



## Educational Discussion: Barometric Pressure Reporting for pO<sub>2</sub>

### 2016-A Aqueous Blood Gas Survey (AQ/AQI)

In the 1997 Critical Care/Aqueous Blood Gas (AQ) Proficiency Survey, it was noted that pO<sub>2</sub> results tended to be lower in regions where ambient barometric pressure (BP) was lower (ie, laboratories well above sea level). A priori this wasn't unexpected: even though oxygen remains roughly 20% at all altitudes, the partial pressure of atmospheric oxygen (pO<sub>2</sub>) itself decreases with BP due to Boyle's Law. In some places, the differences can be substantial. For example, the BP in Denver, Colorado, is typically in the 650 mm Hg range (versus 760 in Boston, Massachusetts); a difference that means a normal arterial pO<sub>2</sub> is roughly 80 mm Hg (versus 100). To address this issue, CAP participants were subsequently instructed to result their blood gas values based on their ambient air pressure (<660 mm Hg; 660-720 mm Hg; >720 mm Hg).

Recent review of pO<sub>2</sub> PT failures by the Chemistry Resource Committee revealed that many of them were due to omission of the BP. In addition, the Committee suspected that a number of submissions may have had the wrong BP entered. The current Committee decided to conduct a review of several recent blood gas Surveys, which revealed that pO<sub>2</sub> results did \*not\* vary appreciably by BP and that there was no increase in failure rate by combining all the BP range groups into one.

Members of the Committee, surprised by this finding, undertook an informal study to confirm the findings and assess the effects of ambient BP on pO<sub>2</sub>. Committee members measured CAP PT materials at various locations representing extremes of BP related to their elevation above sea level (Aurora, CO (5,471 ft); St. Louis, MO (465 ft); Albuquerque, NM (4900 ft) and Boston, MA (19 ft)). The study revealed the following conclusions:

1. PO<sub>2</sub> values across locations were not significantly different if tested immediately upon opening the vial (as instructed).
2. PO<sub>2</sub> levels started to change within 5 minutes of opening the vial such that results could fail PT peer comparison studies if testing was delayed. From the small number of samples tested, the Committee also noted that the rate/degree of change was proportional to the difference in sample pO<sub>2</sub> and environmental pO<sub>2</sub>. This is what one would predict: as the vial contents come to equilibrium with the surrounding atmosphere, the pO<sub>2</sub> will move towards the ambient level.
3. Unrelated to the actual experiment, but uncovered in the review, was the fact that the BP reported on some weather websites is "normalized" to sea level (<http://dnr.wi.gov/regulations/labcert/BODCalibration2.html>) such that BP results obtained by barometer might significantly differ from reported (via internet or local weather media) BP.

Consequently, beginning with this Survey mailing, participants in the AQ/AQI Surveys are no longer asked to provide their local atmospheric pressures. However, the Committee strongly recommends users to test their PT material immediately after vial opening because the probability of failure



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increases by every minute of exposure to ambient atmosphere if the latter is significantly different from sea level atmospheric pressure (where the materials are prepared).

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