

# DUPLICATE BREATH SAMPLES USING THE DRAGER 7110

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The aim of this study was to determine the comparison of duplicate breath samples taken on a Drager Alcotest 7110, Mk II. A total of 216 persons were tested with the second sample being obtained 2 to 10 minutes after the first sample had been analysed. The mean difference between duplicate samples is 0.003 grams of alcohol in 100 millilitres of blood. The minimum difference was 0.000 grams of alcohol in 100 millilitres of blood and a maximum difference 0.015 grams. The Report of the Joint Legal, Policing and Scientific Committee determined that between 0.020 and 0.049 grams of alcohol in 100 millilitres of blood the second result must be within the criteria of  $\pm 0.010$  grams of alcohol in 100 millilitres of blood of the first result. Above 0.050 grams of alcohol in 100 millilitres of blood the second result must be within the criteria of  $\pm 15\%$  of the first result. The failure rate between 0.020 and 0.049 (n=79) is zero with a standard deviation of 0.0014. The failure rate where the BAC is  $> 0.050$  (n=101) is  $< 1\%$  with a standard deviation of 0.0033. 36 subjects were less than 0.020 grams of alcohol in 100 millilitres of blood. Duplicate breath samples can be successfully obtained on a Drager Alcotest 7110 Mk II instrument coupled with a good quality assurance programme.

## Introduction

Originally breath tests were taken as duplicate samples and the higher of the two results was taken as the person's blood alcohol concentration. In the case of *Samuels v Flavel* (SASR 1974), it was ruled that this was not correct and that only one sample was to be obtained. This is the current practice in South Australia.

The Report of The Legal, Policing and Scientific Committee on Drink Driving Reform, May 1999, (The Joint Committee) recommended that duplicate breath samples should be taken from drivers required to submit to a breath analysis and that the lower of the two results to be the driver's blood alcohol concentration.

The objective was to determine whether or not the Drager Alcotest 7110 instrument was capable of effectively analysing duplicate breath samples within the criteria recommended by The Joint Committee.

The Joint Committee requested that field tests be carried out to make these determinations.

In a previous study by Laslett (1991) using the Drager Alcotest 7110 Mk I the samples were taken from persons who had submitted to a breath analysis pursuant to the Road Traffic Act, 1961. The instruments on that occasion had not been programmed for duplicate samples and the second sample could not be taken until all legalities from

the compulsory test had been dealt with. Not all samples were taken within the limits of between 2 and 10 minutes. Similar results were obtained on that occasion as to the current study.

The Drager Alcotest 7110 Mk II breath analysing instrument is used in South Australia for determining the blood alcohol concentration of drivers. The result from this instrument is used for Court purposes.

## **Materials and Methods**

The Drager Alcotest 7110 Mk II breath analysing instrument is calibrated using a Drager Calibrating Instrument which has been fitted with an electronic controlled heating circuit to maintain the temperature of the solutions. The temperature of the solution in the first bowl is maintained at  $37^{\circ}\text{C}\pm 0.2^{\circ}\text{C}$  and the final bowl at  $34^{\circ}\text{C}\pm 0.2^{\circ}\text{C}$ . A mercury-in-glass thermometer (certified by the National Measurement Laboratory) is maintained in the solution of the final bowl and read at regular intervals to ensure that the solution is  $34^{\circ}\text{C}\pm 0.2^{\circ}\text{C}$ .

Certified Ethyl alcohol solutions of 0.100% are prepared by the State Forensic Centre and checked using a gas chromatograph. These solutions must be  $0.100\%\pm 0.003\%$ .

The Drager Alcotest 7110 Mk II is first calibrated with a water solution to set the zero on the instrument. Zero is between  $-0.001$  and  $0.000\%$ . Using the 0.100% ethanol solution, the instrument is calibrated to read  $0.099\%\pm 0.001\%$ .

The instrument after calibration is then subjected to unknown ethanol solution and the correct answer must be obtained before the instrument is passed for use in the field.

The integrity of the instrument is monitored by the use of quality control graphs. If the calibration is one standard deviation from the mean a warning indicator appears. An action warning appears at two standard deviations from the mean. No instrument calibration is accepted for use if the action warning occurs.

The testing of subjects was carried out between February and June, 1999 using a Drager Alcotest 7110, Mk II. Members attended at various licensed venues and with the person's consent, submitted that person to two consecutive breath analyses. All persons submitting to the test were instructed to inhale completely and then to blow into the instrument with one continuous breath until told to stop by the breath analysis operator.

No test was conducted within 10 minutes of a person having last consumed alcohol. The second breath sample was taken between 2 to 10 minutes of the first. Results with a zero BAC were not considered.

## **Results**

A total of 216 persons were tested with the second sample being obtained 2 to 10 minutes after the first sample had been analysed. The mean difference between duplicate samples is 0.003 grams of alcohol in 100 millilitres of blood. The minimum difference was 0.000 grams of alcohol in 100 millilitres of blood and a maximum difference 0.015 grams. The failure rate between 0.020 and 0.049 (n=79) is zero with

a standard deviation of 0.0014. The failure rate where the BAC is  $> 0.050$  ( $n=101$ ) is  $<1\%$  with a standard deviation of 0.0033.

The minimum volume of expired air needed for the analysis is 1.5 litres. All participants supplied at least this minimum requirement. A small number of persons supplied one sample, but chose not to supply the second sample as they did not wish to wait. These results are not included.

The majority of the persons participating were male and aged between 18 to 60 years.

Any results of 0.019 grams of alcohol in 100 millilitres of blood or less were not included as these results are not prosecuted, but a caution given. (36 subjects were less than 0.020 grams of alcohol in 100 millilitres of blood.)

## **Discussion**

South Australian legislation has several levels of prescribed concentration of alcohol.

1. The presence of any alcohol in the blood. (Zero blood alcohol which is restricted to certain persons, but that person is not put into jeopardy until the BAC is 0.020g of alcohol in 100 millilitres of blood or more)
2. 0.050 – 0.079g of alcohol in 100 millilitres of blood.
3. 0.080 – 0.149g of alcohol in 100 millilitres of blood.
4. 0.150 or more grams of alcohol in 100 millilitres of blood.

Each level receives a greater monetary penalty and driver's licence disqualification.

The study has shown that the Drager Alcotest 7110 MkII is capable of complying with the criteria set down by the Joint Committee.

All members of the Joint Committee agreed that duplicate breath samples should be taken and that the second result must be within a given tolerance of the first result. The two samples must be taken within 2 to 10 minutes of each other. The Joint Committee agreed that between 0.020% BAC and 0.049% BAC the results of the second test must be within  $\pm 0.010\%$  BAC of the first test result. From 0.050% BAC and over, the results of the second test must be  $\pm 15\%$  of the first test result.

In all the duplicate results between 0.020%BAC and 0.049% BAC (79), all second samples met the criteria.

In all the duplicate results between 0.050% BAC or more (101), only one second sample did not meet the criteria.

TABLE 1 Extract of results between 0.020 – 0.049% BAC

Sample 1	Sample 2	0.01-	0.01+	0.01 - Pass	0.01 + Pass	Difference
0.026	0.026	0.016	0.036	Yes	Yes	0.000
0.026	0.025	0.016	0.036	Yes	Yes	0.001
0.026	0.027	0.016	0.036	Yes	Yes	0.001
0.026	0.025	0.016	0.036	Yes	Yes	0.001
0.027	0.028	0.017	0.037	Yes	Yes	0.001
0.027	0.026	0.017	0.037	Yes	Yes	0.001
0.027	0.030	0.017	0.037	Yes	Yes	0.003
0.027	0.028	0.017	0.037	Yes	Yes	0.001
0.028	0.025	0.018	0.038	Yes	Yes	0.003
0.028	0.029	0.018	0.038	Yes	Yes	0.001
0.031	0.029	0.021	0.041	Yes	Yes	0.002
0.031	0.031	0.021	0.041	Yes	Yes	0.000
0.031	0.032	0.021	0.041	Yes	Yes	0.001
0.032	0.034	0.022	0.042	Yes	Yes	0.002
0.032	0.033	0.022	0.042	Yes	Yes	0.001
0.033	0.031	0.023	0.043	Yes	Yes	0.002
0.034	0.032	0.024	0.044	Yes	Yes	0.002
0.035	0.034	0.025	0.045	Yes	Yes	0.001
0.036	0.037	0.026	0.046	Yes	Yes	0.001
0.039	0.036	0.029	0.049	Yes	Yes	0.003
0.039	0.039	0.029	0.049	Yes	Yes	0.000
0.040	0.038	0.030	0.050	Yes	Yes	0.002
0.040	0.039	0.030	0.050	Yes	Yes	0.001
0.040	0.044	0.030	0.050	Yes	Yes	0.004
0.044	0.046	0.034	0.054	Yes	Yes	0.002
0.045	0.046	0.035	0.055	Yes	Yes	0.001
0.045	0.043	0.035	0.055	Yes	Yes	0.002
0.045	0.043	0.035	0.055	Yes	Yes	0.002
0.045	0.045	0.035	0.055	Yes	Yes	0.000
0.045	0.043	0.035	0.055	Yes	Yes	0.002
0.046	0.044	0.036	0.056	Yes	Yes	0.002
0.046	0.044	0.036	0.056	Yes	Yes	0.002
0.046	0.045	0.036	0.056	Yes	Yes	0.001
0.046	0.048	0.036	0.056	Yes	Yes	0.002
0.048	0.048	0.038	0.058	Yes	Yes	0.000
0.048	0.046	0.038	0.058	Yes	Yes	0.002
0.048	0.048	0.038	0.058	Yes	Yes	0.000
0.049	0.048	0.039	0.059	Yes	Yes	0.001
0.049	0.048	0.039	0.059	Yes	Yes	0.001
0.049	0.059	0.039	0.059	Yes	Yes	0.010
0.049	0.051	0.039	0.059	Yes	Yes	0.002
0.049	0.048	0.039	0.059	Yes	Yes	0.001

TABLE 2 Extract of results between 0.050 – 0.250% BAC

Sample 1	Sample 2	15%-	15%+	15% - Pass	15% + Pass	Difference
0.051	0.050	0.043	0.059	Yes	Yes	0.001
0.051	0.051	0.043	0.059	Yes	Yes	0.000
0.052	0.050	0.044	0.060	Yes	Yes	0.002
0.052	0.053	0.044	0.060	Yes	Yes	0.001
0.053	0.050	0.045	0.061	Yes	Yes	0.003
0.079	0.085	0.067	0.091	Yes	Yes	0.006
0.080	0.076	0.068	0.092	Yes	Yes	0.004
0.080	0.084	0.068	0.092	Yes	Yes	0.004
0.081	0.079	0.069	0.093	Yes	Yes	0.002
0.083	0.088	0.071	0.095	Yes	Yes	0.005
0.084	0.085	0.071	0.097	Yes	Yes	0.001
0.085	0.099	0.072	0.098	Yes	No	0.014
0.099	0.107	0.084	0.114	Yes	Yes	0.008
0.100	0.099	0.085	0.115	Yes	Yes	0.001
0.101	0.091	0.086	0.116	Yes	Yes	0.010
0.101	0.106	0.086	0.116	Yes	Yes	0.005
0.101	0.103	0.086	0.116	Yes	Yes	0.002
0.103	0.102	0.088	0.118	Yes	Yes	0.001
0.106	0.105	0.090	0.122	Yes	Yes	0.001
0.148	0.157	0.126	0.170	Yes	Yes	0.009
0.148	0.155	0.126	0.170	Yes	Yes	0.007
0.153	0.157	0.130	0.176	Yes	Yes	0.004
0.155	0.160	0.132	0.178	Yes	Yes	0.005
0.163	0.161	0.139	0.187	Yes	Yes	0.002
0.164	0.167	0.139	0.189	Yes	Yes	0.003
0.166	0.167	0.141	0.191	Yes	Yes	0.001
0.175	0.160	0.149	0.201	Yes	Yes	0.015
0.217	0.204	0.184	0.250	Yes	Yes	0.013
0.221	0.225	0.188	0.254	Yes	Yes	0.004
0.223	0.221	0.190	0.256	Yes	Yes	0.002
0.234	0.246	0.199	0.269	Yes	Yes	0.012

The columns Sample 1 and Sample 2 are the breath samples results.

The columns 0.01- 0.01+, 15%- and 15%+ are extreme results where the second sample must fall between.

The columns 0.01-Pass, 0.01+Pass, 15%-Pass and 15%+Pass if showing ‘Yes’ indicate that the particular criteria was met or ‘No’ if not met.

The recommendations of the Joint Committee relating to duplicate sampling for the Road Traffic Act, 1961 are:

“permissible variation” means -

- (a) where the prescribed concentration of alcohol is zero and the initial reading is above zero and less than 0.05 grams of alcohol in 100 millilitres of blood, plus or minus 0.01 grams of alcohol in 100 millilitres of blood

(b) where the prescribed concentration of alcohol is 0.05 grams of alcohol in 100 millilitres of blood and the initial reading is that the prescribed concentration or above, that percentage of that initial reading as prescribed by regulations.

In cases where the two tests are not within the permissible variation then the person is to be offered the opportunity to supply a blood sample or to submit to another duplicate breath sample. Should the person not take the blood sample then the lower of the readings from the four breath samples is to be used.

Where the defendant refuses or fails to comply with directions in relation to the confirmatory test - he/she is to be charged with refusing or failing to comply with the directions of the breath analysis operator.

The taking of duplicate breath samples will bring South Australia and eventually Australia into line with other countries throughout the world. Duplicate sampling helps to eliminate among other things, allegations of mouth alcohol and radio frequency interference. The giving of the lower of the results is in favour of the defendant and is favourably looked on by the judiciary.

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