

## PROCEDURE FOR THE PREPARATION OF 0.08 SIMULATOR EXTERNAL STANDARD SOLUTION FOR USE WITH A BREATH TEST INSTRUMENT

### *Introduction:*

The simulator external standard solution is a water and ethanol mixture formulated to provide a standard ethanol vapor concentration when used in a breath alcohol simulator at  $34 \pm 0.2$  degrees Centigrade, of between .072 and .088 grams of ethanol per 210 liters of air, inclusive. To allow for depletion of alcohol from the solution during its use, the preferred starting concentration is .082g/210L.

The solution shall be prepared from laboratory grade (deionised or tap) water and 200 proof absolute ethanol (USP Grade).

The volume of ethanol required is determined thus. The water/air partition ratio for ethanol at 34 degrees Centigrade is 2585.8 (Jones, 1983). Thus the water/alcohol solution required to produce a 0.082 g/210 liters of vapor equivalent, should be 0.101g/100mL. For convenience, the batches are made up in 54L containers, thus requiring 54.5 grams of ethanol. The density of absolute ethanol at room temperature is 0.79g/mL, thus a volume of 69.1 mL of ethanol in 54L of water is required.

This preparation should be carried out at room temperature.

The reference vapor concentration used should be the average value of the solution concentration (rounded to four decimal places) divided by 1.23 (Jones 1983, Dubowski 1983), and rounded to four decimal places, to give the alcohol concentration in grams per 210 liters of vapor.

### *Equipment:*

1. A calibrated container capable of holding 54 liters.
2. Volumetric glassware (pipette, burette, Erlenmeyer flask, volumetric flask)
3. Mechanical mixer or stirrer
4. HDPE plastic bottles capable of holding 500 milliliters, and caps.
5. Tamper evident tape.



10/30/98

**Reagents:**

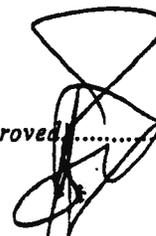
1. 200 proof absolute ethanol (USP Grade)
2. Laboratory grade water

**Preparation and certification:**

- 1) Pipette 69.1mL of ethanol into a 1L volumetric flask, and fill to the mark with water. Invert flask 3 times. Add contents of flask to the mixing vessel. Add 53L of water to the mixing vessel, and seal. Mix the solution by shaking and apply mechanical mixing for at least 2 hours.
- 2) Five separate aliquots from the equilibrated solution shall each be analyzed once by an individual authorized to perform alcohol analysis in the State Toxicology Laboratory, using the currently approved gas chromatography procedure. This may be repeated by any number of analysts. The results of this analysis shall be recorded in a logbook.
- 3) The results of this analysis will be treated as follows. The average of the results from all analysts will be computed (rounded to four decimal places). The standard deviation and relative standard deviation (CV) on all results will be computed. (Freedman et al., 1978).
- 4) The solution will be acceptable for use and so certified if it meets the following criteria. The average solution concentration must be between 0.098 and 0.108g/100mL inclusive. The CV should be 5% or less.
- 5) The solution shall be packaged in plastic bottles, sealed with a lid, identified with a batch number, and sealed with tamper evident tape.
- 6) To obtain reference vapor concentrations, divide the average solution concentration by 1.23, and round to four decimal places.
- 7) The solutions are certified for a period of 1 year following their preparation date.

**Documentation:**

- 1) The record of sample preparation and certification shall consist of the date and batch number of the solution, the volume of ethanol and water used and the analytical results described above. All this information will be recorded in the laboratory logbook.



*References:*

A.W. Jones, Determination of Liquid/Air Partition Coefficients for Dilute Solutions of Ethanol in Water, Whole Blood and Plasma. *Journal of Analytical Toxicology*, 7, 1983 pp193-197

K.M. Dubowski, Breath Alcohol Simulators: Scientific Basis and Actual Performance. *Journal of Analytical Toxicology*, 3, 1983 pp177-182

G.J. Shugar, R.A. Shugar and L Bauman, *Chemical Technicians Ready Reference Handbook*. McGraw-Hill Book Co. 1978.

BAC Verifier DataMaster Operator Instruction Manual, WSP Crime Laboratories Division , May 1985, pp27-28

D. Freedman, R. Pisano and R. Purves, *Statistics*, W.W. Norton & Co., N.Y. 1978

STATEMENT OF STATE TOXICOLOGIST - WSTX-BKL-1 10/30/98

In my capacity as Washington State Toxicologist, and by my authority outlined in RCW 46.61.506, I have reviewed this protocol and find it to be proper and adequate in form and substance for the purpose it was intended. I therefore approve and authorize its use. This supplements the simulator solution protocol dated 9/6/94 which remains in effect.



Barry K. Logan Ph.D.  
Washington State Toxicologist