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Chapter 19

Alcohol Testing in the Workplace

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Introduction

Efforts to prevent alcohol[1]-related problems in the workplace have a long history in the United States. Testing of workers and job applicants for alcohol has more recently been adopted as a tool for the recognition and reduction of alcohol-related problems in the workplace. It has been estimated that one in every ten persons in the United States has an "alcohol problem" (U. S. Department of Labor, 1990), and the total direct and indirect economic costs of alcohol abuse were estimated as $70.3 billion for 1985 (Eighth Special Report, 1993A). Problems of such magnitude clearly affect the workplace as well as other components of society. Further, under the impetus of several highly-publicized accidents and incidents involving the operation of commercial transport aircraft, marine tankers, railroad trains, and subway trains by persons allegedly under the influence of alcohol, the Congress in 1991 enacted the Omnibus Transportation Employee Testing Act of 1991 (Public Law 102-143, 1991). In a preface to the Act, the Congress stated seven findings, including these: 1. "alcohol abuse and illegal drug use pose significant dangers to the safety and welfare of the Nation;" 4. "the use of alcohol and illegal drugs has been demonstrated to affect significantly the performance of individuals, and has been proven to have been a critical factor in transportation accidents;" and 5. "the testing of uniformed personnel of the Armed Forces has shown that the most effective deterrent to abuse of alcohol and use of illegal drugs is increased testing, including random testing;" (Public Law 102-143, 1991). The Act mandates testing for alcohol, under U. S. Department of Transportation (DOT) regulations, of covered persons performing safety-sensitive functions in aviation, railroading, commercial motor vehicle operation, and mass transit operations. Under other existing federal statutory authority, DOT's Research and Special Programs Administration, which regulates pipeline and liquefied natural gas facilities and operations, and the U. S. Coast Guard, which regulates commercial marine transport and recreational watercraft operation, also mandated workplace alcohol testing of covered workers

in the transportation modalities they regulate. It thus came about that the great majority of persons required to undergo alcohol testing in the workplace work in transportation industries which fall under DoT jurisdiction.

Industries and Workplaces Affected by Alcohol

Because of the pharmacological action and effects of alcohol, covered in detail elsewhere in this monograph (See Chapter 2), alcohol-induced impairment of mental and physical capabilities and functions can adversely affect work performance in most, if not all, industries and business activities (Eighth Special Report 1994B). Some workplace activities obviously entail greater actual or potential hazards than others, and involve substantial risks to the worker, the workplace, and other parties if carried out by alcohol-impaired workers. In particular, the transportation workplace in all transport modalities entails basic safety hazards which are increased by the effects of alcohol on workers performing particular safety-sensitive functions. The Department of Transportation in 1994 provided an estimate of the number of workers in safety-sensitive positions in six of the transportation modalities it regulates, shown in Table 19-1 (U. S. Department of Transportation, 1994).

If applicants for safety-sensitive jobs in the DOT-regulated transportation industries are tested for alcohol, as federal law allows but does not require, the number of persons subject to testing for alcohol is obviously greatly increased.

Many non-transportation industries and workplaces involve transport of persons, goods, and materials as a core element. In others, transportation is absent or only incidental to other activities and operations which are inherently hazardous (e.g., mining) or associated with potential risks (e.g., energy production) which are increased when alcohol is present in workers engaged in safety-sensitive functions. Table 19-2 lists ten such non-transportation industries and workplaces which are affected by alcohol. Other commercial activities could be appropriately added to those listed, e.g., health care and medical services, and communications.

Regulated and Nonregulated Testing for Alcohol

The universe of alcohol testing in the workplace is readily divided into governmentally-regulated testing for alcohol, and non-regulated testing; i.e., testing for alcohol which is not required or controlled by law. Until recently, regulated testing was mostly performed under federal mandates. However, an increasing number of states have recently enacted laws which regulate the testing for alcohol and other drugs of workers within the state, under other than federally-regulated testing schemes. In the professional sports arena, such organizations as the National Football League and the National Basketball

Table 19-1 - Commercial Transportation Employees Subject to DoT-Regulated Workplace Alcohol Testing

Industry and DoT O/A	No. of Covered Workers	Safety-Sensitive Employees
Aviation (FAA)	340,000	Flight crew, attendants, & instructors; air traffic controllers; aircraft dispatchers; maintenance, screening & ground security coordinator personnel
Commercial Motor Vehicle (FHWA)	6,600,000	Drivers (commercial vehicle driver's license holders)
Railroad (FRA)	80,000	Hours of Service Act employees: engine, train & signal services, dispatchers, operators
Mass Transit (FTA)	200,000	Vehicle operators, controllers, mechanics and armed security personnel
Pipeline (RSPA)	120,000	Operations, maintenance & emergency response personnel
Maritime (USCG)	120,000	Crewmembers operating a commercial vessel (The USCG has existing rules that require post-accident alcohol testing)
TOTAL	**7,460,000**	

DoT Operating Administrations:

FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
RSPA	Research and Special Programs Administration
USCG	U. S. Coast Guard

Table 19-2 - Some Non-Transportation Industries and Workplace Affected by Alcohol

- Agriculture, forestry & fishing
- Construction & demolition
- Energy production & distribution
- Manufacturing
- Mining
- Petroleum production & refining
- Pipeline operations
- Professional sports
- Public safety & security
- Warehousing & distribution

Association control and regulate testing for alcohol and other abused drugs of professional athletes in their respective franchise clubs. The current situation is shown schematically in Figure 19-1. Some shifting among the several forms of regulation of workplace alcohol testing can be anticipated as the whole system matures and as the states further enlarge their oversight over workplace testing for alcohol and other drugs which is not federally regulated. As is expectable, the majority of testing in the workplace occurs under mandate of law. A much smaller number of employers who are not mandated to do so by law carry out alcohol testing on selected members of their work force under employer policies reflecting the employment-at-will doctrine or labor agreements.

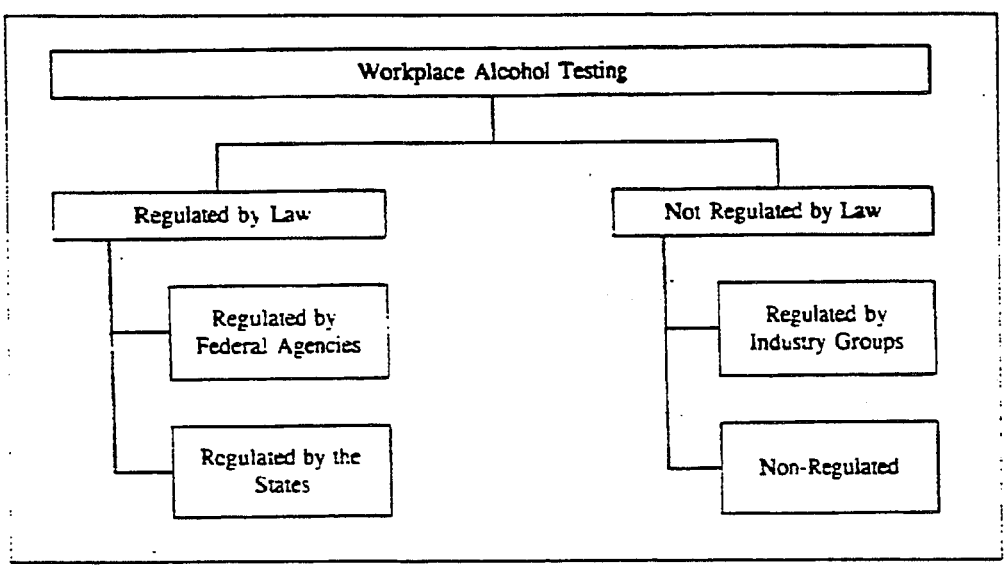

Figure 19-1 Scheme for Regulated and Non-Regulated Workplace Testing for Alcohol.

Some Legal Aspects of Alcohol Testing in the Workplace

The legal background of workplace alcohol testing includes the federal and state regulatory environment, a substantial body of labor case law - mostly at the federal level - and a full array of policies imposed by employers or developed through collective bargaining. Many but not all recent legal aspects of the more fully developed system of workplace testing for drugs-of-abuse other-than-alcohol apply to the alcohol testing situation, e.g., constitutional issues and confidentiality and privacy considerations (Dubowski & Tuggle, 1990). Workers fall into three major categories with respect to alcohol and drug testing: Government employees, private-sector employees covered by union-negotiated or other

contractual relationships, and private-sector employees in employment-at-will settings. In the future, students and perhaps other classes of persons may be merged into one of these categories, or form a separate group. Workers, students, and others differ with respect to what constitutional, statute and administrative laws apply to them.

Traditionally, such constitutional rights as those against unreasonable searches and seizures, to due process of law, and to equal protection under the laws have been held to be applicable only to actions of the federal government and state governments. More recently, these constitutional issues have also been raised concerning non-governmental workers in highly-regulated industries, especially those federally-regulated, such as the transportation industries. Two constitutional issues which have been raised concerning testing for alcohol and other drugs are search-and-seizure and due process. Several U. S. Supreme Court decisions undergird the legality of testing for alcohol and other drugs in the law enforcement and workplace settings, and have circumscribed such testing. In 1966, the High Court addressed the constitutional search-and seizure issue in *Schmerber vs. California* (*Schmerber*, 1966). The Court decided that the extraction of blood from an uncooperative driver under arrest on drinking-driving charges was a search-and-seizure under the Fourth Amendment, but was reasonable in the particular circumstances of that case. The doctrine and impact of *Schmerber* have since been substantially extended since 1966. In *Skinner vs. Railway Labor Executives' Association* (*Skinner*, 1989), the High Court recognized that collection of breath or urine should also be deemed a search, upheld Federal Railroad Administration regulations governing drug and alcohol post-accident and reasonable cause testing of covered railroad employees, and concluded that issuance of a warrant or the existence of probable cause or individualized suspicion is not a minimum essential requirement in establishing the reasonableness of such a search under an administrative testing program. In a companion case, *National Treasury Employees Union vs. Von Raab*, the Supreme Court again upheld a urine drug testing program for certain federal customs officers, and ruled that neither probable cause, reasonable suspicion, nor a warrant is required to collect body fluids under this kind of governmentally sponsored drug-testing program, although such collection does constitute a search (*National Treasury Employees Union*, 1989). A 1993 U. S. District Court ruling affirmed that suspicionless random testing of commercial motor vehicle operators for alcohol and controlled substances, as mandated by Section 5(b) of the Omnibus Transportation Employee Testing Act of 1991, comports with the Fourth Amendment of the U. S. Constitution and is not an unreasonable search-and-seizure (*Owner-Operator Independent Driver Association*, 1993). Likewise, random

breath-alcohol testing of transit system operating employees was upheld by a federal appeals court (*United Transportation Union*, 1989).

Consistent with these court decisions, the alcohol testing mandated by Congress under the Omnibus Transportation Employee Testing Act of 1991 is constitutionally permissible, where the Congress determined that (1) there is a need for properly administered alcohol testing to ensure that employees in transportation industries are not adversely affected by alcohol while performing safety-sensitive functions, and (2) that need outweighs the privacy interests of these employees.

The Fifth Amendment and the Fourteenth Amendment of the U. S. Constitution guarantee that due process of law will be afforded to all persons subject to the actions of the federal, state and local governments[3]. In recent years, there has been a trend to extend due process guarantees to an ever-enlarging universe of quasi-governmental and private actions and issues, especially those of an adverse nature, including "academic due process," disciplinary proceedings of membership organizations, and employer-employee relations involving discharge, etc. The extension of the due process guarantees to the nongovernmental arena has usually been through case law, involving both substantive and procedural due process issues. An essential due process element in all of these situations is the incorporation of adequate procedural safeguards into applicable policies and practices. In the context of workplace alcohol testing, those prime procedural safeguards include (1) actions to assure the reliability and validity of the testing process and its results, and (2) the opportunity for the tested person to challenge a result and/or an adverse action based on a test result. A meaningful opportunity to challenge a test result requires timely notice detailing the reasons for a proposed adverse action, such as termination of employment, full access to all relevant information about the testing process and its outcome in issue, and a forum in which to contest the result, typically a timely hearing. Due process issues have been raised mostly in workplace drug-testing rather than alcohol-testing cases because of the much longer experience with the former, but the same legal principles are applicable. Procedural due process challenges have been aimed at both the testing process (*Banks*, 1982) and its aftermath, such as employee termination (*Shoemaker*, 1985). It has been stated in the drug testing context that due process has been equated to "fundamental fairness" (Kwong, 1988; *Superintendent*, 1985), which generally involves a balancing of competing interests.

There is also a High Court decision on the reliability of forensic breath-alcohol analysis in traffic law enforcement. In *California vs. Trombetta*, the Supreme Court in 1984 dismissed challenges to the reliability of breath-alcohol analysis by means of automated infrared spectrometry, under the due process clause of

the Fourteenth Amendment to the U. S. Constitution (*California*,1984). The Court also held that "the Due Process Clause of the Fourteenth Amendment does not require that law enforcement agencies preserve breath samples in order to introduce breath-analysis tests at trial." It, however, is relevant to workplace alcohol testing that the High Court also acknowledged that "State courts and legislatures, of course, remain free to adopt more rigorous safeguards governing the admissibility of scientific evidence than those imposed by the Federal Constitution," and further, and pertinently, stated that "Respondents could also have protected themselves from erroneous on-the-scene testing by electing to submit to urine or blood tests..." (*California*, 1984). The federal workplace alcohol testing regulations in effect at the time of publication of this monograph do *not* allow tested subjects to choose those tests as either alternatives or in addition to employer-performed alcohol testing. Other constitutional issues which have been raised in federal and state courts in connection with workplace drug testing are equal protection and privacy (Farmer, 1987). Space limitations and the complexity of these issues prevent their discussion here. A comprehensive body of literature does exist on these matters, e.g., (Cornish, 1988). Employers planning to carry out workplace alcohol testing need and should be guided by appropriate legal advice on these and related issues.

The Regulatory Environment

The primary regulatory control of alcohol testing in the workplace is by federal agencies. Federal regulations universally preempt and supersede state laws and regulations except for those concerning traffic law enforcement. In addition, more than one-half of the states have enacted laws providing for state regulation of workplace alcohol (and drug) testing in circumstances other than those subject to federal control. Lastly, rudimentary regulation of alcohol (and drug) testing exists in some specialized workplaces, e.g., professional sports under the aegis of the respective sports leagues or associations. Generally, information about the latter is not public, while the federal and state regulated testing regulations are, of course, fully disclosed and widely publicized. Table 19-3 lists programs for workplace alcohol control and alcohol testing established by several federal agencies, with the respective primary regulatory reference in the Code of Federal Regulations (CFR). The provisions of CFR have the force of federal law and generally supersede any conflicting state laws or regulations. The federal agencies listed in Table 19-3, and others, have in aggregate promulgated hundreds of regulations pertaining to control of alcohol use and abuse and workplace alcohol testing of those members of the federal workplace and employees of federally-regulated industries who perform safety-sensitive functions. Because of their

Table 19-3 - Some Federally-Regulated Workplace Alcohol Control and Testing Programs

Agency	Regulatory Reference[1]
National Aeronautics & Space Administration	14 CFR Part 1272
Nulear Regulatory Commission	10 CFR Parts 2 and 26
U. S. Department of Energy	10 CFR Part 707
U. S. Department of Transportation	49 CFR Part 40
Federal Aviation Administration	14 CFR Parts 61,121,135 et al.
Federal Highway Administration	49 CFR Part 382, et al.
Federal Railroad Administration	49 CFR Part 219
Federal Transit Administration	49 CFR Part 654
Research & Special Programs Administration	49 CFR Part 199
U. S. Coast Guard	33 CFR Part 95
	46 CFR Parts 4,16,et al.

[1]CFR = Code of Federal Regulations

volume and the frequent revisions in these rules, it is impracticable to enumerate and discuss them in this chapter.

The alcohol misuse prevention testing rules of the several federal agencies are based on universal public safety considerations and the general safety authority of the individual agencies. In addition, the Omnibus Transportation Employee Testing Act of 1991 (P.L. 102-143, Title V) is a direct federal statutory mandate for alcohol testing in the aviation, motor carrier, rail, and mass transit industries. Employees and employers in some industries are subject to multi-agency coverage of alcohol misuse and testing regulations; possibly with different definitions of such terms as accident, covered employee, and safety-sensitive function. Most federal agency programs are deterrent-oriented with minor fitness-for-duty components. In contrast, the drug and alcohol control programs of the Nuclear Regulatory Commission are primarily fitness-for-duty programs and are so titled, with a minor deterrent component. The NRC's rationale for its fitness-for-duty program was set forth as follows in its final rule adoption (Nuclear Regulatory Commission, 1989): "The general objective of this program is to provide reasonable assurance that nuclear power plant personnel are reliable, trustworthy, and not under the influence of any substance, legal or illegal, or mentally or physically impaired from any cause, which in a way adversely affects their ability to safely and competently perform their duties. A fitness-for-duty program developed under the requirements of this rule is intended to create an environment which is free of drugs and the effects of such substances."

The Americans with Disabilities Act of 1990 (ADA) is frequently cited as imposing limitations on adverse employer actions taken against certain workers who yield tests positive for alcohol or other drugs (Public Law 101-136, 1990). The Congress declared that among the purposes of the ADA are : (1) "to provide a clear and comprehensive national mandate for the elimination of discrimination against individuals with disabilities;" and (2) "to provide clear, strong, consistent, enforceable standards addressing discrimination against individuals with disabilities." Various provisions of Title I of the ADA relate to workplace alcohol and drug testing. The ADA broadly prohibits discrimination by any covered entity (employer) against a qualified individual with a disability. Court decisions interpreting Section 504 of the Rehabilitation Act of 1973, with which ADA employment provisions are intended to be consistent, have established that alcoholism can be a disability which may call for the reasonable accommodation required by ADA, unless providing that reasonable accommodation creates an undue hardship. The ADA specifically authorizes covered entities to comply with workplace standards of the Department of Defense, the Nuclear Regulatory Commission, and the Department of Transportation relating to alcohol control and alcohol testing of employees. The ADA, however, also prohibits covered entities from conducting a medical examination or making disability-targeted inquiries until after an offer of employment has been made to a job applicant, and subject to certain additional restrictions. It is presently apparently unsettled whether such alcohol testing of job applicants, which is not required by DOT regulations, constitutes a medical examination or inquiry under ADA.

In addition to the federal laws and regulations addressed above, there are many state regulations, typically administered by the State Department of Health, which mirror the federal regulations in many, but not all respects. Because of the preemptive provisions of the Omnibus Transportation Employee Testing Act of 1991 and other federal laws and agency regulations, state laws and regulations only affect alcohol and drug testing which is not federally regulated and is carried out within a given state by entities of that state and its political subdivisions or by private sector employers within the state. Law enforcement applications of alcohol and drug testing are typically excluded. In workplaces or with respect to workers not covered by federal or state laws and regulations, alcohol testing may be, and is, carried out under employer policies which may, in some circumstances, be subject to labor agreements. Such private sector testing, like regulated testing, is also subject to applicable federal laws and regulations, such as the ADA, which impinge on alcohol and drug control and testing programs.

Features of Alcohol Testing in the Workplace

From the overwhelming amount of information about the effects of alcohol and about alcohol abuse and misuse in the workplace and elsewhere (Eighth Special Report, 1994B; Forney, 1987; The Existing Safety Problem, 1994; Pawlowski, 1992; U. S. Department of Labor, 1991), some principles and various recommended policies and practices emerge. Those discussed in this section of this chapter apply generally to unregulated workplace testing for alcohol. They may also be partly applicable to regulated alcohol testing situations; to the extent that differences exist, the pertinent regulations will prevail and control.

The recommended overall general principle is simple: Workers should be free of alcoholic influence at work. The various elements of workplace alcohol control and testing programs are intended to bring about conformance with that principle. In the implementation of the overall principle, three additional recommendations predominate:

1) Workers should abstain from alcohol intake for 12 to 24 hours prior to undertaking critical and safety-sensitive tasks
2) An appropriate program of alcohol testing should be implemented, with on-site and off-site components
3) Breath-alcohol concentrations less than 0.01 g/210 L, and blood and saliva-alcohol concentrations less than 0.01 g/dL should be deemed "alcohol-free status."

Special Features of Workplace Testing for Alcohol

During the past three decades, testing for commonly abused drugs other than alcohol in the military environment and the civilian workplace has been widely practiced and has become commonplace in many settings. In contrast, testing for alcohol has been very widely performed in the United States in connection with traffic law enforcement for more that fifty years; but has only recently been introduced into the workplace as a tool for prevention and control of alcohol abuse.

The special aspects of alcohol control and testing in the workplace include these: Alcohol purchase, use and testing for alcohol are specially regulated by the federal government and the states. Alcohol impairs work performance at all measurable concentrations. The technology of alcohol-testing is highly advanced and is well understood.

There are also several key differences between alcohol and other abused drugs and between testing for alcohol and other commonly abused drugs. First and foremost, alcohol is a licit drug and consumption of alcoholic beverages by adults is lawful, with limited exceptions, such as while driving motor vehicles. The mere presence of alcohol in the body and in body fluids, e.g., breath or

saliva, does not imply a violation of law, as would be true for presence of Schedule I controlled dangerous substances, the possession and use of which is an illegal act. Alcohol in the body has a short half-life,[4] meaning that its elimination from the body is significantly faster than that of other commonly abused drugs, i.e., measured in hours rather than days or weeks. This, in turn, affects the timing of specimen collection for alcohol testing and militates for on-site testing. The relationship between alcohol concentration in such body fluids as blood and breath and alcoholic impairment is well-established. That relationship is, in fact, much better understood and documented than is true for any other drug-of-abuse. Various specific statutory and regulatory prohibitions exist for stated alcohol concentration thresholds; those pertaining to motor vehicle operation are the most widely recognized and applied. Statutory and regulatory limitations on use of alcohol typically address such issues as where, when, under what circumstances, and by whom possession and/or consumption of alcoholic beverages is prohibited or restricted; and typically also establish thresholds of alcohol concentrations in human body fluids at and above which particular actions are interdicted or become unlawful. Finally, in contrast to drug-use testing in urine specimens, review and interpretation of testing results by a medical review officer (MRO) is unnecessary and uncommon.

One additional, universal feature of alcohol testing in the workplace deserves recognition. The majority of workplace alcohol testing is carried out under mandate of law. Moreover, reliance upon workplace alcohol test results in disciplinary proceedings, formal challenge of some test results, and their involvement in arbitration, litigation and other adversary proceedings are expectable and predictable consequences of workplace alcohol testing. Therefore, alcohol testing should be, and is, considered to be a forensic toxicology activity[5]; and should be carried out with due consideration for that status and in accordance with all of the applicable principles, procedures, and safeguards of forensic toxicology.

Purpose of Alcohol Testing in the Workplace

In regulated industries and workplaces such as transportation, testing for alcohol is mandated, and the principal reason for instituting and conducting an alcohol-abuse control and testing program is to comply with the pertinent regulatory mandates. The regulations, of course, are typically justified as necessary to minimize the risks of alcohol in the workplace and to deter inappropriate alcohol use by covered workers.

There remain a number of industries and workplaces with inherent hazards and increased risks, e.g., construction and mining, to which regulated workplace alcohol testing is of only incidental and of limited applicability - usually in connection with commercial motor vehicle operation. In these and other workplaces

for which alcohol testing is not mandated, policy decisions to implement testing are safety-based. The National Safety Council's Committee on Alcohol and Other Drugs in 1995 developed "A Model Program for the Control of Alcohol in the Workplace" (Committee, 1995). That document was developed chiefly to assist employers and others required to establish alcohol testing programs in response to the Omnibus Transportation Employee Testing Act of 1991 and its implementing regulations, and suggests that the purpose of alcohol testing programs is "to help prevent accidents and injuries resulting from the misuse of alcohol by employees who perform safety-sensitive functions in...industry..." That statement succinctly summarizes the principal goal of alcohol testing programs in general.

There are, of course, other indications for workplace alcohol testing as a fact-finding tool in accident investigation, determination of fitness-for-duty, and other specified situations, as further discussed below.

Alcohol Testing Categories and Indications for Alcohol Testing

There are several classifications in use for testing categories, mostly derived from the long experience in applying alcohol testing to traffic law enforcement and to a lesser extent from the current practices in drug-use testing. The simplest classification is by *test class*:

- Initial Test
- Confirmatory Test

Initial tests, sometimes referred to as screening tests or preliminary tests, are intended and useful primarily to establish whether the tested person is alcohol-free or not. Alcohol-free status obviates the need for any further testing for alcohol. Screening tests to be most practical must be simply and rapidly performed with minimal training. They do not possess the necessary validity for evidential use. Confirmatory tests are those performed with evidential-grade testing devices or systems, after an initial test has indicated the presence of alcohol in the tested person. The results of the confirmatory test(s) are those relied upon for such immediate safety-related personnel actions as removal from current safety-sensitive duties, and for any subsequent disciplinary or other employment consequences.

A more comprehensive scheme of classification is by testing categories, shown in Table 19-4.

The testing categories are largely self-explanatory. DOT-regulated testing lacks a requirement for applicant testing, but substitutes a "pre-employment" testing requirement for employees newly hired for or transferred to safety-sensitive duties before they first perform those duties. Reasonable suspicion and reasonable cause testing are the workplace equivalent of the probable cause

Table 19-4 - Workplace Alcohol Testing Categories

- Applicant testing
- Reasonable suspicion and reasonable cause testing
- Fitnes-for-duty testing
- Post-accident testing
- Return-to-duty and follow-up testing
- Random testing

required for a valid arrest on an alcohol-related traffic offense or other criminal charge. In law enforcement situations, alcohol testing involves search-and seizure incident to a lawful arrest, while the lesser probative value indication of reasonable suspicion or reasonable cause suffices to initiate a workplace alcohol test. The random testing category in principle encompasses on-duty testing of all covered employees. It is usually represented as the key deterrent component of a workplace alcohol-misuse control program. Covered employees are subject to unannounced random, patternless testing based purely on a nondiscriminatory class characteristic. It is the only category of testing not triggered by or conducted in response to another event. Random testing rates are prescribed by industry for regulated testing and vary between 25% and 100% of the covered work force annually. The various federal regulations provide for annual review and adjustment of the industry's random alcohol test rate, based on a performance standard related to its random alcohol violation rate. The selection mechanism for random testing must be by means of a scientifically valid, unbiased method such as a computer-generated random number which is matched with employees' social security or employee identification numbers. The controlling principle is that every covered employee must have an equal chance of being tested. It is equally important for the deterrent effect that random tests be spread reasonably throughout the year and not follow a predictable pattern, e.g., always on a given weekday. Typically, random testing is also by far the largest portion of a workplace alcohol testing program, with the possible exception of universal applicant testing.

Nonrandom tests are triggered by a particular event. Post-accident testing is largely self-explanatory, but requires that the employer policy clearly define the triggering accident event in such respects as fatalities, personal injury, property damage of a particular kind or above a fixed dollar amount, connection of the covered employee to the accident apart from later determination of causation, time frames relative to occurrence or discovery of the accident, etc. In regulated testing, these matters are fully covered in the pertinent regulations.

Reasonable Suspicion Testing

This testing occasion is triggered when an employer, though the employer's agent such as a designated and qualified supervisor, has reasonable suspicion or reasonable cause to believe that an employee has violated the employer's alcohol abuse control policy, or violated the provisions of agency rules in regulated testing environments. Commonly, that reasonable suspicion is grounded in the employee's behavior and appearance indicating alcohol misuse. The determination of policy or rule violation must be contemporaneous with the conduct, behavior or appearance involved, be based on specific articulable observation and findings by a trained supervisor, and must occur during, or just preceding or just after the safety sensitive function in issue. The usual determinants will be appearance, behavior, speech, performance, or alcohol beverage odor emanating from the employee. The key is short-term, contemporaneous and articulable observations, rather than such secondary events often associated with chronic substance abuse as a pattern of absenteeism, constant lateness, or abuse of sick leave. In this context, the term "articulable" observations is derived from the case law of evidence in criminal offenses and means observations and findings which can be described with particularity. They encompass but are not limited to the indications that persons are under the influence of or impaired, or apparently intoxicated by alcohol. Because these observations and conclusions are subjective, the reasonable suspicion or reasonable cause determination must be followed by testing for alcohol as soon as possible. The behavior, appearance and results of observation of a covered employee which are considered to give rise to reasonable suspicion testing should not per se be considered to be prohibited conduct that triggers the full consequences of policy or rule violation, without confirmation of alcohol misuse by a positive test result. The acute effects of alcohol, short of obvious intoxication, which can be a guide to the triggering of reasonable suspicion or reasonable cause alcohol testing may include slurred speech, dilated pupils, neuromuscular incoordination, and sensory and perceptual alterations.

Diagnostic features of alcoholic intoxication have been developed by the American Psychiatric Association, as shown in Table 19-5 and in the following excerpted description from the APA's Diagnostic and Statistical Manual of Mental Disorders, DSM-IV™ (Diagnostic and Statistical Manual, 1994):

> "...The essential feature of Alcohol Intoxication is the presence of clinically significant maladaptive behavioral or psychological changes (e.g., inappropriate sexual or aggressive behavior, mood lability, impaired judgment, impaired social or occupational functioning) that develop during, or shortly after, the ingestion of alcohol (Criteria A and B). These changes are

accompanied by evidence of slurred speech, incoordination, unsteady gait, nystagmus, impairment in attention or memory, or stupor or coma (Criterion C). The symptoms must not be due to a general medical condition and are not better accounted for by another mental disorder (Criterion D)... The levels of incoordination can interfere with driving abilities and with performing usual activities to the point of causing accidents. Evidence of alcohol use can be obtained by smelling alcohol on the individual's breath, eliciting a history from the individual or another observer, and, when needed, having the individual undertake breath, blood, or urine toxicology analyses."

Table 19-5 - American Psychiatric Association Diagnostic Criteria for Alcohol Intoxication (Diagnostic and Statistical Manual, 1994)

A. Recent ingestion of alcohol.
B. Clinically significant maladaptive behavioral or psychological changes (e.g., inappropriate sexual or aggressive behavior, mood lability, impaired judgment, impaired social or occupational functioning) that developed during, or shortly after, alcohol ingestion.
C. One (or more) of the following signs, developing during, or shortly after, alcohol use:
   (1) slurred speech
   (2) incoordination
   (3) unsteady gait
   (4) nystagmus
   (5) impairment in attention or memory
   (6) stupor or coma
D. The symptoms are not due to a general medical condition and are not better accounted for by another mental disorder.

Testing Locations - On-Site versus Off-Site

The decision whether to conduct workplace alcohol testing at the employee's work site location ("on-site") or at another location ("off-site") hinges on a variety of factors - economic, time-related, test volume and locations of work sites, etc. Testing conducted under Nuclear Regulatory Commission or Department of Transportation regulations must generally be carried out on-site, except for post-accident testing which may of necessity be performed on injured workers at a hospital or similar health care facility. The purpose of the testing is also dispositive. If the employer policy calls for alcohol-free status of designated employees prior to commencing safety-sensitive functions, testing must generally by performed on-site. In contrast, return-to-duty and follow-up testing could be carried out off-site, say at a counselling clinic. Timely accessibility of test facilities will also control where reasonable suspicion testing is to be done. Random testing

must (in regulated testing) or should (in nonregulated testing) immediately precede or follow a normal work period or shift. In most situations that requirement dictates on-site testing. On-site testing does not, however, require establishing and maintaining a continuously-manned testing facility at every work site. Third-party consortia or a multi-site employer such as an airline can provide mobile equipment and personnel to operate a temporary testing activity at preselected locations, chiefly for random testing which can be appropriately scheduled. On-site testing can be limited to initial (screening) testing for alcohol if a suitably equipped and staffed facility is available within a short distance and time-frame to conduct confirmatory breath-alcohol testing on workers who are escorted to the latter facility after an initially positive screening test result. In DOT-regulated testing, the confirmation test must be conducted within 30 minutes of the completion of the screening test (Department of Transportation, 1995A). In practice, that limits the conduct of screening and confirmation tests at different sites to those at prearranged nearby locations. While covered employers always remain responsible for having the proper category of testing accomplished, they can delegate the testing function to other qualified and authorized parties such as testing consortia or third-party administrators by contract or similar arrangement: that includes confirmatory testing.

The foregoing considerations in workplace alcohol testing differ markedly from the situation for federally regulated workplace urine drug testing, in which on-site activities are typically limited to specimen collection and forwarding, while most actual drug testing and all confirmatory testing is performed in DHHS-certified laboratories.

Alcohol Testing Regulated by the U. S. Department of Transportation

Workplace alcohol testing regulated by the U. S. Department of Transportation is mandated by the Omnibus Transportation Employee Testing Act of 1991 (Public Law 102-143, 1991) for certain transportation modalities and is authorized for others, e.g., commercial marine transportation, by other statutes or under the general safety enforcement authority of the applicable DOT operating administration, e. g., Coast Guard. The pertinent DOT regulations, policies and practices are very comprehensive and have operating administration-specific features. Because of those differences and the inevitable periodic revisions in the regulations, the information in this section is necessarily restricted to DOT-wide provisions. A comprehensive discussion of the background of the DOT regulations and the basis for various DOT decisions on alternatives is contained in the Federal Register issue of February 15, 1994.

Prohibited Conduct

Performance of safety-sensitive functions by a covered employee in any DoT-regulated entity is prohibited: (1) When such person has an alcohol concentration[6] of 0.04 or greater, as indicated by a breath-alcohol test, or temporarily when such person has an alcohol concentration of 0.02 or greater but less than 0.04; (2) while such person is using alcohol; and (3) within 4 hours (8 hours for flight crew-members) after using alcohol. In addition, refusal to submit to testing for alcohol and use of alcohol within 8 hours after involvement in an accident or until tested, for employees required to be tested, are prohibited.

Required Alcohol Testing

Under the Act, as amended in 1995, in general the following categories of alcohol testing are required:

- *Pre-duty* - conducted before employees actually perform safety-sensitive functions for the first time, or when other employees transfer to a safety-sensitive position.
- *Post-accident* - conducted after involvement in accidents by employees whose performance could have contributed to the accident.
- *Reasonable suspicion* - conducted when a trained supervisor observes behavior or appearance in an employee which is characteristic of alcohol misuse.
- *Random* - conducted on a random unannounced basis just before, during, or just after performance of safety-sensitive functions.
- *Return-to-duty and follow-up* - conducted when an individual who has violated the prohibited alcohol conduct standards returns to safety-sensitive duties. Follow-up tests are unannounced and must be conducted for at least 12 months after return to duty, and may be enforced for up to 60 months thereafter.

There are differences in the application of the required testing conditions and schedules among the several DOT operating administrations.

Features of Alcohol Testing under DOT Regulations

Testing for alcohol under the DOT regulations has the following common features:

Alcohol is defined as "The intoxicating agent in beverage alcohol, ethyl alcohol or other low molecular weight alcohols including methyl or isopropyl alcohol." *Alcohol concentration* is defined as "The alcohol in a volume of breath expressed in terms of grams of alcohol per 210 liters of breath as indicated by a breath test..." All alcohol testing is to be carried out on-site at the workplace,

except in some post-accident situations. Breath and saliva are the only acceptable specimens for initial "screening" tests. "Screening" and "confirmation" tests are required in defined circumstances. Breath is the required and only acceptable specimen for "confirmation" tests, with some exceptions for post-accident testing. All testing for alcohol in breath or saliva must be carried out with testing and associated devices appearing on NHTSA Conforming Products Lists (NHTSA, 1994A, B; NHTSA, 1995; NHTSA, 1996). *Screening* tests on breath or saliva must use breath or saliva-alcohol screening test devices appearing on the NHTSA Conforming Products List, or be performed on breath with evidential breath testers (EBTs) appearing on the NHTSA Conforming Products List. *Confirmation* tests must be carried out on breath and must use EBTs which are (1) capable of providing a printed result in triplicate, (2) capable of assigning a unique and sequential number to each completed test, and displaying same before the test, (3) capable of printing on each copy of the result the manufacturer's name for the device, the device serial number, the time of the test, the test number, and the test result, (4) able to distinguish alcohol from acetone at an alcohol concentration of 0.02 g/210 L, and (5) capable of testing an air blank prior to each collection of breath, and of performing an "external calibration check." Confirmation tests must be carried out within 30 minutes of the completion of a screening test which yields an alcohol concentration of 0.02 or greater. A deprivation period of not less than 15 minutes must precede, and thereafter an air blank yielding 0.00 g/210 L result must precede breath collection in a confirmation test. Air blanks are not required before or after a screening test on breath. Testing must be performed by a breath alcohol technician (BAT) who has successfully completed a course of instruction equivalent to the DOT model course, as determined by NHTSA, and who has "demonstrated competence in the operation of the specific EBT(s)" which the BAT will use. Law enforcement officers who have been certified by state or local governments to conduct breath-alcohol testing with the EBT concerned are deemed by DOT to be qualified as BATs. Inability of an employee to participate in or complete a breath-alcohol test requires subsequent evaluation by a physician, with stated consequences. There is no stipulated role for a Medical Review Officer (MRO) in conducting alcohol testing or interpreting alcohol test results.

Significance, Interpretation, and Consequences of Test Results

The significance, interpretation, and consequences of alcohol test results under 49 CFR Part 40 are complex and vary somewhat among DoT operating administrations and with the test category and situation. In general, alcohol test results have the following significance and consequences with a bifurcated 0.02 and 0.04 alcohol concentration standard:

> A breath-alcohol concentration result (screening) less than 0.02 is considered a negative test, and no further testing is authorized. A saliva result (screening) indicating an alcohol concentration of less than 0.02 has the same significance. An alcohol concentration result (screening) of 0.02 or greater on breath or saliva must be followed by a "confirmation" test on breath within 30 minutes of the completion of the screening test. A BrAC result (confirmation) less than 0.02 g/210 L is considered a final negative test. A BrAC result (confirmation) of 0.02 g/210 L or greater requires removal of the covered employee from a safety-sensitive function. If the BrAC is 0.02 g/210 L or greater but less than 0.04 g/210 L, the employee is temporarily prohibited from performing or continuing to perform a safety-sensitive function until the next regularly scheduled duty period, but not less than 8 hours after administration of the test (24 hours for those regulated by FHWA), or until a retest yields a BrAC less than 0.02 g/210 L. A final, confirmed BrAC result of 0.04 g/210 L or greater prohibits the employee from performing or continuing to perform a safety-sensitive function, and subjects the employee to other specified consequences, e.g., mandatory referral to a "substance abuse professional." In the event that the screening and confirmation tests yield different results, the confirmation test result is deemed to be the final result. The rules have somewhat complex provisions for what constitutes or leads to an invalid test. The following events, among others, give rise to invalid tests: (1) The next "external calibration check" of an EBT yielding a result varying from the target value by more than "the tolerance stated in the QAP." In such an event, all test results of 0.02 g/210 L or greater obtained on the device since the last valid "external calibration check" are invalid. (2) Failure to observe the minimum 15-minute deprivation period prior to a confirmation test. (3) Failure to perform an air blank test prior to a confirmation test, or an air blank test result greater than 0.00 g/210 L prior to the breath collection. (4) Failure of the EBT to print a confirmation test result. (5) Failure of the sequential test number or the test result displayed by the EBT to match the printed output.

A schema summarizing the foregoing DOT testing procedure and test result consequences is shown in Figure 19-2.

Extrapolation of results is not permitted. Further and in contrast to the universal practice for breath-alcohol testing in traffic law enforcement, failure of an employee to comply with the instructions of the breath alcohol technician (e.g., to refrain from smoking or ingesting any substance during the 15-minute observation/deprivation period prior to breath-alcohol testing) is not treated as a

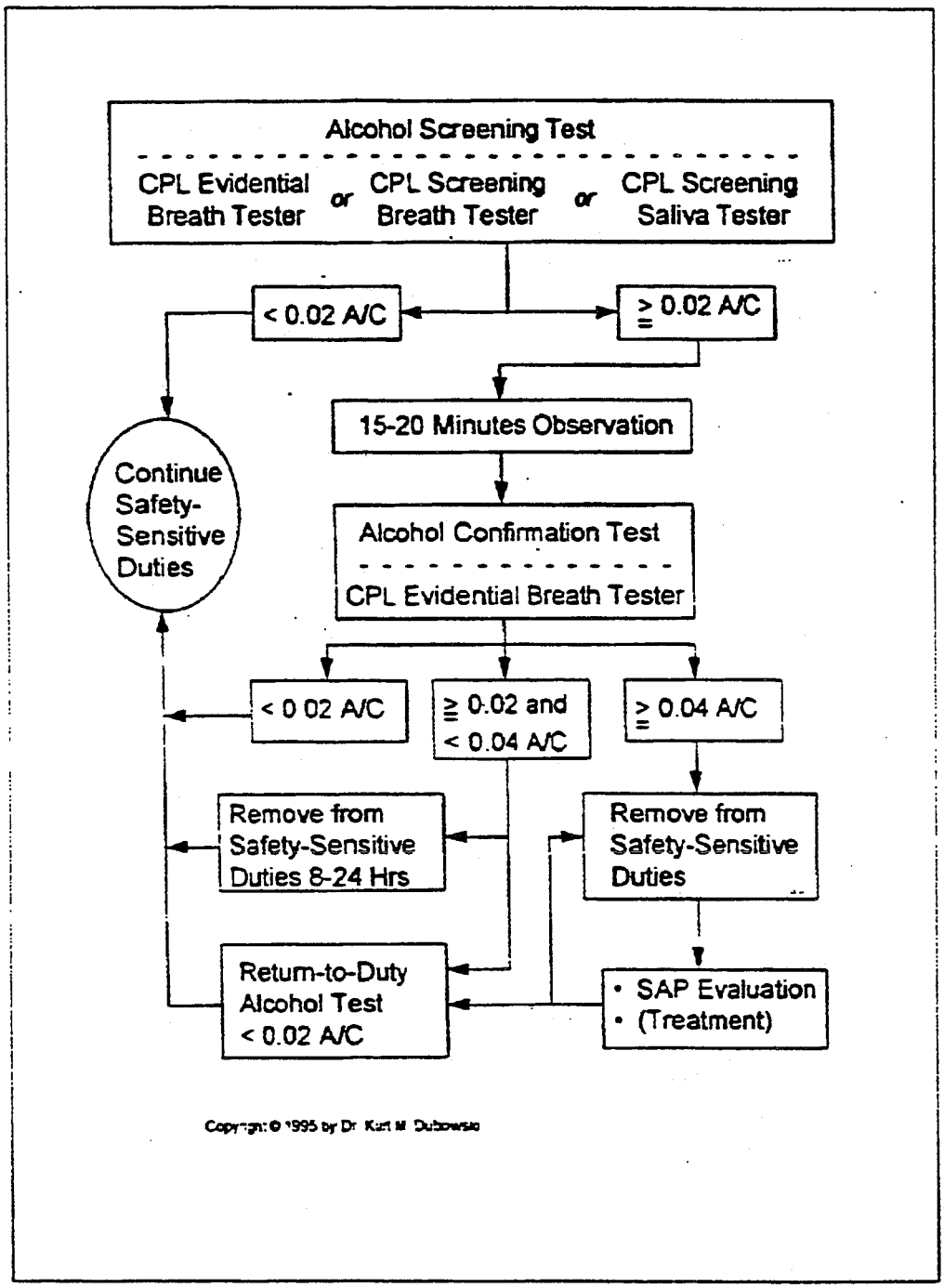

Figure 19-2 DoT Workplace Alcohol Testing Schema.

"refusal" to be tested with no test given. Instead, the test is given and the details of the irregularity are annotated in the record.

Quality Assurance Aspects

Evidential breath-alcohol testing (EBT) devices used for either screening or confirmation tests are subject to a quality assurance plan (QAP) developed by the respective device manufacturer. The QAP for evidential breath-testing devices must be submitted to and approved by NHTSA, and shall: (1) Designate method(s) for performing control tests termed "external calibration checks" of the instrument, using calibrating devices on the NHTSA Conforming Products List of Calibrating Units for Breath-Alcohol Testers. (2) Specify the minimum time intervals for control tests of the device, and the "tolerances on an external calibration check within which the EBT is regarded to be in proper calibration." (3) Specify inspection, maintenance, and calibration requirements and intervals for the EBT. Inspection, maintenance, and calibration of EBTs must be performed by the device manufacturer or a "maintenance representative" certified by the device manufacturer or by an appropriate state agency. Employers must ensure compliance with the details of the QAP, must maintain certain QAP records for 2 years and records of "external calibration checks" for 5 years, and store EBTs in a "secure space" when not in use. The term "external calibration check," as DoT regulations use it, contemplates performance of a control test, such as analysis of a vapor of known alcohol content produced by equilibration of air with an ethanol solution of known concentration at a fixed temperature (Dubowski & Essary, 1992), or analysis of a gas-vapor mixture of known alcohol content released from a compressed gas mixture of alcohol in an inert gas such as nitrogen, adjusted for the ambient atmospheric pressure and the temperature of the sample chamber. There are separate DOT requirements for quality assurance plans for nonevidential screening devices for alcohol.

Statutory and Regulatory Changes in Transportation Workplace Alcohol Testing

Enactment of the Omnibus Transportation Employee Testing Act of 1991 was soon followed by lobbying by transport workers unions, industry organizations and others seeking to repeal or modify various provisions of the Act. Debate over the effectiveness and cost of alcohol testing of applicants for safety-sensitive duty jobs (as distinct from employees) was particularly intense. The Department of Transportation, as a consequence of litigation and its own policy questions on the interpretation of the Act, never implemented applicant or preemployment testing for alcohol by regulation. Subsequent legislation approved on November 28, 1995, P. L. 104-59, Section 342. Alcohol and Controlled Substances Testing.

finally clarified the situation. The Congress directed the Secretary of Transportation to promulgate regulations for alcohol testing which *require* the conduct of reasonable suspicion, random, and post-accident testing for alcohol of mass transportation employees responsible for safety-sensitive functions (as decided by the Secretary) and which *permit* the conduct of preemployment testing of such persons for alcohol at the employer's option. P. L. 104-59 also requires the Secretary of Transportation to promulgate comparable regulations for alcohol testing of motor carrier and air carrier employees, and certain employees of the Federal Aviation Administration.

The statutory language "preemployment testing of such employees" seems destined for further interpretation in the courts. It appears to contemplate conduct of tests for alcohol not on applicants but on persons hired to perform safety-sensitive functions or transferred to such functions, prior to first performance of covered functions. In any event, the principal policy difference between the 1991 Act and the 1995 Act is that preemployment testing for use of alcohol (no longer for use of alcohol "in violation of law or Federal regulation") is now permitted at the option of the employer, but no longer required or controlled by federal law or regulation.

There are also provisions in the federal DoT regulations for periodic changes in the proportion of covered workers required to be randomly tested for alcohol each year, in keeping with the prior year's positive test rate. These random test requirements are industry-specific.

Testing Technology and Practices

Analysis and Specimens

The principles underlying the analysis for alcohol in breath and other specimens are discussed in detail in other chapters in this book. These include such considerations as duplicate testing, mouth alcohol, reporting units, and the applicability of various specimens including breath, saliva, blood and urine.

The DOT regulated program focuses on the use of breath. Breath specimens can be collected by non-invasive techniques, are representative of the dynamic circulating blood and brain alcohol concentrations, have been extensively utilized by law enforcement in drinking driving arrests, and have been successfully accepted and defended in the courts. Blood specimens require the services of a qualified phlebotomist; hence adding cost and the stigma of venipuncture to testing. In addition, blood testing is laboratory based and, therefore, would require certified facilities. Further, the results would be delayed and not immediately

available. The DOT program permits saliva as an alternative screening-only specimen.

Urine specimens, on the other hand, are neither useful nor permitted for DOT testing. Urine is a static specimen and as such is not representative of the blood or breath. Proper collection would require collecting two sequential timed specimens. In the presence of alcohol producing microorganisms and glucose, alcohol can be produced in urine; hence, there could be both qualitative and quantitative concerns when testing at the targeted 0.02 and 0.04 A/C. Additional discussion on this topic is presented in Chapter 5.

Testing in the DOT Program

Testing in the DOT Program is controlled by regulation as previously described. Screening tests permit breath or saliva, while confirmatory tests require breath. DOT regulations provide the following documents which define the criteria for evaluation and provide notice of acceptable products which meet the established criteria:

1. a. Model Specifications for Evidential Breath Testing Devices (NHTSA, 1993)
   b. Conforming Products List of Evidential Breath Testing Devices (NHTSA, 1996)
2. a. Model Specifications for Screening Devices to Measure Alcohol in Bodily Fluids (NHTSA, 1994A)
   b. Conforming Products List of Screening Devices to Measure Alcohol in Bodily Fluids (NHTSA, 1995)
3. a. Model Specifications for Calibrating Units for Breath-Alcohol Testers (NHTSA, 1994B)
   b. Conforming Products List of Calibrating Unit for Breath Testers (NHTSA, 1994B)

These notices have been published in the Federal Register over the years to identify equipment approved for law enforcement DWI programs. Such programs were traditionally focused on 0.08 A/C and above as needed to sustain DWI charges. Recent emphasis in the police arena for youthful offenders targeted at 0.02 A/C and commercial driver offenses focused at 0.04 A/C coupled with the needs of the new DOT workplace program has promulgated a re-evaluation of all specifications and resulted in updating and republication of all documents and lists since 1993.

Screening Tests

Screening tests serve as initial tests; hence, are not preceded by a blank test and may be conducted on single use or multiple use breath or saliva devices meeting the model specifications. Since these tests are not designed to provide quantitative results, the model specifications require only that they can discriminate a negative based on 40 tests conducted at a 0.008 A/C and a positive based on 40 tests at a 0.032 concentration (NHTSA, 1994A). The available saliva tests utilize an enzyme assay technology while the non-evidentiary breath devices are based on fuel cell technology.

Table 19-6 provides a list of approved products as of August 1995 as listed on the Conforming Products List of Screening Devices to Measure Alcohol in Bodily Fluids (NHTSA, 1996).

Table 19-6 - Alcohol Screening Devices

AlcoCheck International, Hudsonville, MI
AlcoCheck 3000 DOT
AlcoScreen 3000
Chematics Inc., North Webster, IN
AlcoScreen 02<SUP>TM
Guth Laboratories, Inc., Harrisburg, PA
AlcoTector Mark X
Mark X AlcoChecker
Repco Marketing, Inc., Raleigh, NC
AlcoTec III
Roche Diagnostics Systems, Branchburg, NJ
On Site Alcohol
Sound Off, Inc., Hudsonville, MI
Digitox DOT
AlcoScreen 1000
STC Diagnostics, Inc., Bethlehem, PA
QED A150 Saliva Alcohol Test

Evidentiary Tests

All evidentiary tests are confirmation tests which are preceded by a 15 minute deprivation period and a blank reading. Breath test devices are required. The revised model specifications include testing at new lower concentrations, 0.02, 0.04, 0.08 and 0.16 A/C as well as a test for the presence of acetone. Three technologies are employed: fuel cells, infrared spectrometry and gas chromatography. These are described in detail in Chapter 8. Evidentiary Breath Testing (EBT) instruments as listed on the January, 1996 Conforming Products List of Evidential Breath Testing Devices (NHTSA, 1996) are shown in Table 19-7.

Table 19-7 - Evidentiary Breath Alcohol Devices

CMI, Inc., Owensboro, KY
- Intoxilyzer 200, 200D, 300, 400, 1400
- 5000, 5000CD, 5000CD/FG5, 5000 (CAL DOJ)
- 5000VA, S-D2

Galls, Inc., Lexington, KY
- Alcohol Detection System - ADS 500

Intoximeters
- Alcomonitor, Alcomonitor CC, Alco-Sensor III
- Alco-Sensor IV, RBT III, RBT III-A, RBT IV, Intox EC-IR
- Portable Intox EC-IR

Life-Loc, Inc., Wheat Ridge, CO
- PBA 3000B

Lion Laboratories
- Alcolmeter, 300, 400
- Intoxilyzer 200, 200D, 1400, 5000CD/FG5

National Draeger, Inc., Durango, CO
- Alcotest 7110 MKIII, 7410
- Breathalyzer 7410, 7410-II

National Patent Analytical Systems, Mansfield, OH
- BAC DataMaster
- BAC Verifier DataMaster

Sound-Off, Hudsonville, MI
- AlcoData

U.S. Alcohol Testing, Inc./Protection Devices, Inc., Rancho Cucamonga, CA
- Alco-Analyzer 1000, 2000, 2100

Verax Systems, Inc., Fairport, NY
- BAC Verifier Datamaster

Fuel cells are the most common and least expensive technology. They are compact and portable. They are sensitive to methyl and isopropyl alcohol to varying degrees in addition to responding to ethyl alcohol. Although accurate, they have seen limited use however, as evidentiary devices in the law enforcement arena. Infrared instruments are generally larger, less portable and more expensive than fuel cells. They use varying wavelengths or combinations of wavelengths to enhance their specificity for ethyl alcohol. They have been the primary instrument used by law enforcement in recent years; hence have been subjected to extensive court review. Gas chromatography units are uniquely specific for ethyl alcohol and no other alcohols interfere. The instruments are notably larger and the most complicated to operate, particularly requiring tanks of compressed gases for operation.

All technologies and devices on the conforming products list (Table 19-7) are approved and acceptable for DOT testing. Although there are differences in

the technologies used, all are capable of making equivalent quantitative measurements for ethyl alcohol and other low molecular weight alcohols in breath.

EBT devices can be compared by cost versus the intended use or need. Screening-only devices (i.e., those which conform to EBT model specifications but do not meet other DOT documentation rules) are fuel cell-based and cost approximately $500-$600. Fuel cell devices that meet confirmation documentation requirements are those interfaced to printers. These are lightweight and portable and cost about $2,000. Their data acquisition and transmission capabilities are generally limited. At the next level are the infrared devices which are less portable and cost about $5,000-$6,000. Most are readily linked to computer systems and have more extensive data capabilities for storing, transmitting and handling information. Finally, the gas chromatographic (GC) devices are larger and more expensive, generally about $6,000-$7,000. Each GC unit is provided with a printer and PC-based computer system. The DOT form is printed by computer on demand. In summary, instrument selection should be based on type and location of use, space available, data handling needs, and volume of work. The DOT program at its inception was designed with the idea that these instruments would be used by employers at their work sites to conduct the required testing. In actual practice, laboratories, third party organizations, individual consulting services, and others are providing a substantial portion of the alcohol testing for the industry. The evidentiary fuel cell printer combinations have emerged as the dominant technology for DOT testing.

Calibrating Devices

All instruments require a means for calibration and quality control. This is achieved in one of two ways: the breath alcohol simulator or the use of dry gases. Model specifications and conforming products lists have been published (NHTSA, 1994B). See Chapter 8 for further discussion. The wet bath simulators are available from a number of manufacturers. In addition, two companies provide dry gas standards as follows:

Scott Specialty Gases/Scott Medical Products
Plumsteadville, PA
Model EBS Gaseous Ethanol Breath Standard
(Available in concentration ranges of 0.038-0.105 A/C with typical values near 0.04, 0.06, 0.08 and 0.10 A/C; Scotty XVII (17L) and Scotty V (105L) one-way transportable cylinders and larger returnable cylinders)

AG Specialty Gas (Acetylene Gas Company)
St. Louis, MO
Ethanol Breath Alcohol Standard
(Available in concentrations of 0.038, 0.040, and 0.100 BrAC)

These meet the model specifications as published and will appear on the conforming products list expected in 1996. Until publication in the Federal Register, they have been granted an exemption and can be used for DOT testing. Compressed gases are different from the wet bath simulators in that the gas concentrations must be adjusted for barometric pressure at the site of use.

Wet bath simulators utilize 500 mL of aqueous solutions of ethanol which are available as certified ready to use solutions or can be made from certified stock solutions by dilution using Class A volumetric pipettes and flasks.

Training Requirements

Breath Alcohol Technicians

The Breath Alcohol Technician (BAT) is an individual trained to proficiency in operating an EBT. Training is conducted according to the 6.5 hour BAT Model Curriculum provided by DOT. This includes: Introduction and Overview; EBT Methodology/Preparing for Testing; Conducting a Screening Test; Conducting a Confirmation Test; Obstacles to Completing a Test; Disclosure of Information and Record Keeping; and Proficiency. Certified BATs must complete the BAT Model Course or its approved equivalent. A Student Handbook and Instructor Training Curriculum are available from DOT (Department of Transportation, 1994A, 1994B). The employer must document BAT training and proficiency. Additional training is required if the BAT performs EBT calibration checks and/or maintenance. Specific instrument training varies according to the instrument selected.

Screening Test Technicians

The Screening Test Technician (STT) performs the screening functions only. Training must be conducted in accordance with the DOT Model Course or its equivalent (Department of Transportation, 1995B). Individuals who successfully complete the model course or its equivalent may perform tests if they have been deemed proficient and able to discern correctly the changes in the test which produces positive or negative results. Training and proficiency must be documented. Anyone meeting the requirements as a BAT may act as a STT.

Testing in the Nuclear Regulatory Commission Programs

The Nuclear Regulatory Commission (NRC) had instituted alcohol testing prior to the DOT Program. Their regulations state:

"Tests for alcohol must be administered by breath analysis using breath alcohol analysis devices meeting evidential standards described in Section 2.7 (O)(3) of Appendix A of the NRC Rules. A breath alcohol content indicating a blood alcohol concentration of 0.04 percent or greater must be a positive test result. The confirmatory test for alcohol shall be done with another breath measurement instrument. Should the person demand further confirmation, the test must be a gas chromatography analysis of blood." (Code of Federal Regulations, 1989)

There are some similarities and differences. Both DOT and NRC principally use breath testing. DOT allows two tests on the same instrument while NRC requires two tests on two different instruments (either of the same or alternate technologies). NRC allows optional blood testing. It should be noted that breath test devices used in NRC programs were evaluated prior to the recent DOT induced Model Specifications and Conforming Product List updates.

Interpretation of Alcohol Test Results

In relation to alcohol testing in the workplace, an understanding of the acute effects of alcohol as reflected by the alcohol concentration of blood, breath or saliva is necessary chiefly in three regards: 1) Establishing appropriate alcohol concentration thresholds, at or above which specified work-related activities such as performance of safety-sensitive functions are prohibited by the employer's alcohol abuse prevention and control policy; 2) interpretation of alcohol test results in reasonable cause or reasonable suspicion and post-accident testing; and 3) assessment of fitness-for-duty. An alternative to promulgating one or more alcohol concentration thresholds is a policy requiring covered employees to be alcohol-free at work. Such "alcohol-free" status can be defined in terms of alcohol concentration as discussed below.

Interpretation of alcohol test results to workplace alcohol testing is addressed in this chapter with special reference only to the extent necessary to supplement the information found elsewhere in this monograph. The workplace is not unique with respect to the significance of alcohol test results or the effects of alcohol on impairment. In the simplest form of alcohol test result interpretation, a given threshold, say zero alcohol concentration[7](A/C) or any other A/C, constitutes the dividing point between permissible and impermissible alcohol presence. A confirmed alcohol test result equal to or greater than that threshold, by itself, triggers the prestipulated consequence, whether standing down from safety-sensitive duties or other work-related outcome. In addition to thresholds established specifically for a given workplace by governmental regulation or by employer policy, the normal per se thresholds and presumptive interpretations of federal,

state, and local statutory prohibitions remain applicable and enforceable by police and prosecuting agencies and the courts. The most common examples are the alcohol elements of motor vehicle offenses, e.g., operating a motor vehicle under the influence of alcohol, or while impermissibly impaired by alcohol or by the combined effects of alcohol and other drugs. There are also special work-related statutory prohibitions, such as that against operating a commercial motor vehicle, as defined by federal law, when the driver has any demonstrable presence of alcohol in the body.

What constitutes "zero alcohol" in a worker is subject to several considerations, including the purely technical issue of what putative alcohol concentration in breath or saliva, if any, could be obtained in a properly conducted alcohol analysis on an alcohol-free subject. As reflected elsewhere in this monograph, modern methods and techniques of breath or saliva-alcohol analysis uniformly yield results of less than 0.01 A/C in alcohol-free subjects. We therefore propose that a breath, blood, or saliva-alcohol concentration of less than 0.01 A/C be considered as indication of alcohol-free state of the tested person at the time of the test. This proposal is substantially consistent with positions of the National Safety Council's Committee on Alcohol and Other Drugs and with the majority recommendation of the Transportation Research Board's Committee on Benefits and Costs of Alternative Federal Blood Alcohol Concentration Standards for Commercial Vehicle Operators, rendered in 1987 (Special Report 216, 1987). Any alcohol concentration of 0.01 A/C or greater would, therefore, indicate the presence of alcohol at the time of the test. An alcohol-free status requirement would appropriately apply only to a true "zero alcohol" employer policy, enforced for example on employees previously diverted to substance abuse evaluation and treatment for documented alcohol abuse, upon their post-treatment return to duty in a safety-sensitive function.

The other extreme is represented by high alcohol concentrations such as those corresponding to visible, gross alcoholic intoxication. Between these extremes are intermediate alcohol concentration thresholds, the most common of which are 0.02, 0.04, and 0.08 A/C.

Acute Effects of Alcohol

The central nervous system depressant effects of alcohol occur at any measurable alcohol concentration; and the measured concentration is a valid correlate of alcohol effects, including impairment of CNS and other body functions. Extensive reviews of the literature by Moskowitz and Robinson (Moskowitz & Robinson, 1988), exploring the evidence of alcohol effects on reaction time, tracking, concentrated attention, divided attention, performance, information processing capabilities, visual function, perception, psychomotor performance, and

driving performance led to the conclusion that impairment measured by those parameters can occur at alcohol concentrations as low as 0.02 A/C; and has been reported for most of these performance areas at alcohol concentrations between 0.01 and 0.02 A/C. A comprehensive survey of the literature reflecting post-1984 research on alcohol effects on human behavior and performance was carried out by Holloway (Holloway, 1994). Among the workplace-relevant conclusions reached in that review were that: 1) 70-80% of the studies reviewed report significant effects for intoxication ratings and for controlled laboratory performance at or below 0.04 alcohol concentration; 2) several task characteristics may influence the relative sensitivities of certain tasks to alcohol effects, including: task complexity, multiple tasks, directed attention or concentration, performance feedback and contingent incentives; 3) several environmental factors or contextual parameters may influence the sensitivity of one or more alcohol effects, including time-of-day, phase of sleep-wake cycle, and social context.

The NSC Committee on Alcohol and Other Drugs in 1971 took the position that "a concentration of 80 milligrams of ethanol per 100 milliliters of whole blood (0.08 per cent w/v) in any driver of a motor vehicle is indicative of impairment in his driving performance" (Committee, 1992). It follows from statistical considerations applicable to any cumulative normal (Gaussian) distribution phenomenon such as driving impairment at various alcohol concentrations that when 100% of the sample population is affected at 0.08 A/C, 50% of the same population is affected at 0.04 A/C. In other words, reliable experimental evidence exists that the driving ability of predictable portions of the population are demonstrably impaired at alcohol concentrations less than 0.04 A/C, half are so affected at 0.04 A/C and all are impaired at 0.08 A/C. It is reasonable to apply the same population impairment statistical approach to other-than-driving tasks in the workplace which make comparable demands on cognition, signal processing, decision-making, psychomotor functions, etc. In effect, that is what imposition of the 0.02 and 0.04 A/C thresholds in the DoT and NRC regulations acknowledges in banning performance of safety-sensitive functions at those alcohol concentrations.

Two other workplace related truisms about alcohol and impairment are: 1) In any given individual, acute impairment increases with increasing alcohol concentration; and 2) the proportion of the population which is acutely impaired in any given respect or to any given extent increases with increasing alcohol concentration. Both of these truisms obviously have functional upper limits.

Combined Effects of Alcohol and Other Drugs

Consideration of interactions between alcohol and other drugs becomes relevant in several workplace-related situations. They include alcohol test results which are markedly inconsistent with observed (impaired) behavior or performance of the tested employee in reasonable cause or reasonable suspicion or post-accident alcohol testing. Another example is the decision on what alcohol concentration, if any other than zero, should be acceptable as a policy matter in workers who are taking prescribed medications chronically, as for management of diabetes or for seizure control. Clearly, some of these decisions involve medical aspects as well as workplace-alcohol issues.

Alcohol has been demonstrated to interact with a great number and variety of other drugs, both therapeutic substances and drugs-of-abuse. Such interactions are so ubiquitous that alcohol probably manifests more combined effects with other drugs than does any other single drug. The nature, extent and duration of interaction depends upon the particular combination of drugs, and fluctuates widely. The most common drug interactions are additive, others are synergistic, potentiating, and antagonistic. An additive effect indicates a summing of the individual effects of the two or more drugs in question. Synergistic effects are those in which the combined effects of two or more drugs are greater than the sum of the individual effects if the drugs were given alone. Potentiation is now usually considered as increasing the effect of a toxic substance acting simultaneously with a nontoxic one. Antagonistic effects are those constituting mutual interference of two or more drugs, thus canceling the respective effects partly or entirely. Thus, the combined effects can produce increases in or diminutions of the normal individual effects or actions, including the production of toxicity. The mechanisms of these various effects are complex and cannot be considered in detail here. The interactions can be functional, chemical as in-vivo changes in one or both of a drug combination, dispositional with respect to duration of action and rate of elimination of the respective drugs, or receptor-based, in which blockage occurs at a receptor site through competition of two or more drugs for the same receptor-action site. A major concern about interaction of alcohol with other drugs is for hazardous additive or synergistic effects with other drugs which are psychoactive, particularly those which are also central nervous system depressants, like alcohol. Prolongation of sedative or other adverse psychoactive drug effects in the workplace is also a concern; the combination of alcohol and diazepam is a prime example of such prolongation of drug action as well as intensification of impairing effects.

Sources for information on interactions of alcohol with other drugs include both classical references (Forney and Hughes, 1968; Hansten, 1989) and current

compilations which are frequently upgraded (PDR Guide, 1996; Drug Interaction Facts, 1996), as well as computerized listings. The combined actions can be one-way or mutual; some drugs increase the subject's sensitivity to alcohol, while the effects of other drugs are enhanced or prolonged by alcohol. A widely used reference on drug interactions lists 93 drugs and drug classes which have been reported to interact with ethanol, from acetaminophen to warfarin (Drug Interaction Facts, 1996).

Hangover Effects of Alcohol

Alcohol and some other drugs have after-effects which persist past the period of actual presence of the parent drug or its metabolites in the body. With alcohol, these residual effects include the "hangover" syndrome experienced, typically, the morning after a bout of heavy drinking. Hangover has been variously characterized as subacute intoxication (Israel and Mardones, 1971), a very mild form of alcohol withdrawal (Mendelson and Mello, 1985A), or a mini-withdrawal syndrome (Mendelson and Mello, 1985B). The term usually refers to the combination of headache, gastric discomfort, general malaise and mild anxiety. However, there may be more severe post-alcoholic effects causing a wide span of physical and physiological distress including fatigue, thirst, vertigo, nystagmus, and nausea in addition to the characteristic "pounding" headache. The syndrome was described more than 25 centuries ago in the Hindu medical literature (Leake and Silverman, 1966). It typically appears many hours after the peak alcohol concentration, often in the morning after an evening-long drinking episode, and is usually most severe when little or no alcohol is detectable in the body. Fortunately, the condition is temporary. Modern studies have demonstrated that the hangover form of alcohol after-effects can and does impair critical task performance, such as aircraft operation (Wise, 1992; Wolkenberg et al., 1975; Yesavage and Leirer, 1986). It is noteworthy that the pilots studied by Yesavage and Leirer could not accurately judge their own degree of flight impairment on the morning after ingesting the alcohol (Modell and Mountz, 1990).

In brief, hangover and other after-effects of overindulgence in alcohol constitute a real and variably-extensive source of performance decrement and impairment for critical work tasks. The situation was well summarized by Kelly et al. in their seminal article: "The results of this investigation show that alcohol in the dose used caused significant impairment and changes in a variety of physiological variables not only during intoxication but also during the post-alcohol stage" (Kelly et al., 1970). Alcohol test results by themselves, of course, afford no information on the presence and intensity, or absence, of hangover and other after-effects of alcohol.

Abstention Period

Some federal anti-alcohol abuse regulations applying to railroading and aviation impose mandatory preduty abstention periods, e.g., 4 or 8 hours during which no alcohol intake is permitted. Even strict and faithful compliance with those restrictions cannot assure alcohol-free status after moderate or greater alcohol consumption, or guarantee that an alcohol concentration below the trigger thresholds of 0.02 and 0.04 alcohol concentration will be reached in every person in that time-frame because of variability in alcohol uptake and elimination patterns in the general population, in addition to beverage-related and drinking situation-specific differences (Dubowski, 1976; Dubowski, 1985; O'Neill, Williams, and Dubowski, 1983). Of the healthy adult male subjects studied by Dubowski, those with the lowest alcohol elimination rate found would require more than 24 hours to become alcohol-free after reaching a 0.15 g/210 L peak breath-alcohol concentration, while those with the highest experimentally determined rate would require only about 6 hours (Dubowski, 1985).

There are, however, some broadly applicable guidelines. Some rule-of-thumb estimates can be derived from well established experimental data showing a mean alcohol elimination from the body of about 100 mg per kilogram of body weight per hour for men. For a typical healthy normal adult man weighing 68 kg (150 pounds), that corresponds to elimination of about the alcohol content of six ounces of beer per hour - or the alcohol content of about one 12 ounce container of beer in two hours. About four hours is typically needed in that situation to become alcohol-free after consuming two 12-ounce portions of beer, six hours for three 12-ounce portions, etc. if the beer is consumed in increments over a reasonable time period rather than as rapidly as possible (Dubowski, 1976). Elimination of alcohol from other sources than beer is mostly comparable for equivalent total alcohol intake.

Clearly, the safest course is to abstain from alcohol intake entirely or for longer than the minimally-mandated periods, if the objective is not to exceed prohibited alcohol concentration thresholds. Over-the-counter disposable alcohol test devices for self-monitoring are available to assist in guidance to alcohol-free status. For workers subject to duty calls on short notice, avoidance of alcohol intake for at least one day or so before any such on-call schedule period is the most appropriate action.

Endnotes

1. The unmodified term *alcohol* as used in this chapter means ethanol
2. The Constitution of the United States, Fourth Amendment: "The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated..."
3. The Constitution of the United States, Fifth Amendment: "...nor shall any person...be deprived of life, liberty, or property, without due process of law..."

   The Constitution of the United States, Fourteenth Amendment: "...nor shall any State deprive any person of life, liberty, or property, without due process of law..."
4. The time required for the alcohol concentration in a given body compartment (e.g., the blood) to be reduced to one-half of the original peak value.
5. The American Board of Forensic Toxicology adopted the following position in November 1986: "It...is declared the policy of the American Board of Forensic Toxicology that drug (substance)-use testing activities by means of laboratory examinations be considered as encompassed within the scope of forensic toxicology when carried out under mandate of law, or under equivalent circumstances."
6. *Alcohol concentration* as that term is used in DOT regulations means the alcohol in breath, in g/210 L, or the alcohol in blood, in g/100 mL.
7. Again for the purposes of this section of this chapter, alcohol concentration means g/210 L of breath or g/dL of blood.

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