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National Transportation Safety Board Safety Study Alcohol and Other Drug Involvement in Fatal General Aviation Accidents, 1983 through 1988

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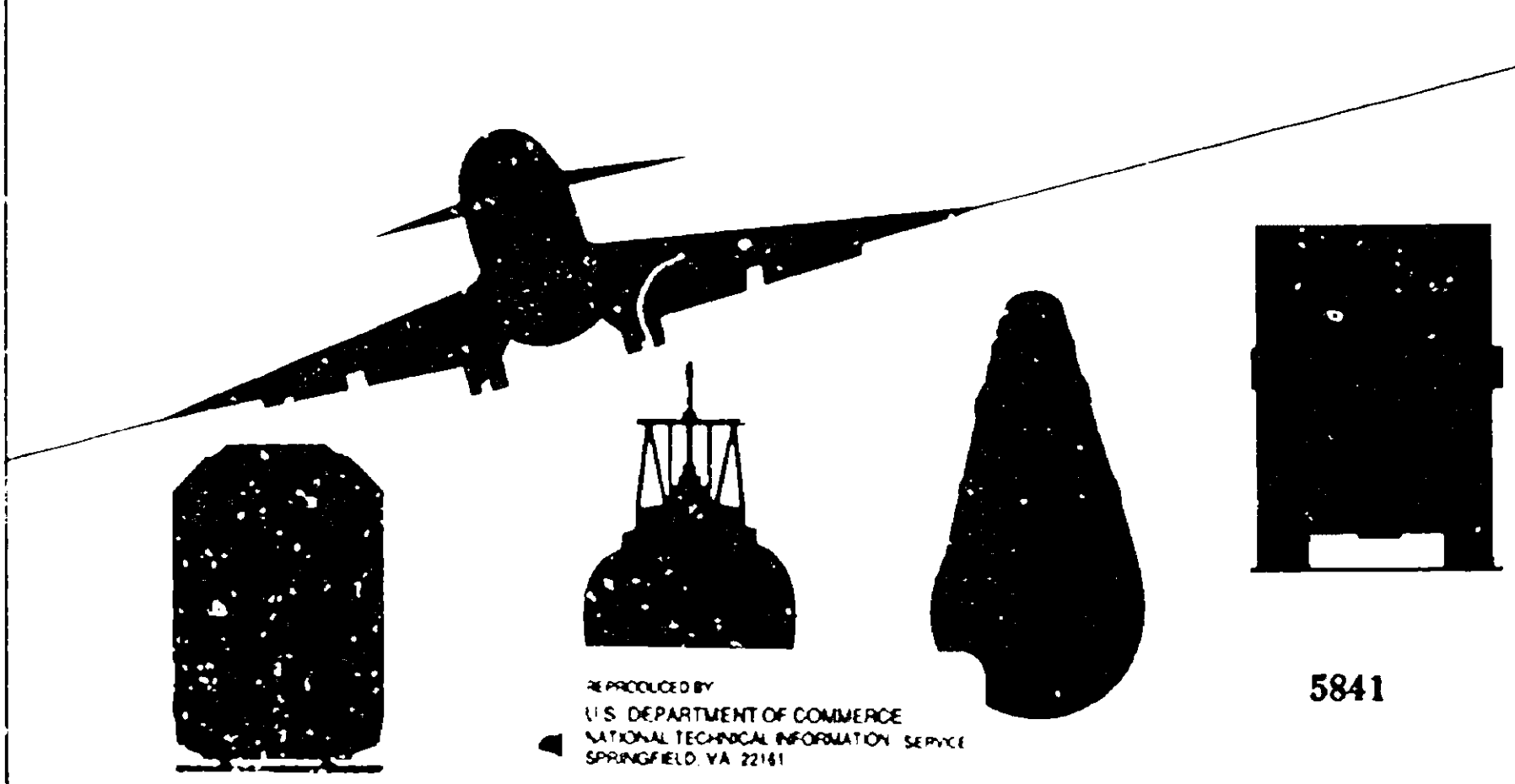
NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

SAFETY STUDY

ALCOHOL AND OTHER DRUG INVOLVEMENT IN FATAL GENERAL AVIATION ACCIDENTS, 1983 THROUGH 1988



Abstract: This study examines alcohol involvement in fatal general aviation accidents that occurred from 1983 through 1988. Despite a downward trend in alcohol-involved general aviation accidents that were fatal to the pilot during the 1983 through 1988 period, about 6 percent of the fatally injured pilots in the study were flying while impaired. The mean blood alcohol concentration (BAC) of the alcohol-positive pilots was 0.15 percent, nearly four times the 0.04-percent BAC offense level established by current Federal Aviation Administration regulations. The safety issues discussed in this report are the need for comprehensive State laws pertaining to alcohol and drug use in general aviation, and the need to prevent pilots from flying while impaired by alcohol or other drugs. Recommendations concerning these issues were made to the Federal Aviation Administration, the States, the Aircraft Owners and Pilots Association, the Experimental Aircraft Association, the National Agricultural Aviation Association, the National Air Transportation Association, the National Association of Flight Instructors, and the National Association of State Aviation Officials..

The National Transportation Safety Board is an independent Federal agency dedicated to promoting aviation, railroad, highway, marine, pipeline, and hazardous materials safety. Established in 1967, the agency is mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The Safety Board makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

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Adopted: October 14, 1992
Notation 5841

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EXECUTIVE SUMMARY

The Safety Board conducted this study to examine alcohol and other drug involvement in fatal general aviation accidents that occurred from 1983 through 1988 and to compare the level of alcohol-involved accidents with the level documented in its 1984 statistical review of alcohol-involved aviation accidents that occurred from 1975 through 1981. For general aviation accidents that were fatal to the pilot-in-command, comparisons are made for two accident groups in terms of accident characteristics, flight conditions, pilot-in-command characteristics, and causes and factors. The alcohol-involved group consists of accidents in which alcohol was cited by the Safety Board as a cause or factor; the second group consists of accidents in which alcohol or other drugs were not cited as a cause or factor. Although the study briefly reviews accidents that were fatal to the pilot-in-command and in which drugs other than alcohol were cited as a cause or factor, the data are too limited for a comparative analysis to the alcohol-involved accidents or to accidents in which alcohol or other drugs were not cited.

During the 1983 through 1988 period, there was a downward trend in total general aviation accidents, fatal general aviation accidents, general aviation accidents fatal to the pilot-in-command, and alcohol-involved general aviation accidents fatal to the pilot. Further, the data show that the percent of conclusive toxicological tests that were alcohol positive for fatally injured general aviation pilots decreased from about 10 percent (corresponding to about 47 accidents per year) in the mid-1970s to about 6.0 percent (about 17 accidents per year) in the late 1980s. However, data on the general aviation pilots fatally injured in alcohol-involved accidents show evidence of high blood alcohol concentrations (BAC). The mean BAC of the alcohol-positive pilots was 0.15 percent, nearly four times the 0.04-percent BAC offense level established by current Federal Aviation Administration regulations. The data also show evidence of certificate violations (pertaining to biennial flight review, medical certificates, and airman certificates), and flying inexperience.

The safety issues discussed in this study are:

- the need for comprehensive State laws pertaining to alcohol and drug use in general aviation; and

- the need to prevent pilots from flying while impaired by alcohol or other drugs.

As a result of this study, recommendations were issued to the Federal Aviation Administration, the States, the Aircraft Owners and Pilots Association, the Experimental Aircraft Association, the National Agricultural Aviation Association, the National Air Transportation Association, the National Association of Flight Instructors, and the National Association of State Aviation Officials.

INTRODUCTION

On September 3, 1988, near El Paso, Texas, a Cessna 170A carrying the pilot and three passengers was observed flying 50 to 75 feet above ground level and maneuvering. When the airplane did not return to the airfield, a search was conducted and the wreckage was located the following morning. Crash evidence indicated that no mechanical failure had occurred prior to impact and that the airplane had collided with the nearly level desert terrain while in a steep left bank with the nose slightly down. All four persons on board were fatally injured. The passengers were apparently on a bird hunting excursion, and four shotguns and many shotgun shells were found in the wreckage area. Toxicological test results of the pilot indicated a 0.152-percent blood alcohol concentration (BAC). The Safety Board determined the probable cause of the accident to be poor judgment, physical impairment by alcohol, and a misjudged altitude by the pilot-in-command.

Purpose of the Study

Because such accidents were continuing to occur, the Safety Board undertook this study to examine the current involvement of alcohol and other drugs in aviation accidents and to compare the current involvement of alcohol with that which existed between 1975 and 1981, as documented in a 1984 Safety Board study.[1] For general aviation accidents that were fatal to the pilot-in-command, comparisons are made for two accident groups (defined in the following section) in terms of accident characteristics, flight conditions, pilot-in-command characteristics, and causes and factors.

Methods

This study examined data in the Safety Board's aviation accident data base to review the role of alcohol in aviation accidents over a 6-year period, 1983 through 1988. Interpretation of data is presented where appropriate.

For the purpose of this study, an alcohol-involved fatal accident is defined as one in which the pilot-in-command was fatally injured and alcohol was cited by the Safety Board as a cause or a factor in the accident.[2] Accident causes and factors are determined by the Safety Board based on the

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[1] National Transportation Safety Board. 1984. Statistical review of alcohol-involved aviation accidents. Safety Study NTSB/SS-84/03. Washington, DC. The 1984 study was based on a review of alcohol involvement in primarily fatal aviation accidents investigated by the Safety Board.

[2] The pilot-in-command was not the crewmember cited for alcohol impairment in three alcohol-involved accidents that were fatal to the pilot-in-command. In these three accidents, identified later in the report, someone other than the pilot-in-command was cited for alcohol impairment; that is, a student pilot or a nonflying pilot.

evidence collected during the investigation of the accidents, including toxicological tests for alcohol. Accidents fatal to the pilot-in-command, the population of accidents for which the most complete toxicological test results are available, were selected as the study population. Nonfatal injury accidents, especially general aviation nonfatal injury accidents, rarely result in toxicological tests of surviving pilots. (This issue is discussed later in the report). However, even in fatal accidents, tests may not have been requested, specimens may not have been available or suitable for testing, and autopsies or toxicological tests may not have been possible for other reasons.[3] Thus, the determination that an accident was alcohol-involved represented a binary (yes-no) determination that alcohol caused or contributed to the accident on the basis of all information available from the investigation, not solely on the results of the toxicological tests.

The extent of alcohol involvement in fatal accidents is compared for two periods: 1975 through 1981 (the period documented in the 1984 safety study), and 1983 through 1988. For the 1983 through 1988 period, the study includes analyses of selected accident and pilot-in-command characteristics of general aviation accidents involving alcohol.

Although overall accident data for 1982 are included in this report, toxicological test data for 1982 are not included. In 1982, the Safety Board developed an extensive revision to the computerized aviation accident/incident reporting system and special reporting supplement on occupant, survival, and injury information (Supplement K to NTSB Form 6120.4). Supplement K forms from 1983 through 1988 provide the data for the toxicological test analysis (see appendix A). The changes implemented in 1982 make comparison of alcohol-involved accident data from that year with other years difficult. As a result, 1982 data on toxicological test results cannot be used and, therefore, are omitted.

The 1984 safety study reported on all alcohol-positive aviation accidents, both fatal and injury. Further, the 1984 study defined an alcohol-involved accident more expansively than this study in that a positive toxicological test result for alcohol of personnel other than the flightcrew (such as ground personnel) would have designated the accident as alcohol-involved, whether or not alcohol was determined by the Safety Board to have been a cause or factor in the accident. To compare data from that study with data from 1983 through 1988, fatal general aviation accident data for 1975 through 1981 have been reanalyzed according to the criteria of this study; that is, accidents fatal to the pilot-in-command with alcohol cited as a cause or factor.

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[3] All accidents investigated by the Safety Board are reviewed for the possibility of post-mortem generation of alcohol due to microbial action. Accidents in which post-mortem generation of alcohol was determined or considered likely are not included in this analysis.

The Safety Board believes that the data on alcohol in this report present an accurate picture of alcohol involvement in fatal general aviation accidents. About 79 percent of the fatally injured general aviation pilots were tested. There is no evidence that the 21 percent of the fatal accidents in which no test results were obtained represent a different population than the 79 percent of the fatal accidents in which tests were obtained. Therefore, the Safety Board believes that the 79-percent subset of fatally injured general aviation pilots is representative of all alcohol-involved general aviation accidents that were fatal to the pilot.

The data and findings from the fatal general aviation accidents involving alcohol may not be representative of all general aviation accidents involving alcohol. Nonfatal aviation accidents may well have characteristics different from those of fatal general aviation accidents. However, the percent of fatal general aviation accidents that involve alcohol is probably higher than the percent of all general aviation accidents that involve alcohol, just as the percent of fatal highway accidents that involve alcohol is estimated to be the upper limit of alcohol involvement in all highway accidents.[4]

The study also looked at accidents fatal to the pilot-in-command in which drugs other than alcohol were cited as a cause or factor for the 1983 through 1988 period. For the purposes of this study, a drug-involved fatal accident is one in which the pilot-in-command was fatally injured and drugs other than alcohol were cited by the Board as a cause or factor. Illicit drugs, prescription drugs, and over-the-counter drugs that can cause impairment when flying, such as antihistamines and decongestants, are among the drugs cited by the Safety Board in the drug-involved accidents. Only a small number of fatal general aviation accidents (35) occurred during the study period in which the Board cited drugs as a cause or factor. Because of the small number of accidents and some problems in obtaining conclusive toxicological tests for drugs during the 1983 through 1988 period, analyses similar to those made for alcohol-involved accidents could not be accomplished. Information about the drug tests and test results is presented in the section "Drugs in General Aviation Accidents Fatal to the Pilot-in-Command."

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[4] (a) Borkenstein, R.F.; Crowther, R.F.; Shumate, R.P.; and others. 1964. The role of the drinking driver in traffic accidents. Bloomington, IN: Indiana University Department of Police Administration. (b) Waller, J.A. 1976. Alcohol and unintentional injury. In: Kissin, B.; Begleiter, H., eds. The biology of alcoholism. New York: Plenum Publishing: 307-349. Vol. 4. (c) U.S. Department of Transportation, National Highway Traffic Safety Administration. 1990. General Estimates System 1989: a review of information on police-reported traffic crashes in the United States. DOT-HS-807-665. Washington, DC. (d) U.S. Department of Transportation, National Highway Traffic Safety Administration. 1991. A decade of progress: a review of information on fatal traffic crashes in the United States in 1989. DOT-HS-807-693. Washington, DC.

Federal Regulations on Alcohol and Drug Testing in Effect From 1983 Through 1988

During the 1983 through 1988 period addressed in this study, Federal Aviation Administration (FAA) rules contained in Title 14 Code of Federal Regulations (CFR) Part 91 prohibited persons from acting as a crewmember while under the influence of alcohol or while using any drug "that affects [the person's] faculties in any way contrary to safety." In addition, a subsection within the regulation, known as the "8-hour rule," prohibits a person from acting or attempting to act as a civil aircraft crewmember within 8 hours after consuming any alcoholic beverage (see appendix B).[5] The FAA amended the alcohol and drug regulations on April 17, 1985, by adding a prohibition against acting or attempting to act as a crewmember with a BAC at or above 0.04 percent (Section 91.17)[6] (see appendix C).

Other regulatory activity related to drug use and testing occurred in the transportation industry during the 1983 through 1988 period, including changes in the regulations relating to testing pilots for alcohol and other drugs. Although the changes occurred too late to affect the testing in accidents reviewed for this study, a brief summary of these changes follows to highlight actions taken to address alcohol and drug use in the industry.

On November 21, 1988, in response to Executive Order 12564 that established the goal of a drug-free Federal workplace, the Department of Transportation (DOT) issued an interim final rule for transportation workplace drug testing (49 CFR Part 40).[7] Concurrently with promulgation of

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[5] Title 14 CFR 91.11, General Operating and Flight Rules. (See appendix B.) Part 91 applies to civil aviation; general aviation pilots are subject to requirements in Part 91.

[6] The revision became effective in June 1985, at which time it was codified as 14 CFR 91.11. In 1990, the regulation was recodified as 14 CFR 91.17.

[7] The DOT rule is consistent with guidelines issued by the Department of Health and Human Services (DHHS) on April 11, 1988, entitled "Mandatory Guidelines for Federal Workplace Drug Testing Programs," which standardized drug testing procedures and required laboratories to be certified by DHHS to provide drug testing services. The DOT final rule was issued on December 1, 1990.

the DOT regulations, the FAA amended its regulations pertaining to drug testing of employees who are subject to 14 CFR Parts 61, 121, and 135 and to alcohol testing of accident/incident-involved pilots who are subject to Parts 61, 91, 121, and 135.[8]

The drug testing regulations for transportation employees subject to Parts 121 and 135, the Parts that regulate air carrier operations, require operators to conduct pre-employment, postaccident, random, reasonable cause, and periodic testing of urine specimens for amphetamines, cannabinoids, cocaine, opiates, and phencyclidine. An employer's testing program may include testing for other drugs, but that testing must be separate and apart from the DOT-mandated drug testing program. The regulations do not currently require employer testing for beverage alcohol, the most commonly abused drug.[9]

Revisions to Section 61.14, promulgated in 1988, also incorporated an "implied consent" provision regarding submission to a drug test for employees of Part 121 and Part 135 certificate holders.[10] Implied consent in this context means that, by virtue of holding a certificate and being employed by a Part 121 or a Part 135 carrier, the employee has given prior "implied" consent to provide a specimen for drug testing upon an employer's request.

The 1988 revision also includes an implied consent provision, contained in Section 61.16, that requires certificate holders subject to Parts 91, 121, and 135 to submit to an alcohol test when requested by a law enforcement officer and to furnish to the FAA results of alcohol tests. Refusal or failure to provide a specimen for alcohol testing may result in certificate suspension or revocation. (Appendixes C and D of this report contain the regulations related to implied consent.)

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[8] 14 CFR Part 61, Certification: Pilots and Flight Instructors; 14 CFR Part 91, General Operating and Flight Rules; 14 CFR Part 121, Certification and Operations: Domestic, Flag, and Supplemental Air Carriers and Commercial Operators of Large Aircraft; and 14 CFR Part 135, Air Taxi Operators and Commercial Operators. Appendix I to 14 CFR Part 121 provides standards and components of the drug testing program and is referenced in Part 135 and other Parts. Part 91 applies to all civil aviation pilots, including general aviation pilots; Part 61 applies to all civil aviation certificate holders, including general aviation certificate holders.

[9] Public Law 102-143 enacted October 28, 1991, requires alcohol testing in commercial transportation operations, including aviation, mass transit, motor carrier, and rail. The DOT is in the process of promulgating regulations related to employee alcohol testing.

[10] On September 5, 1991, FAA published a final rule exempting from drug testing most entities that conduct operations not requiring certification under Parts 121 or 135. One type of commercial sightseeing flight conducted under Part 135 was retained in the FAA employer drug testing program.

Information From Other Sources About Drugs in Aviation

The aviation industry conducted 230,621 toxicological tests of commercial aviation employees and applicants (including flightcrews, air traffic controllers, maintenance workers, and others in safety-sensitive[11] positions) over a 1-year period, January through December 1990. A positive result was obtained in 966 (0.42 percent) of these tests. The distribution of the positive test results is shown in figure 1. More than 46 percent of the positive test results came from pre-employment tests, 46 percent of the positive test results came from random testing, and 8 percent of the positive test results came from postaccident, reasonable cause, and return-to-duty tests.[12] During the first 6 months of 1991, 144,766 employees and applicants were tested. Of those, 1.05 percent (1,524 persons) tested positive for one of the drugs on the test protocol: pre-employment tests accounted for 764 positive results (50 percent of the overall positive tests), random tests 680, return-to-duty tests 37, reasonable cause tests 24, periodic tests 15, and postaccident tests 4.[13] According to the Air Transport Association, in random tests of flightcrews, only 0.29 percent tested positive for drugs.

In a previous press release about drug testing, the FAA indicated "that drug use in aviation is not widespread, but even one drug user is too many and will not be tolerated."[14] However, the Safety Board is concerned that the actual incidence of drug use in the aviation industry may be greater than these data indicate because of the high cutoff concentrations in the DOT drug testing regulations. The Safety Board has recommended changes in these cutoff concentrations in Safety Recommendations I-89-4 through -12 issued to the DOT on December 5, 1989 (see appendix E).

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[11] Safety-sensitive (or sensitive safety-related) positions are identified in the DOT employee drug testing program contained in Appendix I to 14 CFR Part 121. Employees holding these positions must be tested because the performance of their duties is crucial to the safety of transportation. Safety-sensitive positions include flight crewmember, flight attendant, flight or ground instructor, and aircraft dispatcher; and positions involved in aircraft maintenance or preventive maintenance, aircraft security or screening, and air traffic control.

[12] FAA Newsletter, August 13, 1991.

[13] Except for the overall test results, the data do not distinguish between applicants and employees.

[14] FAA press release, January 1991.

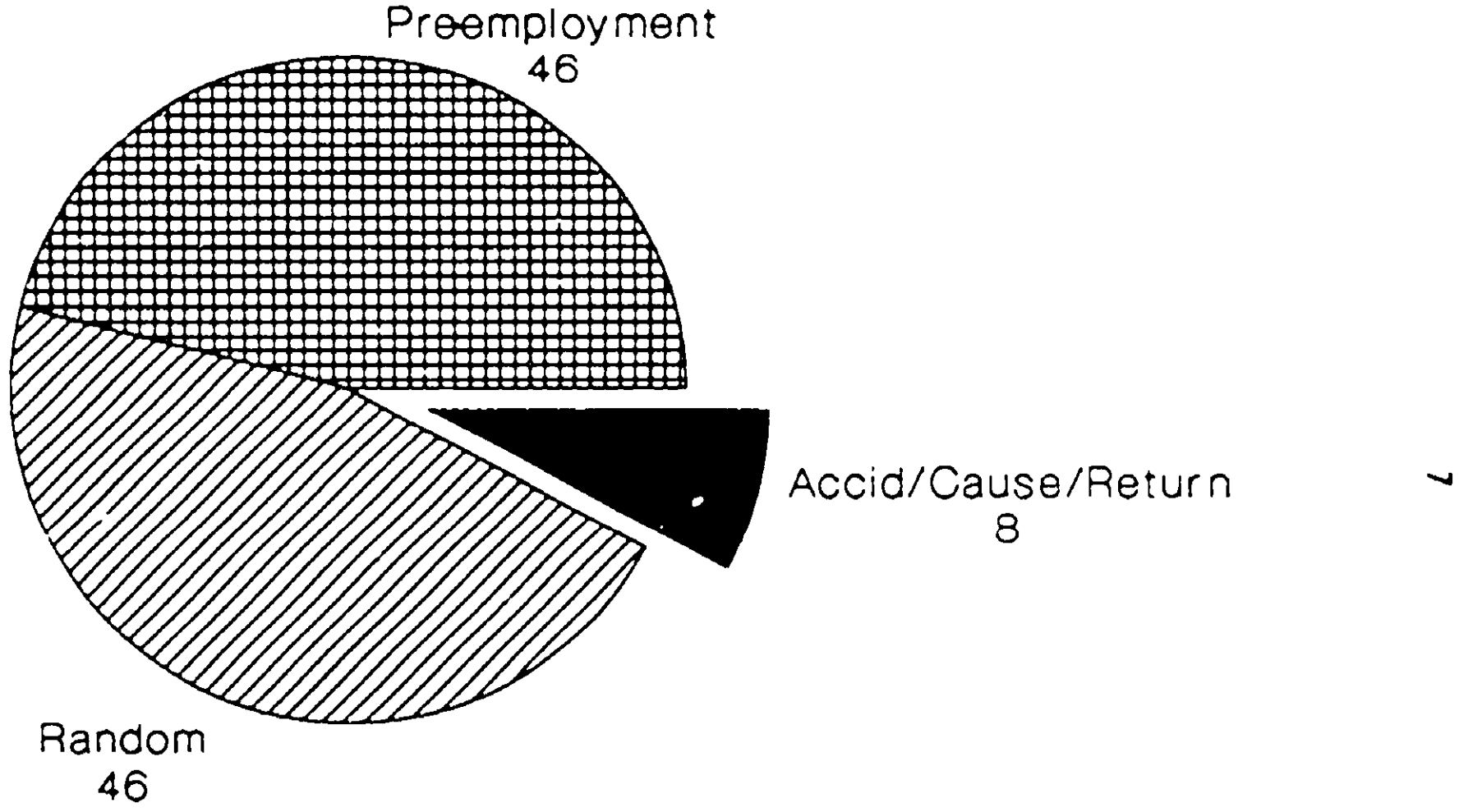

Figure 1.--Distribution of commercial aviation employees and applicants testing positive for drugs in toxicological tests conducted calendar year 1990. Distribution is expressed in percent. (Number of positive tests is 966. Accid/Cause/Return = postaccident, reasonable cause, return to duty.)

A 1991 study by the Armed Forces Institute of Pathology derived from toxicological tests of 377 general aviation fatalities occurring from October 1988 to October 1989 found cannabinoids in 1.3 percent of the fatalities, benzoylecgonine (a cocaine metabolite) in 1.6 percent of the fatalities, and stimulants in only 0.5 percent of the fatalities. The study found "no consistent pattern of drug use."[15]

SmithKline Beecham Clinical Laboratories recently reported on 400,000 toxicological tests taken in 1991 on workers and applicants in "safety-sensitive" transportation jobs subject to Federal regulation. SmithKline reported that 2.6 percent of the 400,000 workers tested positive for one or more drugs.[16]

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[15] Kuhlman, J.J.; and others. 1991. Toxicological findings in Federal Aviation Administration general aviation accidents. Journal of Forensic Sciences 36(4). July.

[16] SmithKline Beecham Clinical Laboratories press release, February 10, 1992; and telephone interview with SmithKline Beecham personnel.

ALCOHOL AND OTHER DRUGS IN COMMERCIAL AVIATION ACCIDENTS

From 1975 through 1988, no pilot of a scheduled commercial carrier (Part 121) that was involved in a fatal accident tested positive for alcohol or other drugs. Further, none have tested positive since 1964, the earliest year for which such data are available.

From 1975 through 1981, scheduled commuter airlines operating under 14 CFR Part 135 experienced 77 fatal accidents from which 47 conclusive toxicological tests were performed; 3 were positive for alcohol (6.4 percent of the 47 conclusive tests) (table 1).[17] From 1983 through 1988, the period of this study, scheduled commuter airlines experienced 30 fatal accidents from which 14 conclusive toxicological tests were performed; none were positive for alcohol. However, the captain of 1 of the 30 commuter accidents tested positive for an illicit or impairing drug other than alcohol (benzoylecgonine, a metabolite of cocaine).[18]

From 1975 through 1981, on-demand (unscheduled) air taxi operators operating under 14 CFR Part 135 experienced 254 fatal accidents from which 162 conclusive toxicological tests were performed. 12 were positive for alcohol (7.4 percent of the 162 conclusive tests). From 1983 through 1988, on-demand air taxi operators experienced 174 fatal accidents. Conclusive toxicological tests were performed in 111 of these accidents, resulting in 2 that were alcohol positive (1.8 percent of the 111 conclusive tests) (see table 1).

The small number of alcohol-involved or drug-involved fatal accidents in commercial aviation makes further analysis of limited value at this time. Therefore, subsequent sections of this report will not address Part 121 or Part 135 operations.

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[17] "Conclusive" toxicological tests are those in which specimens were adequate for alcohol testing, appropriate testing was performed, and a definitive result (positive or negative) was reported.

[18] National Transportation Safety Board. 1989. Trans-Colorado Airlines, Inc., flight 2286 Fairchild Metro III, SA227AC, N68TC, Bayfield, Colorado, January 19, 1988. Aircraft Accident Report NTSB/AAR-89/01. Washington, DC.

Table 1.–Number of fatal accidents, conclusive tests for alcohol, and positive tests for alcohol, 1973 through 1981 and 1983 through 1988[a]

Operation	1975 through 1981				1983 through 1988			
	No. of accidents	No. of conclusive tests	No. of positive tests	Percent positive[b]	No. of accidents	No. of conclusive tests	No. of positive tests	Percent positive[b]
14 CFR Part 121:[c]								
Scheduled commercial carrier[d]	20	–	0	NA	18	–	0	NA
14 CFR Part 135:[c]								
Scheduled commuter	77	47	3	6.4	30	14	0[e]	0
On-demand air taxi	254	162	12	7.4	174	111	2	1.8
14 CFR Part 91:[f]								
General aviation	4,299	3,448	336	9.7	2,760	1,982	133	6.7

– = not available; NA= not applicable.

[a] Data for 1982 are omitted because revisions to the reporting system make it difficult to compare data for 1982 with other years.

[b] Percent of conclusive tests that were positive.

[c] Data for 1975 through 1981 are for all fatal accidents; data for 1983 through 1988 are for accidents that were fatal to the pilot-in-command.

[d] Since 1984, the earliest year for which such data are available, no pilots of Part 121 carriers have tested positive for alcohol or other drugs.

[e] In one of the accidents, the captain tested positive for drugs.

[f] All data (1975 through 1981, and 1983 through 1988) are for accidents that were fatal to the pilot-in-command.

OVERVIEW OF GENERAL AVIATION ACCIDENTS

General aviation composes the largest segment of civil aviation in the United States. Further, the largest proportion of all civil aviation accidents, about 94 percent, involves general aviation aircraft. General aviation also accounts for the largest proportion of fatal accidents (about 93 percent of all fatal civil aviation accidents) and the largest proportion of accidents that are fatal to the pilot-in-command (94 percent of all civil aviation accidents that are fatal to the pilot-in-command).

The number of total general aviation accidents, fatal general aviation accidents, and general aviation accidents fatal to the pilot-in-command all showed a downward trend from 1975 through 1988 (figures 2 and 3). There were 2,760 general aviation accidents that were fatal to the pilot-in-command during the 1983 through 1988 period (the population and period of primary interest for this study).

Pilot Certificates

The number of pilot certificates held in the United States increased slightly from 1975 through 1980 but decreased steadily after 1980 (figure 4). In the 1983 to 1988 period, the number of private pilots decreased nearly 6 percent, and the number of student pilots decreased 7 percent. Student and private pilots accounted for 482,841 airman certificates in 1975 and 508,474 airman certificates in 1981, an increase of 5 percent. The two groups accounted for 465,840 airman certificates in 1983 and 436,699 airman certificates in 1988, a decrease of about 6.3 percent. Overall, from 1975 through 1988, the number of student and private airman certificates decreased by 9.6 percent.

Hours Flown

From 1975 through 1988, the total civil aircraft hours flown increased 26 percent, from 36.4 million hours to 45.9 million hours, but air carriers accounted for most of the increase. From 1983 through 1988, the period of this study, general aviation hours flown decreased 4.5 percent, from 35.2 million hours to 33.6 million hours (figure 5). From 1975 through 1988, however, general aviation accidents decreased almost 40 percent. Thus, the decrease in flying exposure during the 1983 through 1988 period could not account for more than a small part of the decrease in accidents. Figure 6 shows a downward trend in the general aviation accident rate per hundred thousand hours flown.

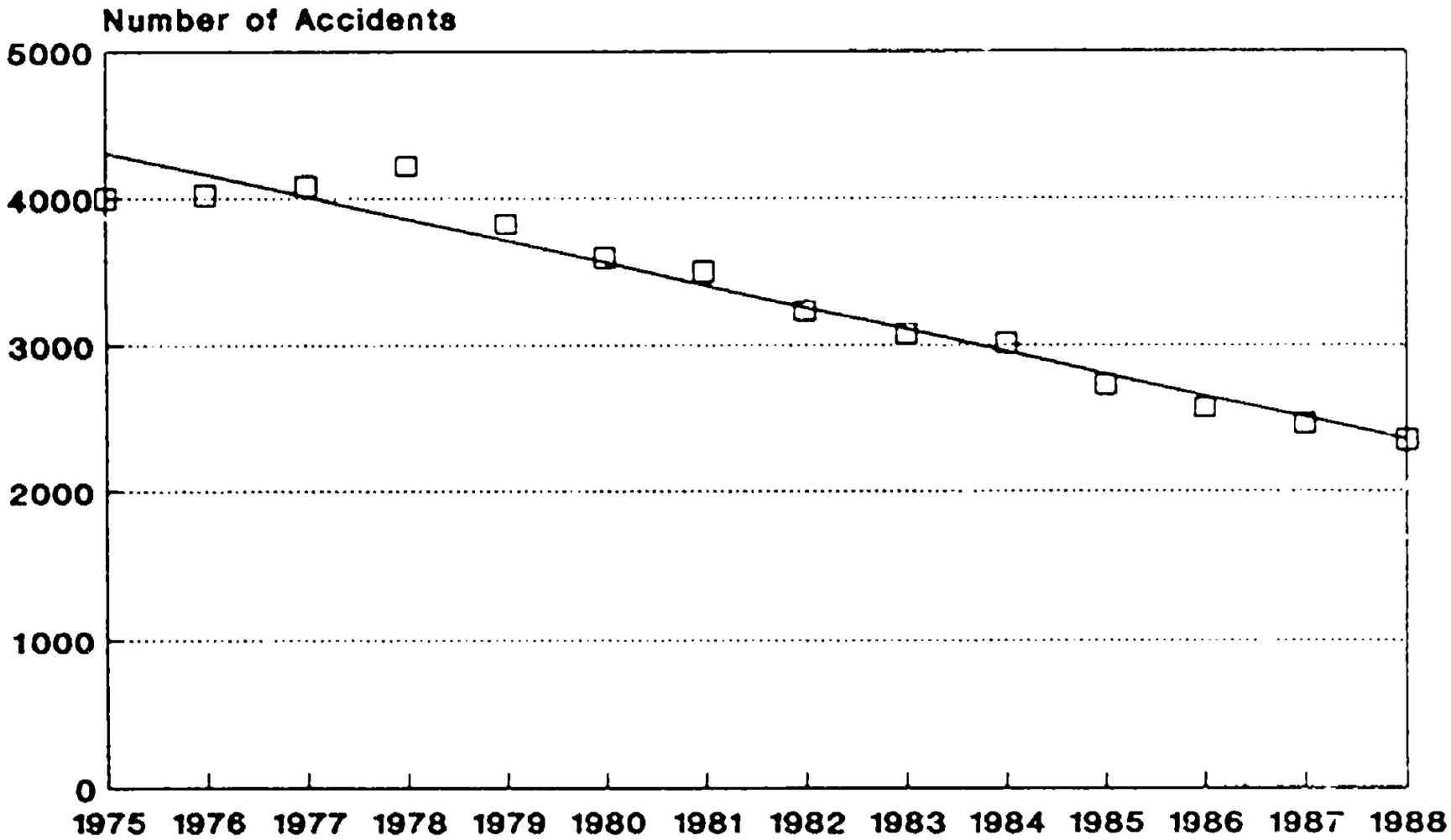

Figure 2.--Number of general aviation accidents, 1975 through 1988.

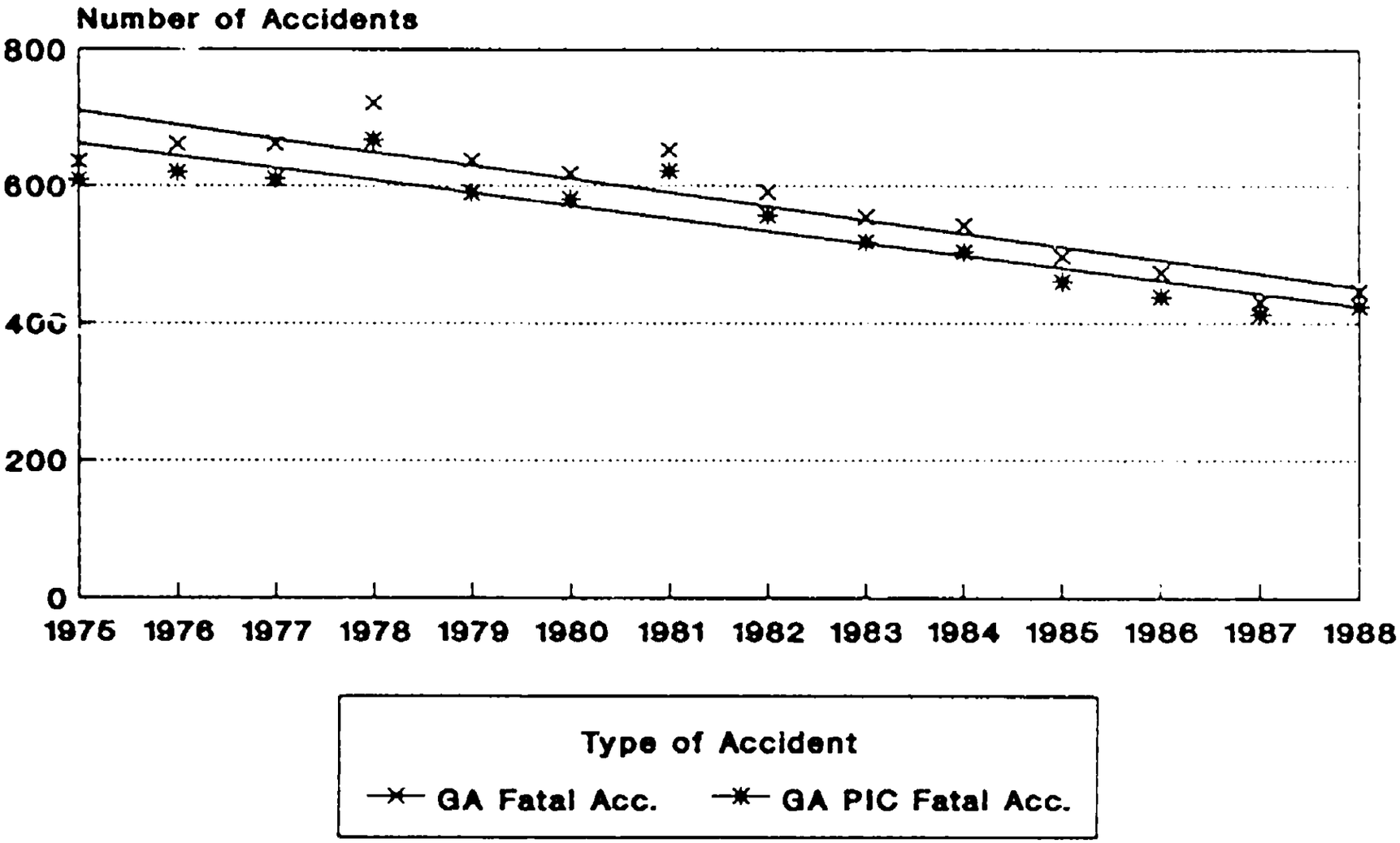

Figure 3.--Number and trend of fatal general aviation accidents and general aviation accidents that were fatal to the pilot-in-command, 1975 through 1988.

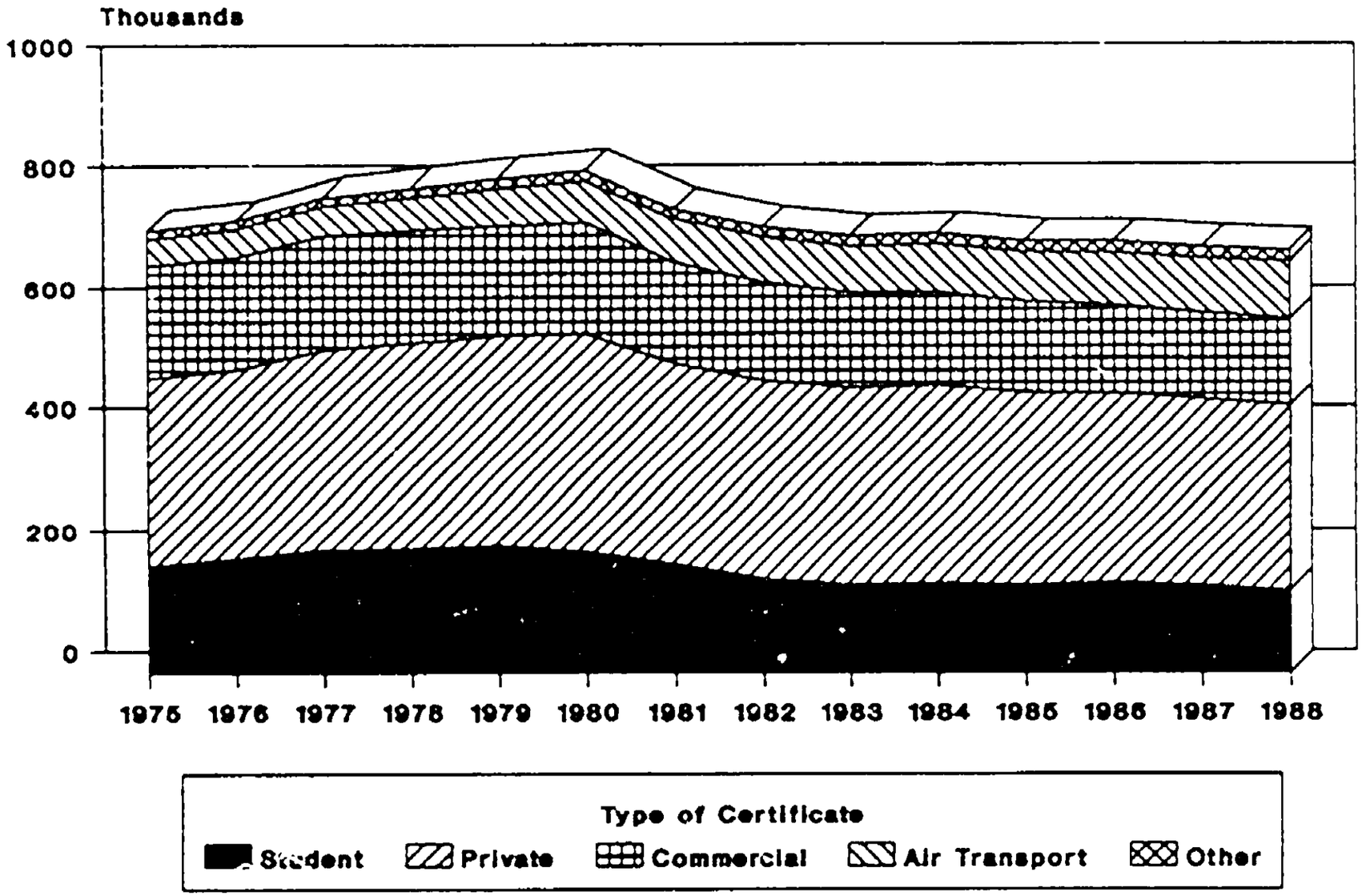

Figure 4.--Number of pilot certificates in the United States, 1975 through 1988.

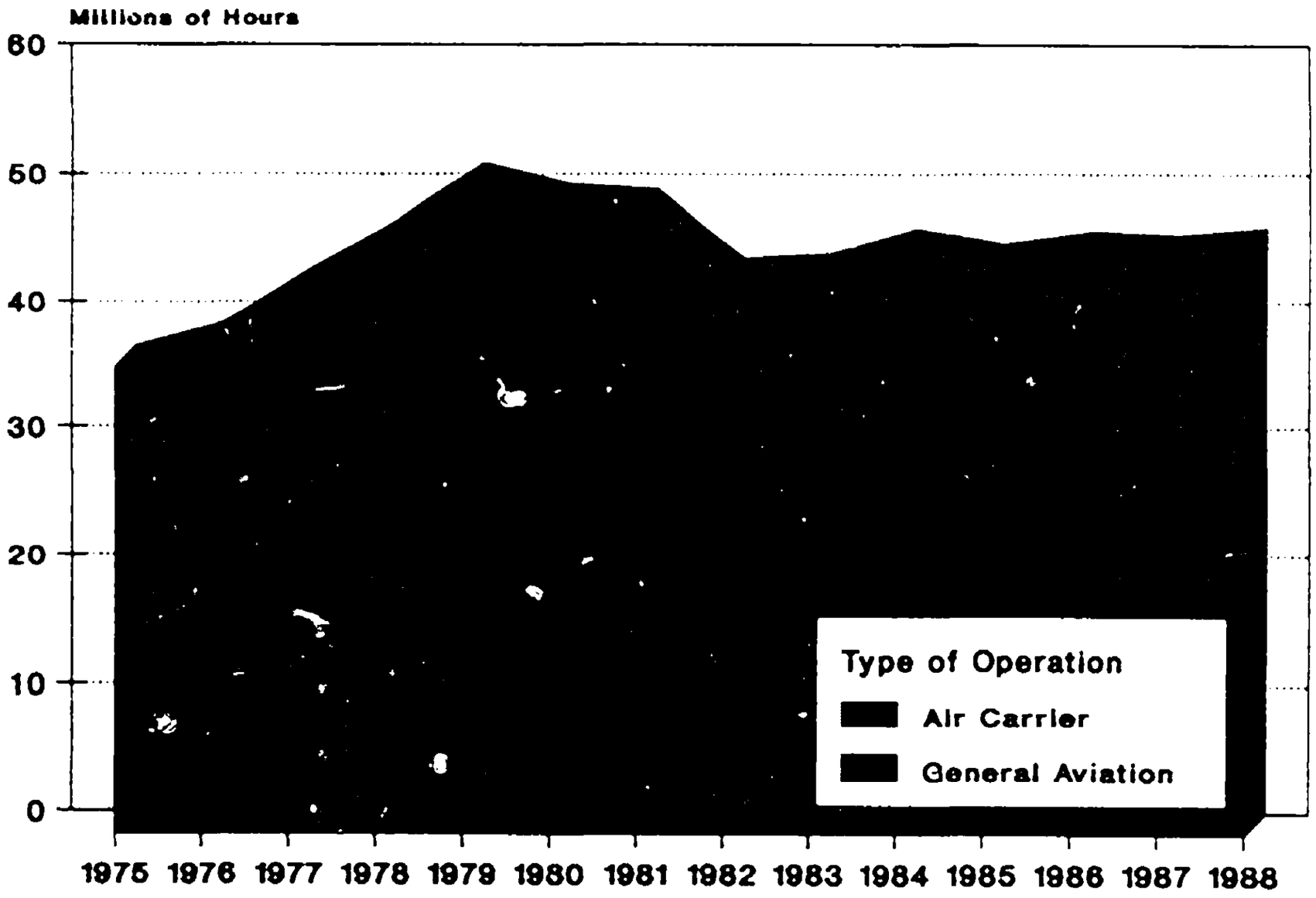

Figure 5.--Number of civil aircraft hours flown, 1975 through 1988. (Source: FAA Statistical Handbook of Aviation, calendar years 1976, 1978, 1980, 1988.)

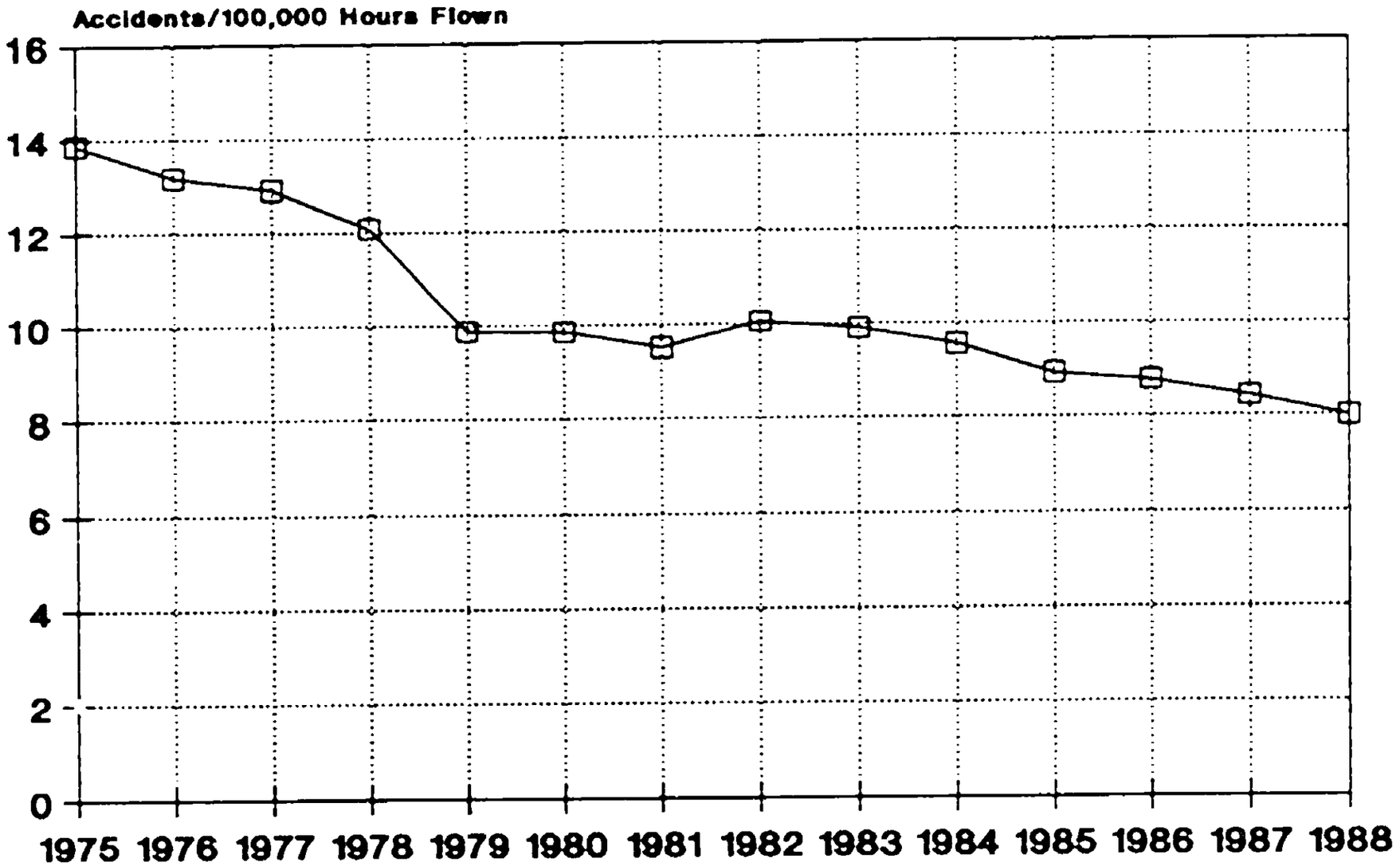

Figure 6.--General aviation accident rate per hundred thousand hours, 1975 through 1988.

ALCOHOL IN GENERAL AVIATION ACCIDENTS FATAL TO PILOTS

Toxicological Testing After Fatal Accidents

Safety Board accident investigation policy and procedures require toxicological testing of fatally injured pilots.[19] Frequently, all fatally injured persons on board are tested. However, as noted in the "Methods" section, toxicological tests may not have been performed on all fatally injured pilots for a variety of reasons, such as the inability to collect specimens or the unsuitability of specimens for toxicological testing. Safety Board data indicate that from 1983 through 1988, toxicological tests were performed on about 79 percent of all fatally injured general aviation pilots.[20]

From the 4,299 general aviation accidents that were fatal to the pilot-in-command during the 1975 through 1981 period, there were 3,448 conclusive toxicological tests; that is, a definitive result (positive or negative for alcohol) was obtained. Thus, a conclusive toxicological test was obtained on 80 percent of all the fatally injured general aviation pilots (3,448 conclusive tests out of 4,299 pilots). Of the conclusive tests, 9.7 percent (336 of the 3,448 conclusive tests) were positive for alcohol. (See figures 7 and 8; also see table 1).

From the 2,760 general aviation accidents that were fatal to the pilot-in-command during the 1983 through 1988 period, there were 2,168 toxicological tests performed on pilots; that is, a test was performed on 78.6 percent of all the fatally injured general aviation pilots. Of those tests, 91.4 percent (1,982 conclusive tests out of 2,168 tests performed) were conclusive. Thus, a conclusive toxicological test was obtained on 71.8 percent of all the fatally injured general aviation pilots (1,982 conclusive tests out of 2,760 pilots). The percent of toxicological tests performed that were conclusive fluctuated from a high of 92.7 percent in 1983 to a low of 85.8 percent in 1985. The percent of conclusive tests that were positive for alcohol also fluctuated, from a high of 8.6 percent in 1983 to a low of 4.4 percent in 1988. During the 1983 through 1988 period, 6.7 percent of the conclusive tests (133 of the 1,982 conclusive tests) were positive for alcohol. (See figures 7 and 8; also see table 1.)

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[19] Fatally injured student pilots and nonflying pilots are tested in addition to the pilots-in-command.

[20] The reporting system used between 1975 through 1981 did not provide reliable information on the number of toxicological tests performed on the fatally injured general aviation pilots. It did, however, provide reliable information on the number of conclusive and the number of positive toxicological tests.

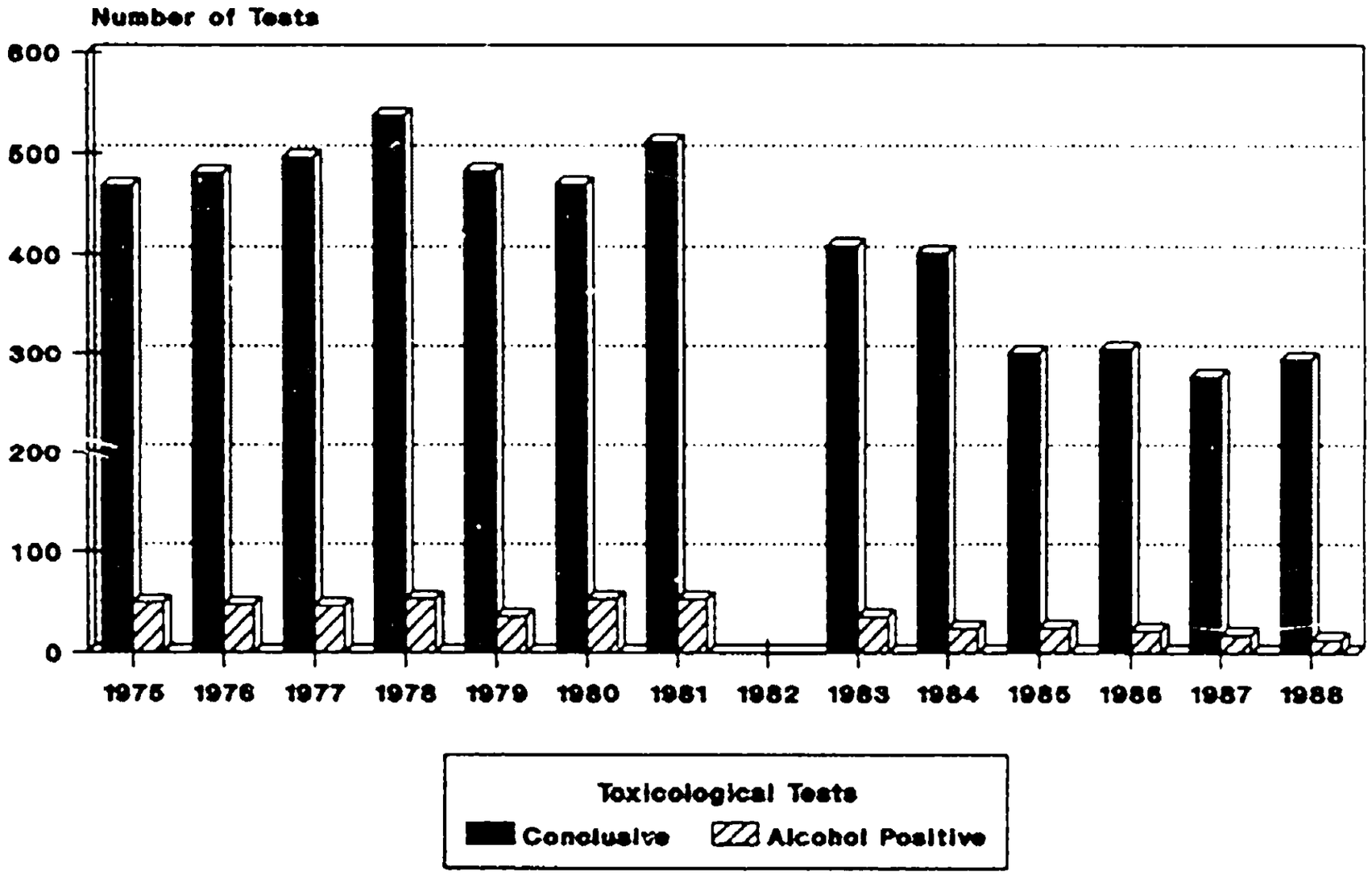

Figure 7.--Number of conclusive and alcohol-positive toxicological tests obtained from fatally injured general aviation pilots, 1975 through 1988. (Number of accidents is 4,299 for 1975 through 1981, and 2,760 for 1983 through 1988.) Data for 1982 are omitted because revisions to the reporting system make it difficult to compare data for 1982 with other years.

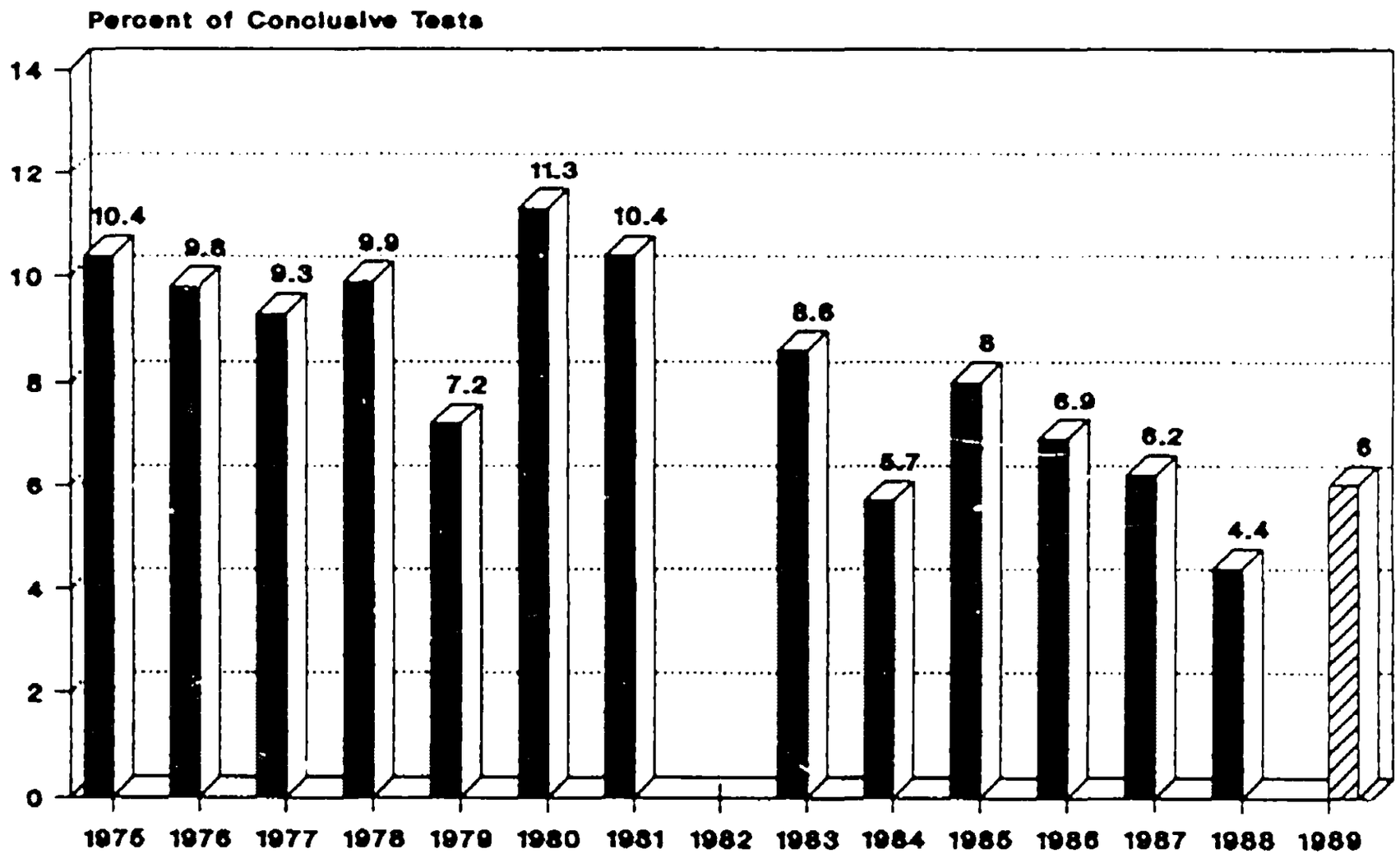

Figure 8.--Percent of conclusive toxicological tests that were positive for alcohol, obtained from fatally injured general aviation pilots, 1975 through 1988. Preliminary data for 1989 are included as a comparison with 1988 data, which may be aberrantly low.

Because the percentage of conclusive tests that were positive for alcohol in 1988 appeared to be aberrantly low, the Safety Board included preliminary alcohol-positive data for 1989. (Complete data for 1989 are not yet available.) Alcohol-positive tests for 1989 ran about 6 percent, just slightly less than the mean for 1983 through 1988. Thus, alcohol data for 1988 are lower than data for the other years in the study and may be spurious. Nevertheless, a linear regression of the data for 1975 through 1989 shows a downward trend in the proportion of conclusive toxicological tests that were positive for alcohol (figure 9). These data show that the percent of conclusive toxicological tests that were alcohol positive for fatally injured aviation pilots decreased from about 10 percent (corresponding to about 47 accidents per year) in the mid-1970s to about 6.0 percent (about 17 accidents per year) in the late 1980s.

In terms of accidents, from 1975 through 1981, there were 336 general aviation accidents that were fatal to the pilot-in-command for which toxicological tests were positive for alcohol. From 1983 through 1988, there were 133 such accidents for which toxicological tests were positive for alcohol. The number per year is shown in the following tabulation:

Year	Number of accidents
1975	49
1976	47
1977	46
1978	53
1979	35
1980	53
1981	53
1983	35
1984	23
1985	24
1986	21
1987	17
1988	13

Although the year-to-year fluctuation in the number of alcohol-involved accidents makes the characteristics of their trend tenuous, these accidents show a decline as did all general aviation accidents, fatal general aviation accidents, and general aviation accidents that were fatal to the pilot-in-command (see figure 3).

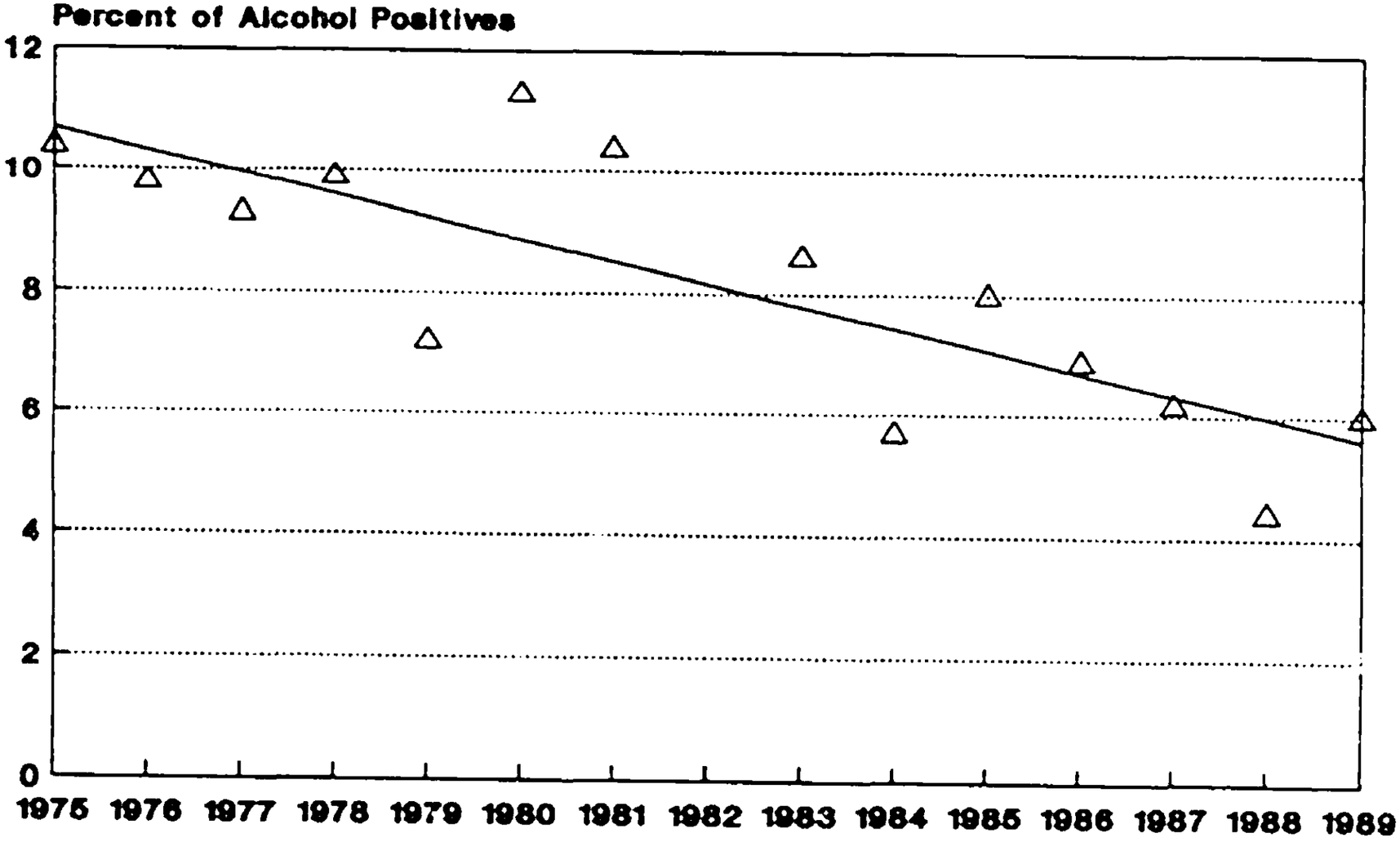

Figure 9.--Linear regression of the proportion of conclusive toxicological tests that were positive for alcohol. The tests were performed on pilots fatally injured in general aviation accidents from 1975 through 1989. Data for 1989 are preliminary, and data for 1982 are omitted because revisions to the reporting system make it difficult to compare data for 1982 with other years.

Blood Alcohol Concentrations of Fatally Injured Pilots

Of the 135 alcohol-involved general aviation accidents that were fatal to the pilot-in-command from 1983 through 1988, 133 pilots tested positive for alcohol. The 133 pilots include 2 student pilots who were flying the aircraft at the time of the accident. In 1 of the 135 accidents, the pilot-in-command did not test positive for alcohol; however, the nonflying pilot had a 0.12-percent BAC. The Safety Board cited physical impairment by alcohol (other crewmember) as a cause in this accident. Toxicological tests were not obtained on the pilots-in-command in 2 of the 135 accidents; however, witness testimony about pre-flight drinking established alcohol impairment of the pilots.

The distribution of blood alcohol concentrations for the alcohol-positive pilots is shown in figure 10. This figure shows a distribution slightly skewed to the left about a mean BAC of 0.15 percent. More than 95 percent of the BACs in the alcohol-involved accident group exceeded 0.04 percent, the BAC level established as an offense by the current FAA regulations, and more than 74 percent exceeded the 0.10-percent level established as a definition of impairment by most of the driving-while-intoxicated laws enacted by States.[21] More than 47 percent of the BACs in the alcohol-involved group exceeded the 0.15-percent level. Accident data in the 1984 report show that for 1977 through 1981, about 86 percent of the pilots in the randomly selected sample of 119 alcohol-involved accidents had a BAC of 0.04 percent or higher, and more than 45 percent had a BAC that exceeded 0.15 percent.[22] According to a 1979 report of the National Highway Traffic Safety Administration (NHTSA), the diagnostic criteria found in the Alcohol Safety Action Projects to be most successful in quickly distinguishing problem drinkers from social drinkers are (1) an arrest BAC of 0.15 percent or greater, (2) a prior alcohol-related arrest, and (3) an approved, structured, written diagnostic test.[23] These criteria are still considered by NHTSA to be indications of problem drinkers.

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[21] State laws use various terms to describe alcohol-impaired operation: driving while impaired, driving while intoxicated, or operating under the influence of alcohol. Similar variations in terminology are found in State laws describing alcohol-impaired flying. As used in this report, driving while intoxicated (DWI) and flying while intoxicated (FWI) refer to any of these terms.

[22] Data for the 1983 through 1988 period are based on a census of all alcohol-involved accidents that occurred during the period, not on a random sample as for years 1977 through 1981. Because the BAC distribution from the random sample of cases in the 1984 report was so similar to the data found for the 1983 through 1988 period, staff did not reanalyze the BAC data for the complete 1975 through 1981 period.

[23] U.S. Department of Transportation, National Highway Traffic Safety Administration. 1979. Results of National Alcohol Safety Action Projects.

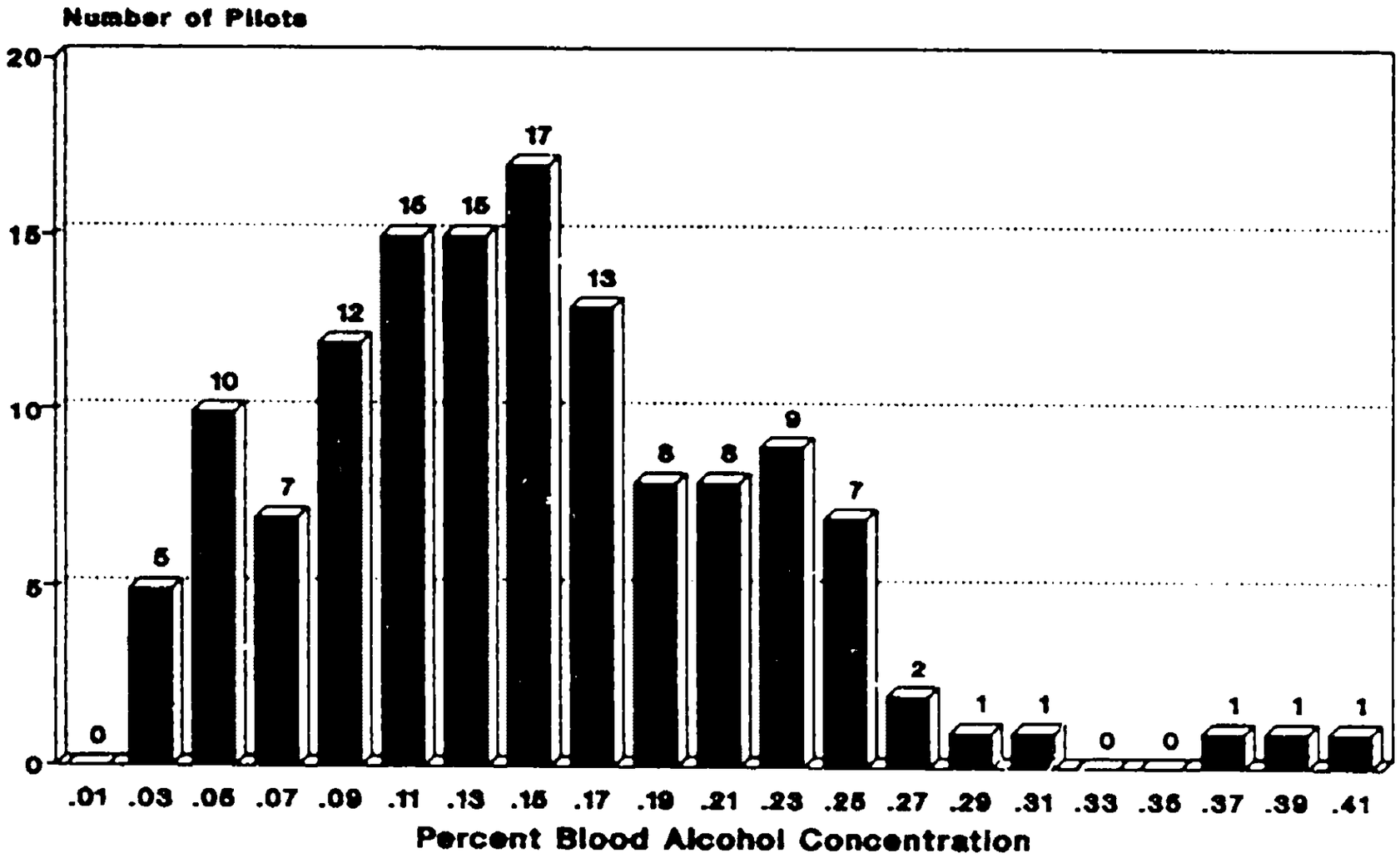

Figure 10.--Distribution of blood alcohol concentrations for alcohol-positive pilots in general aviation accidents fatal to the pilot-in-command, 1983 through 1988.

CHARACTERISTICS OF ALCOHOL-INVOLVED GENERAL AVIATION ACCIDENTS FATAL TO THE PILOT-IN-COMMAND

In an effort to examine the role of alcohol in general aviation accidents that were fatal to the pilot-in-command, the Safety Board compared two accident groups in terms of accident characteristics, flight conditions, pilot-in-command characteristics, and causes and factors. The alcohol-involved group consists of accidents for which alcohol was cited by the Safety Board as the cause or factor. The second group, referred to in this report as the substance-free group, consists of accidents for which alcohol or other drugs were not cited as a cause or factor. Although some of the substance-free accidents may have involved alcohol or other drugs, there was no evidence of their use. Supporting statistical data for the accident groups are presented in appendix F.

Accident Characteristics

From 1983 through 1988, there were 2,760 general aviation accidents fatal to the pilot-in-command: 135 alcohol-involved, and 2,590 substance-free (figure 11).[24] About half of the accidents in each group (49.6 percent of alcohol-involved, and 48 percent of substance-free accidents) resulted in a fatal injury to the pilot-in-command only. The remaining accidents resulted in two or more fatalities.

Purpose of Flight.--Personal flying represents the primary purpose of flight for the alcohol-involved and the substance-free accident groups (figure 12). Of the alcohol-involved accidents, 91.0 percent were personal flights and 4.9 percent were work-related[25] flights. Of the substance-free accidents, 74 percent were personal flights and 20.2 percent were work-related flights.[26]

Day of the Week.--The percentages of fatal accidents vary by day of the week, but were somewhat greater on Saturday and Sunday (figure 13). No substantial difference between the alcohol-involved and substance-free fatal accidents is apparent with respect to the day of the week.

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[24] Dates and locations of the 135 alcohol-involved accidents are given in appendix G. Information pertaining to the 35 drug-involved accidents depicted in the figure is presented in a separate section later in the report.

[25] "Work-related flying" includes executive/corporate, aerial observation or application, and business flights.

[26] Percentages are based on the number of fatal accidents for which the purpose of flight is known. Flights to position or to ferry aircraft have not been included because it is unknown if they were personal or work-related.

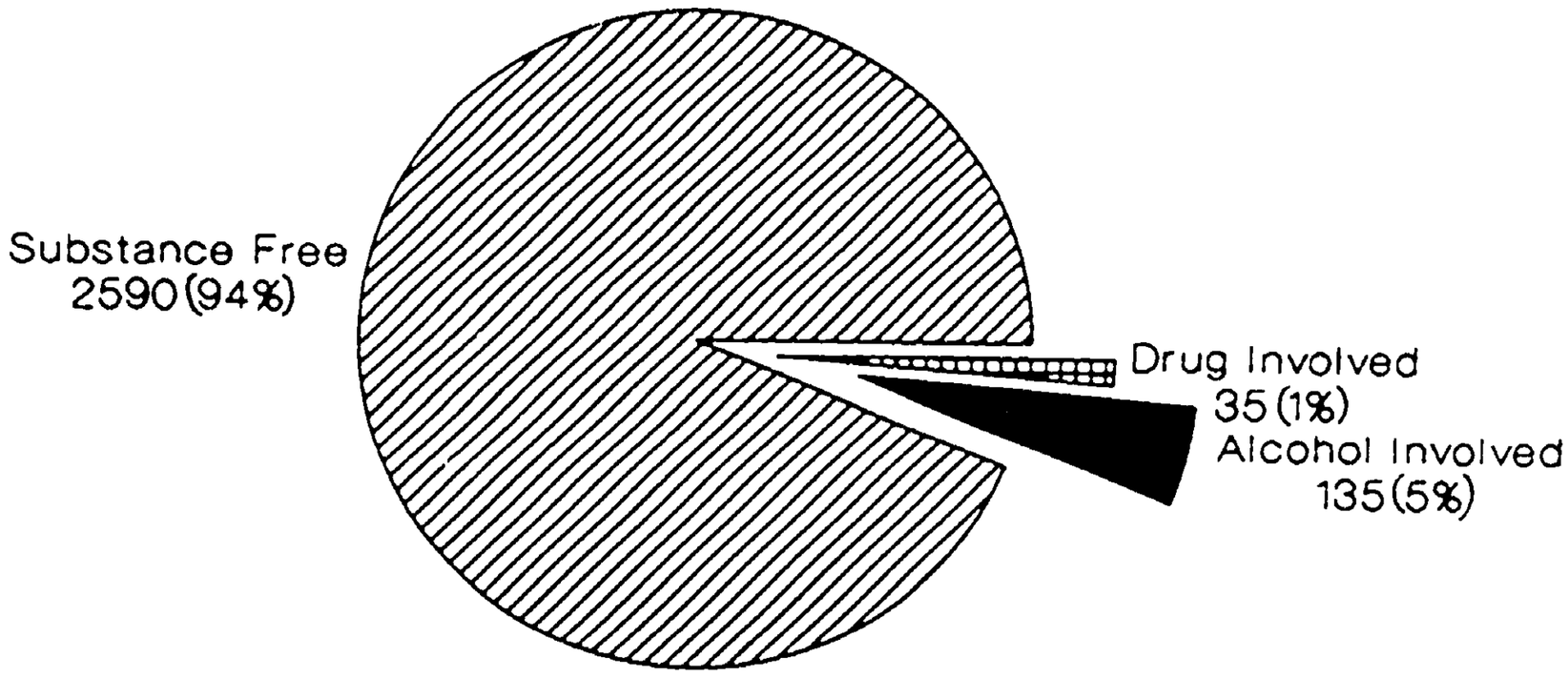

Figure 11.--Distribution of general aviation accidents fatal to the pilot-in-command, by accident group (alcohol-involved, substance-free, and drug-involved), 1983 through 1988.

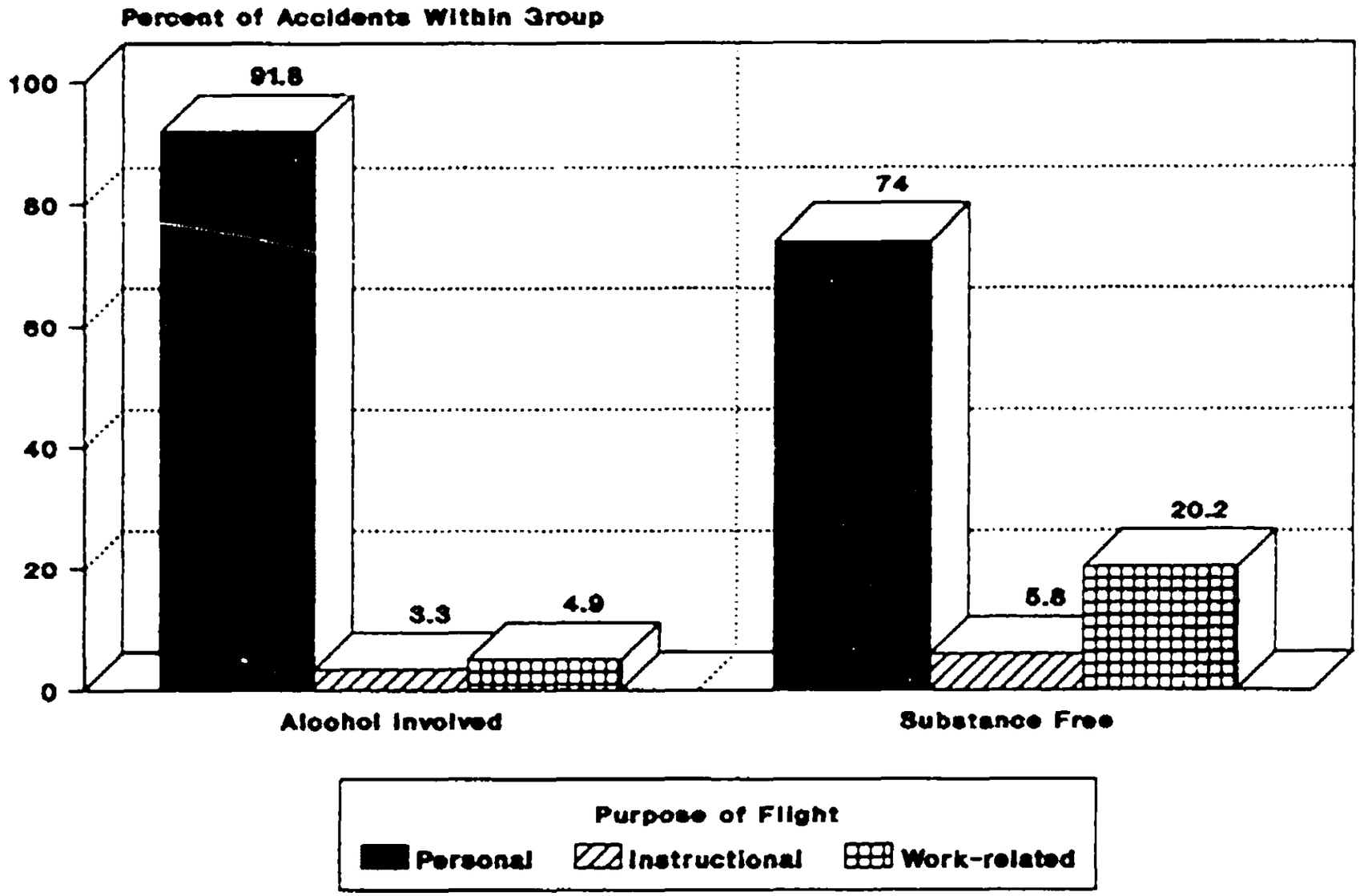

Figure 12.--Percent of alcohol-involved and substance-free general aviation accidents fatal to the pilot-in-command, by purpose of flight, 1983 through 1988. Percentages are based on the number of accidents for which the purpose of the flight is known (alcohol-involved 122; substance-free 2,384). Flights to position or to ferry aircraft (alcohol-involved 1; substance-free 87) have not been included because it is unknown if the flights were personal or work-related.

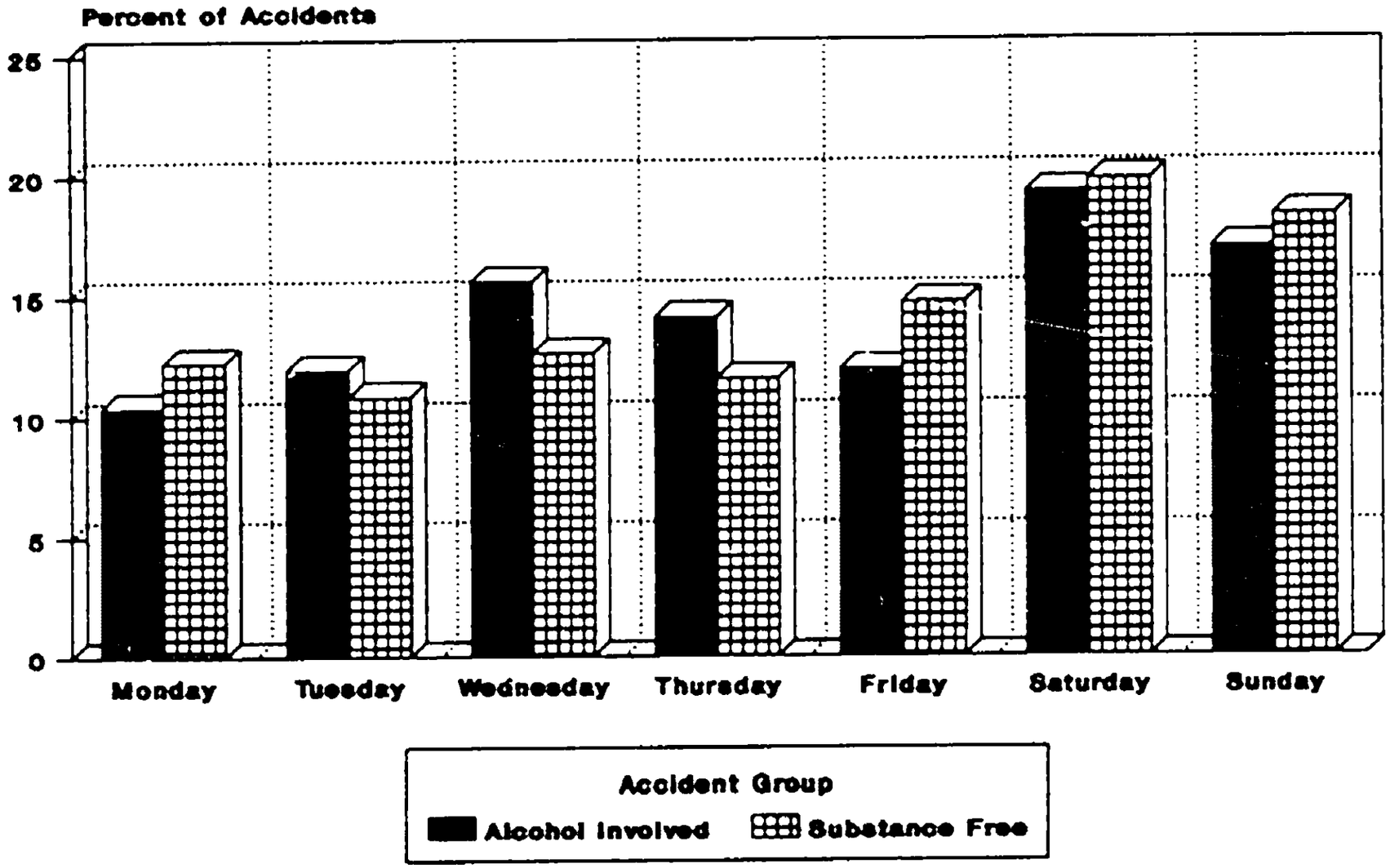

Figure 13.--Percent of alcohol-involved and substance-free general aviation accidents fatal to the pilot-in-command, by day of the week, 1983 through 1988.

Time of Day.--During nighttime hours, 8 p.m. to 3:59 a.m., the percentage of alcohol-involved fatal accidents (43 percent) was 2 1/2 times that of substance-free fatal accidents (16.7 percent) (figure 14). The hours during which alcohol-involved fatal accidents occurred appear roughly consistent with the typical nighttime hours of drinking for the general population.[27]

In terms of light conditions, about 52 percent of the alcohol-involved accidents occurred under limited light conditions (dawn, dusk, or night) compared to about 26 percent of the substance-free accidents (figure 15). Flying at night may present visual, spatial, and task challenges that a substance-free pilot can more ably handle than can an alcohol-impaired pilot.

Accident Location.--Ninety-one percent of the alcohol-involved and 88.8 percent of the substance-free fatal accidents occurred off the airport. (See appendix F for data.)

Number of Engines.--Most fatal accidents involved single-engine airplanes, but a larger proportion of accidents in the alcohol-involved group (93.3 percent) involved single engine airplanes than did the accidents in the substance-free group (83.5 percent). (See appendix F for data.)

Flight Plan.--Flight plans had been filed in only 3 percent of the alcohol-involved fatal accidents and 23.5 percent of the substance-free accidents (figure 16). A flight plan to fly under instrument flight rules had been filed in 2.2 percent of the alcohol-involved and 15.6 percent of the substance-free fatal accidents.

Most general aviation pilots do not have an instrument rating and are not certified to fly in circumstances that require filing a flight plan under instrument flight rules. Thus, most of the general aviation pilots were not required to file a flight plan. Although the filing of a flight plan and the type of flight plan filed--visual flight rules (VFR) or instrument flight rules (IFR)--may be indicative of both the purpose of the flight and the planning involved, the lack of a flight plan may also suggest that the alcohol-involved flights resulting in fatal accidents were more likely to have been spontaneous than they were planned, and that alcohol may have been a factor in that spontaneity. One research study concluded that "alcohol consumption can therefore promote action on impulse without full appreciation of, or concern about, the potential negative consequences of such action."[28] Another possible reason that the pilots did not file a flight plan may be that the impaired pilots may have wanted to avoid contact with aviation authorities with whom a plan is filed.

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[27] (a) National Safety Council. 1976. Alcohol and the impaired driver: a Manual on the medicolegal aspects of chemical tests for intoxication with supplement on breath alcohol tests. Chicago, IL. (b) U.S. Department of Transportation. 1968. 1968 alcohol and highway safety report. Washington, DC.

[28] Modell, J.G.; Mountz, J.M. 1990. Drinking and flying--the problem of alcohol use by pilots. The New England Journal of Medicine 323(7).

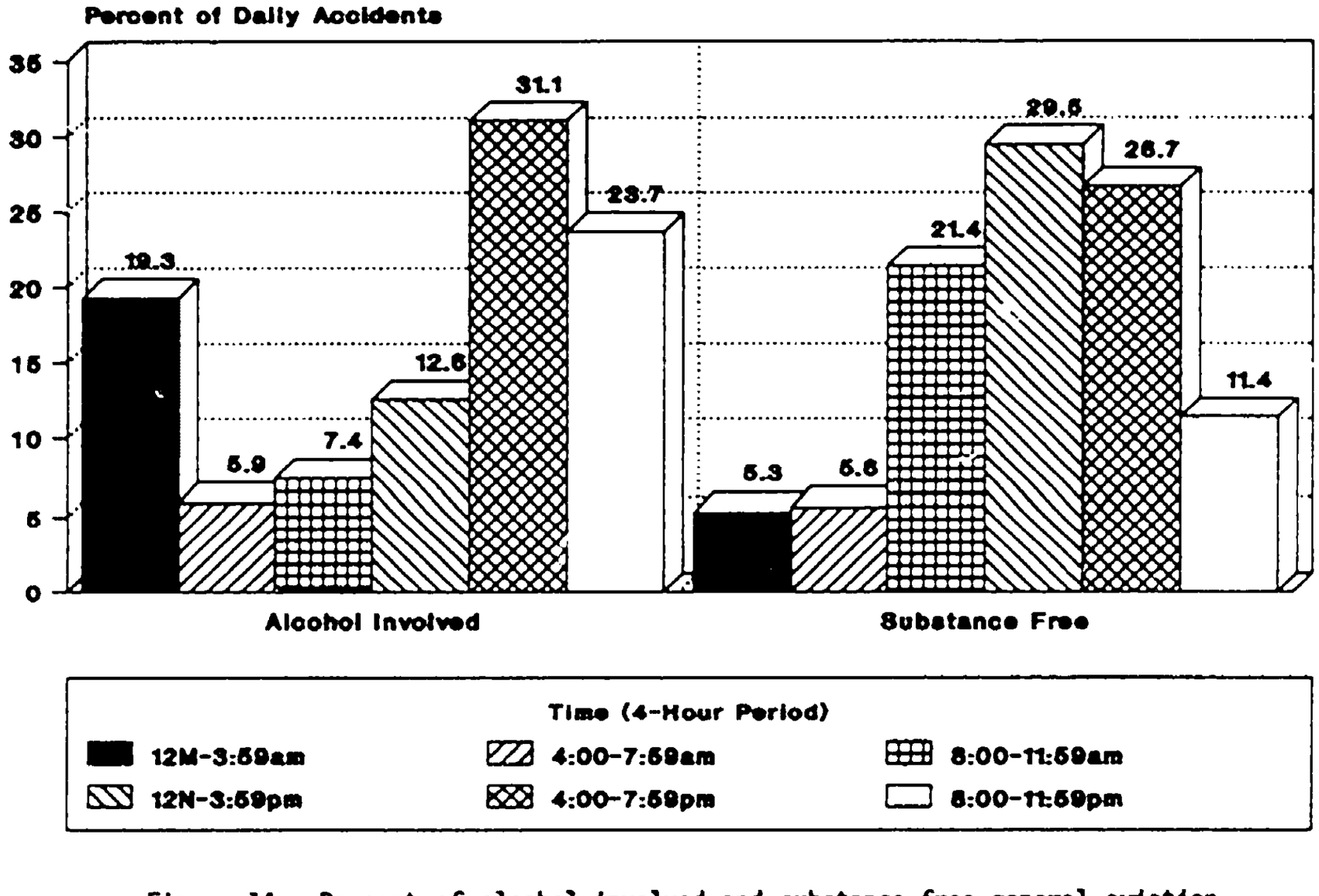

Figure 14.--Percent of alcohol-involved and substance-free general aviation accidents fatal to the pilot-in-command, by time of day, 1983 through 1988. Percentages may not add to 100 because of rounding.

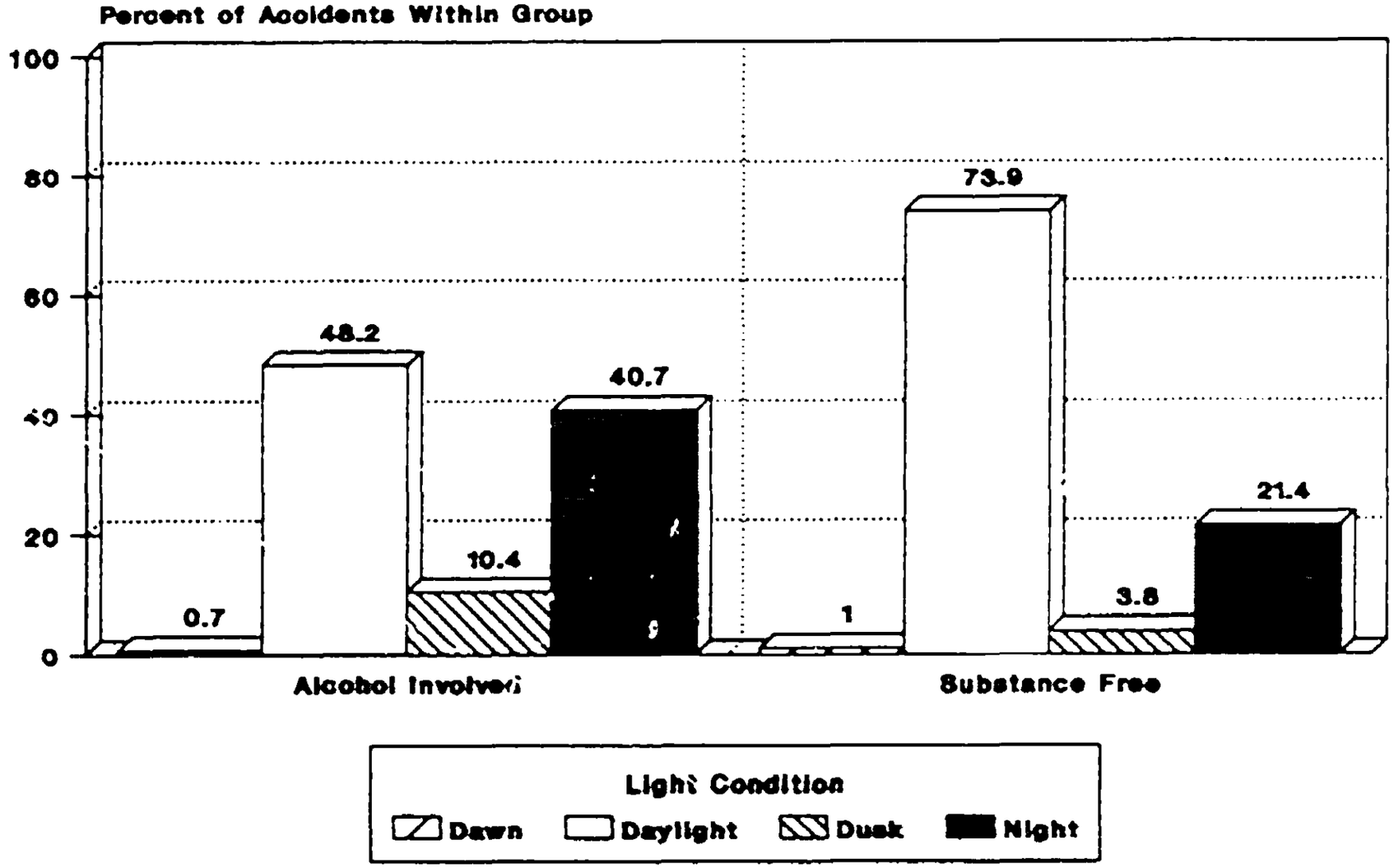

Figure 15.--Percent of alcohol-involved and substance-free general aviation accidents fatal to the pilot-in-command, by light conditions, 1983 through 1988. Percentages may not add to 100 because of rounding.

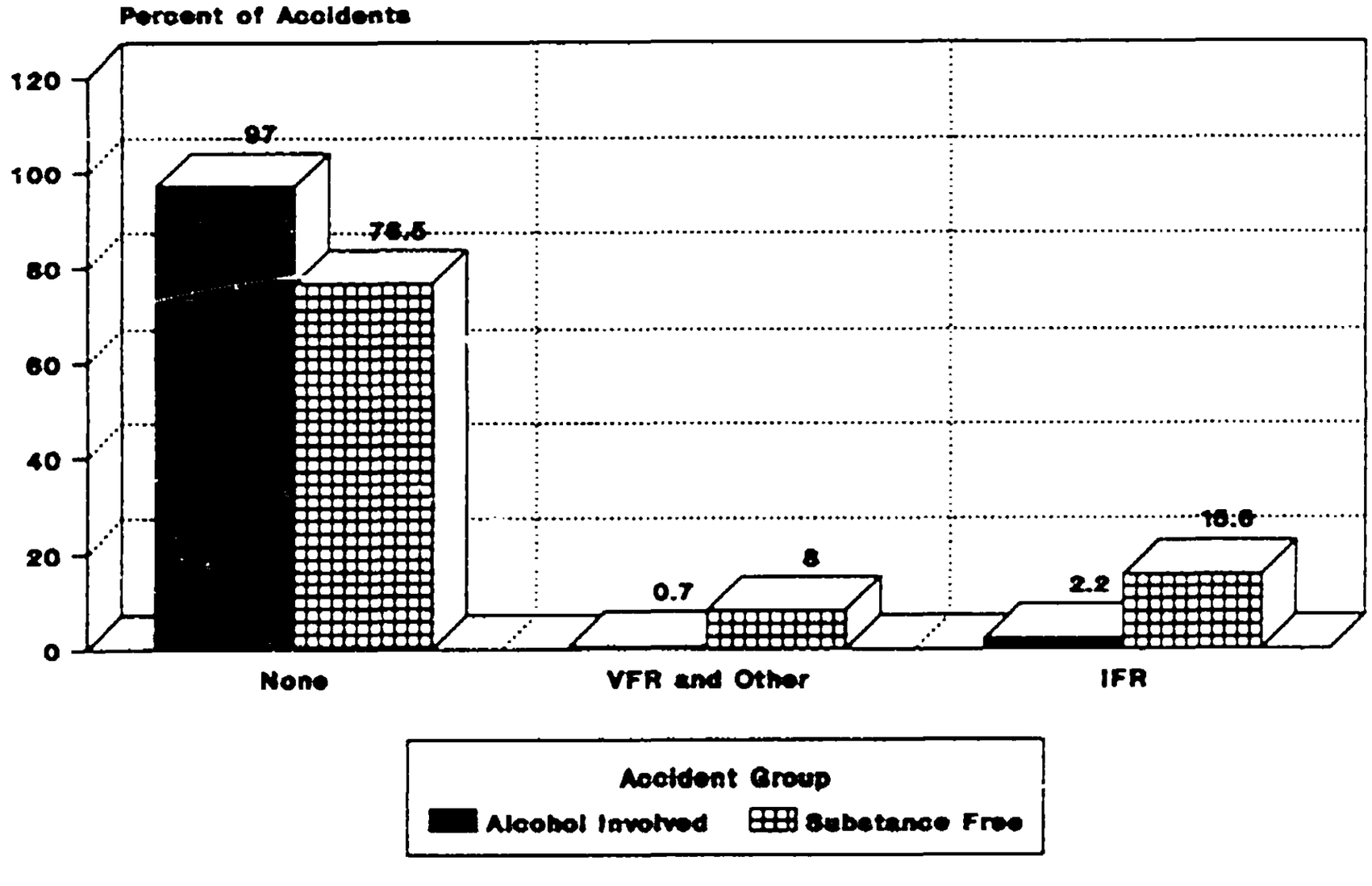

Figure 16.--Percent of alcohol-involved and substance-free general aviation accidents fatal to the pilot-in-command, by type of flight plan, 1983 through 1988. Percentages may not add to 100 because of rounding. (VFR = visual flight rules; IFR = instrument flight rules; Other includes VFR/IFR, company VFR, and military VFR.)

Flight Conditions

Adequate knowledge of flying conditions along the route or in the area in which the general aviation pilot plans to fly is critical for a safe and successful flight. Weather and visibility data were examined for the accident groups.

Basic Weather Conditions.--Most of the fatal accidents--83.2 percent of the alcohol-involved, and 72.4 percent of substance-free--occurred in visual meteorological conditions (figure 17). As indicated in the previous section on flight plans, most general aviation pilots do not have an instrument rating and, therefore, would be less likely to fly in conditions in which instrument meteorological conditions prevail than would be pilots with an instrument rating.[29] (Instrument ratings are discussed later in the report).

Weather Briefing Source.--Most of the accident reports indicated no record of a weather briefing source, implying that no weather briefing was obtained (figure 18). However, a much greater percentage of weather briefings were obtained by pilots in the substance-free accident group (about 35 percent) than by pilots in the alcohol-involved accident group (about 11 percent). Flight service stations were the most common source of pilot weather briefing for both accident groups. The large number of alcohol-involved flights with no weather briefing in association with the large number of personal flights with no flight plan, discussed earlier, further suggests that alcohol-involved flights may have been more spontaneous than planned and may have involved less attention to flying conditions.

Precipitation and Visibility Conditions.--Most of the fatal accidents occurred in the absence of precipitation. No substantial differences between the groups were identified when comparing involvement of adverse weather.

Visibility conditions were similar for both groups of fatal accidents. Most of the accidents occurred when there were no reported visibility restrictions. (See appendix F for data on precipitation and visibility conditions.)

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[29] About 11 percent of all general aviation hours flown in 1988 were flown in instrument meteorological conditions (IMC). Of those hours, about 30 percent were flown in night IMC conditions. (Source: U.S. Department of Transportation, Federal Aviation Administration. 1989. General aviation activity and avionics survey, calendar year 1988. Washington, DC.)

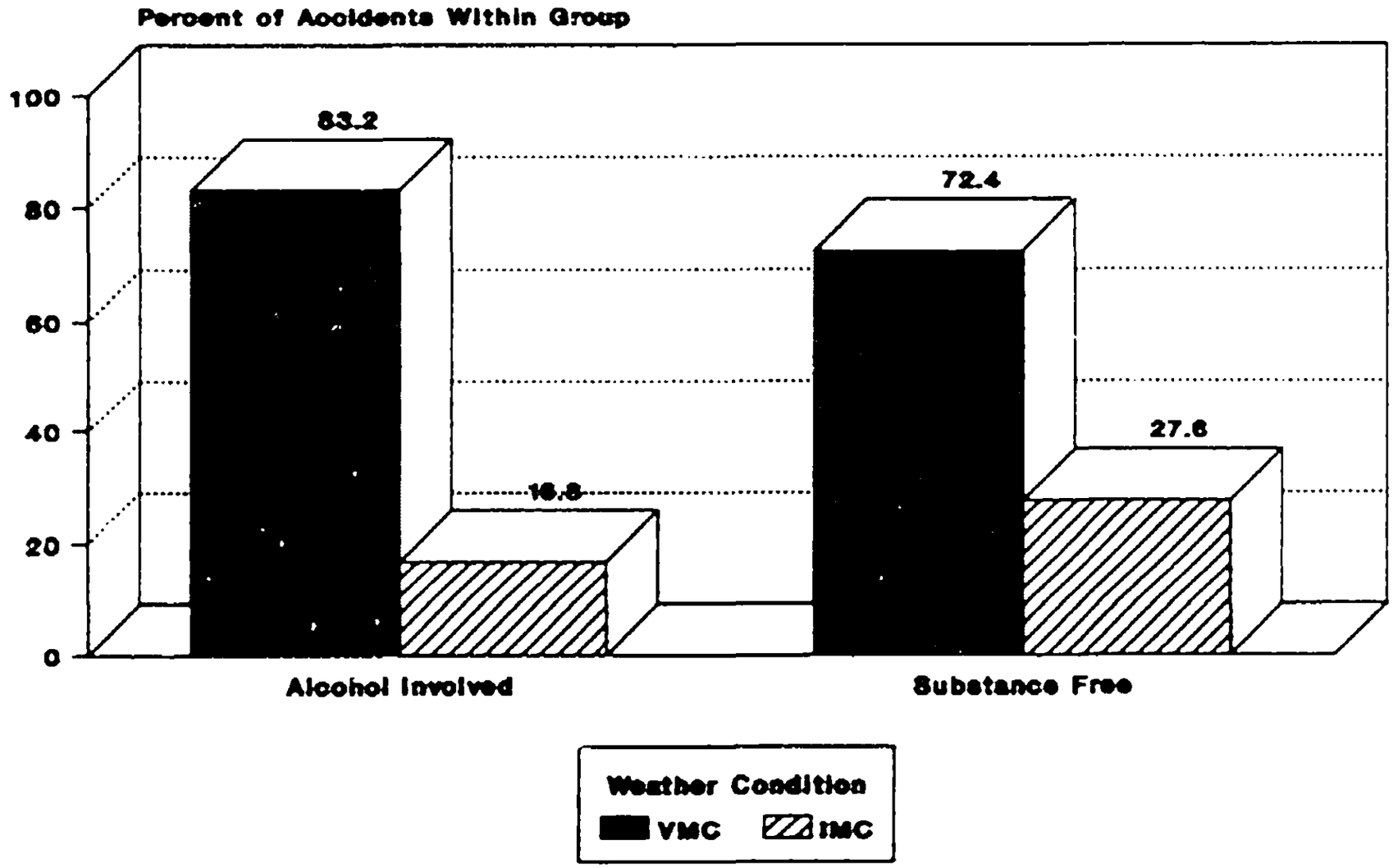

Figure 17.--Percent of alcohol-involved and substance-free general aviation accidents fatal to the pilot-in-command, by basic weather conditions, 1983 through 1988. (VMC - visual meteorological conditions; IMC - instrument meteorological conditions.)

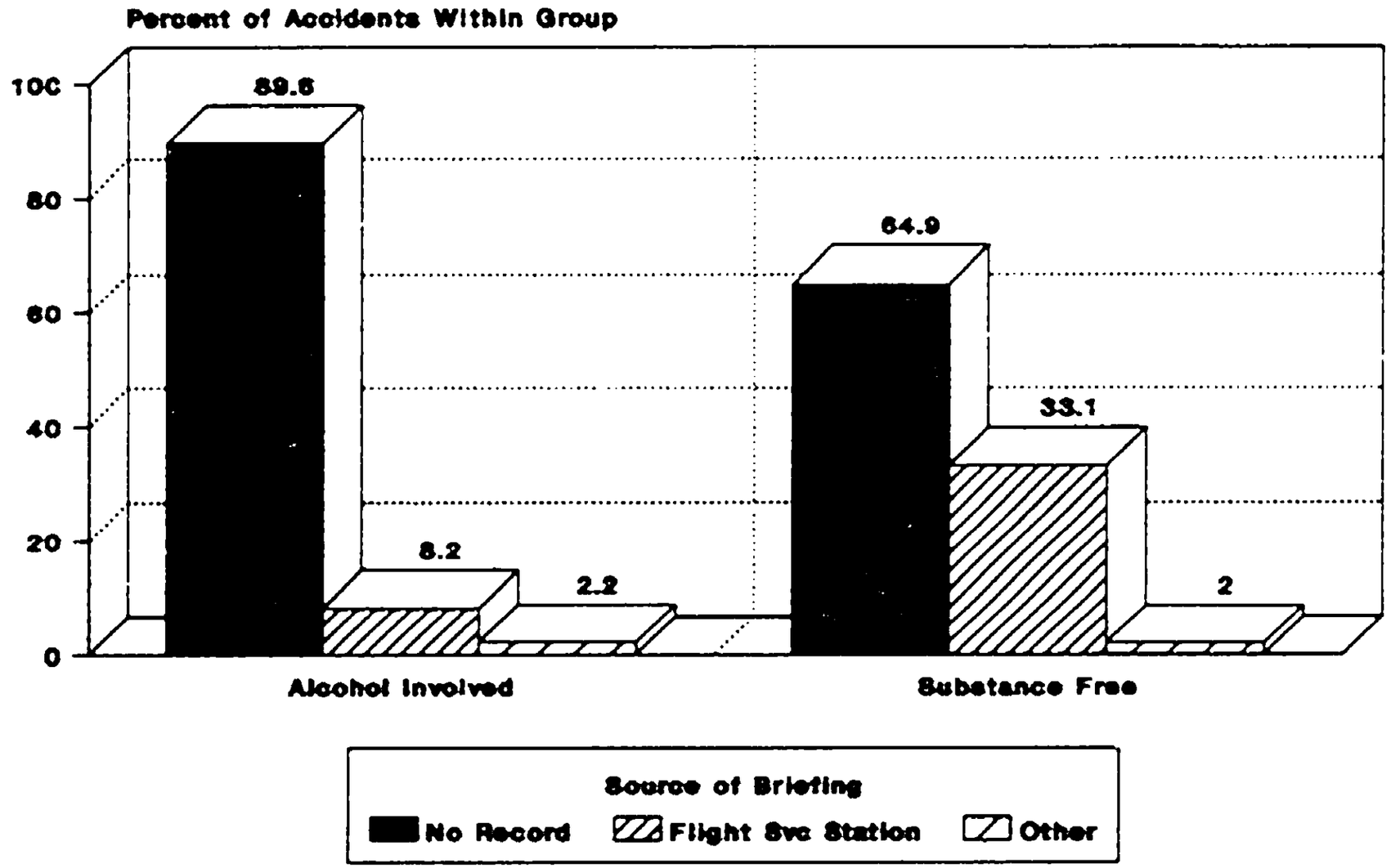

Figure 18.--Percent of alcohol-involved and substance-free general aviation accidents fatal to the pilot-in-command, by source of weather briefing, 1983 through 1988. (Svc = service; Other includes National Weather Service, Pilot's Automatic Telephone Weather Answering Service, commercial, television/radio, and military.)

Pilot-in-Command Characteristics

Gender.--All of the fatally injured pilots-in-command in the alcohol-involved accident group from 1983 through 1988 were male. In substance-free group, 2 percent (51 of 2,590) of the fatally injured pilots-in-command were female.

Pilot Age.--Age distributions differed between the two accident groups with the mean age of fatally injured pilots in the alcohol-involved accident group (39.9 years) somewhat lower than in the substance-free group (44.4 years). There was a larger percentage of fatally injured pilots in the alcohol-involved group between 25 and 39 years old (51.1 percent) than in the substance-free group (30.2 percent) (figure 19). More than 47 percent of the BACs in the alcohol-involved group exceeded 0.15 percent. All of the fatally injured pilots in the alcohol-involved group ages 65-69 (100 percent) had a BAC of 0.15 percent or greater; 63.6 percent of the fatally injured pilots in the alcohol-involved group ages 50-54, and 58.3 percent of the fatally injured pilots in the alcohol-involved group ages 45-49 had a BAC of 0.15 percent or greater (figure 20). According to the Fatal Accident Reporting System (FARS) of the NHTSA, drivers under 25 years old typically have the highest BAC levels in alcohol-related fatal motor vehicle accidents.

Type of Airman Certificate.--The private pilot certificate was the highest level of airman certificate held by most of the pilots in both fatal accident groups (figure 21). The percentage of fatally injured pilots with a student certificate was substantially greater in the alcohol-involved group (13.3 percent) than in the substance-free group (4.3 percent). About 61 percent of the fatally injured pilots in the alcohol-involved group who held a student certificate had a BAC of 0.15 percent or higher (figure 22).

About 5.9 percent of the fatally injured pilots in the alcohol-involved group and 0.9 percent in the substance-free group did not have any airman certificate. The lack of a certificate suggests a disregard for regulations and safety. Of the pilots in the alcohol-involved group who did not have an airman certificate, 75 percent had a BAC of 0.15 percent or higher (figure 23). In terms of aircraft ownership, of the pilots flying without an airman certificate, 3 of the 8 in the alcohol-involved group, and 16 of the 24 in the substance-free group owned the aircraft. Further, 5 of the 8 in the alcohol-involved group, and 5 of the 24 in the substance-free group without an airman certificate were flying stolen or unauthorized aircraft.

Instrument Rating.--As mentioned in the section "Flight Plan," most general aviation pilots do not have an instrument rating. A substantially smaller percentage of the fatally injured pilots in the alcohol-involved group (21.4 percent) were instrument rated than were the pilots in the substance-free group (47.5 percent) (figure 24).

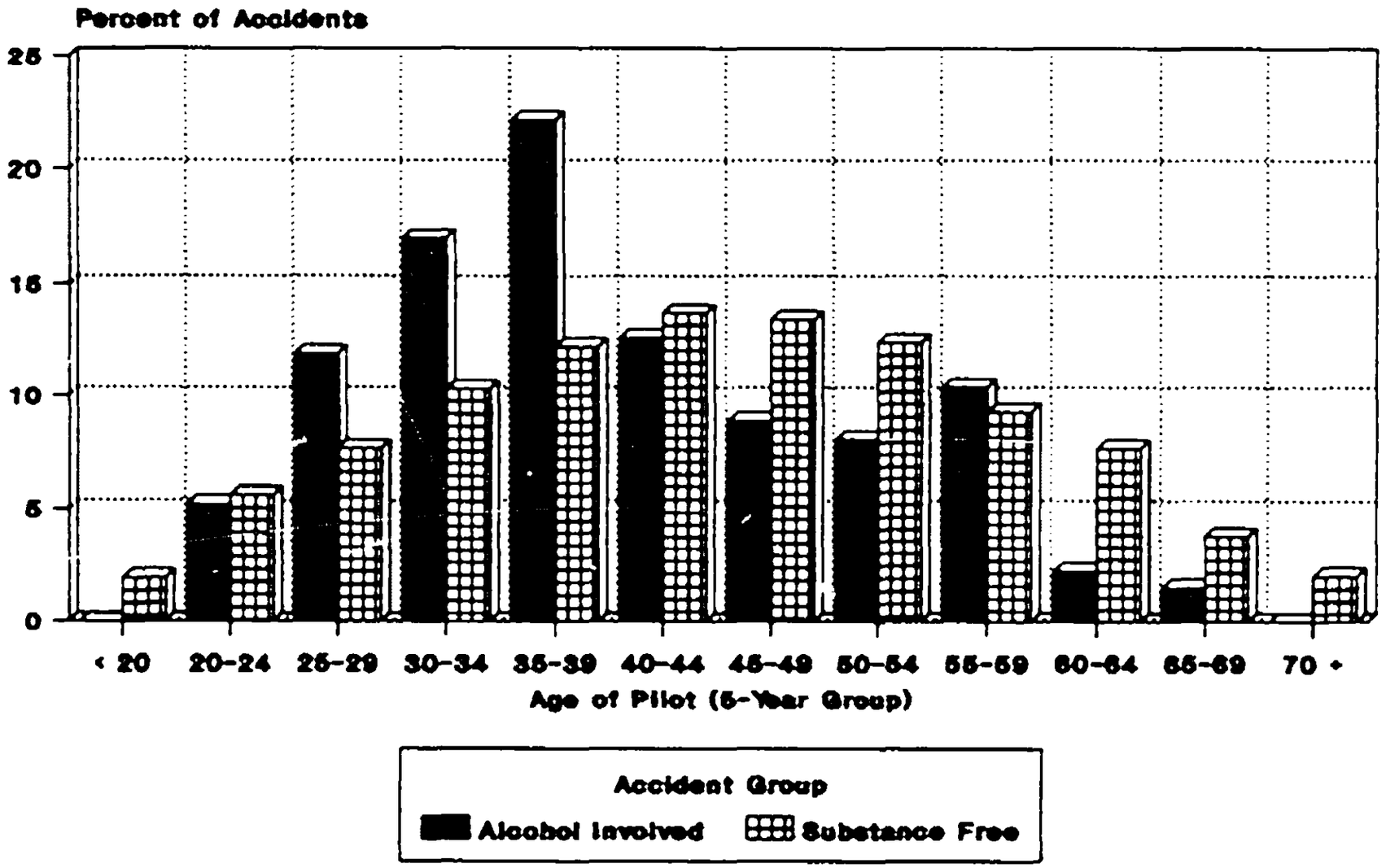

Figure 19.--Percent of alcohol-involved and substance-free general aviation accidents fatal to the pilot-in-command that occurred within an accident group, by age of pilot, 1983 through 1988.

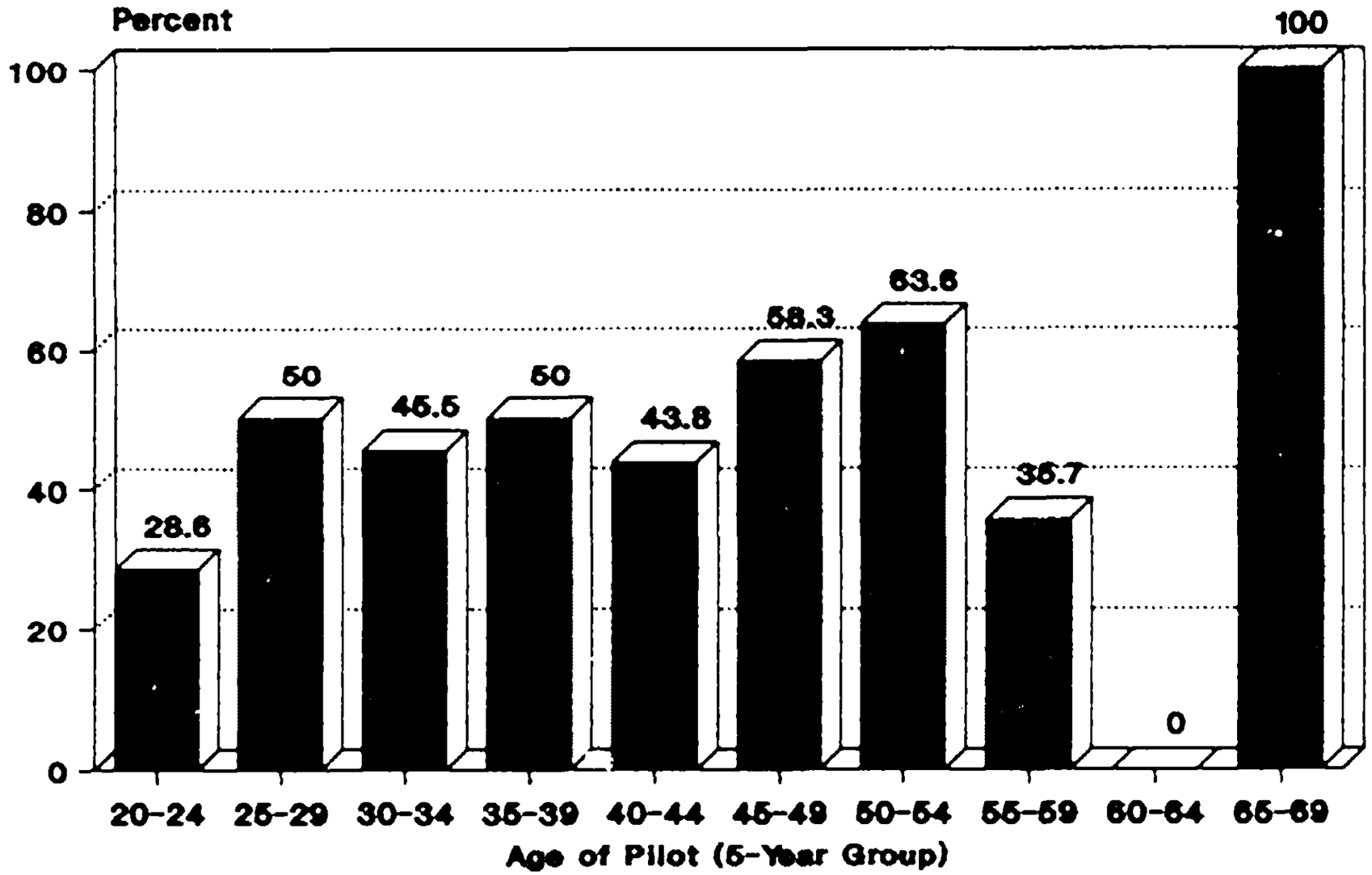

Figure 20.--Proportion of fatally injured general aviation pilots with a BAC of 0.15 percent, by age group, 1983 through 1988.

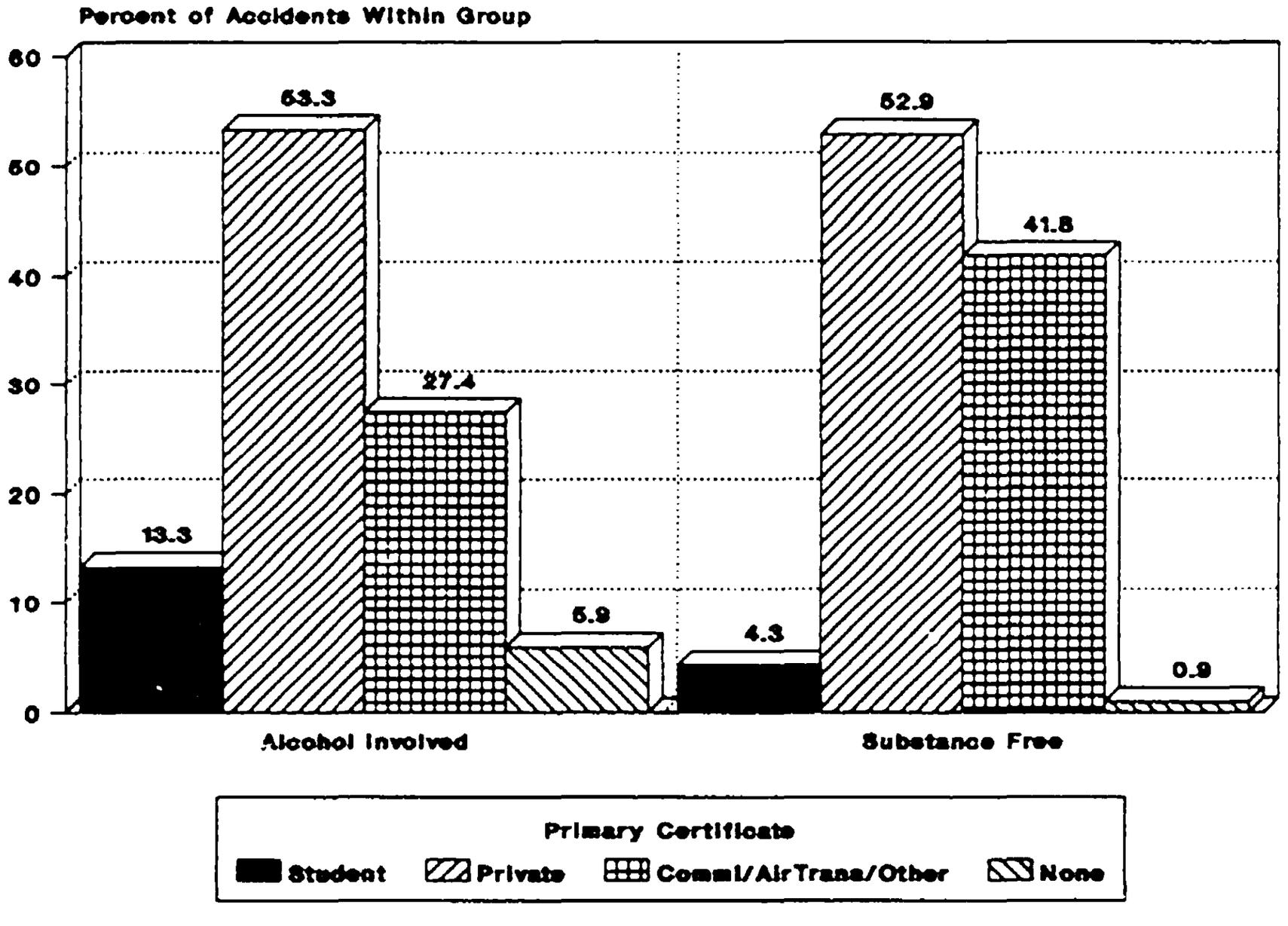

Figure 21.--Percent of alcohol-involved and substance-free general aviation accidents fatal to the pilot-in-command, by type of airman certificate, 1983 through 1988. Data indicate the highest level of airman certificate held; multiple certificates are not indicated. (Comm'l/Air Trans/Other - commercial/air transport/other, including 1 military and 1 foreign in the substance-free group.) Percentages may not add to 100 because of rounding.

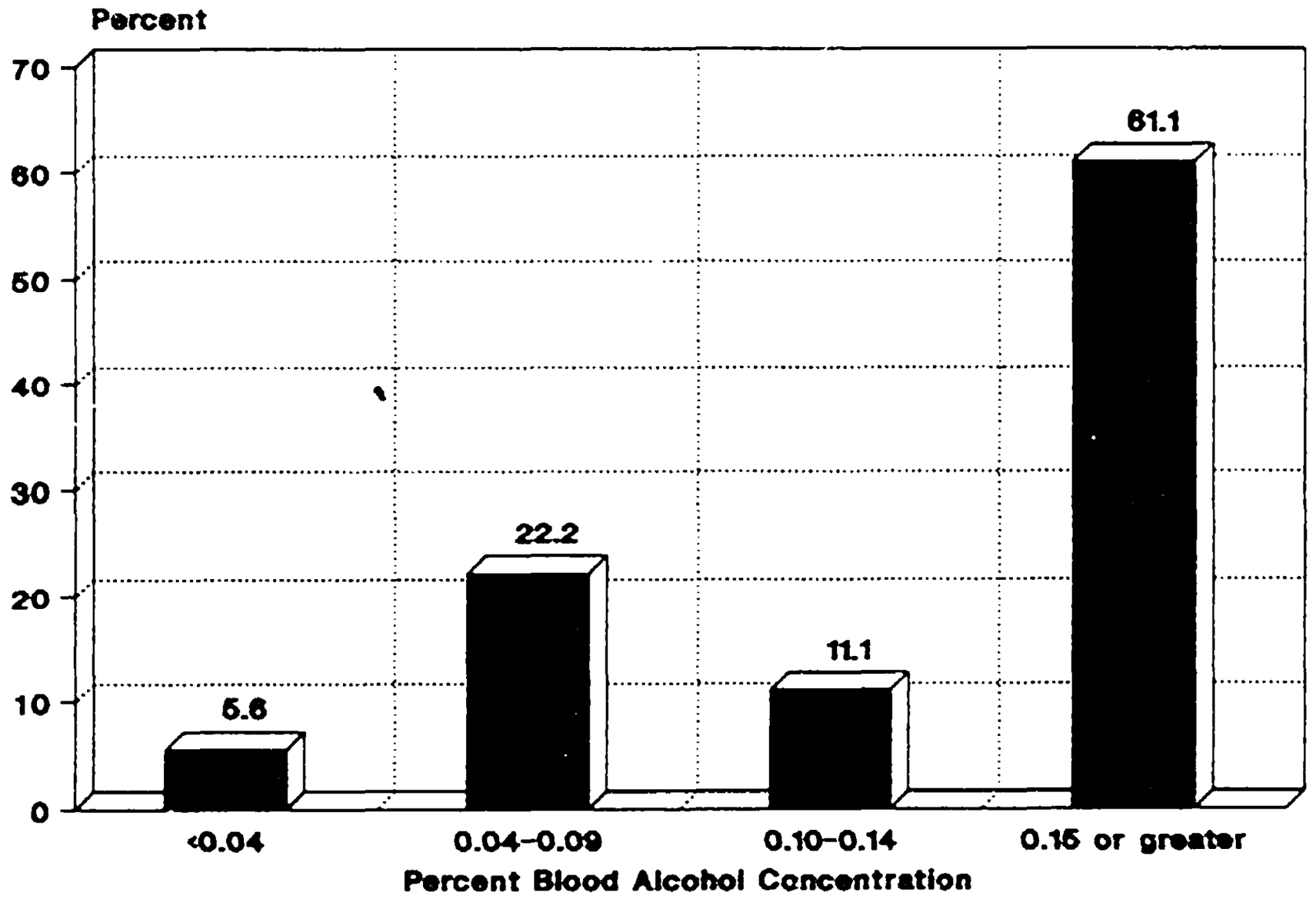

Figure 22.--Proportion of fatally injured general aviation pilots who held a student certificate, by BAC, 1983 through 1988.

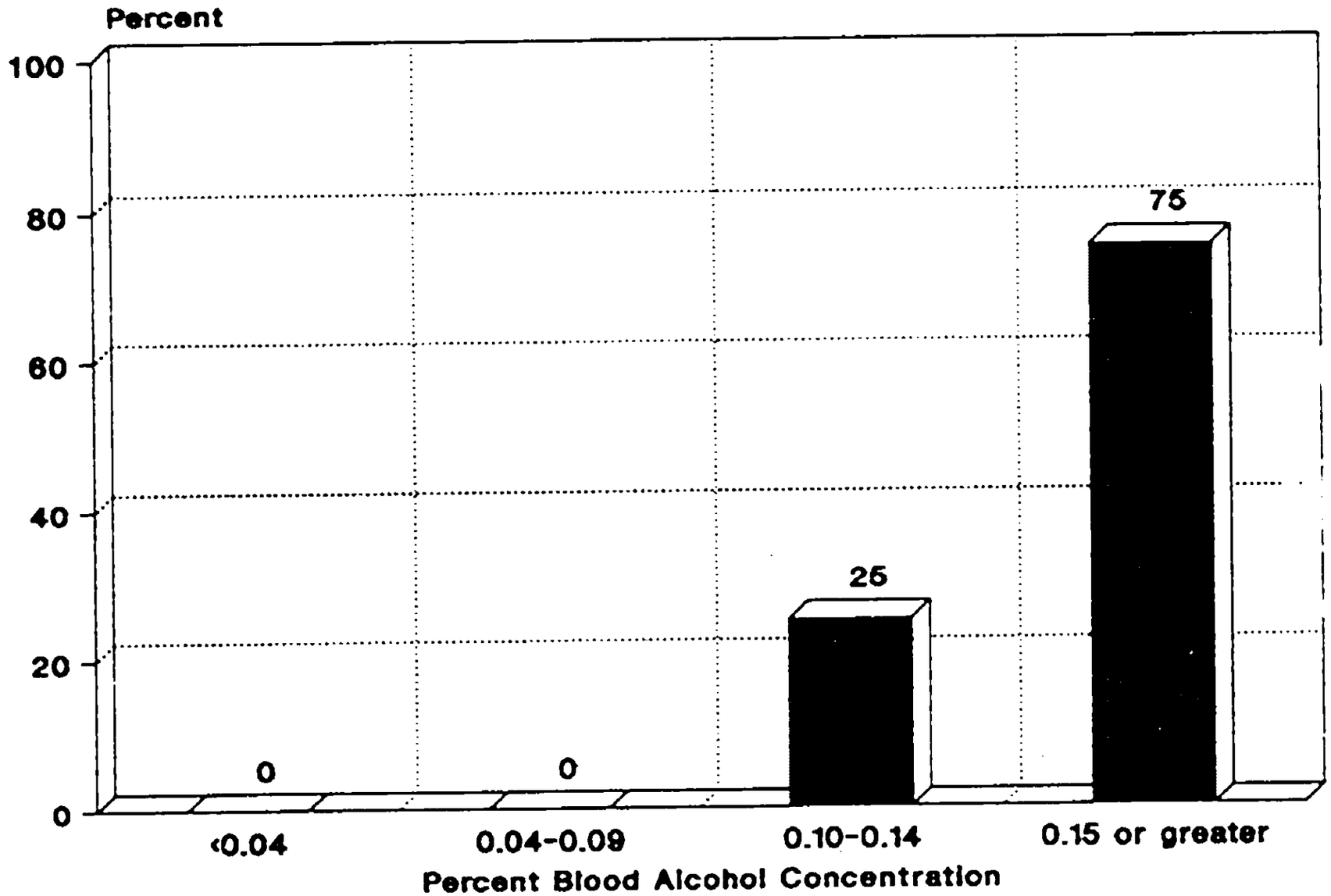

Figure 23.--Proportion of fatally injured general aviation pilots with no airman certificate, by BAC, 1983 through 1988.

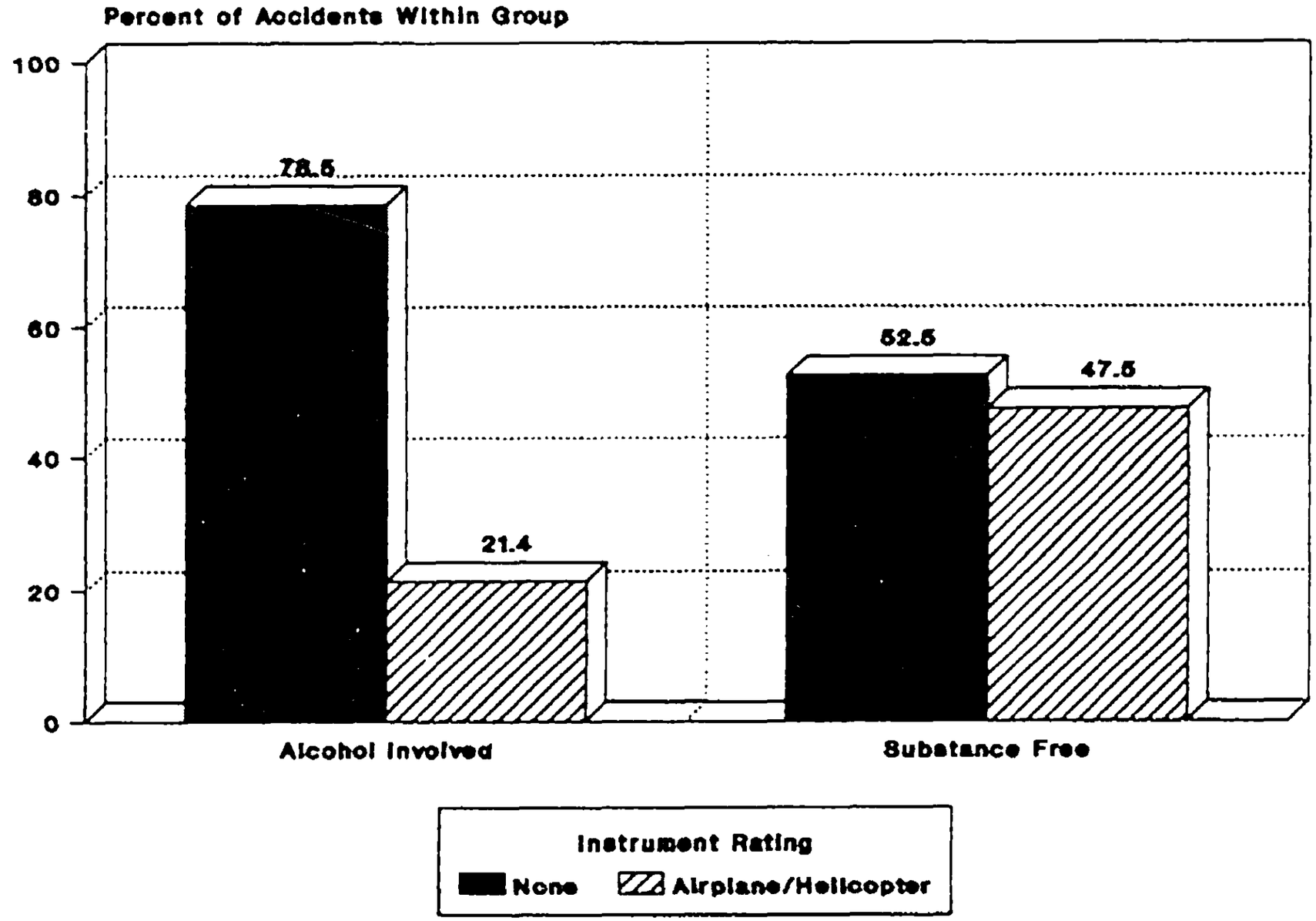

Figure 24.--Percent of alcohol-involved and substance-free general aviation accidents fatal to the pilot-in-command, by pilot instrument rating, 1983 through 1988.

An examination of the pilot's instrument rating showed that for the accidents occurring in instrument meteorological conditions, 77.3 percent of the fatally injured pilots in the alcohol-involved accident group did not have instrument ratings whereas 49.9 percent in the substance-free group did not have instrument ratings.

Flight Time in All Aircraft.--For this analysis, total pilot experience and experience in type, which can be factors in fatal aircraft accidents, were collapsed into five experience categories: less than 100 hours, 101-250 hours, 251-500 hours, 501-1,000 hours, and more than 1,000 hours flight time. Data on pilot flight time in all aircraft were available for all of the alcohol-involved fatal accidents. Although data were available for only 90.2 percent of the substance-free fatal accidents, the Safety Board believes the data reliably indicate the level of pilot experience in the substance-free group. Data for fatal accidents in the alcohol-involved group are shifted toward less experienced pilots (0-100 hours time in all aircraft) whereas accidents in the substance-free group are shifted toward more experienced pilots (more than 1,000 hours time in all aircraft) (figure 25).

Flight Time in Accident Aircraft Type.--Unfamiliarity with the airplane being flown may be a factor in fatal aircraft accidents. Alcohol may cause pilots to make mistakes and misjudgments. Recovery from those mistakes and misjudgments may be more difficult to accomplish when the pilot is less familiar with the airplane. Data on flying time in accident aircraft type are available for 51.1 percent of the alcohol-involved and 61.4 percent of the substance-free accidents. The percentage of pilots with limited experience in type (0-100 hours total flight time in type) was larger in the alcohol-involved group (58 percent) than in the substance-free group (48.2 percent) (figure 26). For flight time in type of 250 hours or less, there is no difference between the two groups.

Flight Time in Last 30 Days.--Nearly 58 percent of the fatally injured pilots in the alcohol-involved group and only 30 percent in the substance-free group had flown 5 hours or less in the 30 days preceding the accident (figure 27). It should be noted, however, that data on flight hours in the last 30 days are available for only 28.1 percent of alcohol-involved and 38.8 percent of substance-free accidents. Although there were limited data available on flight time in last 30 days, the results of the data are consistent with flight time in all aircraft and flight time in accident aircraft type: for the alcohol-involved group, the data are shifted toward less experience.

Biennial Flight Review.--A substantially larger percentage of fatally injured pilots in the alcohol-involved group (23.9 percent) had failed to comply with the biennial flight review requirement for certificate holders than had pilots in the substance-free group (5.8 percent) (figure 28). This suggests a disregard of aviation safety regulations more among pilots in the alcohol-involved group than in the substance-free group.

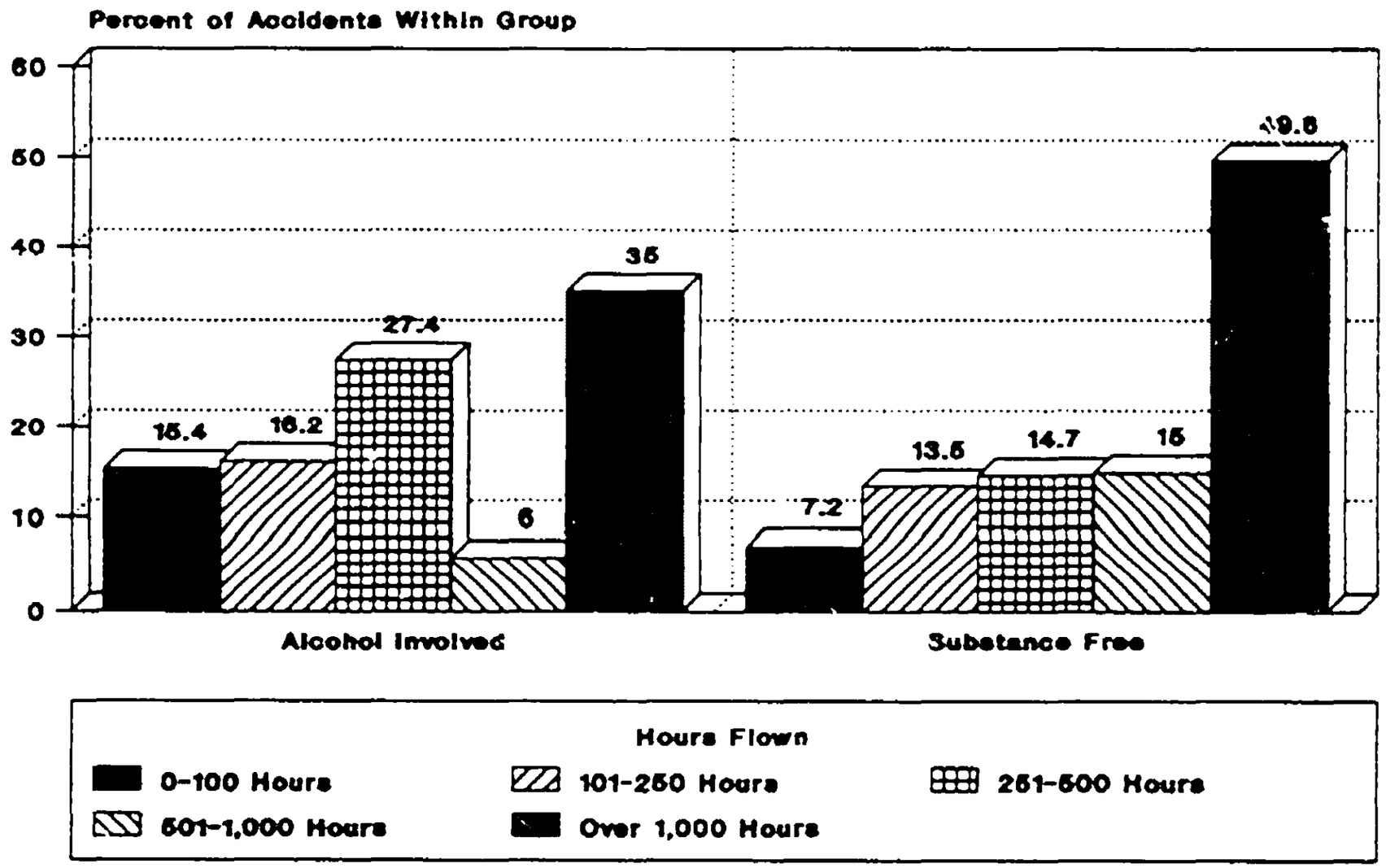

Figure 25.--Percent of alcohol-involved and substance-free general aviation accidents fatal to the pilot-in-command, by total hours flown in all aircraft, 1983 through 1988.

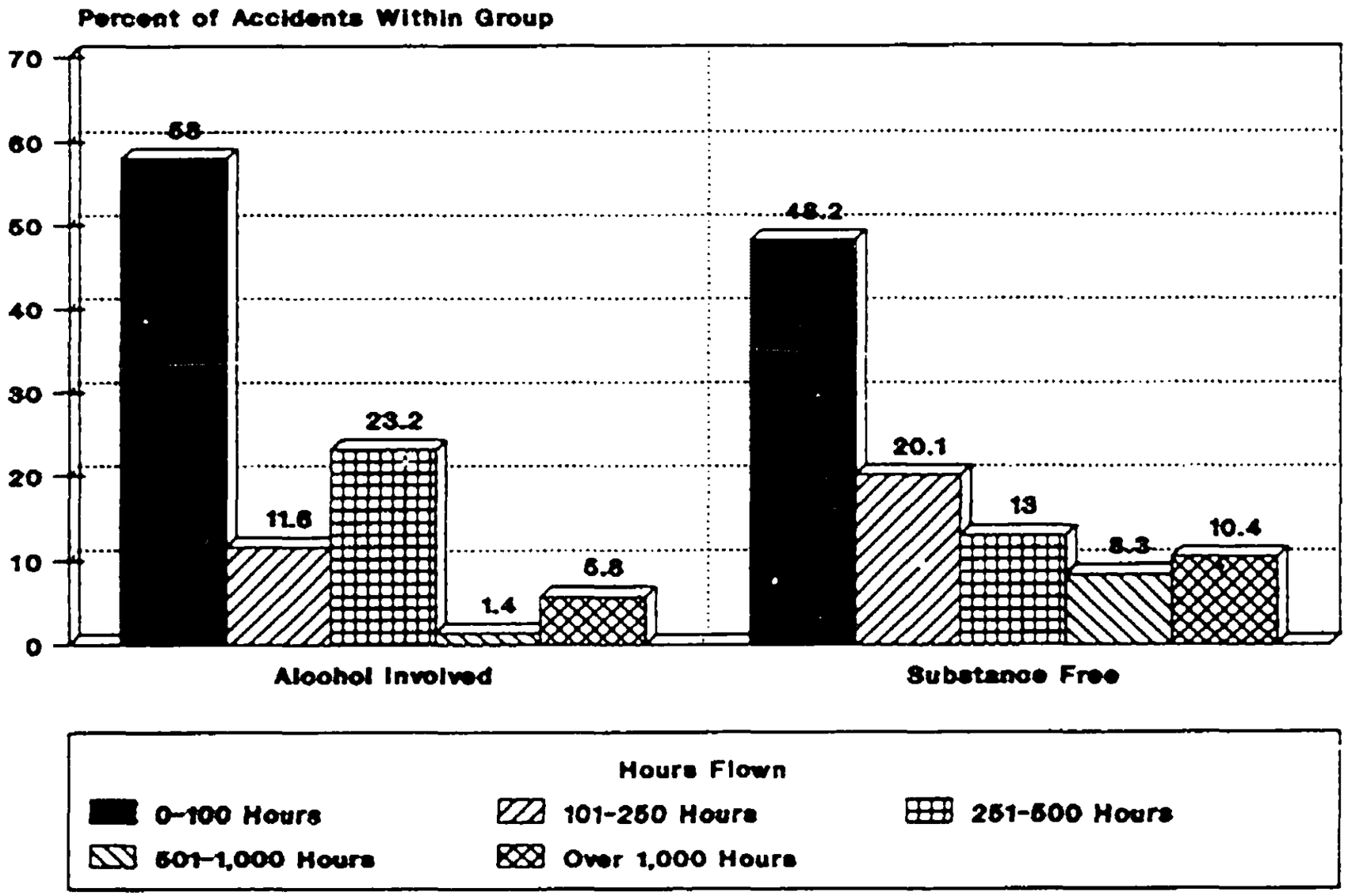

Figure 26.--Percent of alcohol-involved and substance-free general aviation accidents fatal to the pilot-in-command, by hours of flying experience in accident aircraft type, 1983 through 1988.

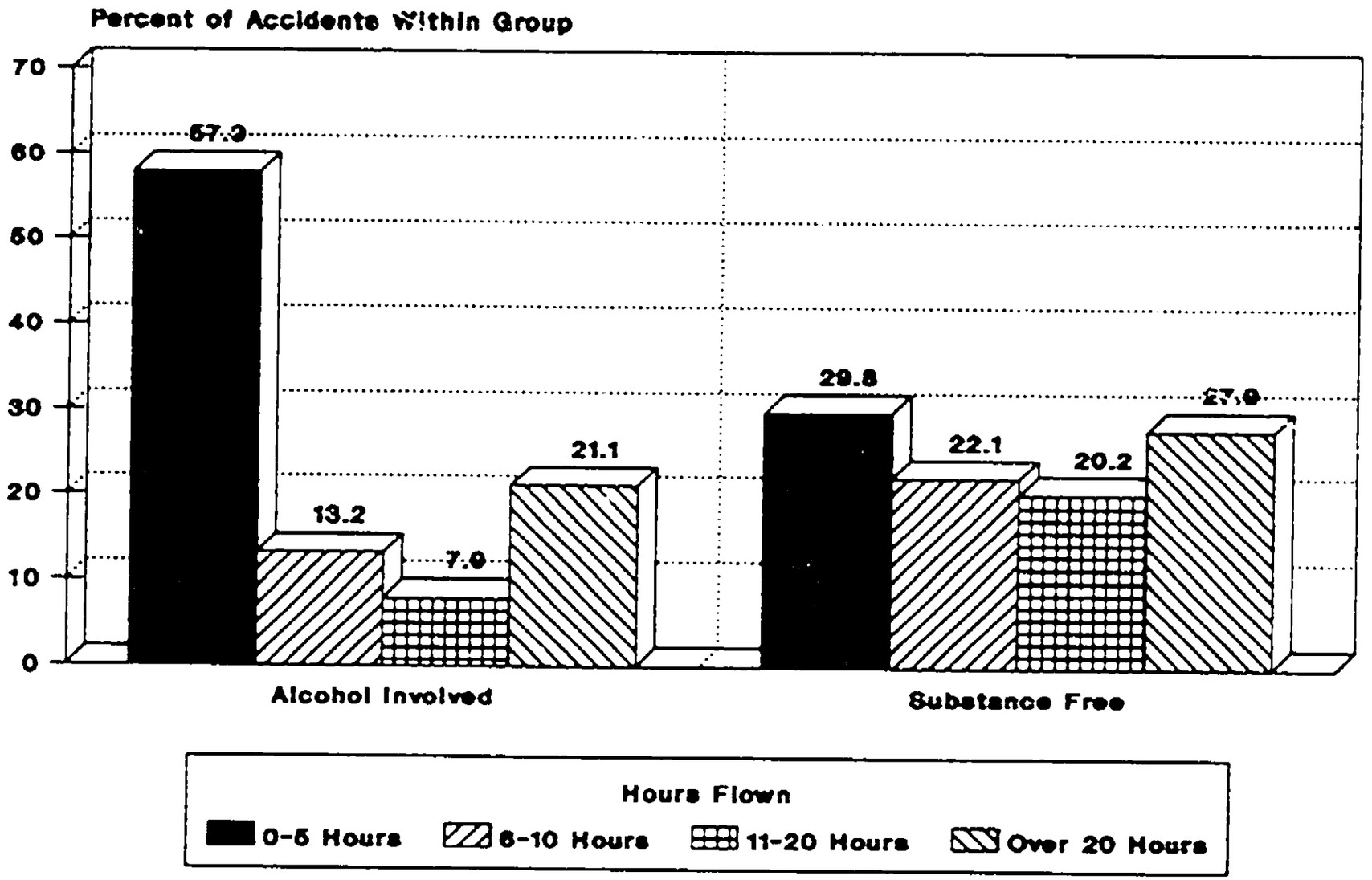

Figure 27.--Percent of alcohol-involved and substance-free general aviation accidents fatal to the pilot-in-command, by hours flown in last 30 days, 1983 through 1988. Percentages may not add to 100 because of rounding.

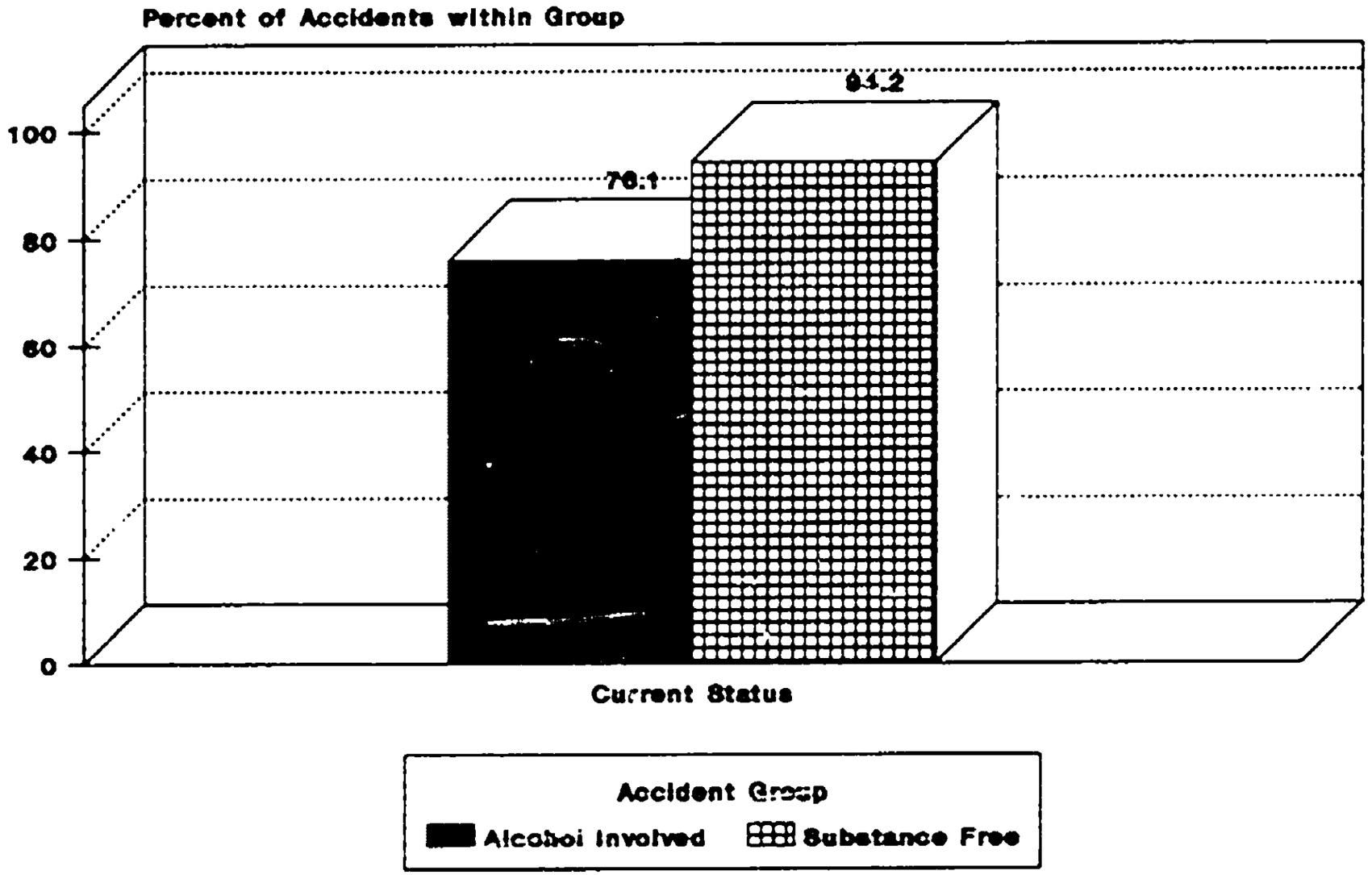

Figure 28.--Percent of alcohol-involved and substance-free general aviation accidents in which the fatally injured pilot-in-command had a current biennial flight review, 1983 through 1988.

Status of Medical Certificate.--Most fatally injured pilots in each accident group held a valid medical certificate; however, there were marked differences between the groups (figure 29). The percentage of pilots with an invalid or expired certificate was about 2 1/2 times greater in the alcohol-involved group (16.8 percent) than in the substance-free group (6.3 percent). Further, 6.9 percent in the alcohol-involved group had no medical certificate compared to 1.4 percent in the substance-free group. Examination of the BAC levels in the alcohol-involved group disclosed that nearly 89 percent of the pilots with no medical certificate had a BAC of 0.15 percent or higher (figure 30).

The lack of valid medical certificates among fatally injured pilots in the alcohol-involved accidents in this study is similar to the findings of the Safety Board's 1984 statistical review of alcohol-involved aviation accidents.

Examination of the data also disclosed the following: 29 percent of the pilots in the alcohol-involved group and 12.8 percent in the substance-free group lacked some form of required certification (an airman certificate or a current biennial flight review or a valid medical certificate).

Causes of Accidents and Contributing Factors

The Safety Board determines causes and contributing factors for each accident it investigates. Multiple causes and factors are cited when applicable in an effort to thoroughly explain the circumstances of an accident. From its investigation of 135 alcohol-involved fatal accidents, the Board cited 711 causes and contributing factors in addition to the alcohol cause or factor by which the accident was classified in the alcohol-involved group. For the 2,590 substance-free fatal accidents, the Board cited 12,703 causes and contributing factors. For this study, accident causes and factors were reviewed to determine whether differences existed between the two accident groups.

Causes and factors attributed to the flightcrew accounted for the largest percentage of Board-cited factors in both accident groups followed by factors attributed to environmental conditions (figure 31). Factors attributed to the aircraft accounted for a small percentage in each accident group. (Factors attributed to facilities and to persons other than the flightcrew were cited infrequently and are therefore not illustrated in the figure.)

Causes and Factors Attributed to the Flightcrew.--For both accident groups (alcohol-involved and substance-free), accident causes and factors attributed to the flightcrew were collapsed into 12 categories for analysis: aircraft controls and displays; planning decision; maintenance decision; weather information; communications; aircraft handling; spatial disorientation; fatigue; physical condition; psychological condition; training and experience; and other factors. Appendix H contains a comprehensive list of the individual causes and factors in each of the 12 categories.

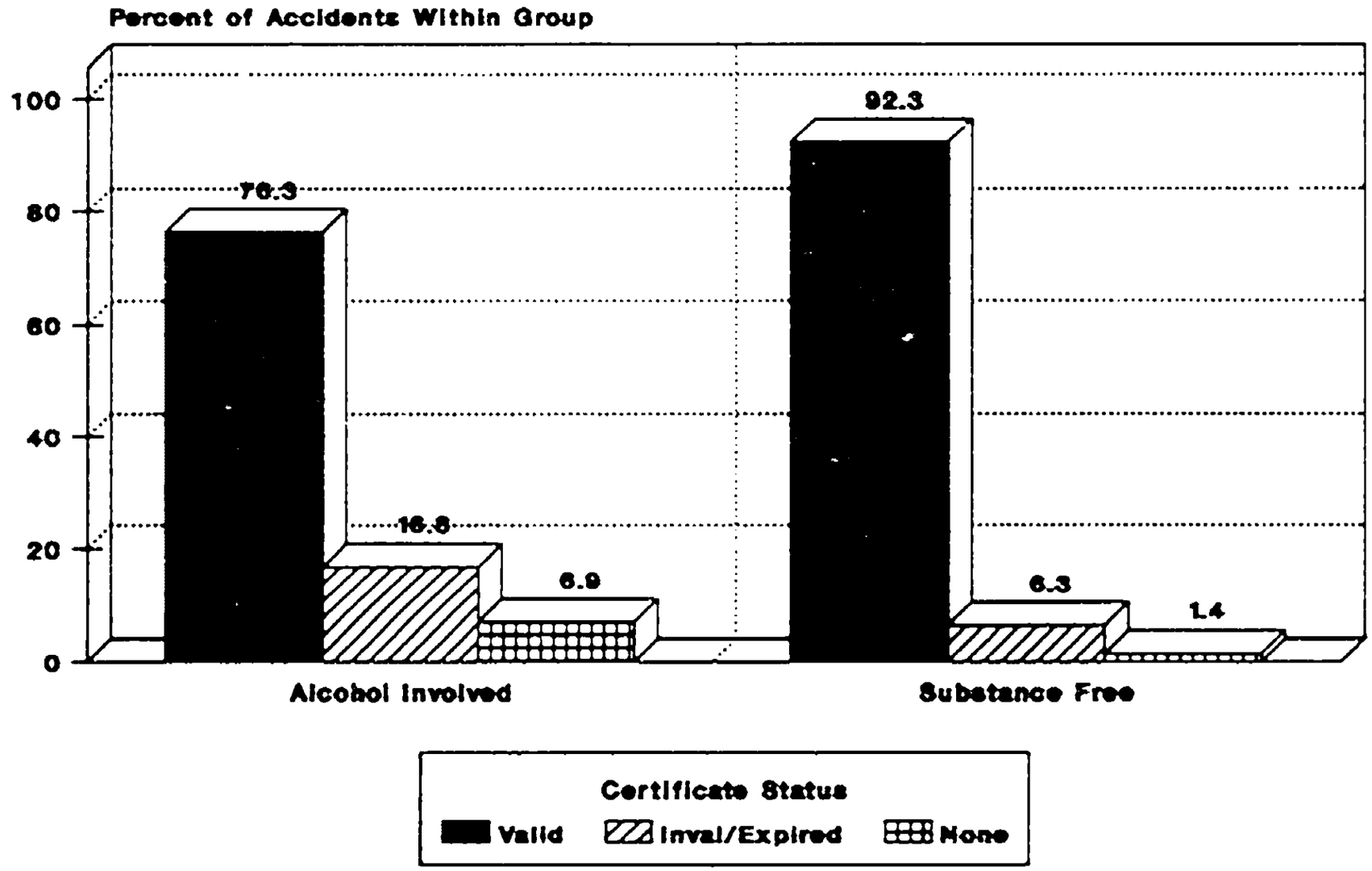

Figure 29.--Percent of alcohol-involved and substance-free general aviation accidents fatal to the pilot-in-command, by status of medical certificate, 1983 through 1988. (Inval/Expired = certificate not valid for this flight/expired.)

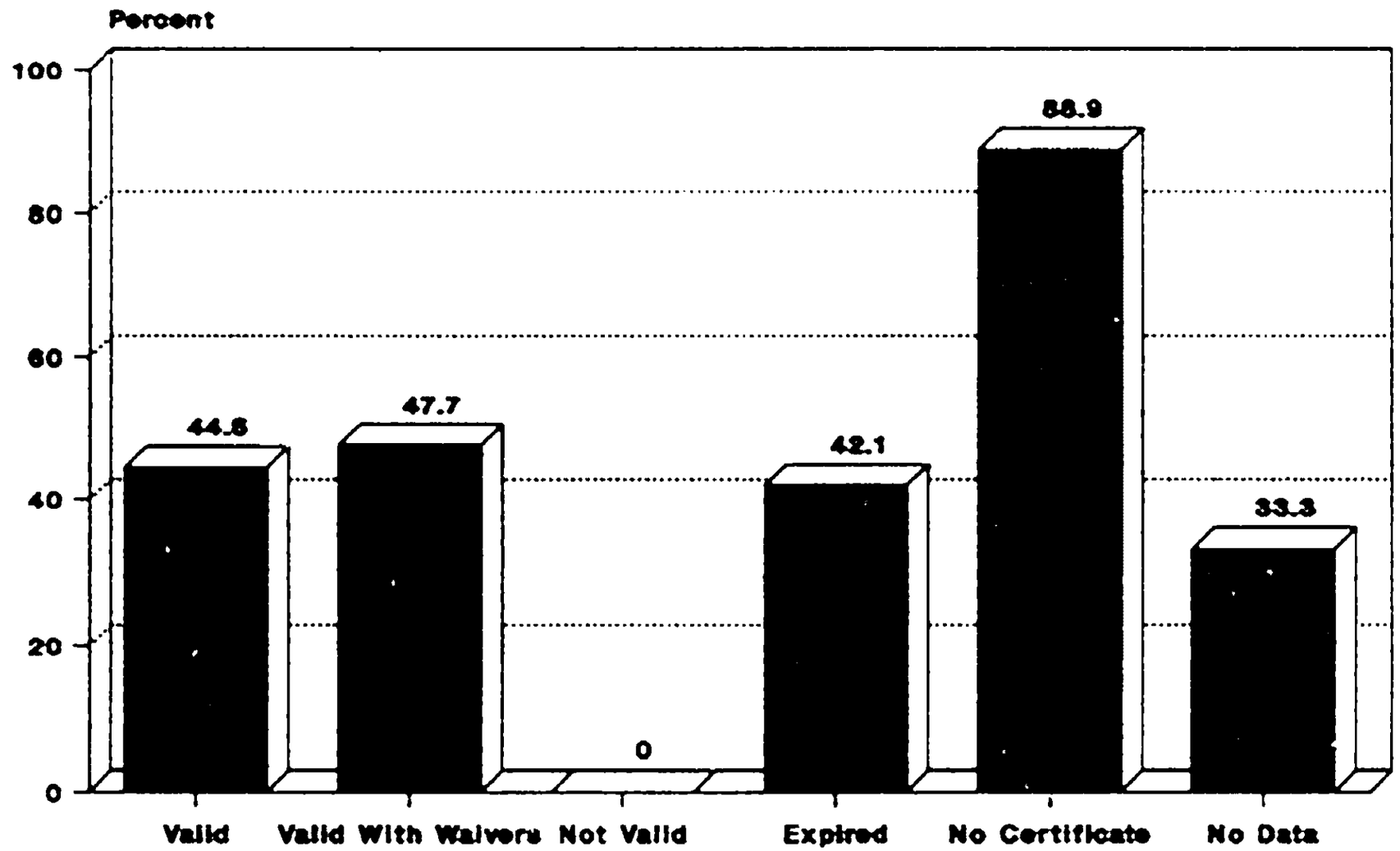

Figure 30.--Proportion of fatally injured general aviation pilots with a BAC of 0.15 percent or greater, by status of medical certificate, 1983 through 1988.

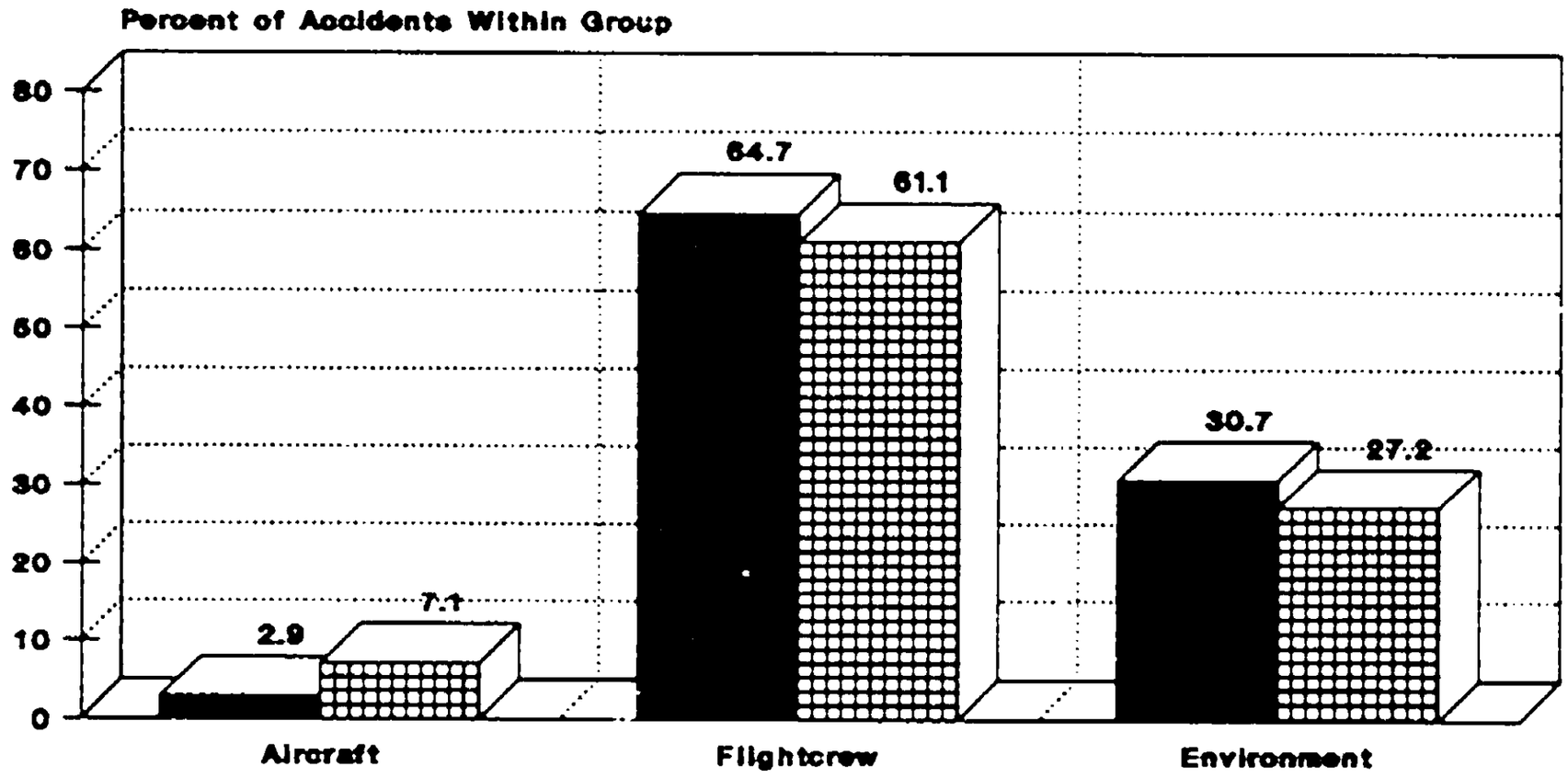

Figure 31.--Percent of alcohol-involved and substance-free general aviation accidents fatal to the pilot-in-command, by attributed cause or factor within an accident group, 1983 through 1988. Percentages for an accident group may not add to 100 either because of rounding or because infrequently cited factors attributed to facilities and persons other than the flightcrew are not illustrated.

For any given category, no dramatic difference is evident between the two accident groups (table 2). However, for each accident group, 2 of the 12 categories--planning decision and aircraft handling--account for most of the factors attributed to the flightcrew.

A small but important difference was identified in the percentage of flightcrew-attributed causes and factors involving buzzing, a subcategory of aircraft handling. Buzzing constituted 4.2 percent of the flightcrew-attributed causes and factors in the alcohol-involved group but only 0.6 percent in the substance-free group.[30] Of the 63 accidents in which buzzing was cited as a cause or factor, alcohol was involved in 20 (32 percent) (figure 32).

Causes and Factors Attributed to Environmental Conditions.--Causes and factors attributed to environmental conditions include weather and light conditions, contact with objects, and terrain or other conditions. Of the environmental conditions, weather conditions were the most frequently cited in each accident group (figure 33). The percentage of accidents in which light conditions were cited was nearly twice as large in the alcohol-involved group as in the substance-free group, reflecting the larger percentage of alcohol-involved fatal accidents that occurred during nighttime hours (discussed previously).

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[30] Of the 477 causes and factors attributed to the flightcrew in the 135 alcohol-involved accidents, buzzing constituted 20 (4.2 percent). Of the 7,768 causes and factors attributed to the flightcrew in the 2,590 substance-free accidents, buzzing constituted 43 (0.6 percent).

Table 2.--Causes and factors in alcohol-involved and substance-free fatal aviation accidents attributed to the flightcrew, 1983 through 1988, by accident group

(In percent within each accident group[a])

Cause/factor category	Accident group	
	Alcohol-involved	Substance-free[b]
Aircraft controls and displays	2.7	3.7
Planning decision	33.8	32.9
Maintenance decision	0.2	1.0
Weather information	0.6	1.8
Communications	0.6	1.1
Aircraft handling[c]	39.2	39.1
Spatial disorientation	4.6	3.1
Fatigue	0.0	0.4
Physical condition	2.3	0.9
Psychological condition	7.8	7.7
Training and experience	6.7	7.9
Other	1.3	0.9

[a] More than one cause or factor is usually cited for each accident. The percentages shown for each cause/factor category are based on the total number of causes and factors attributed to the flightcrew for all accidents within an accident group. For example, for the 186 fatal accidents in the alcohol-involved group, 711 total causes and factors were cited; 477 of the 711 were attributed to the flightcrew. Thus, 477 is the denominator used to determine the percentages shown for the alcohol-involved group. For the 2,880 accidents in the substance-free group, the denominator is 7,766 (of 12,706 total causes and factors). Percentages may not add to 100 because of rounding.

[b] Substance-free means that the Safety Board did not cite alcohol or other drugs as a cause or factor in the accidents. Some of the substance-free accidents may have involved alcohol or other drugs, but there was no evidence of their use.

[c] Includes buzzing as a cause or factor.

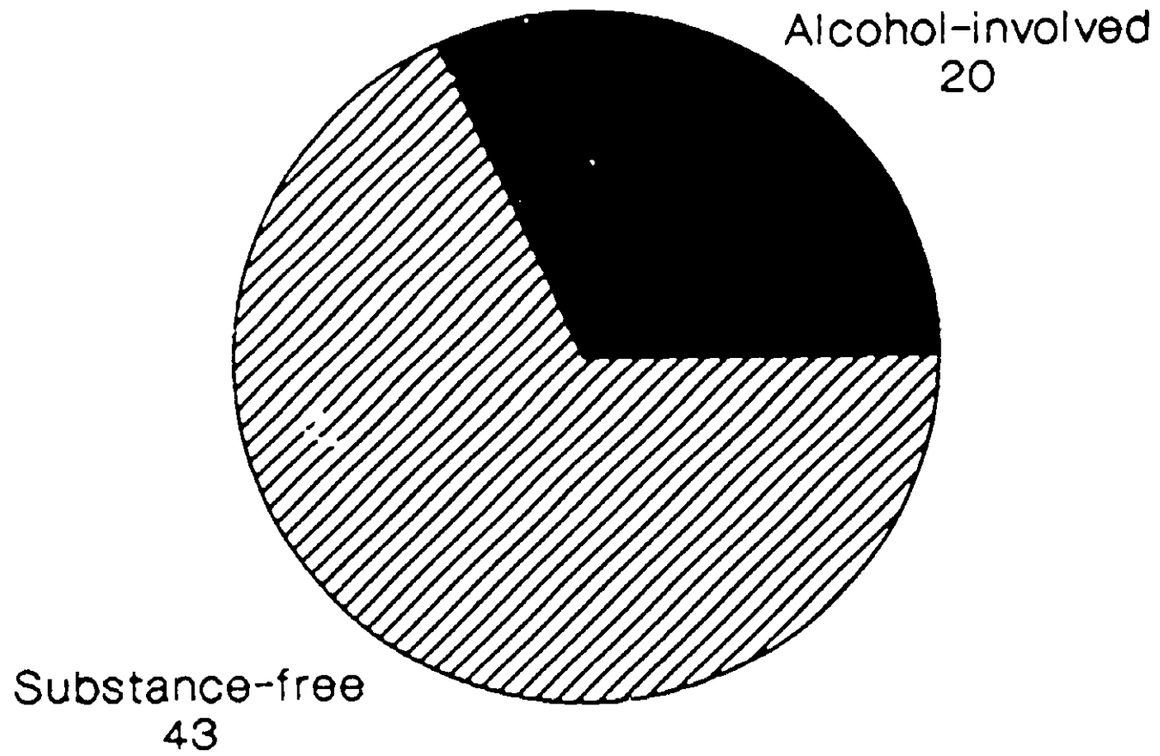

Figure 32.--Number of general aviation accidents fatal to the pilot-in-command in which buzzing was cited as a cause or factor, 1983 through 1988.

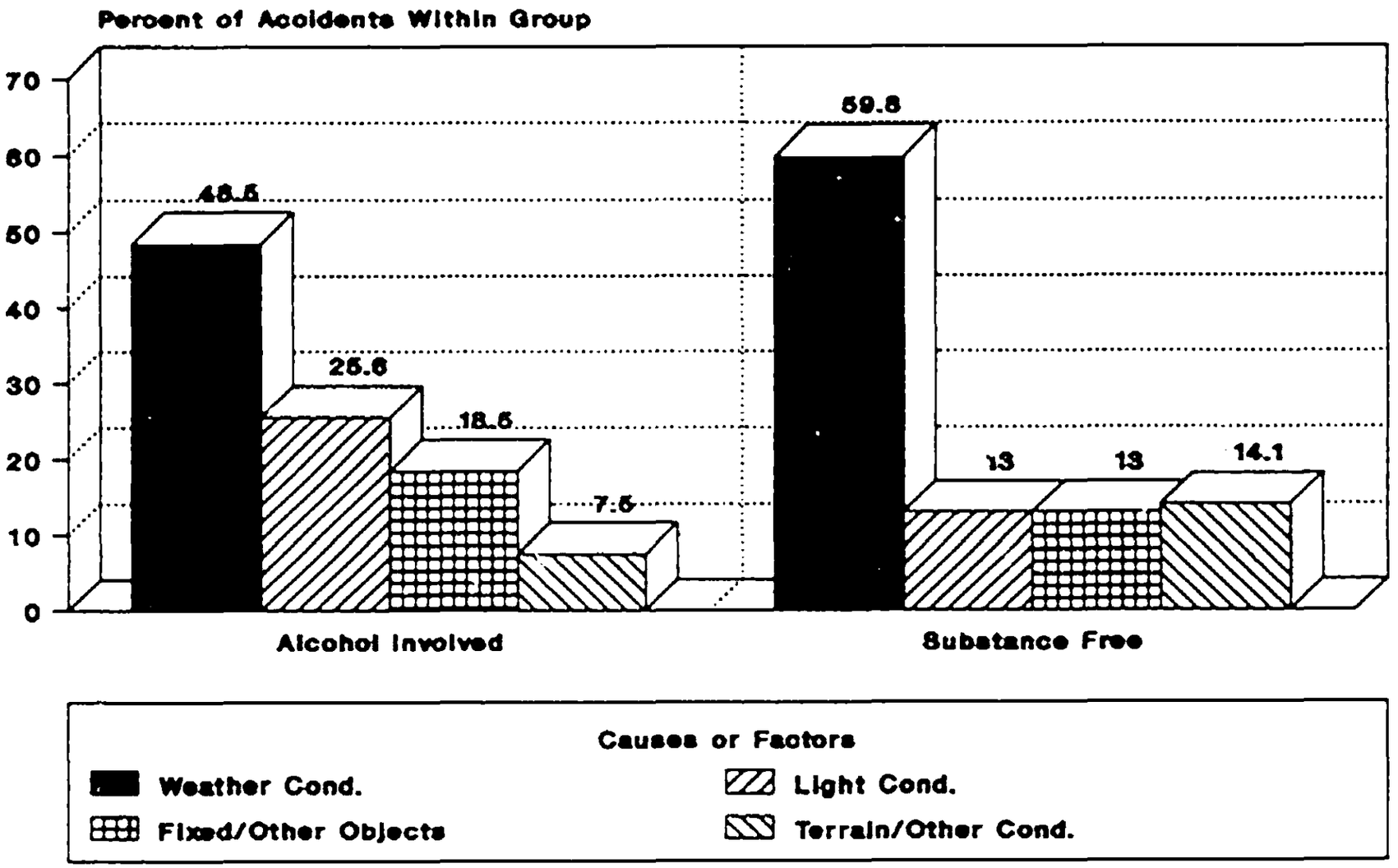

Figure 33.--Percent of alcohol-involved and substance-free general aviation accidents fatal to the pilot-in-command, by environment-attributed causes or factors, 1983 through 1988. Percentages for an accident group may not add to 100 because of rounding.

DRUGS IN GENERAL AVIATION ACCIDENTS FATAL TO THE PILOT-IN-COMMAND

During the 1983 through 1988 period, the laboratory used by the Safety Board to test for drugs of abuse experienced quality control problems and changes in procedures.[31] As testing problems became evident, technical and policy changes were made to improve the accuracy and reliability of toxicological testing. As a result of these problems, which have now been resolved, few conclusive toxicological tests for drugs were obtained and test results from the earlier years of the study period are less reliable than test results from the latter years of the study period, especially 1988.

As indicated in the following tabulation, the number of accidents identified as drug-involved generally increased during the period, possibly as a result of a greater emphasis on drug testing and changes made to improve testing techniques.

Year	Number of Accidents
1983	3
1984	2
1985	6
1986	7
1987	4
1988	13

Testing for drugs other than alcohol following general aviation accidents was not sufficiently frequent during the 1983 through 1988 period to be representative of any segment of general aviation accidents, and no conclusions can be drawn about drug involvement in general aviation accidents. Further, the small number of drug-involved general aviation accidents that were fatal to the pilot-in-command (35) precludes a comparative analysis of the results with alcohol-involved accidents or substance-free accidents that were fatal to the pilot-in-command.[32] General information about the 35 drug-involved accidents and drug test results follows.

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[31] The Civil Aviation Medical Institute (CAMI) of the Federal Aviation Administration operates a toxicological testing laboratory that is used by the Safety Board to test biological specimens from fatal aviation accidents.

[32] Data obtained from the limited sample are included in appendix F as information for researchers and safety specialists.

Multiple drug involvement, sometimes referred to as "polydrug" use, was identified in 15 (43 percent) of the 35 accidents. Of the drugs detected in toxicological tests, cocaine and marijuana were the most frequently identified (12 and 9 accidents, respectively) (figure 34).[33] Review of the accidents with toxicological test results that were positive for drugs indicates that stimulants (19 accidents) were the most frequently identified drug class followed by marijuana and sedative/tranquilizers (9 accidents each), antihistamines (2), and opiates (2) (figure 35). The figure showing drug class includes alcohol because it is often used in combination with other drug classes.

For the accidents with polydrug use, alcohol in combination with another drug was identified in eight accidents: alcohol and cocaine in four, alcohol and marijuana in two, and alcohol and other drugs in two. Marijuana in combination with another drug was identified in four accidents. Cocaine combined with other drugs was identified in two accidents. Other combinations of drugs were identified in two accidents; in one of these accidents, the combination was likely an over-the-counter drug compound.

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[33] Paragraph 91.17(a)(3) prohibits flying under the influence of "any drug that affects the [crewmember's] faculties in any way contrary to safety." Drugs prohibited by this rule include the drugs for which tests are required under the DHHS Mandatory Guidelines for Federal Workplace Drug Testing Programs; other illicit drugs; and some prescription and over-the-counter medications such as cough suppressants, decongestants, antihistamines, and compounds that include such medications. Appendix I of this report lists drugs detected in each of the 35 drug-involved accidents.

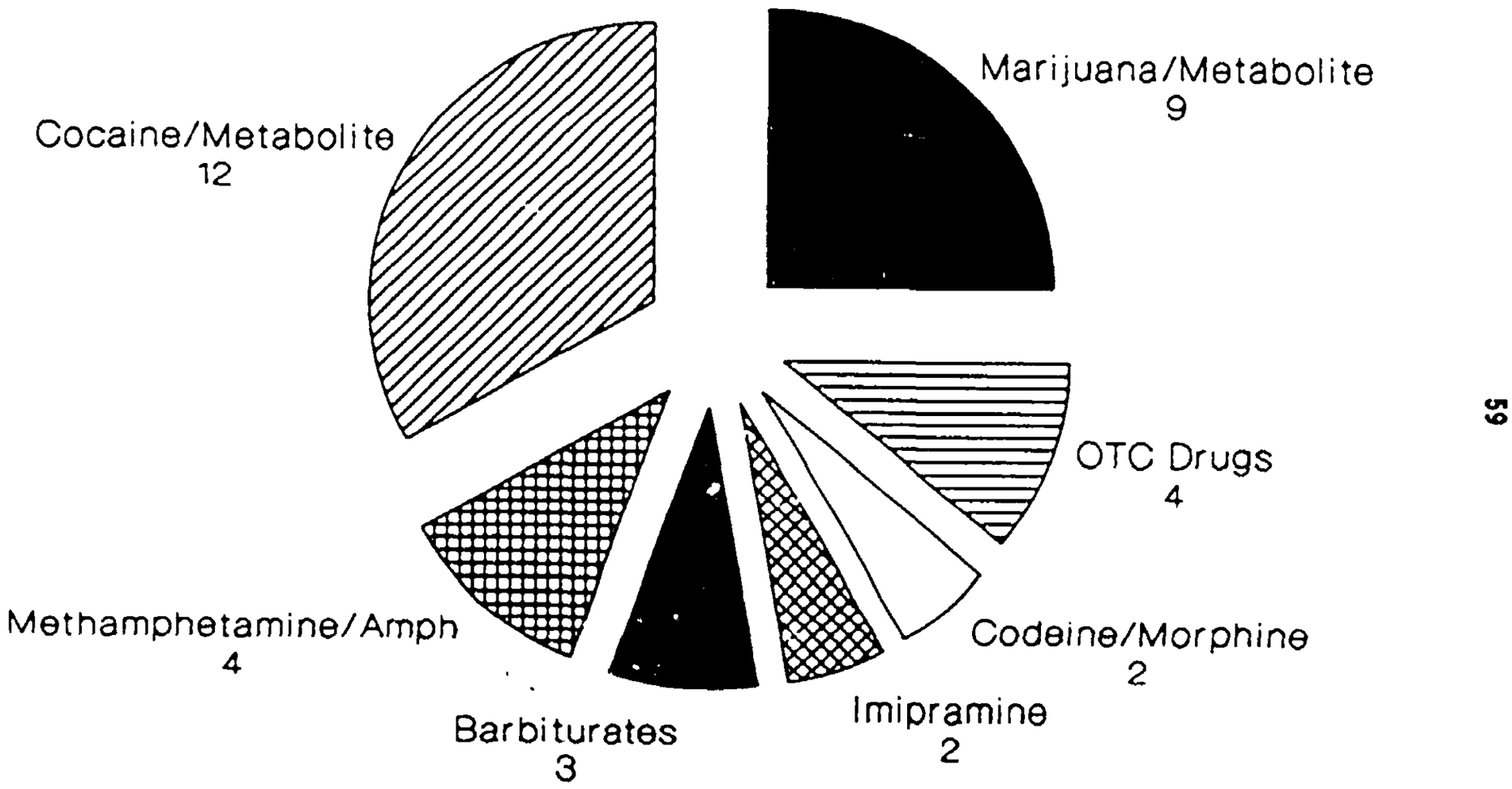

Figure 34.--Most frequently identified drugs detected in drug-involved general aviation accidents fatal to the pilot-in-command, 1983 through 1988. (Amph = amphetamine; OTC = over-the-counter.) Frequency will exceed the number of drug-involved accidents (35) because of multiple drug use.

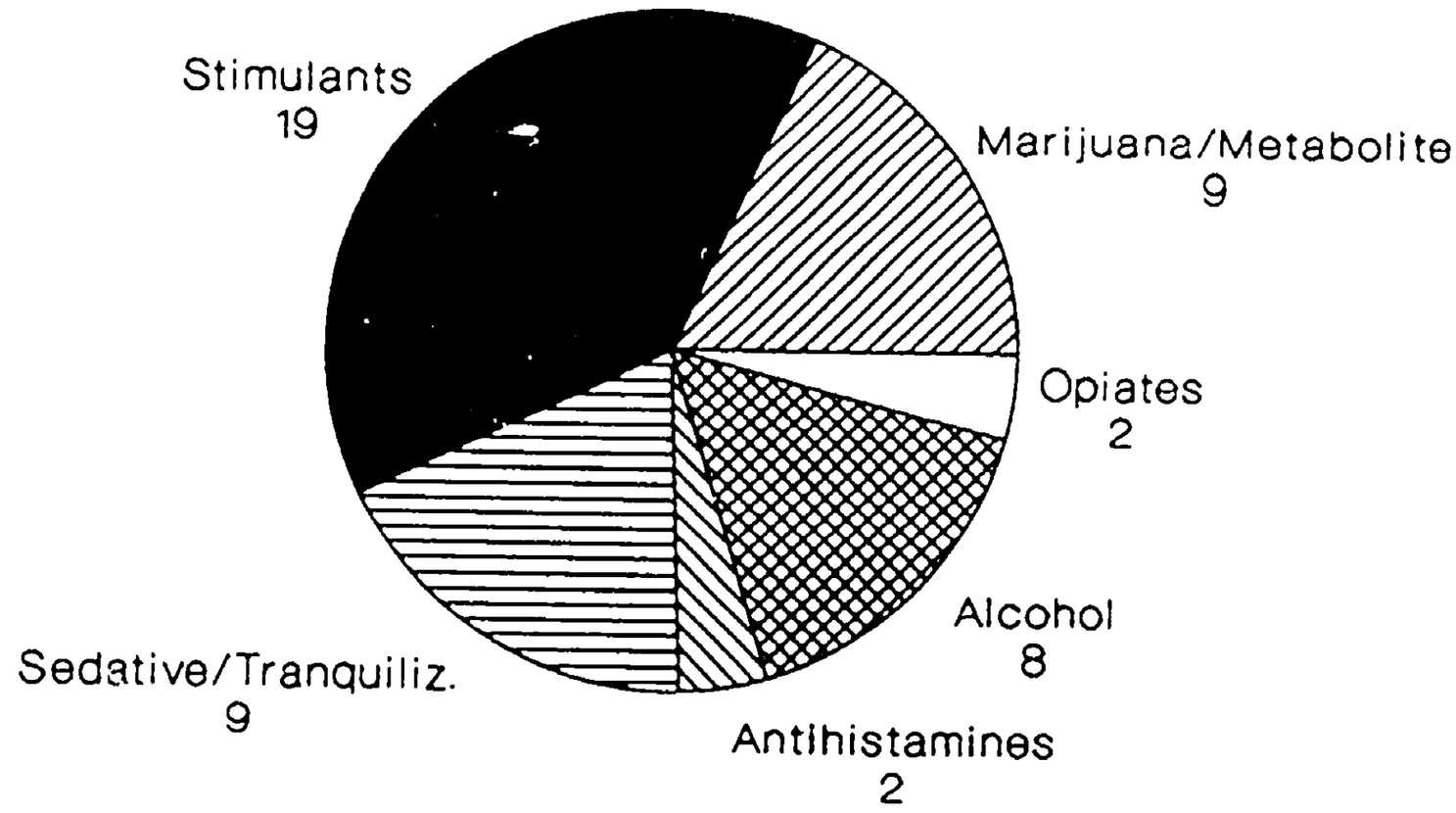

Figure 35.--Classes of drugs detected in drug-involved general aviation accidents fatal to the pilot-in-command, 1983 through 1988. (Tranquiliz = tranquilizers). Frequency will exceed the number of drug-involved accidents (35) because of multiple drug use.

DISCUSSION

As mentioned in the "Methods" section, the percent of fatal general aviation accidents that involve alcohol is probably higher than the percent of alcohol involvement in all general aviation accidents. This assumption about alcohol involvement in general aviation is supported by research on highway accidents, which indicates that the rate of alcohol involvement in fatal highway accidents is greater than in accidents resulting in injuries or property damage. The data from the Safety Board's study for the 1983 through 1988 period indicate that for general aviation accidents that were fatal to the pilot-in-command, alcohol was involved in about 6.7 percent of the accidents for which the toxicological tests were conclusive. Because there was no evidence of selection bias between the 21 percent of the fatal general aviation accidents in which no test results were obtained and the 79 percent in which tests were obtained, this estimate of the incidence of alcohol involvement in fatal general aviation accidents (6.7 percent) appears to be a reasonable upper limit for the estimated alcohol involvement in all general aviation accidents.

Although the percentage of alcohol involvement in fatal general aviation accidents has decreased since the mid-1970s, the Safety Board believes that alcohol involvement in general aviation accidents remains a cause for concern because of its adverse effect on performance. Research has demonstrated that blood alcohol concentrations below 0.04 percent can produce impairment. One study indicates increased pilot errors at BACs as low as 0.025 percent.[34] Another study shows little effect of low BAC (below 0.03 percent) on single performance tasks, but shows a reduced ability to perform complex psychomotor tasks at concentrations as low as 0.015 percent.[35] According to the study, "these effects may be particularly insidious since they occur at blood alcohol concentrations that have little or no noticeable effect on many tasks performed before flight." Additional research found residual detrimental effects of alcohol on flight performance many hours after the BAC had returned to zero, the so-called "hangover effect."[36] Further, other aviation and highway research has shown that pilots and drivers are unable to accurately determine their impairment in the hangover stage.[37]

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[34] Billings, C.E.; and others. 1991. Effects of alcohol on pilot performance in simulated flight. Aviation, Space, and Environmental Medicine. Washington, DC: Aerospace Medical Association; p. 235. March.

[35] Modell, J.G.; Mountz, J.M. 1990.

[36] Kuhlman, J.J.; and others. 1991.

[37] (a) Modell and Mountz 1990. (b) Yesavage, J.A.; Leirer. V.O. 1985. Alcohol hangover in aircraft pilots: a preliminary report of effects 14 hours after ingestion. Stanford, CA: Stanford University School of Medicine. (c) Laurell, Hans; Tornos, Jan. 1982. Hangover effects of alcohol on driver performance. Rep. 222A. Linkoping, Sweden: National Road and Traffic Institute.

Profile of Pilots Fatally Injured in Alcohol-Involved General Aviation Accidents

Data on the general aviation pilots fatally injured in alcohol-related accidents shows evidence of BAC levels that suggest problem drinking. The data also indicate flying inexperience, certificate violations, and risk-taking behavior. From the study data, the Safety Board developed the following profile of pilots fatally injured in the alcohol-involved general aviation accidents from 1983 through 1988.

- The mean BAC of alcohol-positive pilots was 0.15 percent, the BAC level that is strongly associated with problem drinking and nearly four times the 0.04-percent BAC offense level established by current FAA regulations. More than 95 percent of the alcohol-positive pilots had a BAC that exceeded the FAA limit of 0.04 percent, about 74 percent had a BAC that exceeded the 0.10-percent level established as an illegal BAC for drivers by most States, and more than 47 percent had a BAC that exceeded 0.15 percent.

- A larger percentage of alcohol-involved fatally injured pilots had fewer total flying hours, flying hours in type, and flying hours in the last 30 days than did substance-free fatally injured pilots;

- A larger percentage of alcohol-involved pilots held student airman certificates (13.3 percent) than did substance-free fatally injured pilots (4.3 percent);

- A larger percentage of alcohol-involved fatally injured pilots had failed to meet biennial flight review requirements (23.9 percent) than had the substance-free fatally injured pilots (5.8 percent);

- About 23.7 percent of the alcohol-involved fatally injured pilots had an invalid or no medical certificate compared with only 7.7 percent of the substance-free fatally injured pilots.

- Alcohol was involved in about 32 percent of the fatal accidents for which buzzing was cited as a cause or factor.

Although no conclusions can be drawn from the drug-involved accidents, certificate violations and flying inexperience were also evident for pilots in the drug-involved group.

Toxicological Testing After Nonfatal General Aviation Accidents

The information from this study relates only to one segment of general aviation accidents: those in which the pilots-in-command were fatally injured. Little is known, however, about general aviation accidents that are nonfatal because the number of toxicological tests performed after nonfatal general aviation accidents has been small (about 1.0 percent of the 13,677 accidents that occurred from 1983 through 1988[38]) and some test results may not be reported to the FAA.

The low rate of testing pilots involved in nonfatal general aviation accidents is the result of the absence of an implied consent provision (requiring a pilot to submit to toxicological testing) in many existing State flying-while-intoxicated (FWI) laws, and the absence of FWI laws in some States.[39]

The following accident summary illustrates some difficulties associated with obtaining toxicological tests after a nonfatal general aviation accident.

On June 14, 1988, a pilot initiated liftoff for an aerial application operation in the State of Kansas. As the airplane lifted off, it turned to the left. The airplane continued in flight as the pilot dumped his chemical load, hit a tree, and landed in a field adjacent to a highway. The pilot, who stated he had no rudder control, sustained minor injuries and the airplane received substantial damage. The investigating law enforcement officer stated that he detected a strong odor of alcohol on the pilot. The pilot went to a local hospital for treatment of his minor injuries where hospital staff also noted an odor of alcohol on the pilot. The pilot, however, left prior to receiving treatment or providing a specimen for toxicological testing by hospital medical personnel.

FAA regulations require surviving commercial (Part 121 and 135) pilots to submit to a toxicological test for drugs (but not alcohol) following an accident that results in death, serious injury or substantial aircraft damage. Although not required by FAA regulations, many commercial air carriers require testing for alcohol after accidents. As of September 5,

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[38] Of the 13,677 nonfatal general aviation accidents that occurred from 1983 through 1988, there were 142 for which toxicological tests were performed; the Safety Board is not aware of the reasons for which the 142 cases were selected for testing. Of the 142 tests performed, 88 percent (125) resulted in a conclusive test for alcohol. Of these, 38 percent (47 of 125) were positive for alcohol. The rate of testing increased each year of the 1983 through 1988 period; however, testing after nonfatal accidents did not exceed 2.2 percent in any year.

[39] Delaware, Kentucky, Missouri, Pennsylvania, Rhode Island, and Utah do not have FWI laws. The District of Columbia, which has no airport or airstrip within its boundaries, also does not have an FWI law.

1991, FAA regulations specifically exclude general aviation operators flying aerial application for compensation from the drug testing provisions of Part 135 (but not from the requirements of Part 91).[40] Under the Federal regulations pertaining to alcohol and drug testing in civil aviation (14 CFR 91.17), which include general aviation pilots, pilots must submit to toxicological testing for alcohol only if a test is requested by a law enforcement officer under the provisions of State law. In the Kansas accident, no specimen was obtained and no test was performed for the FAA. The Kansas law that prohibits flying while intoxicated establishes a BAC offense level of 0.10 percent and contains an implied consent provision. In this accident, the law enforcement officer did not request and the hospital did not conduct a chemical test before the pilot left the hospital. Despite the lack of action by aviation and enforcement authorities to obtain a toxicological test, witness testimony provided sufficient evidence to the Safety Board regarding the pilot's alcohol use. The Safety Board determined the probable cause of this accident to be inadequate climb by the pilot-in-command, and his physical impairment by alcohol was a contributing factor in the accident.

Under most State laws, an officer may not request a test unless an offense has been committed in the presence of the officer or the officer has cause to believe (based on the odor of alcohol on the pilot or other evidence at an accident) that an offense has been committed. The authority to request such a test is dependent on the existence of a State law pertaining to flying while intoxicated.

Although 44 States have some form of law related to flying while intoxicated, the provisions of the laws vary from State to State (table 3). Only 16 States with FWI laws have an implied consent provision (for chemical testing) and establish a BAC level at which a pilot is presumed to be impaired: Arizona, California, Colorado, Georgia, Idaho, Michigan, Minnesota, Montana, New Hampshire, Oklahoma, and South Carolina establish a BAC of 0.04 percent; Nebraska 0.05 percent; Alaska, Kansas, Louisiana, and Massachusetts 0.10 percent.[41]

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[40] See 14 CFR 135.1(b) and (c) and 14 CFR 135.249, 135.251, and 135.353 for additional information. The Safety Board did not agree with this exemption. (See appendix J for excerpts from the regulation and the Safety Board's comments on the exemption.)

[41] (a) Information on all States except Kansas was obtained from an analysis of State flying-while-intoxicated laws by the Illinois General Assembly. (Kuang, Wen. 1992. Laws against flying under the influence. Legislative Research Unit File 10-376. Springfield, IL: Illinois General Assembly.) (b) Information on the Kansas law was provided to the Safety Board in July 1992 by the Kansas Department of Transportation.

Table 3.–State laws and provisions related to flying while impaired

State	Provisions			FWI law, State Code section
	Implied consent[a]	BAC level	Report to FAA	
Alabama				AL Code ss 4-2-79
Alaska	Yes	0.10	Yes	AK Stat. 2.30.030
Arizona	Yes	0.04	Yes	AZ RS Ann. 28-1750
Arkansas				AR RS 27-116-101
California	Yes	0.04	Yes	CA PUC 21407.5
Colorado	Yes	0.04	Yes	CO RS 41-2-101
Connecticut				CT GS Ann. 15-77
Delaware				
Florida				FL S Ann. 860-13
Georgia	Yes	0.04	Yes	GA C Ann. 6-2-5.1
Hawaii				HI RS 263-11
Idaho	Yes	0.04	Yes	ID Code 21-112(a)
Illinois				IL RS ch.15 1.2/22.43d(a)
Indiana				IN C Ann. 8.21-4-8
Iowa				IA C Ann. 328.41
Kansas	Yes	0.10		KS S Ann. 3-1001
Kentucky				
Louisiana	Yes	0.10	Yes	LA RS Ann, 14:98
Maine				ME RS Ann. tit.6 ss.202
Maryland				MD C Ann. 5-1000
Massachusetts	Yes	0.10	Yes	MA GL Ann. ch90 ss.44
Michigan	Yes	0.04	Yes	MI CH Ann. 259.185(1)
Minnesota	Yes	0.04	Yes	MN S Ann. 360.0752

(continued)

Table 3.–State laws and provisions related to flying while impaired (continued)

State	Provisions			FWI law, State Code section
	Implied consent[a]	BAC level	Report to FAA	
Mississippi				MS C Ann. 61-11-1
Missouri				
Montana	Yes	0.04	Yes	MT C Ann. 67-1-204
Nebraska	Yes	0.05	Yes	NE RS 28-1465
Nevada				NV RS 493.1:30
New Hampshire	Yes	0.04	Yes	NH RS Ann. 422.34
New Jersey				NJ S Ann. 6:1-18
New Mexico				NM S Ann. ch 64
New York				NY GBL 245(7)
North Carolina				NC GS 63-27(a)
North Dakota				ND Cent.C. 2-03-10(02)
Ohio				OH C Ann. 4561.15(C)
Oklahoma	Yes	0.04	Yes	OK S Ann. tit.3 ss.303
Oregon				OR RS 193.160
Pennsylvania				
Rhode Island				
South Carolina	Yes	0.04	Yes	SC Code Ann. 55-1-100
South Dakota				SD CL Ann. 50-13-17
Tennessee				TN Code Ann. 42-1-201
Texas				TX RCS Ann. art 46f-3(2)
Utah				
Vermont				VT S Ann. tit.5 ss.427
Virginia				VA C Ann. 5.1-13

(continued)

Table 3.--State laws and provisions related to flying while impaired
(continued)

State	Provisions			FWI law, State Code section
	Implied consent[a]	BAC level	Report to FAA	
Washington				WA RC Ann. 47.68.220
West Virginia				WV Code 29-2A-11
Wisconsin				WI S Ann. 114.09(1)
Wyoming				WY Stat 10-6-103(A)

[a] The implied consent provision is for chemical testing.

Sources: Information on all States except Kansas was obtained from the analysis by the Illinois General Assembly (Huang, Wen. 1992. Laws against flying under the influence. Legislative Research Unit File 10-376. Springfield, IL: Illinois General Assembly). Information on the Kansas law was provided to the Safety Board in July 1992 by the Kansas Department of Transportation.

It is important to note that a State law requiring a person to submit to a chemical test (for alcohol) may not require a toxicological test. The term "chemical test" means that the law enforcement officer is legally permitted to request a test, usually breath, for alcohol. A toxicological test involves laboratory testing of biological specimens. State law defines the specimen(s) that can be obtained--such as breath, blood, urine, and/or other bodily substance--and whether multiple tests (for alcohol and for other drugs) may be performed.[42]

If a toxicological (or a chemical) test for alcohol is requested from a pilot by a law enforcement officer, the pilot is required by Federal regulation to report the results to the FAA, whether the results are positive or negative. Of the 16 States with FWI laws that include an implied consent provision and establish a BAC offense level, 15 also require reporting of test results to the FAA; the Kansas FWI law does not require reporting of test results to the FAA.[43] Thus, the law enforcement officer may or may not report test results to the FAA, depending on the provisions of the State law. The FAA may also request test results if it is aware of the aviation accident. If the pilot refuses the test or fails to provide a specimen for testing, the pilot is required to notify the FAA. In either case, the FAA may then take action against the pilot's airman certificate. Refusal to submit to a lawfully requested test may result in sanctions by the FAA and, in States with implied consent laws that apply to aviation, the State may impose a sanction provided by State law.

Although a State with FWI laws may take some type of action, it may not take any action against the pilot's Federally issued airman certificate. For example, conviction under the Minnesota FWI law may result in prohibiting the pilot from flying in Minnesota airspace but would not prohibit the pilot from flying in the airspace of other States. Conviction under California law may result in a prison sentence (30 days to 6 months) and a fine ($250 to $1,000). Conviction in Alaska, a State with a comprehensive law on operating under the influence, may result in suspension or revocation of the pilot's drivers license; Alaska's law is comprehensive in the sense that it pertains to the operation of all motorized vehicles, aircraft, and watercraft while intoxicated or impaired.

States cannot adequately identify pilots who fly under the influence of an impairing substance and corrective actions cannot be taken without comprehensive laws that establish a specific BAC offense level, have an implied consent provision to obtain biological specimen(s) for toxicological tests for alcohol and other drugs, define the specimen(s) that may be obtained, and require reporting of toxicological test results and refusals to submit to testing to appropriate authorities. All State driving-while-intoxicated (DWI) laws include these provisions. The Safety Board believes

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[42] A blood test is likely to be requested in States with an implied consent law and when the pilot is unconscious or unable to give consent.

[43] This information is according to the Illinois analysis of FWI laws and the Kansas Department of Transportation.

that State FWI laws should include similar provisions. Thus, the Safety Board urges States to enact comprehensive laws pertaining to alcohol and drug use in aviation, or to amend existing laws as appropriate, to include: (a) an implied consent provision to obtain biological specimen(s) for toxicological tests, for alcohol and other drugs, of pilots involved in accidents that result in death, serious injury, or substantial aircraft damage; (b) definition of the specimen(s) that may be obtained--such as breath, blood, urine, and/or other bodily substance; (c) a blood alcohol concentration that defines the offense; and (d) a requirement to report to the Federal Aviation Administration toxicological test results and refusals to submit to testing.

According to conversations with the FAA personnel at FAA headquarters and the Civil Aviation Medical Institute (CAMI), States with laws that require reporting of toxicological test results from an aviation accident customarily report the results to the FAA Flight Standards District Office (FSDO). It was not clear from these conversations, however, if the results are then transferred to the FAA Flight Standards, Aviation Medicine, or Accident Investigation Office, or what action, if any, is taken on the test results. The Safety Board has encountered similar responses on the subject in other conversations with FAA personnel during the last several years. The lack of consistent and specific responses suggests that the FAA has no established procedures for receiving, processing, and analyzing State toxicological test results transferred from the FSDO. The Safety Board believes that the FAA should establish procedures for receiving, processing, and analyzing toxicological test results reported by the States, including the designation of appropriate FAA field offices (such as the FSDOs or other appropriate FAA offices) to which States are to report toxicological test results and refusals to submit to testing, and the designation of one office within the FAA to which the FAA field offices transfer the test results for analysis.

State and local aviation authorities should be made aware of the procedures established by the FAA for the reporting of toxicological test results to the FAA. Dissemination of the notification procedures could be aided by the National Association of State Aviation Officials (NASAO), which encourages cooperation among States and the Federal government on matters pertaining to civil aviation and provides member access to information on State and Federal aviation programs. Consequently, the Safety Board believes that the FAA should, in conjunction with the NASAO, distribute to State aviation authorities and local law enforcement agencies the procedures for States to follow when notifying the FAA of toxicological test results and refusals to submit to testing.

There appears to be no system-wide FAA drug enforcement or testing program that addresses toxicological testing for drugs following nonfatal general aviation accidents.[44] The FAA regulations require a pilot (or other crewmember) to submit to a test for alcohol when requested by a law enforcement officer and when, under authority of State or local laws, the officer has cause to believe that the pilot is intoxicated; however, the FAA regulations do not require a pilot to submit to a test for drugs when there is cause to believe that the pilot is impaired by drugs. Nevertheless, because some States currently extend, and others may consider extending, their alcohol testing provisions to authorize postaccident testing of general aviation pilots for drugs other than alcohol, pilots may be requested to submit to a test for drugs. According to 14 CFR 91.17(d), the results of any tests for drugs may be requested by the FAA Administrator when there is a "reasonable basis to believe" that a drug-impaired flight occurred. The FAA regulations do not prohibit a general aviation pilot from refusing a drug test.

Most State laws prohibit operation of motor vehicles by persons under the influence of an impairing substance (alcohol and other drugs). Following a nonfatal highway accident, a law enforcement officer may request a toxicological test from a driver when the officer has reasonable suspicion that the driver is impaired by drugs. This suspicion is likely to be based on characteristics such as circumstances of the accident, driver behavior and physiological characteristics, time of day, and the officer's experience with other accidents and drivers. Beginning in November 1990, pilots are required to inform the FAA, in writing, of any conviction or administrative action resulting from the operation of a motor vehicle while intoxicated, impaired, or under the influence of alcohol or a drug (14 CFR 61.15; see appendix K to this report).[45] Failure to comply is grounds for denial of an application, or suspension or revocation of a certificate or rating. Multiple convictions within 3 years on such a driving offense may also be grounds for action against an application, certificate, or rating (Section 61.15).

Following a nonfatal aviation accident, a law enforcement officer may have a reasonable suspicion of drug impairment and may request a toxicological test from the pilot for drugs in States with laws that provide the authority to test for drugs. The FAA considers the operation of an aircraft while under the influence of an impairing substance to be grounds

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[44] The Safety Board does not have authority to test for drug use following nonfatal general aviation accidents; however, as part of its accident investigations, the Board reviews toxicological test results when results are available. Of the 13,677 nonfatal general aviation accidents that occurred from 1983 through 1988, there were 69 accidents (0.5 percent of the 13,677 accidents) for which drug tests were requested: 5 of the 69 drug tests (7.2 percent) were positive.

[45] According to the FAA, between April 11, 1991, and August 18, 1992, 1,000 pilots notified the FAA of DWI convictions (or administrative actions); 19 of these notifications were for multiple offenses; that is, two offenses within 3 years.

for action against the crewmember's certificate or rating (Section 61.15). Thus, it seems reasonable that the FAA should require crewmembers to submit to a toxicological test for drugs, when such a test is requested by a law enforcement officer upon reasonable suspicion, just as the FAA requires of crewmembers regarding tests for alcohol. Accordingly, the Safety Board believes that the FAA should amend 14 CFR 91.17 to require crewmembers to submit to a toxicological test for drugs when requested by a law enforcement officer under authorization of State or local laws.

Measures to Reduce the Number of General Aviation Accidents Resulting From Alcohol or Other Drugs

Data in this report indicate that there are two groups of general aviation pilots for whom some form of substance abuse countermeasure is especially necessary: pilots with high BAC levels, and pilots who have limited flying experience. The following sections discuss measures to reduce the number of general aviation accidents resulting from alcohol or other drugs.

BAC Offense Level in Federal Regulations.--The high BAC levels found in this study are similar to the high BAC levels found in the 1984 study. Further, more than 47 percent of the alcohol-positive pilots had a BAC that exceeded 0.15 percent, the level that is strongly associated with problem drinking. Using a conservative estimate of metabolic rates of alcohol (0.015 percent BAC per hour), it would take nearly 8 hours to reduce the mean 0.15-percent BAC level found in the alcohol-involved group for the 1983 through 1988 period to the 0.04-percent level established as a BAC offense in the current FAA regulations.

Although FAA regulations prohibit acting or attempting to act as a flight crewmember under the influence of alcohol or other drugs and within 8 hours of consuming any alcoholic beverage, current regulations also prohibit flying with a BAC at or above 0.04 percent. Subsequently, the regulations may lead some pilots to believe that some alcohol consumption is acceptable. As discussed earlier, a pilot with a BAC of 0.15 percent, the mean BAC of the alcohol-involved pilots in this study, could stop drinking 8 hours before flight, have a BAC at or below the FAA offense level (0.04 percent), and still be impaired. The Safety Board believes there is adequate evidence of impairment at BAC levels below 0.04 percent. The Board previously recommended that the FAA eliminate the mixed message on "allowable blood alcohol concentrations" by reducing the BAC offense level to the lowest possible level consistent with the capability of testing equipment to measure any ingested alcohol (Safety Recommendation A-84-45, issued May 1, 1984). The recommendation was classified as "Closed--Unacceptable Action" on September 16, 1985, after the FAA modified Part 91 and established 0.04 percent BAC as the level at or beyond which an FAA violation occurs. The Safety Board continues to believe that pilot performance can be impaired at blood alcohol levels below 0.04 percent and that the FAA regulations should prohibit acting or attempting to act as a crewmember when the individual has a BAC above zero.

The Safety Board has also recommended (in Safety Recommendation I-89-12, issued to the DOT December 5, 1989) a zero BAC for Federal and private sector employees in safety-sensitive positions. The recommendation is classified as "Open--Unacceptable Response" because of inaction by the Department of Transportation. However, in October 1991, Congress passed legislation (P.L. 102-143) that requires the DOT to establish regulations for alcohol testing of such employees. The Board encourages the DOT and the FAA to establish provisions for alcohol-free flightcrews in its regulations. The Safety Board will withhold any further recommendation on a zero BAC until receipt and review of DOT's response to Safety Recommendation I-89-12 and its rulemaking on alcohol testing.

Use of the National Driver Register To Screen Applications.--This study indicates, as did the 1984 study, that about one-quarter of the pilots in the alcohol-involved fatal accidents were flying without required medical certification or a current biennial flight review. In addition, a small percentage of pilots in the alcohol-involved fatal accidents had no airman certificate. The examination of the BAC levels of these pilots (presented in the section "Pilot-In-Command Characteristics") shows that 89 percent of the pilots with no medical certificate had a BAC of 0.15 percent or higher. In addition, 75 percent of the fatally injured pilots in the alcohol group who had no airman certificate had a BAC of 0.15 percent. The deficiency of medical, biennial flight review, and airman certification among pilots-in-command who were fatally injured in alcohol-involved general aviation accidents may be indicative of the spontaneous nature of the flight, an attempt to mask a substance abuse problem by avoiding contact with aviation authorities, a disregard for regulations and safety, or a combination of these factors.

In November 1990, the FAA began a program to screen applications for medical certificates using data on DWI offenses recorded in the National Driver Register (NDR).[46] The action resulted, in part, from Safety Recommendations A-88-32 through -35 (issued to the FAA on March 24, 1988), which addressed methods for commercial operators to identify and treat commercial pilots who are abusers of alcohol and other drugs,[47] and from

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[46] The National Driver Register, which is maintained by the NHTSA, is used by Federal and State authorities to identify drivers with suspended licenses or serious driving offenses, such as convictions for driving while intoxicated. According to the FAA, between April 11, 1991, and August 11, 1992, FAA screening of the NDR disclosed 928 pilots with prior DWI offenses on record. These pilots had not notified the FAA of the offenses, as required by Section 61.15.

[47] The identification of aviation pilots with substance abuse problems was included in the Safety Board's "Most Wanted" list of safety improvements issued in October 1990. The purpose of the list, which is drawn up from safety recommendations previously issued, is to bring special emphasis to the safety issues the Board deems most critical. Based on positive action taken by the FAA, the Safety Board removed this issue from its "Most Wanted" list in July 1991.

legislation enacted in December 1987, which included a provision for the FAA to have access to the NDR. Based on rulemaking action taken by the FAA that provided for the FAA, rather than for commercial operators, to screen for DWI convictions, the Safety Board classified the recommendations as "Closed--Acceptable Alternate Action" on February 19, 1991 (see appendix E). According to FAA personnel, about 3 percent of the applicants for FAA medical certificates have alcohol-related offenses in the NDR. FAA personnel indicate that from July 5, 1991, through July 31, 1992, they received and screened 463,391 applications for medical certificates. The NDR records identified 14,125 possible matches (or 3.05 percent of the applications). Of these possible matches, 779 pilots (or 5.5 percent of the NDR matches) were referred to the FAA Chief Counsel for possible airman certificate suspension or revocation action.

Although access to the NDR was not available to the FAA when the pilots in this Safety Board study applied for their medical certificates, the Board was interested in determining whether a check of the NDR would have revealed any prior DWI offenses by the pilots in the alcohol-involved group. The Board was also interested in determining if there was any difference in the prior driving offense records of pilots in the alcohol-involved group compared to those in the substance-free group.

With the cooperation of the Division of Motor Vehicles, State of Virginia, and the National Driver Register, the Board was able to screen the driver records of 94 pilots who were fatally injured in general aviation accidents from 1986 through 1988: 47 pilots from the alcohol-involved group and 47 randomly selected pilots from the substance-free group. Matches with records from earlier years in the study period (1983 through 1985) were not considered likely because records are purged from the NDR after 7 years. There were no matches with the substance-free group; that is, none of the 47 randomly selected pilots from the substance-free group had prior alcohol-related driving offenses.[48] There were six probable matches with 45 of the 47 pilots in the alcohol-involved group. (In two cases no check could be made because the pilot's date of birth was not available.) The number of probable matches by BAC level is summarized below:

BAC level (percent)	Probable matches
Less than 0.04	0
0.04 to 0.099	1
0.10 to 0.149	1
0.15 and above	4

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[48] According to the National Driver Register, 3 matches would be expected out of 100 names searched. One out of every 3 matches would be expected to be alcohol-related.

A check of the State records for the six probable matches indicated that three cases had two alcohol-related offenses within the 1986 through 1988 period. In two other cases, there were multiple entries on the driver's record as a result of one offense; for example, an entry for an administrative license revocation and an entry for a DWI conviction on the same offense.

Regarding the pilots who had a BAC of 0.15 percent or greater at the time of their fatal accident, the results of this survey suggest that, had the NDR been accessible and searched at the time those pilots applied for a medical certificate, the FAA may have identified about 17 percent of them as persons who had a prior alcohol-related offense on their driving record.[49] This information could have served as a method to identify these pilots as substance abusers and to refer them for examination and evaluation by the Federal Air Surgeon (as called for in Safety Recommendation A-88-34).

Materials on the Effects of Alcohol and on Techniques for Intervention.--The data in this report related to flight time in all aircraft, time in type, and time in the last 30 days show that the pilots-in-command in the alcohol-involved fatal accidents tended to have less flying experience than did pilots in the substance-free accidents. Further, the data show that the percentage of pilots with student certificates was three times greater in the alcohol-involved group than in the substance-free group. The difference may indicate a lack of understanding by student and recently certificated pilots about the effects of alcohol impairment on a person's ability to perform flying tasks and to make sound judgments. It may also indicate a need for greater emphasis in ground school and by certified flight instructors on the effects of alcohol and drug use to create a better understanding among students and inexperienced pilots. Of those pilots with a BAC of 0.15 percent or higher, 17.7 percent held a student certificate.

Ground school can serve an important role in the education of new pilots on the effects of alcohol and other drugs on performance. However, ground school instructors and class materials (including textbooks) may address alcohol and other drugs primarily in terms of FAA regulations (the 0.04-percent BAC offense level established by the FAA, and the 8-hour rule) and limit the amount of information pertaining to the effects on performance. For example, one 42-hour ground school conducted over a 14-week period in late 1991 included one 3-hour session on medical factors; only a small portion of the 3-hour session was used to present information on alcohol and

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[49] Some time elapses between issuance of a citation for an alcohol-related offense and entry of a record into the NDR. Consequently, if a DWI offense occurs at about the same time the FAA is processing the pilot's application for a medical certificate, the FAA's search of the NDR may not retrieve the pilot's record. Although the NDR system is limited in this regard, it is the best system currently available for checking a pilot's prior DWI offenses. The FAA considers taking action against a pilot's application, airman certificate, or rating after two DWI offenses within 3 years.

other drugs. Although the instructors and textbooks address alcohol and other drugs, the Safety Board is concerned that the emphasis is not adequate.

Because ground school must cover many topics that are critical to learning about the operation of an airplane, there is a continuing need after ground school and flight training for educational and informational material that pertains to the effects of alcohol and other drugs on pilot performance, not only for pilots with limited flying experience but for all pilots as well. The need for materials on alcohol was previously addressed in the 1984 Safety Board study. The Board recommended that the FAA develop educational and classroom materials on the subject and distribute them through its accident prevention program to appropriate FAA personnel, pilots, fixed-base operators, flying clubs, flight schools, and flight instructors (Safety Recommendation A-84-47, issued May 4, 1984). Based on the action taken by the FAA, and the FAA's plans to develop new materials as information became available, the Safety Board classified the recommendation as "Closed--Acceptable Action" on February 19, 1985. A similar recommendation was issued to the Aircraft Owners and Pilots Association (AOPA), the National Agricultural Aviation Association (NAAA), and the National Association of Flight Instructors (NAFI) urging the organizations to disseminate to their members information on the dangers of alcohol use in aviation (A-84-51, issued May 4, 1984). Based on the actions taken by the organizations, the Safety Board classified the recommendation as "Closed--Acceptable Action" on August 27, 1987.

The efforts taken by the FAA and various organizations to inform pilots about the effects of alcohol on flying may have helped to reduce the incidence of alcohol involvement in fatal aviation accidents. However, considering the high BAC levels found in this study and the 1984 study, additional efforts appear to be warranted to prevent pilots from flying while impaired.

The Safety Board believes that the recent reductions in drunk driving on the highways can be attributed to legislative action, improved law enforcement, citizen advocacy, and to the development and promotion of intervention programs. Highway safety advocates started personal intervention programs with public information messages more than 20 years ago ("Friends Don't Let Friends Drive Drunk") and have expanded them to include actions that persons other than the impaired driver may take to prevent a person from driving while intoxicated (for example, "take the keys," don't ride with a drunk driver, report drunk drivers). The Safety Board believes that peer intervention programs directed at general aviation could also reduce the incidence of flying while impaired by alcohol or other drugs, which, in turn, would reduce the number of accidents attributed to impairment.

Materials that advocate intervention and relate techniques to successfully and safely intervene when a pilot attempts to fly while impaired would enhance current or future programs that promote aviation education, safety, and accident prevention. These materials, such as brochures and the display of posters at FSDOs, fixed-base facilities, and airports, should be directed toward persons in positions to intervene; for example, other pilots,

passengers, fixed-base operators, flight instructors, aviation personnel, and friends and family of flight crewmembers. Further, intervention should also be promoted through mailings to certificate holders and flight instructors, and material for aviation periodicals and other media.

In addition to the FAA, organizations that represent pilots, fixed-base operators, flight instructors, and State aviation officials should be part of the efforts to reduce the number of general aviation accidents involving alcohol or other drugs through educational and informational materials. Accordingly, the Safety Board believes that the FAA, with the assistance of the AOPA, the NAAA, the NAFI, the Experimental Aircraft Association, the National Air Transportation Association, and the National Association of State Aviation Officials, should develop and disseminate, as appropriate, any new educational and informational materials that may be needed on (a) the effects of alcohol and other drugs on flying and in general aviation accidents, and (b) procedures or actions that will encourage pilots, fixed-base operator personnel, flight instructors, Flight Standards District Office personnel, aviation safety specialists, and family and friends of pilots to intervene when a general aviation pilot attempts to fly after consuming alcohol or using other drugs.

FINDINGS

1. Since 1964, the earliest year for which such data are available, there have been no alcohol- or other drug-involved fatal accidents involving air carriers operating under 14 CFR Part 121.

2. From 1983 through 1988, there were 30 fatal accidents involving scheduled flights operating under 14 CFR Part 135. None of the pilots tested positive for alcohol; one tested positive for drugs other than alcohol. During the same period, there were 174 fatal accidents involving unscheduled Part 135 flights: 1.8 percent of the conclusive toxicological tests from these accidents (2 accidents) were positive for alcohol.

3. There was a downward trend among total general aviation accidents, fatal general aviation accidents, general aviation accidents fatal to the pilot-in-command, and alcohol-involved general aviation accidents fatal to the pilot during the 1983 through 1988 period.

4. The percent of general aviation accidents with conclusive toxicological tests that were alcohol positive for fatally injured pilots decreased from about 10 percent (about 47 accidents per year) in the mid-1970s to about 6.0 percent (about 17 accidents per year) in the late 1980s.

5. The mean BAC of alcohol-positive pilots was 0.15 percent, the level that is strongly associated with problem drinking and nearly four times the 0.04-percent BAC offense level established by current FAA regulations. More than 95 percent of the alcohol-positive pilots had a BAC that exceeded the FAA limit of 0.04 percent, about 74 percent had a BAC that exceeded the 0.10-percent level established as an illegal BAC for drivers by most States, and more than 47 percent had a BAC that exceeded 0.15 percent.

6. Postaccident tests for alcohol or other drugs were obtained in 1 percent of the nonfatal accidents occurring from 1983 through 1988. The low percentage of tests after nonfatal aviation accidents is the result of inadequate State laws pertaining to alcohol and drug use in aviation.

7. The number of general aviation accidents with drug-positive tests from fatally injured pilots increased from 3 accidents in 1983 to 13 accidents in 1988; however, toxicological testing for drugs was not sufficiently frequent to draw any conclusions about drug use trends in general aviation accidents.

8. The percentage of fatally injured pilots with student certificates was larger in the alcohol-involved accident group (13.3 percent) than in the substance-free group (4.3 percent). The percentage of fatally injured pilots with no airman certificate was larger in the alcohol-involved group (5.9 percent) than in the substance-free group (0.9 percent). The percentage of fatally injured pilots with an instrument rating was smaller in the alcohol-involved group (21.4 percent) than in the substance-free group (47.5 percent).

9. A larger percentage of the fatally injured general aviation pilots in the alcohol-involved accident group had fewer flying hours, both total hours and hours in accident aircraft type, than did pilots in the substance-free group. Similarly, a larger percentage of pilots in the alcohol-involved group had fewer flying hours in the 30 days prior to the accident than did pilots in the substance-free group.

10. About 25 percent of the fatally injured pilots in the alcohol-involved accident group and 6 percent in the substance-free group did not have a current biennial flight review. Similarly, about 25 percent of the fatally injured pilots in the alcohol-involved accident group and 8 percent of the substance-free group did not have a valid medical certificate.

11. About 29 percent of the pilots in the alcohol-involved group and 13 percent in the substance-free group lacked some form of required certification (an airman certificate or a current biennial flight review or a valid medical certificate).

12. A substantially larger percentage of the alcohol-involved fatal accidents occurred on personal flights (about 92 percent alcohol-involved and 74 percent substance-free), without a flight plan (97 percent alcohol-involved and 76.5 percent substance-free), in visual meteorological conditions (83.2 percent alcohol-involved and 72.4 percent substance-free), and without a weather briefing (89.6 percent alcohol-involved and 64.9 percent substance-free). Most flights in both accident groups (alcohol-involved and substance-free) were flown under similar meteorological conditions.

13. Of the 63 accidents in which buzzing was cited as a cause or factor, alcohol was involved in 20 accidents (about 32 percent).

14. Weather conditions were cited in 48.5 percent of the alcohol-involved fatal accidents and 59.8 percent of the substance-free fatal accidents. Light conditions indicative of night flying were cited in a larger percentage of the alcohol-involved fatal accidents (40.7 percent), than in the substance-free fatal accidents (21.4 percent). About 43 percent of the alcohol-involved accidents and 16.7 percent of the substance-free accidents occurred between 8 p.m. and 3:59 a.m. The time of occurrence of alcohol-involved fatal accidents appears roughly consistent with the typical nighttime hours of drinking for the general population.

RECOMMENDATIONS

As a result of this safety study, the National Transportation Safety Board made the following recommendations:

--to the Federal Aviation Administration:

Establish procedures for receiving, processing, and analyzing toxicological test results reported by the States, including the designation of appropriate Federal Aviation Administration (FAA) field offices (such as the Flight Standards District Offices or other appropriate FAA offices) to which States are to report toxicological test results and refusals to submit to testing, and the designation of one office within the FAA to which the FAA field offices transfer the test results for analysis. (Class II, Priority Action) (A-92-107)

Distribute, in conjunction with the National Association of State Aviation Officials, to State aviation authorities and law enforcement agencies the procedures for States to follow when notifying the Federal Aviation Administration of toxicological test results and refusals to submit to testing. (Class II, Priority Action) (A-92-108)

Amend 14 CFR 91.17 to require crewmembers to submit to a toxicological test for drugs when, under authorization of State or local laws, a test is requested by a law enforcement officer. (Class II, Priority Action) (A-92-109)

With the assistance of the Aircraft Owners and Pilots Association, the Experimental Aircraft Association, the National Air Transportation Association, the National Agricultural Aviation Association, the National Association of Flight Instructors, and the National Association of State Aviation Officials, develop and disseminate, as appropriate, any new educational and informational materials that may be needed on (a) the effects of alcohol and other drugs on flying and in general aviation accidents, and (b) procedures or actions that will encourage pilots, fixed-base operator personnel, flight instructors, Flight Standards District Office personnel, aviation safety specialists, and family and friends of pilots to intervene when a general aviation pilot attempts to fly after consuming alcohol or using other drugs. (Class II, Priority Action) (A-92-110)

--to the Aircraft Owners and Pilots Association, the Experimental Aircraft Association, the National Agricultural Aviation Association, the National Air Transportation Association, the National Association of Flight Instructors, and the National Association of State Aviation Officials:

With the assistance of the Federal Aviation Administration, develop and disseminate, as appropriate, any new educational and informational materials that may be needed on (a) the effects of alcohol and other drugs on flying and in general aviation accidents, and (b) procedures or actions that will encourage pilots, fixed-base operator personnel, flight instructors, Flight Standards District Office personnel, aviation safety specialists, and family and friends of pilots to intervene when a general aviation pilot attempts to fly after consuming alcohol or using other drugs. (Class II, Priority Action) (A-92-111)

--to the National Association of State Aviation Officials:

Distribute, in conjunction with the Federal Aviation Administration (FAA), to State aviation authorities and law enforcement agencies the procedures for States to follow when notifying the FAA of toxicological test results and refusals to submit to testing. (Class II, Priority Action) (A-92-112)

--to the Governors and Legislative Leaders of the States:

Enact comprehensive laws pertaining to alcohol and drug use in aviation, or amend existing laws as appropriate, to include: (a) an implied consent provision to obtain biological specimen(s) for toxicological tests, for alcohol and other drugs, of pilots involved in accidents that result in death, serious injury, or substantial aircraft damage; (b) definition of the specimen(s) that may be obtained--such as breath, blood, urine, and/or other bodily substance; (c) a blood alcohol concentration that defines the offense; and (d) a requirement to report to the Federal Aviation Administration toxicological test results and refusals to submit to testing. (Class II, Priority Action) (A-92-113)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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Member

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Member

Adopted: October 14, 1992

APPENDIX A

NTSB AVIATION ACCIDENT REPORT FORM: SUPPLEMENT K--OCCUPANT, SURVIVAL, AND INJURY INFORMATION

National Transportation Safety Board

FACTUAL REPORT AVIATION

NTSB Accident/Incident Number

Supplement K Occupant Survival and Injury Information

1 Seat No.
A _____
B If Seat Unknown Enter Persons Name
_____
C Other

2 Position
1 ☐ Pilot in command
2 ☐ Second pilot
3 ☐ Other crewmember
4 ☐ Passenger
A Other

For non-survivable accident, go to block 36

3 Age
A _____ Yrs
B Under 24 mos., enter months _____
C Other

4 Height
_____ Inches
A Other

5 Weight
_____ Lbs
A Other

6 Injury Index
1 ☐ None
2 ☐ Minor
3 ☐ Serious
4 ☐ Fatal

7 Condition Prior to Accident *(Multiple entry)*
1 ☐ Smoker
2 ☐ Language difficulty
3 ☐ Pre-existing disease
4 ☐ Prothesis
A Other

8 Physically Handicapped *(Multiple entry)*
1 ☐ No
2 ☐ Blind
3 ☐ Mobility impaired
4 ☐ Deaf
A Other

9 Seat Belt Adjustment
1 ☐ Not fastened
2 ☐ Loose
3 ☐ Snug
4 ☐ Tight
5 ☐ Fastened-Tightness Unknown
6 ☐ Not seated
7 ☐ Seat not equipped
A Other

10 Shoulder Harness Adjustment
1 ☐ Not fastened
2 ☐ Loose
3 ☐ Snug
4 ☐ Tight
5 ☐ Fastened-Tightness Unknown
6 ☐ Seat not equipped
A Other

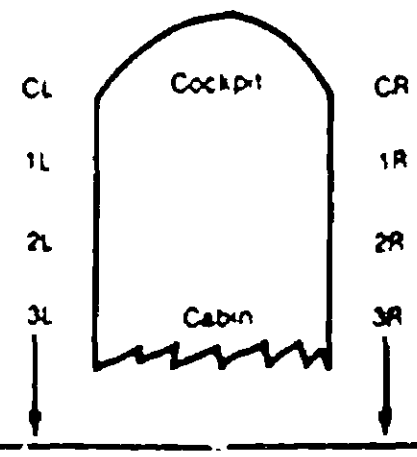
11 Knew Impact/Accident Coming
1 ☐ Yes
2 ☐ No
A Other

12 Braced for Impact
1 ☐ Yes
2 ☐ No
A Other

13 Direction of Movement at Impact *(Multiple entry)*
1 ☐ Forward
2 ☐ Rearward
3 ☐ Upward
4 ☐ Downward
5 ☐ Left
6 ☐ Right
A Other

14 Exit Used
1 ☐ Did not escape
2 ☐ Split in fuselage
A Exit number (use diagram)
_____
B Other

Exit Diagram



Use following codes for overhead hatches
Cockpit 99
Cabin 88
Tailcone 77

15 Escape Hampered by *(Multiple entry)*
1 ☐ Not hampered
2 ☐ Smoke
3 ☐ Heat
4 ☐ Injuries
5 ☐ Trapped
6 ☐ Darkness
7 ☐ Debris
8 ☐ Disorientation
9 ☐ Difficulty Using Exit
A Specify _____
B Other

16 Briefed on Emergency Procedures *(Multiple entry)*
1 ☐ No
2 ☐ Before takeoff
3 ☐ Before impact/accident
A Other

17 Evacuation Aided by *(Multiple entry)*
1 ☐ Passenger
2 ☐ Crew
3 ☐ Bystander
4 ☐ CFR personnel
5 ☐ Unaided
A Other

18 Injured During Evacuation
1 ☐ Yes
2 ☐ No
A Other

Complete this section if oxygen was used.

21 Type of Equipment
1 ☐ Supplemental
2 ☐ Portable
A Other

22 Difficulty in Use
1 ☐ Yes
2 ☐ No
A Other

23 Type of Oxygen System
1 ☐ Solid state
2 ☐ Gaseous
A Specify _____
B Other

National Transportation Safety Board

FACTUAL REPORT
AVIATION

NTSB Accident/Incident Number

Supplement K Occupant Survival and Injury Information (continued)

Complete this section for accidents involving fire. 24 ☐ No fire involved *(Go to block 29)*

25 Fire First Sighted *(Location)*
1 ☐ Inside aircraft
2 ☐ Outside aircraft
3 ☐ Both
A Other

26 Smoke Mask/Goggles Used *(Multiple entry)*
1 ☐ No
2 ☐ Yes
3 ☐ Both
4 ☐ Difficulty in use
A Other

27 Material of Clothes Worn *(Multiple entry)*
1 ☐ Synthetic
2 ☐ Nonsynthetic
3 ☐ Fire resistant
4 ☐ Mix-synthetic and nonsynthetic
A Other

28 Exposure to Heat/Fire *(Multiple entry)*
1 ☐ Head/face
2 ☐ Arm(s)
3 ☐ Hand(s)
4 ☐ Leg(s)
5 ☐ Torso
6 ☐ Feet
A Other

Complete this section for accidents involving ditching/water impact. 29 ☐ No water impact *(Go to block 36)*

Flotation Devices	A Available			C Used			E Familiar With Use			G Problems In Use			I Malfunctioned With Use			K Equipment Damaged		
	1 Yes	2 No	B Other	1 Yes	2 No	D Other	1 Yes	2 No	F Other	1 Yes	2 No	H Other	1 Yes	2 No	J Other	1 Yes	2 No	L Other
30 Liferaft																		
31 Vest-Inflatable																		
32 Vest-Non-Inflatable																		
33 Cushion																		

34 Time in Water
A _____ Hrs
B _____ Mins C Other

35 Rescued by
1 ☐ Boat
2 ☐ Airplane
3 ☐ Helicopter
4 ☐ None
A Other

Occupant Injuries—*Complete applicable parts for survivors and nonsurvivors.*

Items 36 thru 39 apply ONLY to flight crewmembers.

36 Medication Prescribed
1 ☐ No
A Yes *(Specify:* _____*)*
B Other

37 Medication Being Taken
1 ☐ No
A Yes *(Specify:* _____*)*
B Other

38 Medication/Drugs Found
1 ☐ No
A Yes *(Specify:* _____*)*
B Other

39 Pre-existing Disease Found at Autopsy

1 ☐ No autopsy performed
2 ☐ None reported
A Yes *Specify:* _____
B Other

Results of Toxicological Analyses—*Complete as applicable for survivors and nonsurvivors.*

40 Toxicology *(Multiple entry)*
1 ☐ Not ordered
2 ☐ Not ordered—performed
3 ☐ Ordered—performed
4 ☐ Ordered—not performed
5 ☐ Embalmed
6 ☐ Specimen not available/unsuitable for analysis
A Other

National Transportation Safety Board

FACTUAL REPORT
AVIATION

NTSB Accident/Incident Number

Supplement K Occupant Survival and Injury Information (continued)

Results of Toxicological Analyses—*(Complete as applicable for survivors and nonsurvivors.) (continued)*

Substances	A Test Results			C Level of Substances Found
	1 Positive	2 Negative	B Other	
41 Ethanol (Alcohol)				Mg %
42 CO (Carbon Monoxide)				% Saturation
43 hb (Hemoglobin)				gm %
44 HCN (Hydrogen Cyanide)				Microgram ml
45 Acidic and Neutral Drugs				
46 Basic Drugs				
47 Marijuana				
48 (Specify) _____				

List any additional toxicological substances discovered below

A Substance Code	B Level of Substances Found	A Substance Code	B Level of Substances Found
49		56	
50		57	
51		58	
52		59	
53		60	
54		61 (Specify)	
55		62 (Specify)	

Toxicological Substances/Codes