The Orange County Breath Alcohol Proficiency Testing Program

MH Breen
RL Reckers
RL Moore

Forensic Science Services Laboratory, Orange County Sheriff-Coroner Department, 320 North Flower Street, Santa Ana, California 92703, USA

Background
Breath testing for alcohol in a forensic setting requires an ongoing quality assurance program. (1) Proficiency testing is an important part of quality assurance, especially in the forensic context. (1-2). While there are external proficiency tests for many other forensic disciplines, there is no external proficiency test provided for breath alcohol analysis from any commercial source or from most state regulatory agencies, including California. Beginning in 1999, the Orange County Sheriff-Coroner Department, Forensic Science Services laboratory, began providing a breath alcohol proficiency sample to volunteer laboratories with forensic breath alcohol testing programs. The purpose of this program was to evaluate the feasibility of providing external breath alcohol proficiency samples to the forensic breath alcohol testing community.

Sample solutions were prepared by adding 200 proof ethanol to 25 liters of distilled water in a 25 liter Nalgene screw top container. Sufficient alcohol was added for each set to approximate the target value. The actual solution concentration was determined by direct oxidation using Sulfuric Acid/Potassium Dichromate titrated with Sodium Thiosulfate to a Potassium Iodide endpoint, calibrated against US National Institute of Standards and Technology traceable Potassium Dichromate. Six replicates were done by two analysts for a total of 12 determinations. The solution concentration was stated to be the average of these 12 results, provided that all replicate values are within 5 percent of the mean.

The target value for breath alcohol analysis was determined by multiplying the solution concentration by 0.827 to derive the expected value when used in a simulator at 34.0 degrees C and a breath testing instrument calibrated to give results in grams of ethanol per 210 liters of breath. (3-5).

Sample aliquots were prepared by dispensing 500 ml of the stock solution into 500 ml Nalgene screw top containers. The containers were sealed at the top and labeled with the lot number of the solution.

Set 1
The test solution for set 1 was prepared on March 23, 1999 and was determined to have a target value of 0.083 grams of alcohol per 210 liters of air. Samples were distributed to volunteer laboratories at a meeting of the California Association of Criminalists Alcohol Study Group in April of 1999, and at the International Association for Chemical testing meeting in Wilmington, North Carolina, also in April of 1999. Additional samples were mailed in May of 1999. Samples were supplied with a sheet of instructions and a sheet for reporting the results. Each laboratory was requested to provide 9 results for the submitted solution, each reported to three decimal places. Fourteen of 29 laboratories responded.

The average of all the values reported was 0.083. Individual results ranged from 0.079 to 0.089. The range of averages reported by each laboratory was 0.080 to 0.087. The
Median value was also 0.083, with a range of median values from each laboratory of 0.080 to 0.087. The standard deviation for all values was 0.0026, and the range of standard deviations for each laboratory was 0.0009 to 0.0038.

**Set 2**
The test solution for set 2 was prepared on June 2, 2000 and was determined to have a target value of 0.052 grams of alcohol per 210 liters of air. Samples were distributed to volunteer laboratories at a meeting of the California Association of Criminalists Alcohol Study Group in June of 2000 and at the Forensic Alcohol Supervisor course in September of 2000. Additional samples were mailed in November of 2000. Nineteen of 23 laboratories responded, 18 with all 9 results.

The average of all the values reported was 0.052. Individual results ranged from 0.048 to 0.057. The range of averages reported by each laboratory was 0.049 to 0.054. The Median value was also 0.052, with a range of median values from each laboratory of 0.049 to 0.054. The standard deviation for all values was 0.0017, and the range of standard deviations for each laboratory was 0.0000 to 0.0027.

**Set 3A and 3B**
Two test solutions were prepared for the third round of testing. Both were prepared on August 31, 2001. The test solution for set 3A was determined to have a target value of 0.246 grams of alcohol per 210 liters of air. The test solution for set 3B was determined to have a target value of 0.058 grams of alcohol per 210 liters of air. Twenty-one of 31 laboratories responded.

The average of all the values reported for set 3A was 0.251. Individual results ranged from 0.241 to 0.262. The range of averages reported by each laboratory was 0.243 to 0.255. The Median value was also 0.250, with a range of median values from each laboratory of 0.246 to 0.258. The standard deviation for all values was 0.0049, and the range of standard deviations for each laboratory was 0.0009 to 0.0057.

The average of all the values reported for set 3B was 0.056. Individual results ranged from 0.049 to 0.061. The range of averages reported by each laboratory was 0.050 to 0.060. The Median value was also 0.056, with a range of median values from each laboratory of 0.050 to 0.060. The standard deviation for all values was 0.0028, and the range of standard deviations for each laboratory was 0.0000 to 0.0023.

**Conclusions**
Those laboratories that participated were given an opportunity to evaluate the accuracy and precision of their breath testing methodology, at least with a standard alcohol water solution from an external source. The results were overall very good.

While the benefit of the program to other labs was significant, in that it gave the participating labs a source for external proficiency samples for forensic breath alcohol testing programs, the time required to administer the program outweighs the benefits to the host laboratory, who do not get to participate in the proficiency program.

**References**

