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DETERMINING BLOOD/ALCOHOL CONCENTRATION: TWO METHODS OF ANALYSIS

Teresa Thompson

I. INTRODUCTION

Montana's "driving under the influence" [DUI] statute,[1] prohibits individuals from operating motor vehicles while under the influence of alcohol. In 1983, the Montana Legislature also enacted a per se statute which prohibits operation of motor vehicles by individuals with blood/alcohol concentration levels of 0.10% or more.[2] The DUI statute frames the presumption that individuals with blood/alcohol concentrations of 0.10% or more are per se under the influence of alcohol.[3]

Chemical analysis determines the blood/alcohol concentration of a DUI suspect and yields more concrete evidence of intoxication than that which can be provided by eyewitness opinion.[4] This article focuses on two chemical procedures: blood analysis by gas chromatography and breath analysis by infrared spectrometry. It includes an overview of applicable Montana statutes and discusses the administrative rules which prescribe the procedures appurtenant to these tests.

II. OVERVIEW

An individual who operates or controls[5] a motor vehicle on the

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1. MONT. CODE ANN. § 61-8-401(1)(a) (1983) provides in pertinent part that: "It is unlawful and punishable as provided in 61-8-714 for any person who is under the influence of . . . alcohol to drive or be in actual physical control of a motor vehicle . . . ."

2. MONT. CODE ANN. § 61-8-406 (1983) provides: "It is unlawful and punishable as provided in 61-8-722 for any person to drive or be in actual physical control of a motor vehicle upon the ways of this state open to the public while the alcohol concentration in his blood, breath, or urine is 0.10 or more." *See also* P. MELOY, R. JENSEN, L. TAYLOR, DEFENDING THE DRUNK DRIVING CHARGE IN MONTANA 6 (1984) [hereinafter cited as MELOY] (referring to this statute as the "per se violation").

3. MONT. CODE ANN. § 61-8-401(3)(c) (1983) provides in part: "If there was at that time an alcohol concentration of 0.10 or more, it shall be presumed that the person was under the influence of alcohol. Such presumption is rebuttable."

4. L. TAYLOR, DRUNK DRIVING DEFENSE § 14.1 (1981).

5. State v. Ruona, 133 Mont. 243, 248, 321 P.2d 615, 618 (1958). The Montana Supreme Court defines "actual physical control" as existing or present bodily restraint, directing influence, domination, or regulation of an auto. If the individual is asleep or passed out behind the wheel, he is deemed to be in actual physical control under the statute. Further, if the individual is stuck in a borrow pit, he does not relinquish regulation or control of the vehicle. *Id.*

ways of this state open to the public[6] gives implied consent to chemical testing for determination of the alcohol content of his blood, breath, or urine if arrested for driving under the influence of alcohol.[7] If a peace officer has reasonable grounds to believe that an arrestee has violated either the DUI or per se law, and directs that the chemical test be administered, the arresting officer may designate the type of analysis to be performed.[8]

Chemical analysis measures by weight[9] the percentage amount of alcohol in a subject's blood. Comparison of the amount to a percentage scale ascertains the presumptive level of an arrestee's intoxication.[10] Alcohol concentration means "either grams of alcohol per 100 milliliters of blood, grams of alcohol per 210 liters of breath, or grams of alcohol per 75.3 milliliters of urine."[11]

Blood analysis directly determines blood/alcohol concentration. Breath and urine analyses provide only indirect determinations of blood/alcohol concentration.

> While urinalysis and breath analysis are attempts to determine indirectly the amount of alcohol in the blood by measuring the alcohol in the urine or breath and then attempting to theorize what the corresponding amount of alcohol is in the blood, blood analysis takes the direct approach of analyzing the blood itself and measuring the amount of alcohol actually present in the given sample.[12]

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6. MONT. CODE ANN. § 61-8-101(1) (1983) provides: "As used in this chapter, 'ways of this state open to the public' means any highway, road, alley, lane, parking area, or other public or private place adapted and fitted for public travel that is in common use by the public." See also MONT. ADMIN. R. 23.2.902(8) (1980) which provides: " 'Highway' means the entire width between the boundary lines of every way publicly maintained when any part thereof is open to the use of the public for purposes of vehicular travel."

7. MONT. CODE ANN. § 61-8-402(1) (1983) provides in part:

> Any person who operates a motor vehicle upon ways of this state open to the public shall be deemed to have given consent, subject to the provisions of 61-8-401, to a chemical test of his blood, breath, or urine for the purpose of determining the alcoholic content of his blood if arrested by a peace officer for driving or in actual physical control of a motor vehicle while under the influence of alcohol.

8. *Id.*

9. MONT. ADMIN. R. 23.3.937(3) (1980) provides in part:

> The results of an analysis of blood, breath, urine or other bodily substance shall be expressed in terms of percent by weight and volume, that is, grams of alcohol per 100 milliliters of blood, to the second decimal place as found. For example, 0.237% found shall be reported as 0.23%. Percent by weight/volume is obtained by dividing the weight of alcohol expressed in grams in a sample by the volume of the sample expressed in milliliters, and multiplying by 100. It is then equivalent to grams of alcohol per 100 milliliters of fluid analyzed.

10. TAYLOR, *supra* note 4, § 5.1.

11. MONT. CODE ANN. § 61-8-407 (1983).

12. TAYLOR, *supra* note 4, § 5.11.

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The results of chemical analysis may establish legal presumptions: (1) if the alcohol concentration measures less than 0.05%, the law presumes that the person was not under the influence of alcohol; or (2) if the blood/alcohol concentration measures 0.10% or more, the statute imposes a rebuttable presumption that the person was under the influence of alcohol.[13] The statute also provides a collateral middle ground: no presumption arises when an individual's blood/alcohol concentration measures in excess of 0.05% but less than 0.10%. The blood/alcohol concentration may be considered, however, in determining the individual's guilt or innocence.[14]

Evidence of blood/alcohol concentration, along with any other competent evidence of intoxication, may be admitted in any criminal action or other proceeding which alleges that the driver operated a motor vehicle while under the influence of alcohol. There are, however, restrictions on the admissibility of an evidentiary report of the test results or facts concerning the administration of the test.[15]

In a criminal prosecution, the admissibility of test results depends upon strict compliance with the procedures prescribed by the Montana Code Annotated and the Administrative Rules of Montana.[16] But test procedures for civil actions "need not comply with criminal case statutory procedures, [and need only] accord with good practice in the field to assure reliable results."[17]

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13. MONT. CODE ANN. § 61-8-401(3) (1983).

14. *Id.*

15. McAlpine v. Midland Electric Co., ___ Mont. ___, 634 P.2d 1166, 1171 (1981). The court in *McAlpine* held that, in criminal prosecutions, test procedures must comply with the Administrative Rules of Montana. *See also* State v. McDonald, ___ Mont. ___, 697 P.2d 1328 (1985). The court in *McDonald* held that a criminal defendant on a charge of driving under the influence is entitled to the procedural safeguards of the Administrative Rules of Montana. To admit evidence of blood alcohol content and a test report, the State must lay a foundation pursuant to MONT. CODE ANN. § 61-8-404(1)(b) (1983) which incorporates the ARM: (1) the laboratory analysis must be done in a laboratory qualified under the rules of the Department; (2) the report must be prepared in accordance with the rules of the Department; and (3) if a blood sampling, the person withdrawing the blood must be demonstrably qualified to do so. *McDonald*, ___ Mont. at ___, 697 P.2d at 1330.

16. MONT. CODE ANN. § 61-8-404(1)(b) (1983) requires that the report of the facts and results of the analysis be "prepared in accordance with any applicable rules of the department; and . . . if the test was on a blood sample, the person withdrawing the blood sample must have been competent do to so under 61-8-405(1)." *Id.* at 61-8-404(1)(b)(ii), (iii).

MONT. CODE ANN. § 61-8-405(1) (1983) specifies that:

> Only a physician or registered nurse or other qualified person under the supervision and direction of a physician or registered nurse acting at the request of a peace officer may withdraw blood for the purpose of determining the alcoholic content therein. This limitation shall not apply to the taking of breath or urine specimens.

17. *McAlpine*, ___ Mont. at ___, 634 P.2d at 1171 (quoting Bach v. Penn Cent.

Both the DUI and the per se statutes impose fines, imprisonment, license suspension, and the required completion of an alcohol information course on DUI offenders.[18] If an arrestee refuses to submit to a blood/alcohol test, the "implied consent" statute imposes an automatic ninety day license suspension "with no provision for a restricted probationary license."[19]

III. Blood Analysis by Gas Chromatography

Blood analysis provides a direct determination of a subject's blood/alcohol level and avoids the application of theories or inferences regarding that determination.[20] The Montana Criminal Investigation Laboratory[21] determines blood/alcohol concentration percentages through the process of gas chromatography.[22] Gas chromatography exclusively measures ethyl alcohol. The procedure allows an analyst testifying at a judicial proceeding to demonstrate that the instrument specifically tests for ethyl alcohol. Because of its exclusivity, it is the preferred method of blood analysis.[23]

This process utilizes vapor diffused from the blood sample into the headspace of the sealed container. To conduct the test an analyst injects the headspace vapors into a column containing a packing material coated with a liquid phase which separates vola-

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Transp. Co., 502 F.2d 1117 (6th Cir. 1974)), *quoted with approval in* Bartel v. State, ___ Mont. ___, ___ P.2d ___, 42 St. Rptr. 1, 7, *withdrawn, aff'd on rehearing,* ___ Mont. ___, ___ P.2d ___, 42 St. Rptr. 1266, 1272 (1985).

18. Mont. Code Ann. §§ 61-8-714 to -722, 61-5-205(2) to -208 (1983). But see Mont. Code Ann. § 61-8-408 (1983), which prohibits multiple convictions. "When the same acts may establish the commission of an offense under both 61-8-401 and 61-8-406, a person charged with such conduct may be prosecuted for a violation of both 61-8-401 and 61-8-406. However, he may only be convicted of an offense under either 61-8-401 or 61-8-406."

19. Mont. Code Ann. § 61-8-402 (1983).

20. D. Dennison, T. Prevet, M. Affleck, Alcohol and Behavior 41 (1980) ("When alcohol enters the stomach, it diffuses through the walls of the stomach and is absorbed immediately into the bloodstream. Within a few minutes after ingestion, alcohol is detectable in the blood."); Taylor, *supra* note 4, at § 5.1.11.

21. The laboratory is located at 275 W. Front Street, Missoula, Mont. 59801.

22. Interview with Kenneth Anderson, Toxicologist, Head of Alcohol and Abused Substances Section of the Mont. Criminal Investigation Lab., Missoula, Mont. since June, 1980; B.S. microbiology and medical technology, Univ. of Mont. (January 1985). Interview with Jim Hutchison, Chief Toxicologist of the Mont. Criminal Investigation Lab., B.S. medical technology, Univ. of Mont. 1970, certified medical technologist 1971, analytical toxicologist specializing in clinical and forensic toxicology 1971-present (June 1985). Interview with Bill Newhouse, Forensic Scientist of the Mont. Criminal Investigation Lab., B.S. physics, Purdue Univ. 1970 graduate studies, Purdue Univ. 1970-1972, Criminalist, Cal. Dep't of Justice, Sacramento Lab. 1972-1980, Mont. Dep't of Justice 1981-present (June 1985). *See also* Mont. Admin. R. 23.3.935 (1980).

23. Taylor, *supra* note 4, § 5.11.1B. (1981 & Supp. 1984). See also Mont. Admin. R. 23.3.902(1) (1980), which provides that "[a]lcohol refers to ethyl alcohol . . . ."

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tile compounds including ethanol.[24] The volatile compounds move through the column and separate according to their molecular weights and boiling points.[25] The process separates the alcohol molecules and as the volatiles pass through a detector at the end of the column, an electrical impulse is recorded. The impulse signifies the quantity of ethyl alcohol in the blood.[26] The retention time and the magnitude of the electrical impulse allows the analyst to quantitate the amount of ethanol present in the blood sample.[27] Because gas chromatography analyzes blood "specifically for ethyl alcohol to the exclusion of all other interfering substances, [it is] the method of choice for testing blood samples."[28]

A. *Procedure for Blood Analysis*

Only persons authorized by law may collect a blood sample for alcohol analysis.[29] The collection of such a sample occurs at the written request of a peace officer who observes the sample collection, when possible, so that he "may attest to the sample's authenticity. The officer should then initial or mark the sample seal for further identification."[30] A medical doctor, nurse, or technician[31] draws the sample from the subject and places it in a clean, dry test tube or other container which contains an anticoagulant and a preservative.[32] The law enforcement officer who requested that the

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24. Interviews with Kenneth Anderson, Jim Hutchison, and Bill Newhouse, *supra* note 22. The column contains 0.2% Carbopak B or 100/120 mesh carbowax 1500.

25. TAYLOR, *supra* note 4, § 5.9.1; interview with Jim Hutchison and Bill Newhouse, *supra* note 22.

26. TAYLOR, *supra* note 4, § 5.9.1; interview with Jim Hutchison and Bill Newhouse, *supra* note 22.

27. TAYLOR, *supra* note 4, § 5.9.1; interview with Jim Hutchison and Bill Newhouse, *supra* note 22.

28. TAYLOR, *supra* note 4, § 5.11.1B (1981 & Supp. 1984).

29. MONT. ADMIN. R. 23.3.931(3) (1980) requires that "[a]t least 5 milliliters of blood should be collected for analysis."

30. MONT. CODE ANN. § 61-8-402 (1983); MONT. ADMIN. R. 23.3.931(6). *See supra* notes 7, 8.

31. MONT. CODE ANN. § 61-8-405(1) (1983). See also MONT. ADMIN. R. 23.3.931(1) (1980) which provides in part:

> Blood samples may be collected from living individuals only by persons authorized by law, upon written request of a peace officer. The skin at the area of puncture must be thoroughly cleansed and disinfected with an aqueous solution of non-volatile antiseptic. Alcohol of phenolic solutions may not be used as a skin antiseptic.

32. MONT. ADMIN. R. 23.3.931 (1980) prescribes that:

> [the] blood sample must be deposited into a clean dry container, containing a solid anti-coagulant and preservative . . . . Sodium flouride or its equivalent must be used as a preservative. Sodium citrate or potassium oxalate or equivalent must be used as an anti-coagulant. If no additive or additives other than those listed above are used, a comment so stating should accompany the sample. If other addi-

sample be drawn, or the person who collected the sample, then seals the tube with evidence tape[33] and mails it to the Criminal Investigation Laboratory in Missoula.[34] The following information must accompany the sample: "(a) Name of the suspect; (b) Date, time and site (location of body) of collection; and (c) Name or initials of persons collecting and/or sealing sample."[35]

Before testing, the analyst[36] places the sealed sample container in a water bath. Alcohol present in the blood diffuses into the air in the headspace above the liquid[37] in accord with the physical gas law: the ratio of alcohol concentration in the blood to that in the air above it is constant.[38]

Next, the analyst draws the headspace sample from the sealed container by inserting the needle of a syringe through its rubber stopper.[39] The analyst then injects the headspace vapor into the gas chromatograph instrument. The sample passes through the column and separates out the ethyl alcohol present in it. By injecting this headspace vapor into the gas chromatograph, the analyst can determine the alcohol concentration in the blood.[40] The instrument records any ethyl alcohol present in the sample as an electrical signal. The instrument displays the blood/alcohol content on a strip chart recording that resembles an electrocardiogram chart.[41]

B. *Admissibility of Blood Analysis Results*

Evidence of an alleged drunk driver's blood/alcohol concentration, including factual testimony regarding the blood analysis and

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tives are employed, the name of the additive and its quantity should be listed. *Id.* at 23.3.931(4), (5). Revised regulations, to be published for review this summer, are permissive rather than mandatory regarding the use of anti-coagulants and preservatives. Interview with Jim Hutchison and Bill Newhouse, *supra* note 22.

33. MONT. ADMIN. R. 23.3.931(4) (1980).

34. There are no rules regarding mailing procedure. The sample may be mailed in a cardboard container provided by the Mont. Criminal Investigation Lab., but use of the container is optional. The rules do not require refrigeration but the sample is refrigerated at the laboratory until it is tested. Interview with Kenneth Anderson, *supra* note 22.

35. MONT. ADMIN. R. 23.3.931(4) (1980).

36. MONT. ADMIN. R. 23.3.935(4) (1980) requires that the analyst be qualified according to MONT. ADMIN. R. 23.3.906 (1980) which refers to "minimum educational and experience requirements contained in 'conditions for coverage of Services of Independent Laboratories Under the Federal Insurance for the Aged Act,' Title 20 Code of Federal Regulations Chapter 111, part 405."

37. Interviews with Kenneth Anderson, Bill Hutchison, and Jim Newhouse, *supra* note 22.

38. *Id.*; 1 R. ERWIN, DEFENSE OF DRUNK DRIVING § 17.05, at 17-33 (1985).

39. *Id.* at 17-27.

40. *Id.* at 17-33.

41. TAYLOR, *supra* note 4, § 5.9.

its result, may be admitted if: (1) a qualified person withdrew the blood sample;[42] (2) the test was a laboratory analysis conducted in a laboratory operated by the Department of Justice or one certified or exempted from certification according to the procedures prescribed by the Administrative Rules of Montana;[43] and (3) the laboratory analysis "report was prepared in accordance with any applicable rules of the department."[44]

The Montana statutes and administrative rules[45] require that only qualified persons withdraw blood samples from DUI suspects. The foundation for the production of evidence of blood/alcohol analysis should include a factual demonstration that a qualified person acting under the direction of a physician or registered nurse withdrew the blood sample at the written request of a peace officer.[46] The Administrative Rules of Montana define "physician" and "registered nurse" but fail to offer guidance regarding the specific training or skills that attach to the term "qualified person."[47]

In the determination of blood/alcohol concentration, blood analysis must occur in a laboratory operated by or certified by the Department of Justice.[48] The rules do not define the certification requirements for blood analysis laboratories.[49] The laboratories and their employees must maintain records and submit monthly reports to the Department of Justice. Further, the administrative rules impose an extensive certification procedure on laboratory installations[50] and provide for on-site surveys and testing to assess the proficiency of laboratory analysts.[51]

While Montana's administrative rules fail to define requirements for laboratory certification, they exempt some installations from certification. Exempted installations are those in which analysts perform routine laboratory procedures (including alcohol analyses) under the direct supervision of a laboratory director. The

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42. MONT. CODE ANN. §§ 61-8-404(1)(b)(iii) to -405 (1983); MONT. ADMIN. R. 23.3.931(1) (1980).

43. MONT. ADMIN. R. 23.3.903, .906 (1980).

44. MONT. CODE ANN. §§ 61-8-404(1)(b)(ii), -405(1) (1983).

45. MONT. CODE ANN. §§ 61-8-404(1)(b)(i), -405 (1983); MONT. ADMIN. R. 23.3.931 (1980).

46. MONT. ADMIN. R. 23.3.931 (1980).

47. MONT. ADMIN. R. 23.3.902 (1980). The rules are currently undergoing a revision to specify that a "qualified person" is a medical technician. Interview with Jim Hutchison, *supra* note 22.

48. *McAlpine*, ___ Mont. at ___, 634 P.2d at 1171, designates the Administrative Rules of Montana as the applicable rules.

49. Interview with Jim Hutchison and Bill Newhouse, *supra* note 22.

50. MONT. ADMIN. R. 23.3.901, .903, .911-.922 (1980) provide an extensive series of installation qualifications to be satisfied before an installation can be certified.

51. MONT. ADMIN. R. 23.3.919 (1980).

laboratory director and the persons performing the alcohol analyses must meet minimum education and experience requirements enunciated in the Code of Federal Regulations.[52]

Testimony regarding the facts and results of a blood analysis may be admitted into evidence if "the report was prepared in accordance with any applicable rules of the department."[53] The rules, however, offer no guidelines regarding the contents of such a report or its preparation. The absence of specific guidelines may reflect an intent to defer to the reporting capabilities of the various analysis instruments. The gas chromatograph utilized by the Montana Criminal Investigation Laboratory provides a printout which reports both the analysis data and the analysis result.[54] If the rules' silence does reflect a deference to the various forms of instrument feedback, then the phrase "applicable rules of the department"[55] refers to those rules which pertain to the particular instrument, its accuracy, and its maintenance.

Each analysis instrument must be approved, calibrated, and standardized by the Department of Justice.[56] Each installation must employ an operator supervisor who prepares and submits monthly reports to the Department of Justice. The operator supervisor maintains and calibrates the blood analysis instrument and ensures laboratory adherence to the Administrative Rules of Montana.[57]

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52. 20 C.F.R. § 111 (1985), part 405 contains the minimum educational and experience requirements necessary to satisfy exemption from the certification requirements.

53. MONT. CODE ANN. § 61-8-404(1)(b)(ii) (1983).

54. Interview with Kenneth Anderson, *supra* note 22.

55. MONT. CODE ANN. § 61-8-404(1)(b)(ii) (1983).

56. MONT. ADMIN. R. 93.3.935(4) (1980) approves the gas chromatographic method.

57. MONT. ADMIN. R. 23.3.922(3) (1980) provides:

> Each installation must have at least one operator supervisor who is responsible for the maintenance and calibration of testing devices, record keeping, reporting results and ensuring that the installation adheres to this subchapter.
>
> An installation performing blood and urine tests shall maintain the following records:
>
> (1) Records of certification, including:
>
> (a) Certification of installation when applicable; and
>
> (b) Certification of personnel when applicable;
>
> (2) Records of tests on samples from fatalities and others. These records must include information required to complete forms furnished by the department;
>
> (3) Records of maintenance of instrumentation when applicable;
>
> (4) Records of personnel training levels when applicable;
>
> (5) A detailed description of techniques or methodology employed; and
>
> (6) A copy of this rule.

See also MONT. ADMIN. R. 23.3.939, .940 (1980). MONT. ADMIN. R. 23.3.941(1) (1980) also provides in part:

> (1) An installation qualifying for certification shall submit to the department a monthly report including all information required to complete forms furnished

IV. Breath Analysis by Infrared Spectrometry

Breath analysis measures the amount of alcohol present in the breath. Although it affords only indirect determination of blood/alcohol concentration, breath analysis enjoys wide acceptance as a producer of reliable and competent evidence.[58]

Breath analysis depends on the lungs' ability to absorb alcohol from the blood. After ingestion, alcohol passes through the stomach wall and upper portion of the small intestine.[59] It then enters the intestinal tissue linings.[60] The blood stream distributes the alcohol throughout the body. It carries the alcohol first to the liver, then through the heart and into the capillary beds of the lungs' alveolar sacs[61] which act as large sponges and retain the alcohol for a period of time.[62] Theoretically, the alcohol concentration in the alveolar air spaces is determined by the alcohol concentration of the blood present in the capillaries of the lungs.[63] The alcohol in the blood diffuses from the blood into the breath in the alveolar sacs.[64]

Breath analysis instruments measure the amount of alcohol vapor present in the breath.[65] The determination of blood/alcohol concentration through breath analysis relies on a scientific presumption called Henry's Law: the principle that in a sealed container, for a known temperature, the ratio between the amount of alcohol in the air and the amount of alcohol in the water is fixed. In theory, there is "a constant ratio between the concentration of alcohol in the blood and the concentration of alcohol in the alveolar air of the lungs."[66] The average ratio employed by breath instrumentation to measure blood alcohol equivalents is 1:2100, i.e., 2.1 liters of deep lung breath contain the same weight of alco-

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by the department. Copies of this form will be furnished by the department to the installations. The installation shall submit the form to the department not later than the tenth day of the month following the month of record.

58. Taylor, *supra* note 4, § 5.6.

59. Erwin, *supra* note 38, § 18.00 at 18-3 (quoting William Boaz and Jack L. Rudy from a paper presented at the California Public Defender Association Drunk Driving Trial Seminar (1976)).

60. Interview with Jim Hutchison and Bill Newhouse, *supra* note 22.

61. Mont. Admin. R. 23.3.902(3) (1980) provides: " 'Alveolar' refers to the smallest air sacs of the lungs, the air in which is in equilibrium with respect to alcohol with the immediately adjacent pulmonary arterial blood plasma."

62. Erwin, *supra* note 38, § 18.00 at 18-3 (quoting William Boaz and Jack L. Rudy, *supra* note 60).

63. Taylor, *supra* note 4, § 5.6.

64. Interview with Jim Hutchison and Bill Newhouse, *supra* note 22.

65. Taylor, *supra* note 4, § 5.6.

66. *Id.*

hol as 1 cubic centimeter of pulmonary (lung) blood. After analysis determines the concentration of alcohol in the alveolar (deep lung) air, the 1:2100 ratio is applied to establish the blood/alcohol concentration.[67]

A. *Infrared Spectrometry by the Intoxilyzer 5000*

One method of breath analysis uses infrared spectrometry by the Intoxilyzer 5000, manufactured by CMI, Inc.[68] The instrument determines the alcohol[69] sample by measuring its ability to absorb infrared energy.[70] The Intoxilyzer 5000 employs a quartz iodide lamp to project infrared energy through a lens and across the sample chamber where a second lens focuses the energy leaving the chamber through three rotating filters and onto an infrared energy detector.[71] The rotating filters allow only certain specified infrared energy frequencies to pass through to the energy detector.[72] The instrument traps the breath sample in a chamber, passes an infrared light through it and measures the amount of light absorbed by the alcohol present in it.[73] As the concentration of alcohol in the breath sample increases inside the chamber, the amount of infrared energy reaching the detector circuit falls in a predictable manner because the alcohol molecules absorb specific infrared wavelengths.[74]

Before testing a breath sample, the Intoxilyzer 5000 establishes a zero reference point by measuring the amount of infrared energy that reaches the detector when the sample chamber contains air from the room in which the instrument is located.[75] When a subject's breath enters the sample chamber, any alcohol molecules present in the breath absorb some of the infrared energy projected across the chamber.[76] The instrument determines breath al-

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67. ERWIN, *supra* note 38, § 18.01 at 18-6; TAYLOR, *supra* note 4, § 5.6; MONT. ADMIN. R. 23.3.937(2) (1980) which prescribes the conversion ratio: "The breath analysis of the calculation of the blood alcohol concentration must be on the basis of alveolar air to blood ratio of 2,100:1 and of mixed expired air to blood ratio of 3,200:1."

68. A subsidiary of Fed. Signal Corp., Minturn, Colo. Montana law enforcement agencies currently employ 35 Intoxilyzer 5000 instruments. The agencies hope to have 50 or more in service by the end of 1985.

69. MONT. ADMIN. R. 23.3.902(1) (1980) provides that "[a]lcohol refers to ethyl alcohol."

70. TAYLOR, *supra* note 4, § 5.8.

71. MELOY, *supra* note 2, at 154.

72. *Id.*

73. MELOY, *supra* note 2, at 154; TAYLOR, *supra* note 4, at § 5.8.1.

74. MELOY, *supra* note 2, at 154.

75. *Id.*

76. *Id.*

cohol concentration by measuring the decrease in the energy that reaches the detector against the amount of energy previously recorded at the zero reference point.[77] Next, the unit converts the breath alcohol concentration figure to a blood/alcohol concentration percentage and displays[78] the result in percent weight by volume.[79]

The instrument provides an evidence card[80] that lists the date, machine name and serial number, the alcohol concentration value of a preliminary air blank, the subject's breath sample blood/alcohol concentration value, and the alcohol concentration value of a final air blank which purges the chamber after the testing of the breath sample.[81] The evidence card also records the time of day the instrument performed the analysis and its lower portion contains blank lines on which the operator lists the arrestee's name, the time the officer first observed the arrestee, the name of the installation at which the intoxilyzer is located, the name of the operator, and any additional information or comments.[82]

The Intoxilyzer 5000 utilizes a computer which communicates messages and commands to the operator through its visual display panel.[83] The instrument can check its calibration against vapor from a standard alcohol solution[84] and offers the optional function of saving the subject's breath sample by capturing the alcohol in a silica gel collector tube which the operator can attach to the instrument.[85] The sample can then be reanalyzed[86] at an independent

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77. *Id.*

78. *Id.* "Digital Display—A sixteen character alphanumeric readout that relates which operation the instrument is performing, alerts the operator to required actions, and expressed Blood Alcohol Concentration (BAC) in percent weight by volume." *Id.* at 145.

79. *Id. See also* MONT. ADMIN. R. 23.3.937 (1980).

80. MELOY, *supra* note 2, at 145. "Evidence Card—A formatted multi-copy card that provides a printed record of the date, model and serial number of the instrument, test procedure, test results, and time of test." *Id.*

81. *Id.* at 151.

82. *Id.* at 153.

83. *Id.* at 149-52.

84. *Id.* at 160.

85. *Id.* The Intoxilyzer 5000 offers a "Sample Capture Option—Following analysis of a breath sample (the Breath Test Mode), the instrument displays a command requesting the operator to attach a silica gel collector tube to the instrument." *Id.* at 147. *See also* TAYLOR, *supra* note 4, § 5.6 (1981 & Supp. 1984):

> While some breath testing instruments destroy the sample when analyzing it . . . the Intoxilyzer is especially attractive for saving breath samples since the analyzed sample is not destroyed by the instrument. . . . [T]he breath sample is saved simply by clearing the chamber after the test and pumping the breath from the chamber through the silica gel tube, which is then sealed and maintained until the defense requests it for testing.

86. TAYLOR, *supra* note 4, § 5.6 (1981 & Supp. 1984). The defendant pays the cost of the second analysis while the police agency incurs an added expense of approximately $1.50.

laboratory.[87]

Included in the features of the instrument are a twenty-four hour time clock (with battery back-up)[88] and computer functions that process and analyze the data, verify the instrument's calibrations,[89] and cancel the test if the instrument detects the presence of radio frequency interference.[90] Additionally, the Intoxilyzer 5000 monitors infrared energy at three predetermined wavelengths.[91] One wavelength coincides with a major absorption band of ethyl alcohol; the second and third wavelengths detect absorption caused by acetone or other interferant compounds that may be present in the blood.[92] It features micro-processor controls that allow the instrument to function with a minimum of officer involvement and to produce the blood/alcohol percentage result in approximately two minutes.[93]

B. *Procedure for Administering an Intoxilyzer 5000 Breath Test*

Intoxilyzer 5000 operators should conduct the breath analysis "according to techniques supplied by the manufacturer."[94] The operator should observe the arrestee for at least fifteen minutes prior to administering the test so that his body processes will have had time to eliminate any traces of residual mouth alcohol.[95]

To begin the breath analysis, the operator (1) places a new mouthpiece[96] into the breath tube,[97] (2) presses the start-test but-

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Id. § 5.6, at 151 (Supp. 1984).

87. *Id.* The silica gel absorbs "the alcohol and other volatiles from a measured sample of breath . . . . The analysis of this breath sample will show if there are any other interfering substances that may have caused a false high reading on the evidential breath-testing instrument." *Id.*

88. MELOY, *supra* note 2, at 147.

89. *Id.* at 148-49.

90. *Id.* at 151.

91. TAYLOR, *supra* note 4, § 5.8.2 (1981 & Supp. 1984).

92. *Id.*

93. Interview with Kenneth Anderson, *supra* note 22.

94. MONT. ADMIN. R. 23.3.933(1) (1980).

95. MELOY, *supra* note 2, at 157. "The mucous lining of the mouth cavity and nasal passages stores alcohol for some time after a person consumes alcohol. Normal body processes eliminate residual mouth alcohol within 15 minutes. Therefore, an operator should observe a subject for at least 15 minutes before performing a test." *Id.* "If the tested individual has belched, vomited, or regurgitated just before breathing into the machine, alcoholic substances from the stomach will contaminate the breath with alcohol and the result will be a very high reading." TAYLOR, *supra* note 4, § 5.6. The Intoxilyzer 5000 rejects breath samples containing residual mouth alcohol and displays "Invalid Sample" on its digital read-out screen. MELOY, *supra* note 2, at 151.

96. MELOY, *supra* note 2, at 157. "Mouthpiece—A disposable, clear plastic part which fits in the end of the breath tube, accepts the subject's breath, and prevents unwanted sub-

ton,[98] and (3) inserts an evidence card into the instrument.[99] Next the instrument uses the room air to establish a zero reference point and samples a known alcohol solution to provide a calibration check. The instrument then purges the sample chamber with another air blank to reestablish the zero reference point. The arrestee blows a breath sample into the sample chamber, and finally, the machine purges the sample chamber by again measuring room air.[100] The instrument emits an audible tone at a predetermined pressure when the arrestee blows into the sample chamber.[101] If the arrestee fails to supply a sufficient amount of alveolar breath within three minutes, the instrument cancels the test and its digital read-out screen displays "Deficient Sample."[102] The instrument measures any decrease in the amount of infrared energy reaching the detector. It converts the measurement to a blood/alcohol concentration percentage and prints the percentage result on the evidence card.[103]

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stances from entering the instrument." *Id.*

97. *Id.* "A heated reinforced plastic tube through which the subject blows into the sample chamber." *Id.*

98. Interview with Bill Newhouse, *supra* note 22.

99. *Id.* at 150. The digital display requests the operator to insert the evidence card by displaying a flashing signal: "Insert card."

100. Interview with Bill Newhouse, *supra* note 22.

101. *Id.*

102. MELOY, *supra* note 2, at 152. "In order to obtain a good breath sample, the breath instrument should be equipped to determine both the plateau in the breath-alcohol level and the plateau in the temperature of the breath entering the machine. When both plateaus are obtained, the breath most closely resembles alveolar air." TAYLOR, *supra* note 4, § 5.6, at 150 (Supp. 1984). MONT. ADMIN. R. 23.3.933(3) (1980) requires: "The quantity of breath shall be established only by direct volumetric measurement, or by collection and analysis of a fixed breath volume at constant known temperature." MONT. ADMIN. R. 23.3.936(3) (1980) also provides:

> The department shall examine and evaluate any breath testing instrument submitted for its approval. The department may approve the instrument if the instrument and technique meet the following criteria:
>
> (a) The quantity of breath analyzed for its alcohol content may be established only by direct volumetric measurement or by collection and analysis of a fixed breath volume;
>
> (b) Breath specimens collected for analysis must be essentially alveolar in composition;
>
> (c) The instrument must be capable of analyzing a suitable reference sample, such as air equilibrated with a reference solution of known alcohol content at a known temperature. The results of such analysis must agree with the reference sample value within the limits of 0.01% weight/volume or other such limits set by the department; and
>
> (d) The specificity of the procedure must be adequate and appropriate for the analyses of breath specimens for the determination of alcohol concentration in traffic law enforcement.

103. MELOY, *supra* note 2, at 151.

C. *Admissibility of Breath Analysis Results*

A Montana statute allows testimony regarding the breath analysis procedure and its result to be admitted into evidence.[104] The person who conducted the analysis must verify the analysis report by demonstrating that the instrument and procedure accorded with the Administrative Rules of Montana.

The rules require that the breath testing instrument or testing technique be approved by the Department of Justice.[105] The instrument must collect and establish a direct volumetric measurement of a specimen "essentially alveolar in composition."[106] Further, "[t]he instrument must be capable of analyzing a suitable reference sample, such as air equilibrated with a reference solution of known alcohol content at a known temperature."[107] The reference analysis results must agree with the known value of the reference sample "within the limits of 0.01% weight/volume."[108] The instrument must test for and determine the alcohol content of a breath sample.[109]

An installation performing breath analysis must maintain records of: (1) installation certification; (2) personnel certification and training levels; (3) all tests performed and the results of such tests; and (4) a copy of Montana Administrative Rule 23.3.939 (1980).[110] The rules apply stringent certification and record keeping standards to the analysis instruments and procedures.[111] The Department of Justice must certify "[e]very person and installation involved in alcohol analysis . . . . Every person or installation not already certified must become certified before such analyses are considered valid by the [Department of Justice]."[112]

To qualify for certification, an installation must: (1) employ at least one certified operator supervisor; (2) have approved testing instruments and instrument accessories; (3) pass an on-site inspection conducted by the Department of Justice; and (4) demonstrate an ability to meet the requirements of Subchapter 9 of the Administrative Rules of Montana.[113] An operator supervisor is a person

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104. MONT. CODE ANN. § 61-8-404 (1983).
105. MONT. ADMIN. R. 23.3.936(1) (1980).
106. MONT. ADMIN. R. 23.3.936(3)(a), (b) (1980). *See also* MONT. ADMIN. R. 23.3.902(3) (1980).
107. MONT. ADMIN. R. 23.3.936(3)(c) (1980).
108. *Id.*
109. MONT. ADMIN. R. 23.3.936(3)(d) (1980).
110. MONT. ADMIN. R. 23.3.939 (1980).
111. MONT. ADMIN. R. 23.3.901, .902(6), .903-.905, .911-.916, .933 (1980).
112. MONT. ADMIN. R. 23.3.911(1) (1980).
113. MONT. ADMIN. R. 23.3.903 (1980).

who has successfully completed an approved training course or passed an examination prescribed by the Department of Justice.[114] To obtain certification, the operator supervisor also must successfully complete "a course in chemical tests for alcohol including legal aspects of chemical testing, the effect of alcohol on the human body, operational principles of the selected testing methods and laboratory participation using the appropriate equipment."[115]

Ironically, the rules prescribe only indefinite and ambiguous requirements for the certification of breath analysis instrument operators.[116] To obtain certification as an operator, the applicant may complete an approved training course, pass an examination, or simply demonstrate sufficient skill as both an instrument operator and an interpreter of the analysis results.[117] The Department of Justice provides the examination, approves the training courses, and evaluates the demonstrations of skill.[118]

V. Conclusion

The laws of Montana operate with procedures prescribed by administrative rules to protect both the arrestee's rights and the right of Montana citizens to be free from risks engendered by drunk drivers. The reliability of chemical analysis continues to improve as the instruments become more accurate and alcohol specific. Careful adherence to instrument manufacturers' directions and to the administrative rules reduces the danger of unfair convictions while it provides the state with admissible evidence for the prosecution of drunk driving cases.

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114. Mont. Admin. R. 23.3.904 (1980).

115. *Id.*

116. Mont. Admin. R. 23.3.905 (1980). *See also* Mont. Admin. R. 23.3.901(b) (1980); Mont. Code Ann. § 61-8-405(4) (1983). The statute provides that "a physician or registered nurse or other qualified person under the supervision and direction of a physician or registered nurse . . . may withdraw blood . . . . This limitation shall not apply to the taking of breath . . . specimens." See Mont. Code Ann. § 61-8-405(6) (1983) which requires only that: "The division of motor vehicles in cooperation with the division of forensic sciences, or any other appropriate agency, shall adopt uniform rules for the giving of blood alcohol tests and may require certification of training to administer such tests as deemed necessary."

117. Mont. Admin. R. 23.3.905 (1980).

118. *Id.*