy, eight weeks and I have been certified as a Breathalyzer Operator, a 56 hour course and also the recertification of eight hours.
Q When were you initially certified as a Breathalyzer Operator?
A November, 1972.
Q And where did you take that course?
A From the State of Minnesota Bureau of Criminal Apprehension.
Q Basically what do you do at that course or learn at that course?
A How to operate and test for D.W.I. or the alcohol blood content.
Q What type of machine is the Breathalyzer and how do they teach you what — what do you do there at the school?
A We run simulator tests. We have lectures and lab work; run actual subjects who have been drinking.
Q Then you said you were recertified. What do you mean by that?
A We go up to learn any new procedures and this also enables the State to be sure that we are still familiar with the machine and have been running the proper amount of tests per month.
Q How often is that done?
A That we run the tests?
Q No, that you recertify?
A Every year.
Q When were you last recertified?
A October, 1973.
Q That would be approximately a month prior to the incident that we're concerned with here today?
A That's correct.
Q Now calling your attention to November 2nd, 1973 were you on duty in the evening of November 2, '73?
A Yes, I was.
Q And where is that you're on duty?
A In the Small County Jail, Big Berg, Minnesota.
Q And do you have a breathalyzer there at the jail?
A Yes, we do.
Q Do you recall Trooper Smokey coming to the jail with a Mr. Green?
A Yes sir, I do.
Q And did he then ask you to perform a test on Mr. Green?
A Yes sir.
Q Can you tell the jury basically what you do when you operate the Breathalyzer Machine? That is, what do you have to do in connection with the operation of that machine?
A Well basically I follow the Breathalyzer Operational Checklist, step by step.
(State Exhibit A is marked for identification.)
Q Showing you what's been marked as State's Exhibit A, is that the checklist that you have just referred to?
A Yes it is.
Q Now where did you learn that you were to follow this.
A From our training for certification of the Breathalyzer.
Q And where do you obtain those checklists?
A From the same source.
Q Now on November 2, 1973 how long did you observe Mr. Green prior to administering the test to him?
A Twenty minutes.
Q. During that time did you see him eat anything or consume anything or place anything in his mouth?
A No sir, I did not.
Q Did you then administer the test to him by following the steps outlined on the checklist?
A Yes sir.
Q As a result of that test did you determine the blood alcohol content of his blood?
A I did
Q And is that reading shown on your checklist?
A Yes it is; point 16.

DEFENSE ATTORNEY: Your Honor, I object on the basis there is no foundation, it's prejudicial and I'm going to ask the Court to direct a mistrial in this case. Now the witness obviously has been trained to get out this reading before there is sufficient foundation for it.

THE COURT: Well your motion is denied.

Members of the jury, disregard the last statement made by this officer.It hasn't been determined by the Court at this time that any reading should be admitted into evidence, so please disregard that.

BY PROSECUTOR:

Q Did you do every one — each and every one of the steps listed on the checklist?
A Yes I did.
Q In connection with the administration of the test to Mr. Green?
A Yes sir.
Q Did you record the doing of those steps on the Exhibit A that you hold in front of you?
A Yes sir.

Q And how did you record those — that you had done each step?
A I recorded each step as it's completed.
Q And what signifies that you have done that?
A By a check.
Q Now, as a result of the test that was administered to Mr. Green, what reading did you receive?

DEFENSE: Objection Your Honor, no proper foundation.
THE COURT: Objection sustained.
PROSECUTOR: May we approach the bench?
THE COURT: Sure.

(The following discussion was had at the bench, out of the hearing of the jury, between counsel and the Court.)

PROSECUTOR: Your Honor, the basis of my understanding is that he administered the test and he has been certified as a breathalyzer operator and that's all that's necessary at this point to lay foundation for the test result. According to the Quinn case if he says that he followed all the steps that he's taught in school that's sufficient and I'll supply additional foundation if the Court desires, but I'm sorry, that's my understanding of the Quinn Case and I have furnished that information.

THE COURT: Well, step around here.
(Off the record discussion.)

BY PROSECUTOR:

Q Would you tell us, Mr. Smith, what the first thing was that you did on the night in question, in connection with getting the test of Mr. Green?
A The first step in the operation of the machine?
Q Yes?
A Well, that's to plug it in, turn it on and allow the machine to warm up.
Q And did you do so on this particular night?
A Yes I did.
Q And then what was the next thing that you did?
A I—we have a—gauge the test ampoule, as on the checklist here.
Q Did you do that this particular night?
A Yes I did.
Q In connection with Mr. Green?
A Yes sir.
Q What was the next thing that you did?
A Then I test the other ampoule and record the control number.
Q Did you do that this particular night?
A Yes I did.
Q And what control number did you record?
A Number 2.
Q And going back to the first step, did you record the temperature that you obtained on the machine when you let it warm up?
A Yes.
Q What temperature was that?
A 49 degrees Centigrade.
Q Do you have a serial number on your Breathalyzer Machine at the Sheriff's office?
A Yes we have.
Q Do you record that on this checklist?
A Yes I have.
Q Then what was the next step that you did in connection with this test?
A Then I purge the machine.
Q Did you do this on this particular night?
A Yes I did.
Q And what was the next step that you did?
A Then we take a room air sample.
Q Did you do that?
A Yes sir, I did.
Q Did you record the time that you did this?
A Yes I did.
Q What time was that?
A 2250 or ten minutes to eleven.
Q And did you get a reading on the room air sample?
A Yes sir, I did.
Q What was that?
A Point zero, zero two.
Q And what did you do next?
A Then I take the sample from the defendant.
Q And did you take a sample of the breath of the defendant?
A Yes sir, I did.
Q And what do you do in connection with taking that sample?
A I indicated to him that I wanted a good deep breath, to continue blowing into the machine until I indicated he should stop.
Q Did he do that?
A Yes sir, he did.
Q Did you record the time that you did that?
A Yes sir, I did.
Q What time was that?
A 2255 or five minutes to eleven.
Q Did you then get a reading on your machine of the alcoholic content of the defendant's breath?
A Yes sir, I did.
Q And is this converted by the reading into the blood alcohol content?
A Yes sir.
Q And what reading was that?

DEFENSE: Objection Your Honor; there is no proper foundation.
THE COURT: Overruled. You may answer the question.
THE WITNESS; Point 16.

BY PROSECUTOR:

Q That's called point one six?
A Yes sir.
Q What did you do next?
A Then I take a simulator test.
Q For the jury's information, what's a simulator test?
A That's a known solution of an alcohol content in the jar to be sure our machine is operating properly.
Q Did you do this on the night in question?
A Yes sir, I did.
Q Did you record the time that you did that?
A Yes sir.
Q What time was that?
A That was 2259 or one minutes—minute to eleven.
Q And did you record on there the number of the simulator solution?
A Yes sir.
Q What did you do next? Did you take a test of the simulator solution?
A Yes I did.
Q And what reading did you get on the simulator solution?

DEFENSE: Objection Your Honor; there is no foundation showing that the simulator was compounded or who compounded it and whether or not it was properly analyzed or prepared.
THE COURT: The objection is overruled.

PROSECUTOR: Objection overruled; thank you, Your Honor. You can answer the question.

THE WITNESS: It was point one one.

BY PROSECUTOR:

Q Now after you had done that, what's the next thing that you do?
A It's a disconnect.
Q And do you record the temperature again?
A Yes sir, I did.
Q Did you record it this night?
A Yes I did.
Q What was the temperature on this occasion?
A Fifty degrees Centigrade.
Q Now did you sign this Exhibit A?
A Yes I did.
Q And did Trooper Smokey sign as a witness your — in your presence?
A Yes he did.
Q And everything except Trooper Smokey signature that's written on Exhibit A was written there by you?
A Yes it is.
Q Is this kept as a record by you at the sheriff's office?
A Yes it is.
Q And did you attach to the operational checklist the test records on the room air, the subject's breath and the simulator solution?
A Yes.
Q Did you do this on this occasion?
A Yes.
Q Did you also fill in the information contained on the writing portion of those slips?
A Yes sir, I did.
Q Are those attached to Exhibit A?
A Yes they are.

PROSECUTOR: At this time we'd offer Exhibit A Your Honor.

DEFENSE: Objection Your Honor; self serving.

THE COURT: Overruled on that ground.

DEFENSE: Also hearsay.

THE COURT: Overruled on that ground.

DEFENSE: Have you completed your examination?

PROSECUTOR: Yes, I have completed my examination.

CROSS EXAMINATION

BY DEFENSE:

Q Officer, you have been a policeman for about two years, is that correct?
A Yes sir.
Q And prior to being a policeman what did you do?
A I worked for Western Airlines.
Q Do you have any training in chemistry?
A No sir.
Q Physiology?
Q Mathematics?
A High school and college.
Q How about high school chemistry?
A No sir.
Q So apparently all you know, you learned at some police school in relation to this breathalyzer, correct?
A That's correct.
Q And that was during a 40 hour or 44?
A Pardon me?
Q Forty-four hour course?
A Fifty-six hour.
Q Oh, fifty-six. And part of that course is devoted to testifying in Court isn't it?
A Yes sir.
Q In fact there is a mock trial or sample trial?
A Yes sir.
Q Where you observe a police officer being cross-examined by lawyers and they attempt to make a case, correct?
A Yes sir.
Q And this is supposed to teach you about what you're expected to know about the Breathalyzer?
A Yes sir.
Q So that possibly takes four hours of the 56 hours?
A That's correct.
Q And part of the course involves what you termed, 'drinking suspects', correct?
A That's correct.
Q Where other law enforcement officers are furnished alcohol by the Minnesota Bureau of Criminal Apprehension and are told to drink the alcohol and then they are supposed to test each other, is that correct?
A That's correct.
Q And they apparently consume alcohol and to such a degree they become intoxicated, correct?
A That's correct.
Q And that's part of your training?
A Yes sir.
Q Okay. Now you said that you followed all the steps on the operating checklist, is that correct?
A Yes sir.
Q And you were taught to follow those steps because if you didn't follow each and every one of those steps it might result in an error, correct?
A Correct.
Q You don't know how the Breathalyzer works, do you officer, in effect what the theory is predicated on?
A No sir.
Q They didn't teach you that?
A Just basics.
Q As a matter of fact they spend about half the morning teaching you those basics, don't they?
A Yes.
Q Do you recall any of it?
A Enough I think that if the machine malfunctioned I should be able to pinpoint what it might be.
Q And repair it?
A No sir.
Q Just tell whether or not it's malfunctioning, correct?
A That's correct.
Q And what are some of malfunctions that you noticed about the Breathalyzer?
A I had noticed none.
Q Never saw a machine malfunction?
A No.
Q But you think you have enough training on the theory of the machine to tell whether or not it's malfunctioning?
A Yes sir.
Q Would you tell us on what basis you can make that statement?
A By following the checklist.
Q So if you follow the checklist you're never going to make a mistake?
A Yes sir.

Q Well I suppose in working for Western Airlines, you know the pilots are furnished checklists and expected to follow the checklist each and every time to make a take-off or landing?
A That I don't know.
Q Let's assume that you didn't work for Western Airlines. Just on the basis of your general knowledge, don't you know that?
A I have hearsay.
Q Well it's hearsay as to what's been told you about the Breathalyzer, and it's accuracy or reliability or even the steps, isn't it?
A No sir.
Q Well they told you about it, correct?
A It's my understanding it has been tested and proven.
Q Okay, It's tested by whom?
A By the state.
Q You took a test, right?
A Correct.
Q And you managed to pass that test?
A That's correct.
Q Did you graduate at the top of your class?
A Yes I did.
Q So you were the outstanding operator for this particular week?
A No, not the outstanding — I was in the top portion of the class.
Q So then you knew more than the other officers about the theory or scientific basis on which the Breathalyzer is predicated?
A Not necessarily, no.
Q Well you knew more than the other officers apparently, since you were on top of the class?
A Not necessarily either.
Q Well you're better at taking tests then?
A That's probably correct.
Q Not necessarily in performing the test, but you're better at responding to whatever questions were asked?
A That's correct.
Q Now officer, you know about the absorption factor as far as alcohol getting into the bloodstream, don't you?
A Yes sir.
Q And tell the jury what you know?
A How the blood is absorbed into the bloodstream?
Q I guess the blood is already in the bloodstream.
A I'm sorry; the alcohol.
Q All right. So it will get into the bloodstream in a period of time, depending upon the amount of food they have in the stomach. Anything else?
A That's basically what it is.
Q Now what you're testing officer, essentially, is the amount of alcohol in the breath of an individual and translating it by means of this machine, into what it's supposed to be in the blood, right?
A Yes sir.
Q So this isn't direct blood analysis, is it?
A No sir.
Q There is nothing in this machine that's able to analyze a little tiny drop of blood?
A No sir.
Q Now the Breathalyzer itself is a machine made by a manufacturer called the Stevens Corporation and sold to police departments, correct?
A That's correct.
Q And they promote their products to police officers and furnish literature promoting their products, is that correct?
A Yes sir.
Q You're furnished this literature and you're taught to believe that this machine is reliable and is predicated on a reliable scientific principle, aren't you?
A Yes sir.
Q And you believe it?
A Yes sir.
Q Now, it's not alcohol in the blood that affects or allegedly affects the ability to drive, is it?

PROSECUTOR: Objected to as going beyond the scope of the knowledge of this witness.
DEFENSE: He said he was an expert.
THE WITNESS: No sir.
THE COURT: Objection sustained.

BY DEFENSE:

Q Officer, the alcohol contained in the blood is then circulated or were you taught that at your course, that it's circulated to the brain, correct?
A Yes sir.
Q And it's at the brain that essentially there is an impairment of alcohol or an alcohol impairment function, correct?
A Correct.
Q The Breathalyzer doesn't measure what's in someone's brain does it?
A No sir.
Q It's measuring the alcohol that allegedly is in the breath of an individual or a suspect, right?
A Right.
Q So it does it by means of a—a conversion between the amount of alcohol in a measured sample of breath as opposed to the amount of alcohol that's in an equal part of blood, doesn't it?
A Yes sir.
Q But there is no blood in the machine is there?
A No sir.
Q All that's in the machine are chemicals, correct?
A Correct.
Q And the chemicals are potassium dichromate and sulphuric acid, is that correct?
A Right.
Q And if there's an error in the compounding of the chemicals it will result in an inaccurate reading?
A Yes sir.
Q If the temperature gauge is not functioning properly it's going to affect the validity of your reading, is it not?
A Yes sir.
Q And if the machine—the photoelectric filters are not properly adjusted it's going to affect the validity of the machine or the reading, correct?
A That's correct.
Q And if there is something involving some malfunction or slippage in the clutch or what you term the blood alcohol pointer, that's going to affect the validity of the machine or it's reading?
A Yes sir.
Q Are there any others? We have gone through about four operational errors in the basics of the machine or possible operational errors. There are several others, aren't there officer?
A No sir. I think you've pretty well covered it.
Q Okay. We have outlined about four of them?
A Yes.
Q How long did it take you to warm up your machine on the night in question?
A Well in the particular area it's in now it takes about 45 minutes.

Q Did you have any other notes, other than what's been admitted as State Exhibit A in reference to this particular test?
A No sir.
Q Could you identify Mr. Green please?
A Yes sir. It's the party sitting right behind you.
Q Do you have a specific recollection that Mr. Green was the gentleman that was in the Small County Jail on November 2nd?
A Yes sir.
Q So you would recognize him any time?
A Yes sir. I would.
Q And you didn't have to be told by the prosecutor or Trooper Smokey that this was Mr. Green?
A No sir, I did not.
Q Is he the only subject that you have tested since November?
A No sir, he is not.
Q How many have you tested?
A I test approximately ten to twenty a month.
Q So you have seen approximately 60 individuals since Mr. Green and you met briefly on the night of November 2nd?
A Yes sir.
Q And you can testify that you do recall him independently of any advice from either the prosecutor or Mr. Smokey.
A Yes sir, I can.
Q Is there any particular reason why you can recollect Mr. Green?
A Yes sir.
Q Because Trooper Smokey told you that Mr. Green allegedly forced him off the road?
A No sir.
Q Is it because of his long hair?
A No sir.
Q Moustache?
A No sir.
Q Height or weight?
A No sir.
Q Something he said to you?
A No sir.
Q Something he said to you? Or his behavior on that night?
A No sir.
Q Now officer, you had never met him before have you?
A I have not.
Q And what was his behavior towards you? Was he antagonistic? Was he polite? Has he cooperative?
A He was a little reluctant, but he did cooperate.
Q He was reluctant because he wasn't familiar with it?
A I'm not sure.
Q Did you ask him why he was reluctant?
A No sir. I asked him if he was willing to blow into the machine.
Q And he said yes?
A Yes sir.
Q You didn't advise him of the Implied Consent Law?
A No sir.
Q The other officer had done that?
A Yes sir.
Q How often have you and Trooper Smokey worked on or been on the same sort of case similar to this?
A This is the first one.
Q By that you mean this is the first time he has ever brought that suspect—
A To my testing—
Q To you?
A Yes.
Q But you have seen him in the Small County Sheriff's Office before and apparently on numerous occasions?
A Yes I have.
Q Now are you the principal operator of the Breathalyzer machine in Small County?
A No sir. There are five of us certified in our department.
Q All policemen, correct?
A Yes sir.
Q Do you know whether or not Trooper Smokey advised the defendant that he had a right to make tests or have tests conducted independent of the test that you gave him?
A No sir.
Q Mr. Green was taken to the county jail and incarcerated after this test, wasn't he?
A Yes sir.
Q Now all your training has been by law enforcement people for law enforcement purposes?
A Yes sir.
Q Officer, after you made your tests or after you recorded the results on your exhibit here, you then apparently ceased to use that machine, correct? In other words you shut it down or turned it off?
A Yes sir.
Q You don't use it constantly, do you?
A No sir.
Q It's not on and off?
A No sir.
Q I mean it is on and off?
A Yes sir. Right. We unplug it.
Q Now you stated this is in a particular location and because of the location that your machine is in, it requires a longer warm-up, is that right?
A Yes sir.
Q Apparently it's stored in some sort of colder room or exposed to lower temperatures?
A No. It's the area of the building in a room with no windows that makes it—there is a little less heat back there.
Q And this operates on an electric current correct?
A That's correct.
Q And is it used by any other officers other than the Small County officers?
A There is one highway patrolman that has authority to use it who has been certified.
Q So there are four operators right or were there six operators?
A Yes sir.
Q At this time?
A Yes sir.
Q And each operator is responsible for the care and maintenance of the machine at each and every use, is that correct?
A Yes.
Q The chemicals that you use are not compounded by you, correct?
A That's correct.
Q You have no opinion or you have no information as to what strength they are compounded at or whether or not they are accurate?
A Other than they are certified to us by the State.
Q Well certified. Now you used the term hearsay. Isn't that hearsay?
A Yes sir. I suppose you could—
Q Because somebody told you they did something doesn't necessarily mean it was done.
A That's correct.

Q So you have these chemicals that you used and are supposed to be mixed and checked to be accurate or made in the proper strength.

A Right.

Q And all you do is pick up the test ampoule and check to see whether or not there is enough in it or not. You look at it to see what the fluid level is?

A I first wipe off the ampoule and then I gauge it.

Q Now does it say anything about wiping off the ampoule on your test record?

A No sir.

Q Officer, it's fairly routine to you on this point, isn't it, in giving a test?

A No sir. I would say not. You mean by memory?

Q Yes?

A No sir.

Q So you have to follow this checklist each and every time?

A Yes sir.

Q But it doesn't become a routine-like habit with you? I mean you don't know what step to take until you look at what's on the checklist?

A Right. I always refer to it.

Q And you always follow what the checklist says?

A That's correct.

Q But the checklist doesn't have anything about wiping off the test or sample ampoule does it?

A Yes sir—no sir.

Q So that apparently isn't important?

A Yes sir, it is. Once I pick it up my fingerprints are on it.

Q Are all the steps on here important in the operation of the machine?

A Yes they are.

Q But some aren't included. Some of the important steps apparently aren't included?

A No sir.

Q And you have a specific recollection that at 1122 on the night of November 2, 1973 that you wiped off the test ampoule that you were going to use in the test conducted on Mr. Green?

A Yes sir.

Q Officer, aren't you really testifying as to what your habit is or routine that you usually wipe of the ampoules?

A Sure. Each one I wipe off.

Q But each one doesn't necessarily mean each particular time you followed your routine does it?

A Pardon me?

Q You're not trying to convince the jury that you actually remember specifically each and every time you pick up an ampoule that you wiped it off?

A Very definitely.

Q You do remember that?

A Yes.

Q Because it's very important?

A I think it is.

Q But not important enough to keep on a—or make part of a checklist?

A No sir, because not each operator pulls it out the same way.

Q So apparently then there is some method or discretion in the manner in which an operator operates a machine or gets a test result?

A No sir.

Q Well you just told us that each—it depends upon how each and every operator takes the machine or operates the machine, that—

PROSECUTOR: Objection. That's not a correct characterization of the witness' testimony.

THE COURT: Objection sustained.

BY DEFENSE:

Q My question more properly should be, it's your testimony that each and every operator takes the ampoule out of the machine in a different manner?

A Out of the carton and into the machine.

Q Wouldn't you concede officer, that that's a different method of operation?

A No sir.

Q They all do it the same, but some do it differently?

PROSECUTOR: Objected to again as not the witness' testimony and arguing with the witness.

THE COURT: The objection is sustained.

BY DEFENSE:

Q Now officer, the needle that you use or what you call the blood alcohol pointer is a freely swinging—it swings up and down doesn't it?

A Freely?

Q Yes?

A I don't quite understand your question.

Q Well the needle itself has to move doesn't it?

A By the balance wheel.

Q So you move that anywhere you want to move it, correct?

A That's correct.

Q And then you stamp the record or what you have got on here as a record by pressing down on the needle, correct?

A Yes sir.

Q And you can press that down any place you want to press it, correct?

A Yes sir, I could.

Q So there is no sort of fail-safe mechanism on the Breathalyzer, is there?

A No sir.

Q So there—so the operator can put it in any place he wants to put it?

A Yes sir, he could.

Q And it has to travel apparently downward from its plane or its fixed position before it touches this paper, doesn't it?

A Yes sir.

Q And you press it with what, the pencil point or a pointer or your thumb?

A Finger.

Q You take a finger and reach out and push it down?

A That's correct.

Q And you attempt to push it down directly, not deviate either to the right or left, is that correct?

A That's correct.

Q Because if you deviate it you're going to have a slightly inaccurate test result, is that correct?

A Very slight.

Q Well, of course, that depends upon how far a thumb might slip or finger might slip?

A (No response.)
Pardon me. Was that a question?

Q Yes?

PROSECUTOR: Sounded like a statement to me.

DEFENSE: Well I'll save the statements until later.

THE WITNESS: Could you rephrase it please?

DEFENSE: Could the reporter read it back?

(Question read by the reporter.)

THE WITNESS: No sir. I don't agree with that.

BY DEFENSE:

Q Well you said that the result would only vary slightly depending upon how far a finger might move or a thumb might slip.
A Right.
Q Now your machine apparently didn't get up to 50 degrees centigrade did it?
A No sir. As I recall it was 49 degrees.
Q And after you gauge the ampoule you put it in the machine right?
A That's correct.
Q And you testified that you wiped if off because if you didn't wipe it off it might have some kind of effect on the result, correct?
A. It could, yes
Q But you wiped it off apparently holding it with one hand wiping it with another?
A That's correct.
Q And then did you also wipe off the sample ampoule?
A Yes sir, I do.
Q And as you break it you have to make sure that you don't spill any of the contents, don't you?
A That's correct.
Q And apparently you didn't regauge the ampoule after you broke open the seal?
A I did regauge it.
Q Does it say here on your checklist that you regauged the—
A Yes sir, it does.
Q Okay. And then you picked it up and inserted this bubbler into the ampoule itself didn't you?
A That's correct.
Q Which requires you again to hold or touch the ampoule?
A No sir. You just press down on it and the bubbler just inserts into the ampoule.
Q Now you didn't testify as to what steps if any, you took in preparation of the ampoule itself or strike that, of the bubbler, did you officer?
A No sir. It wasn't asked.
Q But that's important apparently to the safe conduct or good operation of the test to make sure that the bubbler is free of any contamination?
A Yes.
Q But the prosecutor didn't ask you that did he?
A No.
Q He overlooked it and you didn't think it was important?
A I wasn't asked.
Q So after you put the bubbler into the test ampoule, you then conducted what you call the room air blank?
A Yes sir.
Q And this machine is used only for the purpose of attempting to ascertain whether or not there is alcohol either in the breath or in the air or something that's injected into the machine for it to analyze, correct?
A Right.
Q So according to your result there apparently was some amount of alcohol or alcoholic fumes or something that reacted with that test solution to cause a reading, correct?
A Very possibly, yes.
Q Well you stated on direct examination that you got a reading of point 002?
A Um-hmm.
Q And that was just from apparently being let in the open air of this particular room?
A Um-hmm.
Q Or could it also be from some residual or check—chemical or residual alcohol maintained in the machine itself?
A No sir.
Q Left over from another test?
A No sir.
Q It couldn't because you purged it?
A Yes.
Q Because you're purging it with room air?
A That's correct.
Q But it's apparently subject to alcohol fumes if people have been drinking and come into that room?
A That I'm not aware of.
Q How else would you explain the fact there is a reading when you took the room air blank?

PROSECUTOR: Objected to again as going beyond this witness' chemical knowledge.
THE COURT: Overruled.

BY DEFENSE:

Q How would you get a reading?
A That I'm not aware of.
Q Now every suspect that's brought in that elects to take or is requested to take and furnish a sample uses this machine? All the officers use the machine, correct?
A The five or six that are certified.
Q And you said yourself that you conduct about 20 tests a month?
A Yes sir.
Q And do you conduct more or fewer tests than your fellow officers?
A About average.
Q So there is over 100 tests run through this machine?
A Some months there is, yes.
Q And the only way to cleanse or flush out that machine is to use the room air to flush it out before each and every test?
A Yes sir.
Q Now officer did you take out, after you made a room air blank, the test ampoule and reinsert another ampoule?
A No sir.
Q Why not?
A Because there wasn't enough tolerance to call for repurging.
Q But there was some apparent reaction in your test solution? And into this contaminated solution you asked Mr. Green to furnish a sample of his breath?
A No sir. It wasn't contaminated to that extent.
Q Just slightly?
A Right.
Q And through this slightly contaminated solution you asked him to give you a sample, correct?
A Yes sir.
Q And then after you got the sample of Mr. Green or from Mr. Green you then used your, what you called a simulator, right?
A Yes sir.
Q And did you put in a new test ampoule?
A No sir.
Q And through this apparently more than slightly contaminated solution you ran your simulator?
A That's correct.
Q And it showed a reading of point one one?
A Yes sir.
Q Officer, on your test record you got it point one zero one and then it looks like a decimal point one.
A Should be a zero point one one.

Q Did you make a mistake in recording the result?
A No sir.
Q Do you want to look at it?
A Sure.
Q Is that a decimal point there between those two ones?
A No sir, not mine.
Q Somebody tamper with the record?
A No sir. It looks like a hole in it.
Q Before or after it left your custody?
A It was not in mine.
Q Do you want to examine that record closely now officer to see if there were any other changes or alterations?
A There are none.
Q That's all with the exception of this hole?
A Yes sir.
Q You're sure?
A Yes sir, it is.
Q Okay. Now officer, the room temperature or strike room—the recorded temperature for your simulator test seems to indicate that the machine had warmed up to 50 degrees centigrade by the time you took that test, correct?
A No sir, if I recall, you're reading the 50 degrees centigrade.
Q Yes, that's right.
A That was the temperature of the machine at the end of the test, not of the simulator.
Q So apparently by the time you finished the test it went up one degree?
A That's correct.
Q To 50?
A (No response.)
Q Officer, how long did it take you to commence preparation of your machine to make the room air run, the first test that you ran?
A From the initial time of plugging it in?
Q Correct?
A Approximately 45-50 minutes.
Q Do you know when Mr. Green first came into the Small County Jail?
A The time?
Q Yes?
A No sir.
Q You don't record that?
A No sir.
Q Now officer, you have been taught at the Bureau of Criminal Apprehension about the absorption rate in alcohol, correct?
A They indicated it on certain days, yes sir.
Q And there is what you call the blood alcohol curve, isn't there?
A That I'm not aware of. I'm not familiar with.
Q Well it's a graph isn't it, indicating the course at which the blood alcohol level of a subject after they have consumed a drink of alcohol and it begins and goes up and then reaches its peak and then comes down?
A They did show us such a graph, yes sir.
Q They did? All right. And you have been taught, officer, that it takes about half an hour to an hour, depending upon the individual before the alcoholic beverage is consumed or from the point if its consumption to the point of its highest reading?
A That I'm not familiar with.
Q Well it's just common sense, isn't it, that after you drink a drink it doesn't immediately show up on the so-called Breathalyzer?

PROSECUTOR: Objected to again as beyond the scope of knowledge of this witness and within the scope of knowledge of other chemists and experts that may testify.
THE COURT: Sustained.

BY DEFENSE:

Q You have never been instructed that it's essential to take a sample from a suspect as close as possible or as practical to his arrest, to make sure or to insure the reading's accuracy?
A Have they instructed me to do such?
Q Right?
A It has been mentioned in class.
Q But you couldn't get the sample from Mr. Green as quickly as you would have liked to because your machine wasn't plugged in.
A No sir. That's not correct.
Q Why didn't you take it more quickly?
A Mr. Green was not there.
Q Well officer, the officer was in communication with the Small County Sheriff's Office, wasn't he, by radio?
A No sir, he was not.
Q The highway patrol isn't in communication with your station?
A No sir, he's not.
Q Not, you mean on his radio?
A The highway patrol telephoned us.
Q So he calls into the highway patrol office who calls you, correct?
A Right.
Q So when you got that call you plugged in the machine?
A Yes sir, I did.
Q What time did you plug it in?
A I don't recall. I don't recall the time.
Q Was it plugged in when Mr. Green got there?
A Yes.
Q Was it already warmed up by the time he got there?
A No sir. It was warming up then.
Q And apparently it had to warm up from 45 to 50 minutes?
A Total time, yes.
Q So Mr. Green came sometime between that 45 to 50 minute period?
A That's right.
Q So you didn't have an opportunity apparently to get prepared, did you?
A Yes sir, I did.
Q Well now officer, now that you admit that the closer you take the reading or the test from the time that the suspect is apprehended, the more valid or — yes, the more valid the results are, correct?
A Bearing on his arrest right.
Q Because he can be either going up or he can be either going down?
A That's correct.
Q But because of the fact that your machine isn't connected all the time a suspect has to wait, doesn't he?
A No sir. He has to wait regardless for 15 to 20 minutes to be observed by the operator.
Q Regardless of whether the machine were—regardless of whether the machine has been warmed up or not you would have made him wait for 15 to 20 minutes before you gave him the test?
A That's correct.
Q Did you explain to Mr. Green why he had to wait?
A Yes sir.

Q What did you tell him?
A I explained to him for the purposes of having had drinks we wanted to be sure—we wanted to be sure they were all in his bloodstream as it should be and there is nothing in the mouth recently that night.
Q So you wanted to wait for any alcohol that might have been in his stomach to get out into his bloodstream, is that right?
A That's the proper way.
Q You answered yes to that question didn't you?
A Yes sir.
Q Officer, I asked you how long it took to run the room air blank or room air test from beginning and after your machine was warmed up to 49 degrees centigrade. How long did it take before you get a reading?
A Of the subject?
Q No, no, the room air blank?
A I suppose it would be approximately five to ten minutes, whatever it says on the checklist here.
Q I thought, officer, that you had a specific recollection of what happened the night of November 2 about 1030 or eleven o'clock?

PROSECUTOR: Objected to as argumentative.
THE COURT: Overruled.
THE WITNESS: Yes I do.

BY DEFENSE:

Q But you can't remember whether it was five or ten minutes and you have to look at that sheet there to remember whether or not or what the time interval was?
A The times I would have to look at, yes.
Q Isn't it important officer, that the amount of time necessary for the machine to analyze? Isn't that a critical factor?
A Yes sir. That's why it's timed on there.
Q So the longer you allow these chemicals to react, the higher the reading you're going to get, aren't you?
A No sir.
Q So after the first room air sample was taken it was about five to ten minutes to Mr. Green's sample. How long did that take for his sample to be analyzed, from the time that you prepared the machine, through shutting it down or completing your sample of him, shutting it down I mean as to him, before you got your reading?
A His test actually takes a minute and a half.
Q All right. And then the third test with the simulator, how long did that take?
A From the subject or actual simulator test?
Q Actual—no—by subject, the subject was a glass bottle wasn't it?
A No. Were you referring—
Q We're talking about the simulator?
A You're to the simulator?
Q I asked you how long it took to do the simulator test?
A The simulator takes a minute and a half also.
Q Officer, have you had any idea or do you have any idea as to the size or the volume of breath that your machine analyzed that night in comparison to the amount of blood that would be analyzed?
A No sir.
Q Could you concede officer it's extremely minute?
A The amount of air?
Q Well, converting it to blood it would be extremely—an extremely minute quantity of blood?
A Yes sir.
Q Officer, have you been taught that there are other substances that would cause the chemicals in your machine to react, other than alcohol?
A Yes sir.
Q What other substances would cause a reaction?
A As I recall, there was a certain type of mouthwash that might affect the chemical.
Q Anything else?
A Cigarette smoking may have some effect on it.
Q Anything else?
A That's about it.

DEFENSE: I have nothing further.

REDIRECT EXAMINATION

PROSECUTOR:

Q Officer, you indicated that you waited 15 to 20 minutes for the test. Have you been instructed to do this?
A Yes sir.
Q And what do you watch for during that 15 to 20 minute period?
A To be sure that the party taking the test or that will be taking the test has nothing in his mouth or puts nothing in his mouth.
Q Would this include things like mouthwash and the cigarettes you mentioned on questioning by counsel?
A Yes, that's correct.
Q And I believe I asked you this, but did you see Mr. Green put any cigarettes or mouthwash in his mouth or any other substance during that 15 to 20 minute period?
A No sir, nothing at all.
Q Now you also stated, in response to counsel's question that you could push the needle down anyplace you wanted to. Can you tell me whether you pushed that needle down or where you pushed it down in connection with the test of Mr. Green?

DEFENSE: Objection; self serving.
THE COURT: Overruled.
THE WITNESS: At point 16.

BY PROSECUTOR:

Q And how did it happen that it's pushed down at that point?
A Well we balance the machine according to the amount of alcohol in the sample taken.
Q So that in fact is the result of the test taken?
A Yes sir, that's correct.

PROSECUTOR: That's all the questions I have.

RECROSS EXAMINATION

DEFENSE:

Q Officer, are you quite certain that the defendant didn't place anything into his mouth?
A Yes sir, I am.
Q I guess that you were preparing this machine and taking these samples and directing your attention very closely and very scrupulously to the following of the operational checklist, weren't you?
A Yes sir.
Q But on the other hand it's your testimony that not only were you scrupulously paying attention to the preparation and operation of the machine; that you were also watching the defendant too?
A That's correct.
Q So it was a situation of having one eye on each?
A The corner of the eye.

Q Now wouldn't it also result in an inaccurate reading if the defendant had in any way brought up any stomach gas or regurgitated in any way?

A Yes sir.

Q And I suppose you could see that out of the corner of your eye, too?

A Yes sir.

Q Thanks officer.

THE COURT: Do you have any other questions?

BY PROSECUTOR:

Q Where was the defendant in relationship to you when you were preparing the machine during that 15 to 20 minute period?

A Two feet to the right of me.

PROSECUTOR: That's all the questions I have.

DEFENSE: Just one second.

Apparently this test record is being offered in evidence, is that right? It hasn't been received, although it's been referred to. I take it you want to offer it in evidence at this time?

PROSECUTOR: I thought that I had offered it and the Court received it.

THE COURT: Well but if you wish to offer it in evidence it would have to come in as an ordinary business record I take it. We know this man prepared it, but there would have to be some testimony on where the record is kept and if it's kept in the ordinary course of affairs you know.

REDIRECT EXAMINATION

BY PROSECUTOR:

Q Officer, will you tell the Court where you kept that record up until that time you delivered it to me?

A This is kept in the Small County Jail in the desk where the Breathalyzer is kept.

Q And are all the records of a similar nature kept there?

A Yes sir, they are.

Q And every time you run a test do you keep such records?

A Yes sir, we do.

Q And you got that today and delivered it to me this morning, is that correct?

A Yes sir. I picked it up last night while on duty.

PROSECUTOR: That's all the questions I have.

DEFENSE: Are you offering it at this time?

PROSECUTOR: Yes. I offered it previously and I'll offer State's Exhibit A.

THE COURT: Okay. Any objection?

DEFENSE: Same objection.

THE COURT: Objection overruled—received.

RECROSS EXAMINATION

DEFENSE:

Q There is nothing left from this test other than the record that you say that you kept? And the things that you have written down?

A Yes.

Q And the test ampoule is gone?

A Yes sir.

Q And would you concede there is no way of checking or corroborating the test?

A That's correct.

Q Okay, that's all.

PROSECUTOR: I have nothing further.

THE COURT: Okay. You may step down.

COURT DECISIONS REGARDING BREATH TESTINGS

1. **State vs McWhite** - Blood test must be offered in addition to breath or urine tests. 1970
2. **State vs Cornelius** - Blood, Breath and Urine tests can all be offered at the same time. 1971
3. **State vs Lauseng** - If defendant is unable to give a sample of **his** choice, he must take an alternate test. Example - if a urine test is chosen and person cannot comply, then he must give either a Breath or Blood test. 1971
4. **State vs Schlief** - A guilty plea is 'reasonable grounds' for refusal of testing. Cannot invoke Implied Consent Law. 1971
5. **State vs Palmer** - (a) Defendant does **not** have constitutional right to consult attorney before test.
   (b) Once refusal of any of three tests has been made, the defendant does **not** have the right to change his mind.1971
6. **State vs Quinn** - Breathalyzer results are admissable as evidence without the need for expert testimony, (BCA personnel), providing the operator conducted the test properly, (following checklist). Court is to take judicial notice of Breathalyzer as an accurate testing device. Prosecution should know this and make the court aware of this decision. 1971
7. **State vs Andrews** - Refusal to take a chemical test is **not** admissable as prosecution evidence. 1974
8. **State vs Becky** - Miranda warning should be given **after** subject has been asked to take a chemical test. Miranda does not apply to a 'yes' or 'no' answer to a request for a test. 1971
9. **State vs Cormican** - If officer does not actually see subject driving vehicle, subject can only be charged with 'being in physical control,' if he is in a car and keys in ignition. Cannot be charged with 'operating a vehicle.' 1972
10. **State vs Harris** - Implied consent can be invoked if there is probable cause subject was operating the vehicle. 1972
11. **State vs Andrews** - Refusal of test not admissable in DWI trial. 1973
12. **State vs Prideaux** - You must inform the defendant of his right to counsel prior to his decision to take or refuse a test. (Reverses State vs Palmer, Subd. a) 1976
13. **State vs Anderson** - Insisting on urine test on advice of counsel is not valid for refusal of testing. 1976
14. **State vs Wiehle** - The license of an unconscious driver can be revoked under the implied consent law if the conditions of State vs Overing are met (1979)
15. **State vs Niemi** - (10th Judicial District) Officer may proceed with implied consent processing after the permitted telephone call even if his attorney told the officer that he would be at the police station in twenty minutes (1981)

OPTIONAL READING AND REFERENCES

CHAPTER IX

THE PHARMACOLOGY OF ALCOHOL AND ITS RELATIONSHIP TO DRINKING AND DRIVING

Leon A. Greenberg[1]

With the growing use of motor vehicles for commercial, occupational and recreational purposes on expanding miles of highways, the destructive consequences seen to result from the combination of driving with drinking alcoholic beverages, continue to pose an increasingly provoking problem. It is both a behavioral and a pharmacological problem, complicated by the interaction of the two; it is a sociobiological problem.

It is a social problem because performance in both drinking and driving, separately and in their combination, is considerably influenced by their occasion, purpose and social context. It is a social problem in the sense that of some 90 million people in this country who drink, 80% to 90% drive. Tens of millions of people drive with some alcohol present in their bodies, and do so repeatedly, and will undoubtedly continue to do so. Furthermore, there are among these people many kinds of drivers and driving and many categories of drinkers and drinking. While gross impairment inevitably and undeniably occurs with sufficiently high levels of alcohol in the blood, the relative extent to which lower levels are seen to be involved in traffic violations and accidents is highly relevant to any realistic steps toward solution of the problem. If alcohol-involved traffic offenses are limited largely to categories of drinking drivers with high blood alcohol levels, as might be the case, the negative or even hostile public attitude toward sweeping restrictive action directed at all drinking drivers becomes another social problem.

The problem is a biological one in that it involves the pharmacological action of alcohol on the central nervous system and related bodily functions. Because of the obvious intoxicating drug action of alcohol, as commonly seen after larger amounts are consumed, efforts to deal with the problem have been centered largely around the pharmacological aspects of alcohol deemed to be relevant to driving, and with clinical and chemical techniques for the diagnosis of alcohol-caused impairment. These efforts have resulted in much research in the fields of physiology, pharmacology and biochemistry, dealing with such matters as how alcohol is absorbed into the body, how it is distributed in the body, how it is destroyed and eliminated, and the effects of different amounts on various bodily functions and performance considered to be pertinent to driving skill. The efforts have resulted in the development of sensitive chemical analytical techniques and ingenious devices for assessing the alcohol content in the body to implement the enforcement of control programs. The present discussion will be limited to these biological aspects of the problem. It will review some major features of current knowledge and indicate new relevant questions which this knowledge suggests.

1. ABSORPTION OF ALCOHOL

The important pharmacological effect of alcohol relevant to driving is its action on the central nervous system, distorting some of its normal functions. To exercise this effect, ingested alcohol must first be absorbed from the alimentary tract into the blood stream and thus transported to the site of its action in the brain. The intensity of this action of alcohol is proportional to its concentration in the circulating blood. The absorption of ingested alcohol is not instantaneous and therefore, its full effect does not immediately follow drinking. During the time of absorption, the concentration of alcohol in the circulating blood rises until the maximum level is attained. Thereafter, the level of alcohol in the blood and body declines due to its elimination and destruction in the body.

The time required for ingested alcohol to be completely absorbed may vary from less than an hour to several hours, depending on a variety of factors. The greater the amount ingested, the longer it will take for all of it to be absorbed. Alcohol is absorbed more rapidly from diluted beverages than from stronger ones. Retention of the stomach contents under conditions of emotional tension or gastric distress may also delay absorption. But probably the most common factor influencing the rate of alcohol absorption is the nutritional state of the stomach. The presence of food in the stomach exercises a profound effect in delaying the absorption of ingested alcohol. This effect of food is seen in the common experience that one or two drinks taken on an empty stomach often produce a more rapid and noticeable effect than if consumed during or shortly after eating. The tradition of having the cocktail party before dinner is not without rationale; each drink goes a lot further.

With the prolongation of absorption, due to any cause, the maximum level of alcohol in the blood will be attained later and will be lower. The reason for this lies in the fact that alcohol is being eliminated from the body during the period of absorption. These features are demonstrated in typical blood alcohol curves shown in Figure 1 following the ingestion of the same amounts of alcohol on an empty stomach and after eating. Without food in the stomach, the amount of alcohol consumed is completely absorbed and the maximum level is attained in the blood in one hour. About 15 minutes after ingestion of the alcohol, its level in the blood is only half of the maximum. With food in the stomach the maximum level of alcohol in the blood is not attained until two hours, and is considerably lower than that obtained without food.

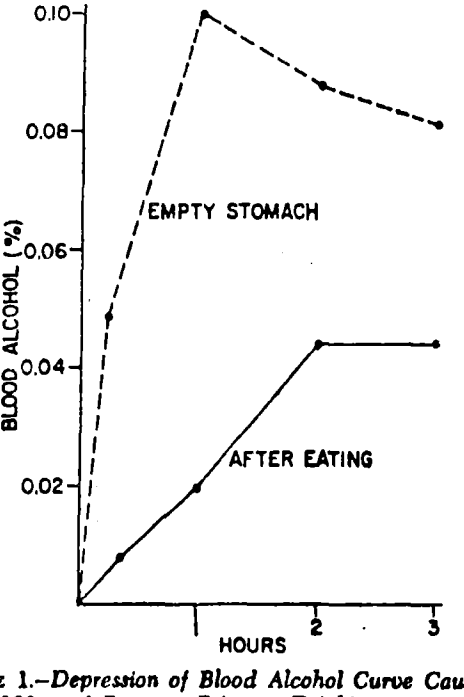


FIGURE 1.—*Depression of Blood Alcohol Curve Caused by Eating 1100 g of Potatoes Prior to Drinking.* [From Tuovinen (1, p. 70).]

The time required for the absorption of ingested alcohol and its variability may have some important implications, both in the medicolegal application of chemical testing to the drinking driver and in the validity of statistical generalizations drawn from police records as to the frequency of traffic violations and accidents at various levels of alcohol in the blood. In its normal use by police, the chemical test is usually performed some time after the occurrence of the violation or accident. If the drinking preceded the driving by a relatively short time, the level of alcohol in the blood when the police first intervene may be considerably lower than at the time of chemical testing. The level of alcohol in the blood presumed to have existed at the time of a driver's apprehension may thus be significantly overstated. An example of this possibility may be seen in Figure 1. Even when the stomach is empty and absorption is most rapid, the blood alcohol content of a driver 15 minutes after drinking, may be half that 45 minutes later when a chemical test might be conducted. With food in the stomach, the discrepancy may be even greater. Similarly, the relative number of traffic offenses and arrests actually occuring at a lower level of blood alcohol may, as judged from police records, be underestimated. In view of these features of alcohol content and driving performance would require chemical testing at the time of performance. While this condition is generally met in laboratory experiments and in occasional experimental traffic surveys, it is lacking in usual practice by police, whose records are often the basis for individual prosecution and statistical generalization. This lack can be obviated by the development of appropriate and practical analytical techniques or devices.

2. DISTRIBUTION OF ALCOHOL IN THE BODY

Following its absorption from the alimentary tract, alcohol is quickly carried by the circulating blood to all the bodily tissues where it is temporarily stored in the water of the tissues until it is removed gradually by metabolic destruction and elimination. The extent of the effect of alcohol, as of any drug, is determined by its concentration at the site of its action. The concentration of alcohol in the body as a whole is, of course, equal to the total amount present in the body divided by the body weight. But since alcohol is dissolved uniformly in all of the water in the body, the concentrations in each of the various bodily tissues differ in proportion to their water content. Brain tissue is not readily accessible for analytic diagnostic purposes, except post mortem, but the brain is so richly supplied with circulating blood that its relative alcohol content is closely reflected in the blood alcohol level.

Since the percentage of water in the blood is about 1.4 times that in the body as a whole, the concentration of alcohol in the blood is equally greater than that in the body as a whole. Thus, if a person weighing 70 kg (154 lb) has in his body 70 g of alcohol (about 7 oz. of whiskey), the concentration of alcohol in the body as a whole will be 0.10%. The concentration in the blood will be 1.4 times this or 0.14%. An ounce of whiskey present in the body of the above person will produce 0.02% of alcohol in the blood. For any given amount of alcohol in the body, the concentration in the blood will obviously vary inversely with the weight of the drinker; with half the body weight, the concentration will be approximately double; with twice the body weight, the concentration will be half.

Knowledge of this relationship between the total amount of alcohol in the body and its concentration in the blood is most useful in research and in clinical and forensic application. While the factor of 1.4 varies somewhat among individuals due to some variation in the relative amounts of water in the body as a whole and the blood, it does allow reasonably accurate estimation of the blood alcohol level that will occur from various amounts consumed. Chemical testing of the blood provides an assessment of the minimal amount of alcoholic beverage that must have been consumed—an amount that the apprehended drinking driver is often prone to understate grossly.

3. DISAPPEARANCE OF ALCOHOL FROM THE BODY

Once ingested alcohol has been absorbed into the body tissues, it starts to undergo destruction by biological oxidation and elimination, mainly through the breath and urine. Approximately 90% is destroyed by oxidation and 10% is eliminated unchanged. The rate at which alcohol disappears from the body through these combined channels, may be expressed in terms of the actual amount lost each hour per unit of body weight. In human beings, it has been found to average about 0.10 g of alcohol per Kg of body weight each hour. In a person weighing 150 lb., this amounts to an hourly disappearance of about two-thirds of an ounce of whiskey. This rate of alcohol loss from the body for each unit of body weight amounts to an hourly decline of 0.015% of alcohol in the blood regardless of body weight. Although this rate of alcohol disappearance from the blood (after absorption is completed) varies somewhat among individuals and under different conditions, the variations are so small that the average value may safely be used for clinical and medicolegal purposes. Contrary to some common beliefs, the dissipation of alcohol from the body is not significantly hastened and inebriety, thereby diminished through such maneuvers as exercising, inhaling pure oxygen, taking drugs or drinking black coffee.

4. EFFECT OF ALCOHOL ON DRIVING PERFORMANCE

With the view that impairment of driving performance by alcohol is attributable to its effects (by way of its action on the central nervous system) upon the sensory and motor functions considered to be involved in the mechanical acts of driving, the earliest, and by far the largest amount of drinking and driving research was concerned with the impairing action of various amounts of alcohol on such isolated functions. These functions included a wide variety of phenomena such as reaction time, muscular coordination, sensory perception and discrimination. All the researches demonstrated clearly that with sufficient amounts of alcohol, sensitivity is reduced, reaction time is slowed, ability to discriminate is diminished, digitaldexterity is reduced, auditory and visual discrimination and judgment fall away, tactile perception is lowered, and speed of motor response drops.

Since the marked depreciating effect of alcohol on performance of these functions, in gross and obvious states of drunkenness, hardly required experimental affirmation, most of the researches were primarily concerned with the question of the minimal amounts of alcohol consumption and the lowest levels of alcohol in the blood at which impairment begins. Impairment of performance was seen in some individuals at concentrations of alcohol in the blood even below 0.05%, and in virtually all individuals with concentrations above 0.10%

The researches have in most instances, been of high quality and have enhanced basic knowledge about the impact of different amounts of alcohol on various individual bodily functions. One can hardly take issue with the conclusions that relatively small amounts of alcohol may perceptibly impair some of these isolated functions under the conditions of laboratory performance. On the other hand, the relevance of such degrees of impairment to the quality of performance in the complex context of actual driving is still to be determined.

In consideration of the uncertain relationship between impairment of individual functions as tested in the

laboratory situation and impairment of total performance in the actual driving situation, research in the field of drinking and driving turned to other media of investigation. Instead of single functions, total performance of experimental subjects operating simulated driving machines, such as the Link Trainer, and negotiating actual driving courses equipped with experimental obstacles, was the object of assessment after administration of various amounts of alcohol. In these studies, too, measurable decrement of performance was demonstrated at levels of alcohol in the blood even well below 0.10%.

While some of the behavior studied in these experiments was relevant to total driving behavior, the experimental conditions were still quite different in many respects from those of the actual driving situation on public highways. They differed, for example, in the driver's perception of and response to such features as the purpose of the performance or the rewards or penalties connected with the quality of the performance. It is difficult to assess to what extent the performance by such experimental drivers may be influenced by their preconception of what the drinking should do to their driving.

The most direct and perhaps the most valid indicator of the impairment imposed on actual driving by various amounts of alcohol would appear to be in the measure of the consequences of driving after drinking, such as traffic violations, accidents and fatalities.

Although traffic violations and accidents do occur without alcohol, differences in the frequency of such events in drivers with various amounts of alcohol in the blood and those with no alcohol should provide valid measures of the role of alcohol. The relative accident frequency among such populations can furthermore be assessed indirectly by a comparison of the occurrence and distribution of various blood alcohol levels as between the accident-involved and noninvolved driver population. The two populations must, of course, be matched with respect to other variables such as road conditions, weather and other features which may seriously affect accident occurrence. Pursuing such an approach to the question of alcohol effect on driving performance, data concerning blood alcohol levels among drivers involved in traffic accidents, obtained from police and medical examiner reports, were studied. The findings of such earlier studies in four cities whose police records included information on the blood alcohol content in accident-involved drivers taken to hospitals or morgues are shown in Table 1.

The category designated as 'had been drinking' included those whose blood alcohol content was less than 0.15%; 'under the influence' included those with 0.15% or more. These police records provided no information about blood alcohol levels in nonaccident-involved drivers; consideration of other variables affecting driving performance was lacking; and only two broad categories of blood alcohol content were considered in these studies. In connection with one study (Evanston), however, a comparison experimental survey was made of the percentage of nonaccident drivers with blood alcohol levels of 0.15% or more. There were 33 times as many in this category among the accident-involved drivers as among the controls.

Notwithstanding their shortcomings, such studies did indicate strongly that among drivers with high levels of alcohol in the blood (0.15% or more), the frequency of accident occurrence is many times greater than among drivers with no alcohol; a conclusion that is beyond dispute today. But as a basis for assessing the adverse effect of various levels of blood alcohol content on driving performance they offer wholly inadequate information; they do not allow a quantitative expression of the progression of impairment with increasing blood alcohol content, particularly at low and moderate levels.

A few subsequent experimental traffic surveys and studies, incorporating better experimental design and control, sought to obviate this lack. The most recent and carefully designed one was conducted in 1964 in Grand Rapids, Michigan (3). Through measurements of blood alcohol levels in both an accident-involved and a control driving population, matched with respect to exposure (time, place and conditions at the time of the accident), the relative probability of causing an accident was calculated with levels of alcohol in the blood from zero to over 0.16%. The curve representing the progression of this probability is shown in the article by Zylman, (4) in the present **Supplement.**

The relative probability of causing an accident when no alcohol is present in the blood is necessarily '1.' As the blood alcohol level increases, a unique phenomenon appears to occur. The probability of causing an accident appears to diminish slightly until a minimum is reached at the level of 0.03%. The reason for this decrease remains uncertain. Other than the possibility that this phenomenon represents an artifact in the design of the survey or a unique quality of the population tested, the phenomenon suggests that in the context of actual driving performance, blood alcohol levels below 0.05% may affect favorably elements in the performance other than those which research has shown to be affected adversely by such blood alcohol levels. Study of this phenomenon offers the possibility of learning more about all of the elements involved in driving performance and the effects of alcohol upon them and their interaction.

With blood alcohol levels at 0.04% or 0.05%, the probability of causing an accident is not different from that with no alcohol. For a person of average size, this amounts to the consumption of about two cocktails or bottles of beer. Such moderate use of alcohol does not appear to be inconsistent with traffic safety under the conditions of the survey. Above this level, the probability of causing an accident rises increasingly and rapidly. At 0.10% alcohol in the blood, the probability becomes 6 - or 7-fold; at 0.15% it is more than 25-fold.

For the purpose of establishing the most realistic legal mandates concerning the minimal levels of blood alcohol at which drivers may be considered to be operating unsafely, further knowledge as afforded by such well-designed and conducted studies as the Grand Rapids one is essential. All of the scientific evidence indicates that above 0.05% alcohol in the blood many individual functions may suffer some impairment, experimental driving performance depreciates, and the probability of traffic accident causation increases with rising blood alcohol levels. But the levels at which to draw lines of legal mandate about drinking and driving are something more than just a pharmacological question. In view of such consideration as the categories of blood alcohol levels as well as the categories of driving in which the major part of the problem prevails, and the public response to unrealistic sweeping restrictive and punitive legal regulations, the question is also a social and epidemiological one. However, these matters must be dealt with in contexts other than the present discussion.

TABLE 1.—*Percentage of Accident-Involved Drivers Who "Had Been Drinking" (BAC<0.15%) or Were "Under the Influence" (BAC 0.15%+) in Four Cities**

Location of Study	*<0.15%*	*0.15%+*
Evanston, Ill.	38	21
Uniontown, Pa.	48	37
Cleveland, Ohio	56	38
New York, N. Y.	51	42

* From Berry (2, p. 335)

5. CHEMICAL TEST LAWS

Notwithstanding the fact that drinking and driving is a complex biological and behavioral problem whose most effective handling involves interdisciplinary social as well as pharmacological considerations, the amount of destructive consequences of alcohol-impaired driving, seen increasingly with the growing volume of road traffic, demanded some degree of immediate control. 'Drunken driving' laws had long existed in most jurisdictions in this country. But their enforcement required convincing evidence that the driver's appearance and behavior were those of gross intoxication, a requirement that often could not be met in many whose driving performance was, nevertheless, seriously impaired by alcohol. Another dimension was needed to implement legal mandates against drunken driving.

Such a dimension was apparent in the development of research into the pharmacological effects of alcohol and the magnitude of these effects in relation to blood alcohol content. For some years this research almost exclusively represented scientific inquiry into the problem of drinking and driving. Study of the problem and its control as a social and complex behavioral as well as pharmacological phenomenon was all but absent. Although many of the pharmacolgical findings were of questionable relevance to actual driving performance, and none contributed more than a fragmentary view of the total problem, they were avidly taken as a basis for expanded legislative enforcement and punitive action. Chemical-test laws were added to the existing statutes against drunken driving. It should be pointed out that this implementation of the law has merely had the effect of refining and strengthening its enforcement; it has contributed little to a more comprehensive view of the multiple facets of the problem from which effective control may ultimately emerge.

With the introduction of chemical-test laws and, in connection with these, the substitution of the concept 'under the influence' for 'intoxication,' the first question to be asked was at what level of alcohol in the blood is a driver 'under the influence' so far as operating a motor vehicle is concerned? This question was submitted in 1938 to technical committees of the American Medical Association and the National Safety Council as a basis for formulating medicolegal blood alcohol test standards. The term 'under the influence' as applied to a driver was taken to mean that the ability to operate a motor vehicle is in some degree lessened by alcohol. The committees jointly recommended the use of three categories of blood alcohol levels in formulating chemical test standards to be applied to suspected drivers:

1. A blood alcohol content from 0 up to 0.05% by weight should constitute prima facie evidence of sobriety.
2. A blood alcohol content from 0.05 and up to 0.15% by weight should have no prima facie value, but could be used as evidence in conjunction with other symptoms for prosecutory purposes.
3. A blood alcohol content of 0.15% or more by weight should constitute prima facie evidence of being 'under the influence.'

Recognizing that no one point in the blood alcohol scale can be designed above which all drivers are 'under the influence,' and below which no driver is 'under the influence', the middle category, in which some drivers may be 'under the influence' and others not, was considered to allow for individual variations in susceptibility to alcohol.

These recommended standards were virtually unanimously adopted and incorporated into chemical-test laws. But as more information has emerged from further research, particularly in the study of alcohol and traffic accidents, further refinements in these standards have been advocated and innovated. In a number of present chemical test statutes, blood alcohol contents of 0.10% to 0.15% are considered to constitute prima facie evidence of 'impaired driving,' a lesser degree of 'under the influence.'

Needless to say, as the entire blood alcohol scale is divided into more and narrower categories, each with its separate legal implications and penalties, the burden of precision placed upon chemical testing becomes more than the presently used police techniques can sustain. With increasing multiplicity of such categories the adequacy of allowance for acknowledged individual differences in susceptibility to alcohol becomes increasingly questionable. Such conditions can lead only to more legal quibbling and court litigation. Whether and to what extent the present legislative, enforcement and punitive chemical-test programs alone are achieving resolution of the drinking-driving problem still remains to be determined by appropriate research.

CONCLUSIONS

A public problem may best be defined in terms of its magnitude and nature. The frequency of occurrence of particular undesirable phenomena describes the magnitude of the problem, for it is this frequency which gives it the dimension of a 'problem.' The populations or circumstances in which the problem-provoking phenomena predominate characterizes the nature of the problem, for these indicate the conditions for their occurrence and suggest the appropriate directions of preventive action.

In the problem of drinking and driving, the provoking phenomenon is the number of traffic accidents considered to be caused by alcohol-impaired driving performance. The amounts of alcohol involved in these events are not germane to the question of magnitude as defined by the number of alcohol-involved accidents. Whether this number is incurred by a large population of drivers with blood alcohol levels less likely to cause accidents or a small population with higher blood alcohol levels more likely to cause accidents is irrelevant to this question. On the other hand, if the accidents are incurred mainly by drivers with certain categories of blood alcohol content, knowledge of this will better identify the problem and the important targets for preventive action. Such knowledge is lacking. Many experimental laboratory researches have demonstrated the impairment of some functions by alcohol, and traffic studies have already provided some indication of the probability of accident causation by various amounts of alcohol. But the question of the particular segments of the drinking-driver population, with respect to the magnitude of their blood alcohol levels as well as other characteristics, in which the problem may mainly lie, remains to be explored through appropriate research. Such research would surely describe the nature of the problem more definitively.

In considering the role of the pharmacological effects of alcohol in the problem of drinking and driving, the levels of alcohol in the blood at which the major part of the problem occurs is important. If the problem stems primarily from drivers with high blood alcohol levels it is one thing, if it results from lower levels it is another. The effects of different amounts of alcohol on total behavior of the human organism differ not only in degree, but also in kind. With extremely high concentrations of alcohol in the blood (about 0.40% to 0.50%) coma occurs; behavior is completely dominated by the anesthetic action of the drug. Such concentrations are obviously not involved in the problem since nobody drives in this condition. With lesser but intoxicating amounts of alcohol in the blood (about 0.15% to 0.40%) impairment of motor functions,

muscular coordination and sensory functions is so profound that, notwithstanding other elements underlying behavior, driving performance is seriously impaired. If the problem of drinking and driving centers around such blood alcohol levels, then it can be said that the pharmacological effect of alcohol is a dominant factor. With even lesser amounts of alcohol in the blood its pharmacological actions, though they may still be demonstrated, become increasingly less influential to the point of being obscured or superseded by other elements underlying behavior.

The role of the pharmacological effects of alcohol in the problem of drinking and driving, therefore, cannot be defined except in the context of some knowledge of where the problem lies. If the problem centers primarily around drivers with small amounts of alcohol in the body and the blood, then determinants of performance other than pharmacological and their interaction with alcohol must be explored. The abundant study of the physiology and pharmacology of alcohol — its absorption, distribution, elimination and pharmacological effects — as related to the subject of drinking and driving has so far outstripped research into other elements in the problem that it might profitably wait for the latter to catch up. In doing so it may, perhaps, perceive more effective application of its rich fund of facts to an understanding and solution of the problem.

REFERENCES

1. Tuovinen, P.I. Uber den Alkoholgehalt des Blutes unter verschiedenen Bedingungen. Skand. Arch. Physiol. 60: 1-134, 1939.
2. Berry, D.S. Alcohol and Traffic. In: Alcohol, Science and Society. New Haven; Quarterly Journal of Studies on Alcohol; 1945.
3. Borkenstein, R.F., Crowther, R.F., Shumate, R.P., Ziel, W.B. and Zylman, R. (Dale, A., ed.) The Role of the Drinking Driver in Traffic Accidents. Bloomington, Indiana University,Dept. of Police Administration; 1964.
4. Zylman, R. Accidents, Alcohol and Single-Cause Explanations; lessons from the Grand Rapids study. Quart. J. Stud. Alc. Supple. No. 4 pp. 212-233, 1968.

ABSTRACT:

The relationship of alcohol absorption and blood alcohol levels and its variability are discussed in connection with the medicolegal aspects of chemical testing of the drinking driver and statistical generalization of police records of such tests. Data on the rate of disappearance of alcohol from the body are presented and its use in the estimation of the blood alcohol concentration after various amounts of commonly used beverages is given.

Two types of drinking-driving research are currently being done; laboratory studies of the action of various amounts of alcohol on isolated functions involved in the act of driving which, up until now, has dominated the research and, the more direct approach to the problem, comparison of the frequency of traffic violations, accidents and fatalities among otherwise matched populations of drivers with and without alcohol in their blood. The relative probability of accidents caused by varying amounts of alcohol, suggested by the Grand Rapids study, is briefly discussed: With blood alcohol levels of 0.04 or 0.05% the probability is not different from that with no alcohol; at 0.10%, the probability becomes 6- or 7-fold; at 0.15% more than 25-fold.

Current drinking-driving research suggests that traffic accidents may be used as valid indicators of the drinking-driving problem. Much information is lacking, however, and some suggested areas of research are studies of the success of the present law enforcement and punitive chemical-test programs; of the particular segments of the drinking-driving population with respect to blood alcohol levels and other characteristics responsible for the problem; and of the role of the pharmacological effects of alcohol in the problem.

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DRIVING IMPAIRMENT THROUGH USE OF DRUGS

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Impairment of the mental and physical capabilities of the driver is not confined to the alcoholic beverages. Though alcohol is the well known and justly publicized culprit, other substances commonly embraced in the broad term, 'Drugs,' are also quite capable of causing a drunken or intoxicated condition, and are today presenting an ever-increasing problem to traffic enforcement.

To the average citizen the term 'drug' carries some connotation of a potent, illicit substance with which some persons are improperly associated. The term 'dope' is often thoughtlessly substituted for 'Drug.' Yet the growing problem in traffic is concerned with a host of substances in pharmaceutical trade and widely used in proper medical care. Some illegal use is naturally to be expected. Of these, we may mention the true narcotics embraced by the Harrison Act; the barbiturates; the tranquilizers; the anti-histamines; and the amphetamines. Increasing requests are made by the traffic officer and the prosecutor, of scientists for information and assistance to identify and deal with the drug-influenced driver. Compared with our available tools for dealing with the drinking driver, we have at present only very limited means of identifying and measuring the drug-impaired driver. However, our fund of knowledge is growing rapidly in this area.

In considering drugs, we must remember that only a very small amount is required to cause a pronounced effect, whereas some several ounces of alcohol are needed to yield a comparable intoxication. This in large measure defines the problem of detecting the drug in a specimen of blood or urine from a living subject. Drugs cannot be detected in the breath. Generally, this small drug quantity is only slowly destroyed or metabolized in the human body, so that rather extended effects are realized from dosages of one grain or less. By contrast, alcohol is generally destroyed at the rate of one-third to one-half ounce per hour!

A very important, yet treacherous, fact can overtake and even cause death in the unsuspecting who consume alcoholic beverages when they are taking sedative drugs. This drug-alcohol combination in many instances produces a mutual aid effect whereby each enhances the effect of the other, so that 1 plus 1 no longer make 2, but make 4 or 5 units of effect. This coordinated effect, known as synergism, has not only accounted for numerous accidental deaths, but has also given rise to the 'cheap drunk' accomplished with a bottle of beer and single pill or capsule of any one of several, readily available hypnotic drugs. The latter situation would require identification of both blood alcohol level and drug level to explain his condition. Obviously, a blood alcohol determination only would grossly underestimate his impairment. Frequently, it is only this inconsistency between determined blood alcohol level and the advanced impairment that raises a suspicion that drugs are involved.

Although chloral hydrate is a long-known, chemically simple substance that has enjoyed some popularity as 'knock out drops' for purposes of robbery or intrigue, its use presents no significant traffic problem, though it is a narcotic-type drug. It still finds limited use in medicine and is quite capable of seriously affecting driving ability. Numerous other potent sedatives constitute the major offenders and several groups will be considered here.

NARCOTICS

The term 'narcotic' is derived from the Greek word 'Narkoun' — to be numb, bring sleep. It is therefore a term that broadly defines the mode of action of drugs. Those substances defined as narcotics and embraced in the Harrison Narcotic Act are mainly opium, its derivatives, and the closely related, synthetic compounds. Among those we find morphine, codeine, dilaudid, ethyl morphine, heroin, demerol and dolophine. These are potent narcotics that require only very small dosage in the average person to produce diminished sensibility to such uncomfortable sensations as pain, hunger, and fatigue. Hence, they induce the pleasing sensation of emotional tranquility. Such mental functions as concentration, judgment and memory are disturbed as the subject becomes dreamy and drowsy with the exclusion of external stimuli. With this impairment, the driver fails to notice traffic signals, while speed and distance are only vaguely realized due to inattention and reduced visual acuity. Obviously, such a person is a great danger in traffic for the same basic reasons that the drinking driver is a menace.

Whether the driver is taking such drugs on his own, or by prescription of a licensed physician is not material, since his driving ability is affected either way. A duty therefore devolves upon medical practitioners to caution their patients of this effect when prescribing.

BARBITURATES

The barbiturates are synthetic derivatives of barbituric acid, and they are narcotic in their action. These substances are marketed in the form of tablets and capsules, with and without other drugs, and find wide use in medicine to calm nervousness and bring sleep. Sometimes, the hypnotic effect is preceded by excitement and behavior best described as inebriation.

In capsule form, they have found wide, illicit use and such names as 'red birds,' 'blue birds,' 'yellow jackets, 'goof balls', etc., were given by the promiscuous drug users as based upon the capsule color. Today, some distinctively colored and shaped tablets contain barbiturates compounded with other drugs. These enjoy a certain popularity also, and are not new in traffic enforcement.

The barbiturates may be grouped broadly into long-acting, and short-acting as based upon duration of effect. Some act promptly with a potent initial effect, and are then rapidly destroyed in the body to allow the subject to awake without the continued dizzy feeling caused by some of the long-acting members, while Pentothal and Seconal are examples of short-acting barbiturates.

Due to their wide popularity in medicine, together with general availability, there is widespread use, both lawful and illegal, of the barbiturates. It is not surprising to learn, therefore, that this group of drugs is most commonly encountered, next to alcohol, in dealing with the influenced driver.

These barbiturates all influence the driver by sedation, and, broadly speaking, cause much the same effect as alcohol. Taken with alcohol, the combination results in a very profound effect much greater than the simple arithmetic sum of the separate effects. This is especially dangerous.

TRANQUILIZERS

In the last decade we have been supplied with a newer, mild-acting drug group that has enjoyed wide popularity for the relief of nervous tension and anxiety. Annual consumption by the American public is expressed in tons rather than pounds. Such general use, when considered together with their sedative effects, naturally has brought them to the attention of traffic authorities.

The term 'tranquilizers' is applied to a number of compounds not especially related chemically but all having in common a mild sedative effect without clouding consciousness or inducing sleep when taken in small doses. Generally, they are muscle relaxants that affect some reflexes to relieve mental apprehension. They are often used in hypertensive cases (high blood pressure). The effect is largely on the attitude and outlook. But in larger doses, or together with other drugs or alcohol, more potent effects are noted that involve greater sedation to the stage of dizziness and drowsiness. It is apparent, then that the tranquilizers, too, present a danger where the driver is concerned to involve his critical reflexes and mental powers.

Perhaps the most often mentioned compound of this group is Meprobamate, also known as Miltown and Equanil, but a number of others are widely used, including Valmid, Parsidol and Reserpine.

ANTI-HISTAMINES

This family of synthetic drugs first gained popularity as a treatment for symptoms of the common cold. It is rather well established now that they have little if any affect on the course or symptoms of a cold. However, various compounds of this group have been found to be rather effective in the control of allergies and the attending symptomatic discomfort.

They are rather potent substances that act chiefly by sedation, causing inattention, confusion, and drowsiness. To quote from a well-known text on pharmacology by Sollman: 'This confusional state would dispose toward accidents in operating automobiles and other machinery.'

Allergies have been identified as quite common and responsible for many conditions heretofore termed as specific disease entities. They constitute a large fraction of medical practice and the anti-histamines form a major part of the corrective regimen. Such widespread use naturally presents the danger of a driver under the effects of an anti-histamine drug. To enhance this danger, these drugs are known to have erratic and unpredictable effects on many persons, so that the unsuspecting driver may be caught unaware. Caution should be a watchword regarding their use.

Although many compounds and trade names are common to drug trade, we might mention a few of the more common anti-histamines such as Benadryl, Dramamine (for motion sickness), Pyribenzamine, Phyrilamine, and Phenergan.

AMPHETAMINE

Though not related in their action to the sedative-type drugs thus far discussed, the amphetamines deserve some attention since they are often encountered among drugs appearing in the traffic problem. Of this group, benzedrine is the most common, with other closely related compounds frequently making their appearance because of similar effects. Since the free base, benzedrine, is volatile and acts as a decongestant in nasal membranes, it found considerable use in certain inhalers. Related compounds find use in the control of obesity, and in relief from fatigue and drowsiness.

Tablets and capsules containing this drug are often illicitly sold and find ready demand from truck drivers and others trying to avoid fatigue. Benzedrine compounds are also among the more common drugs much in demand by our prison population, and thereby present another specialized enforcement problem.

In addition to the action of relieving drowsiness and fatigue, the amphetamines obscure nature's danger signals of fatigue. The daily wear and tear on the human body necessitates repair through sleep and there is no substitute for the repair brought by rest and sleep. And though benzedrine relieves drowsiness and fatigue, it does not provide the needed body repair, but only relieves the uncomfortable symptoms of the fatigue to permit delay of needed sleep. The drug tends to increase mental alertness and facilitates the flow of thought, but at the **expense of concentration.**

A fictitious sense of self-confidence and well-being is common, and therein lies the same danger as in case of a driver in the earlier stages of alcoholic influence.

Much of the danger from the use of the amphetamines by drivers stems from excessive use where sleep is postponed by days rather than hours. Traffic officers report such descriptions as 'asleep with eyes open,' and little or no response to questions or other stimuli. Obviously, such persons have forced themselves to a state of physical exhaustion. But long before this extreme, like the effects of alcohol, the decreased attention to the process of driving renders the user less capable since his normal abilities are impaired. It is this criterion that renders the use of any drug a danger by impairing that driving ability which we would otherwise normally possess.

So many of the drugs in common use today are of the sedative types here described, while many others have such effect as a side reaction, that it can be recommended as a general safety measure, namely, that danger lies in the use of drugs by the driver in modern traffic. Hence, the use of drugs holds much the same concern as the use of alcohol, since driver impairment is the common consequence. The traffic problem requires laws designed to cope with the drugged driver as well as the drinking driver.

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SELECTED REFERENCES ON CHEMICAL TESTS FOR INTOXICATION

A. GENERAL INFORMATION SOURCES

1. Casier, H. and Delaunois, A.L.: **L'INTOXICATION PAR L'ALCOOL ETHYLIQUE,** Paris, Masson and Cie., 1947.
2. **CHEMICAL TESTS FOR INTOXICATION MANUAL,** ed. by Committee on Medicolegal Problems, American Medical Association, Chicago, American Medical Association, 1959.
3. **THE CONSUMERS UNION REPORT ON WINES AND SPIRITS,** Mt. Vernon, Consumers Union of the U.S., 1962.
4. Elbel, H. and Schleyer, F.: **BLUTALKOHOL,** 2nd ed., Stuttgart, Georg Thieme Verlag, 1956.
5. Friedemann, T.E. and Dubowski, K.M., 'Chemical Testing Procedures for the Determination of Ethyl Alcohol,' J. Amer. Med. Assoc. 170:47-71 (1959).
6. Harger, R.N., 'Ethyl Alcohol', in **TOXICOLOGY - MECHANISMS AND ANALYTICAL METHODS.** Volume II, ed. by C.P. Stewart and A. Stolman, New York, Academic Press, Inc., 1961, pp.86-152.
7. Harger, R.N. and Hulpieu, H.R., 'The Pharmacology of Alcohol,' in **ALCOHOLISM,** ed. by G.M. Thompson, Springfield, Charles C. Thomas, 1956, pp. 103-232.
8. Lolli, G.: **SOCIAL DRINKING. THE EFFECTS OF ALCOHOL,** New York, Collier Books, 1960.
9. Muehlberger, C.W., 'Medicolegal Aspects of Alcohol Intoxication,' in **LEGAL MEDICINE,** ed. by R.B.H. Gradwohl, St. Louis, C.V. Mosby Co., 1954, pp. 754-797.
10. Newman, H.W.: **ACUTE ALCOHOLIC INTOXICATION,** Stanford, Stanford University Press, 1941.
11. Roueche, B.: **ALCOHOL. ITS HISTORY, FOLKLORE, EFFECT ON THE HUMAN BODY,** New York, Grove Press, Inc., 1962.
12. Roueche, B., 'Annals of Medicine — Alcohol,' The New Yorker 35 (No. 47, 48, 49): 32, 39, 78 (Jan. 9, 16, 23, 1960).
13. Seifert, P.: **GRUNDLAGEN DER BLUTALKOHOLFORSCHUNG,** Leipzig, Barth Verlag, 1955.
14. von Oettingen, W.F.: **THE ALIPHATIC ALCOHOLS: THEIR TOXICITY AND POTENTIAL DANGERS IN RELATION TO THEIR CHEMICAL CONSTITUTION AND THEIR FATE IN METABOLISM.** Public Health Bulletin No.281, Washington, U.S. Government Printing Office, 1943.
15. Widmark, E.M.P.: **DIE THEORETISCHEN GRUNDLAGEN UND DIE PRAKTISCHE VERWENDBARKETT DER GERICHTLICH-MEDIZINISCHEN ALKOHOLBESTIMMUNG,** Berlin, Urban and Schwarzenberg, 1932.

B. JOURNALS DEVOTED EXCLUSIVELY TO ALCOHOL

1. Blutalkohol. Verlag Deutze Polizei, Hamburg, Germany.
2. The Quarterly Journal of Studies on Alcohol. Rutgers University Center of Alcohol Studies, 73 Easton Ave., New Brunswick, New Jersey.
3. Revue de l'Alcoolisme. Masson et Cie., 120 Bd. Saint-German, Paris 6, France.

C. PROCEEDINGS OF MAJOR MEETINGS

1. ALCOHOL AND ROAD TRAFFIC. Proceedings of the First International Conference on Alcohol and Road Traffic, Stockholm, 1950, Stockholm, Kugelsbergs Boktryckeri, 1951.
2. **ALCOHOL AND ROAD TRAFFIC.** Proceedings of the Second International Conference on Alcohol and Road Traffic, Toronto, 1953. Toronto, Garden City Press Co-Operative, 1955.
3. **PROCEEDINGS OF THE SYMPOSIUM ON ALCOHOL AND ROAD TRAFFIC,** Bloomington, 1958. Bloomington, Indiana University, 1959.
4. **ALCOHOL AND TRAFFIC SAFETY.** (Proceedings of the National Conference on Alcohol and Traffic Safety, Pittsburgh, 1961). Public Health Service Publication No. 1043, Washington, U.S. Government Printing Office, 1963.
5. **ALCOHOL AND ROAD TRAFFIC.** Proceedings of the Third International Conference on Alcohol and Road Traffic, London, 1962, London, British Medical Association, 1963.

D. SOME RECENT REVIEWS OF ALCOHOL LITERATURE AND PRACTICE*

1. Borkenstein, R.F., 'The Evolution of Modern Instruments for Breath Alcohol Analysis,' J. Forensic Sci. 5:395-407 (1960).
2. Dubowski, K.M.: **AN EVALUATION OF METHODS FOR THE DETERMINATION OF ETHYL ALCOHOL IN BIOLOGICAL MATERIALS,** Ph.D. Dissertation, Columbus, The Ohio State University, 1949.
3. Dubowski, K.M., 'Some Major Developments Related to Chemical Tests for Intoxication,' Police 2 (No.2): 54-56, 1957.
4. Harger, R.H. and Forney, R.B., 'Aliphatic Alcohols,' in **PROGRESS IN CHEMICAL TOXICOLOGY,** Volume 1, ed. by A. Stolman, New York, Academic Press, Inc., 1963, pp.54-134.
5. Kalant, H. 'Some Recent Physiological and Biochemical Investigations on Alcohol and Alcoholism — A Review,' Quart. J. Studies on Alcohol 23:52-93 (1962).

6. Lundquist, F., 'The Determination of Ethyl Alcohol in Blood and Tissues,' in **METHODS OF BIOCHEMICAL ANALYSIS,** Volume 7, ed. by D. Glick, New York, Interscience Publishers, Inc., 1959, pp. 217-251.
7. Mattil, F.: **DIE ALKOHOLBLUTPROBE,** Berlin, Erich Schmidt Verlag, 1956.

E. LEGAL ASPECTS

1. Booth, C.E.: **DRINKING DRIVER DEFENDANT. A HANDBOOK FOR OFFICERS,** Daytona Beach, Charles E. Booth, 1951.
2. Donigan, R.L.: **CHEMICAL TEST CASE LAW,** Evanston, Northwestern University Traffic Institute, 1950.
3. Donigan, R.L.: **CHEMICAL TESTS AND THE LAW,** Evanston, Northwestern University Traffic Institute, 1957.
4. Donigan, R.L.: 1959 **POCKET SUPPLEMENT TO CHEMICAL TESTS AND THE LAW,** Evanston, Northwestern University Traffic Institute, 1959.
5. Donigan, R.L.: 1961 **POCKET SUPPLEMENT TO CHEMICAL TESTS AND THE LAW,** Evanston, Northwestern University Traffic Institute, 1961.
6. Erwin, R.E.: **DEFENSE OF DRUNK DRIVING CASES,** Albany, Banks and Co., 1963.
7. Erwin, R.E.: 'Trial of a Drunk Driving Case — Defense Viewpoint,' Trauma 3 (No. 1): 47-127, 1959.
8. Ladd, M and Gibson, R.B.: 'The Medico-Legal Aspects of the Blood Test to Determine Intoxication,' Iowa Law Rev. 29:191-268 (1939).

F. MAJOR SUMMARIES: OFFICIAL REPORTS

1. Andreasson, R.: **ALCOHOL, DRIVERS AND TRAFFIC SAFETY,** 2nd ed., Stockholm, Ansvar International Insurance Co., Ltd., 1960.
2. Borgmann, W.: **BLUTALKOHOL BEI VERKEHRSSTRAFTATEN,** Bielfeld, Kirschbaum Verlag, 1955.
3. **CHEMICAL TESTS FOR INTOXICATION — INTERIM REPORT OF THE NEW YORK STATE JOINT LEGISLATIVE COMMITTEE ON MOTOR VEHICLE PROBLEMS,** Legislative Document No. 25, Albany, Williams Press, Inc., 1953.
4. Committee on Tests for Intoxication: **EVALUATING CHEMICAL TESTS FOR INTOXICATION,** Chicago, National Safety Council, 1953.
5. Crime Detection Laboratory, Royal Canadian Mounted Police: **REPORT ON IMPAIRED DRIVING TESTS,** ed. by B.B. Coldwell, Ottawa, Queen's Printer, 1957.
6. **RECOGNITION OF INTOXICATION,** 2nd ed., London, British Medical Association, 1958.

G. FORENSIC ASPECTS

1. Dubowski, K.M., 'Alcohol Determination — Some Physiological and Metabolic Considerations,' in ALCOHOL AND TRAFFIC SAFETY, ed. by B.D. Fox and J.H. Fox, Public Health Service Publication No. 1043, Washington, U.S. Government Printing Office, 1963.
2. Dubowski, K.M., 'Some Practical Laboratory Aspects of Forensic Alcohol Determinations,' Proc. Iowa Acad., Sci. 63:364-390, 1956.
3. Forrester, G.C.: **CHEMICAL TESTS FOR ALCOHOL IN TRAFFIC LAW ENFORCEMENT,** Springfield, Charles C. Thomas, 1950.

H. EFFECTS OF ALCOHOL: DRIVING IMPAIRMENT

1. Borkenstein, R.F., Smith, H.W., Lucas, G.H.W. and Shupe, L.M.: **A PRACTICAL EXPERIMENT ON THE EFFECTS OF ALCOHOL ON DRIVING SKILL,** Louisville, Southern Police Institute, 1956.
2. Chastain, J.D., 'The Effects of 0.10 Percent Blood Alcohol on Driving Ability,' Traffic Safety Research Rev. 5 (No.3): 4-7, (1961).
3. Coldwell, B.B., et al., 'Effect of Ingestion of Distilled Spirits on Automobile Driving Skill,' Quart. J. Studies on Alcohol 19:590-616 (1958).
4. Drew, G.C., Colquhoun, W.P. and Long, H.A.: **EFFECT OF SMALL DOSES OF ALCOHOL ON A SKILL RESEMBLING DRIVING,** Medical Research Council Memorandum No. 38, London, H.M. Stationery Office, 1959.
5. Forney, R.B., et al., 'Performance in a Gymkhana Sports Car Event with Low Levels of Blood Alcohol,'Traffic Safety Research Rev. 5 (No.3): 8-12 (1961).
6. Goldberg, L., 'Quantitative Studies on Alcohol Tolerance in Man. The Influence of Ethyl Alcohol on Sensory, Motor and Psychological Functions Referred to Blood Alcohol in Normal and Habituated Individuals,' Acta physiol. Scand. 5 (Suppl. 16): 1-128 (1943).
7. Graf, O.: **ALKOHOLWIRKUNG UND BLUTALKOHOL —KONZENTRATION,** Hamm/Westf., Hoheneck-Verlag, 1960.
8. Greenberg, L.A., 'The Definition of an Intoxicating Beverage,' Quart. J. Studies on Alcohol 16:316-325 (1955).
9. Holcomb, R.L., 'Alcohol in Relation to Traffic Accidents,' J. Amer. Med. Assoc. 111:1076-1085 (1938).
10. Loomis, T.A. and West, T.C., 'The Influence of Alcohol on Automobile Driving Ability,' Quart. J. Studies on Alcohol 19:30-46 (1958).
11. Wayne, E.J., et al.: **RELATION OF ALCOHOL TO ROAD ACCIDENTS,** London, British Medical Association, 1960.

I. BREATH ALCOHOL ANALYSIS

PRINCIPLES, PROCEDURES AND PROBLEMS

1. Chastain, J.D.: **A CORRELATION STUDY OF BLOOD ALCOHOL LEVELS AS DETERMINED BY ALCOMETER, BREATHALYZER, AND DIRECT BLOOD ANALYSIS,** Austin, Texas Dept. of Public Safety, 1957.
2. Greenberg, L.A., 'Physiological Factors Affecting Breath Samples,' J. Forensic Sci. 5:411-422 (1960).
3. Greenberg, L.A. and Lester, D., 'Alcohol Breath Tests and Breath Deodorization by Chlorophyll Derivatives,'Quart. J. Studies on Alcohol 15:16-20 (1954).
4. Grosskopf, K., 'Die Atemalkohol—Betimmung als analytische Aufgabe,' Angew. Chem. 66:295-297 (1954).
5. Harger, R.N., et al, 'The Partition Ratio of Alcohol Between Air and Water, Urine and Blood: Estimation and Identification of Alcohol in These Liquids from Analysis of Air Equilibrated with Them,' J. Biol. Chem. 183:197-213 (1950).
6. Harger, R.N., Forney, R.B., and Baker, R.S., 'Estimation of the Level of Blood Alcohol from Analysis of Breath. II. Use of Rebreathed Air,' Quart. J. Studies on Alcohol 17:1-18 (1956).

7. Harger, R.N., Forney, R.B. and Barnes, H.B., 'Estimation of the Level of Blood Alcohol from Analysis of Breath,' J. Lab Clin. Med. 36:396-318 (1950).
8. Sillery, R.J., Williams, L.A., and Langtry, A.C., 'Correlation Between Ethyl Alcohol Levels in Venous Blood and Alveolar Air Samples,' J. Lab. Clin. Med. 54:613-616 (1959).
9. Smith, H.W. and Lucas, D.M., 'Breath Tests for Alcohol,' Criminal Law Quart. 1:25-45 (1958).
10. Smith, J.C., 'The Avoidance of Biologic Variables in Breath Tests for Alcohol in Blood,' Am. J. Clin. Path. 32:34-40 (1959).

BREATH ALCOHOL APPARATUS

1. AN INFORMATIVE GUIDE TO THE OPERATION OF MOBAT, A COMPLETE BREATH ALCOHOL TESTING PROGRAM, San Bernadino, Luckey Laboratories, Inc., 1963.
2. Borkenstein, R.F., and Smith, H.W., 'The Breathalyzer and Its Application,' Medicine, Science and The Law 1:13-22 (1961).
3. Forrester, G.C.: **ALCOHOL, TRAFFIC ACCIDENTS AND CHEMICAL TEST EVIDENCE:TRAINING MANUAL — THE PHOTOELECTRIC INTOXIMETER,** Niagara Falls, Intoximeter Association, 1960.
4. Greenberg, L.A. and Keator, F.W., 'A Portable Automatic Apparatus for the Indirect Determination of the Concentration of Alcohol in the Blood,' Quart. J. Studies on Alcohol 2:57-72 (1941).
5. Grosskopf, K., 'Technical Analysis of Gases and Liquids by Chromometric Gas Analysis,' Angew. Chem. 63:306-311 (1951).
6. Harger, R.N., Forney, R.B. and Baker, R.S., 'Estimation of the Level of Blood Alcohol from Analysis of Breath. II. Use of Rebreathed Air,' Quart. J. Studies on Alcohol 17:1-18 (1956).
7. Harger, R.N., Lamb, E.B. and Hulpieu, H.R., 'A Rapid Chemical Test for Intoxication Employing Breath,' J. Amer. Med. Assoc. 110:779-785 (1938).
8. Jetter, W.W., Moore, M., and Forrester, G.C., 'Studies in Alcohol. IV. A New Method for Determination of Breath Alcohol,' Am. J. Clin. Path. (Tech. Suppl.) 11:75-89 (1941).
9. Kitagawa, T., and Wright, B.M., 'A Quantitative Detector-tube Method for Breath-Alcohol Estimation,' Brit. Med. J. 2:652-653 (1962).
10. Kobayaschi, Y., 'Gas Analysis by Means of Detector Tubes, VIII. Rapid Method for the Determination of Ethyl Alcohol and Methanol in Air,' J. Chem. Soc. Japan 56:526-527 (1953).

SPECIAL TOPICS

BREATH COLLECTION AND PRESERVATION

1. Salem, H., Lucas, G.H.W., and Lucas, D.M., 'Saran Plastic Bags as Containers for Breath Samples,' Canada, Med. Assoc. J. 82-682-683 (1960).

CHEMICAL TESTS UTILIZATION

1. USES OF CHEMICAL TESTS FOR INTOXICATION 1962, REPORT OF THE COMMITTEE ON ALCOHOL AND DRUGS, Chicago, National Safety Council, 1963.

DIABETES AND ALCOHOL

1. Blotner, H., 'Blood Alcohol in a Diabetic,' J. Amer. Med. Assoc. 175:218 (1961).
2. Coldwell, B.B., and Grant, G.L., 'The Disappearance of Alcohol from the Blood of Diabetics,' J. Forensic Sci. 8:220-230 (1963).

MOUTH ALCOHOL

1. Lins, G., and Raudonat, H.W., 'Gaschromatographische Untersuchungen uber die Verweildauer von Athanol in den Schleimhauten der Mundhohle nach Alkoholgenuss,' Duet, Z. gerichtl, Med. 52:242-245 (1962)

*Ecclesiastes 1:9, 10

2100 part alveolar air = 1 part of blood (for alcohol content)

52.5 milliliters alveolar air = 1/40 milliliters blood (for alcohol content)

52.5 milliliters = 1/10 pint

3 milliliters of reagent solution in ampoule
3 milliliters = 1/10 ounce
reagent solution is: .025% potassium dichromate
50% sulfuric acid
trace of silver nitrate catalyst

Breathalyzer Temperature = 50°C (±3°) = 122°F.

Simulator Temperature = 34°C (±.2°) = 93.2°F.

Body Temperature = 37°C = 98.6°F.
Breath Temperature = 34°C = 93.2°F.

$F° = (C° \times 1.8) + 32 \qquad C° = \frac{(F° - 32)}{1.8}$

$$\text{Pure ETOH in body} = \frac{\text{wt.} \times .67 \times \text{A.C.} \times 16}{.8}$$

$$\frac{\text{Oz. of pure ETOH}}{\text{\% ETOH in beverage}} = \text{ounces of beverage}$$

100 proof liquor = 50% ethyl alcohol
80 proof liquor = 40% ethyl alcohol
% = parts per 100

ethyl alcohol (C_2H_5OH) is a depressant.

ALCOHOL CONCENTRATION — abbreviated A.C.

(a) grams of ETOH/100 ml of blood
(b) grams of ETOH/210 liters of breath
(c) grams of ETOH/67 ml of urine
(from Minnesota Statute 169.01 Subd.61)

0.05 Alcohol Concentration or below indicates not under the influence.

0.05 - 0.10 Alcohol Concentration can indicate under the influence when backed by proper physical evidence.

0.10 Alcohol Concentration or above, it is illegal to operate a motor vehicle.

Alcohol is eliminated from the body at an average of 2/3 - 3/4 ounces of 100 proof per hour or Alcohol Concentration declines at 0.015 per hour.

State vs. Quinn 1971
Breathalyzer results admissible without expert testimony providing operator conducted test properly. Supreme Court takes judicial notice of Breathalyzer.