Dear Mr. Bly:

I have been provided your name as the head of the ASTM D323 committee. I would like to comment on this text so that it may eliminate some confusion in the industry and government with the results of the Reid vapor pressure method.

Most of the confusion is centered around the reporting of the final results and their relationship to Note 1: "Because the external atmospheric pressure is counteracted by the atmospheric pressure initially present in the vapor chamber, the Reid vapor pressure is an *absolute* pressure at 37.8°C (100°F) in kilopascals (pounds-force per square inch). The Reid vapor pressure differs from the true vapor pressure of the sample due to some small sample vaporization and the presence of water vapor and air in the confined space".

In Chemical Engineering and in thermodynamics, the term *absolute* pressure is used to refer to the pressure in a system including the atmospheric pressure. It is, in fact, the total pressure of the system. Chemical thermodynamic and other process calculations normally require pressures as absolute pressures. *Gauge* pressure refers to the pressure read on a typical pressure gauge where the gauge reads zero when open to the atmosphere.

Consider a standard pressure gauge that reads zero when open to the atmosphere. The absolute pressure is actually 101.325 kPa (assuming standard atmospheric/barometric pressure). If the same gauge is attached to an apparatus and the pressure is measured to be 100 kPa, the absolute pressure is 100 + 101.325 = 201.325 kPa. The gauge pressure for these scenarios will be zero and 100 kPa, respectively.

Vapor pressure for chemical engineers is a fairly well understood topic. For pure compounds, vapor pressure is equal to the boiling point pressure of the compound. The true vapor pressure represents the bubble point pressure of a system at a stated temperature. Both of these are frequently encountered types of vapor pressure, with volumes of experimental data available in the literature, and it is rare to see them expressed in anything but absolute pressure. This fact along with Note 1 of the standard leads individuals to believe incorrectly that the RVP is an absolute pressure in the sense defined above. The values read from the RVP procedure are read from zero based pressure gauges. Consequently, from a process perspective they are truly *gauge pressures*. This results in approximately one atmosphere shift in common belief versus reality. The results from D323 are indeed equal to the difference between the final pressure of the apparatus and the initial starting pressure. However, if reporting this difference rather than a point measurement is the intended interpretation, a statement should be made making this clear to the reader. Personally, I would not recommend reporting the RVP as a pressure difference as vapor pressures are never reported in this manner.

This issue is further compounded by the fact that the pressures are simply reported as psi or kPa in the standard. For process engineering, a vapor pressure will always be reported in psia or psig (kPa or kPa(g)[1]) to clearly indicate if the atmospheric pressure is included in the reported value. This is the only

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[1] Unfortunately kPa (and bar) reporting can be confusing at times because there is no standard designation of absolute versus gauge readings. In Chemical Engineering publications, kPa usually indicates absolute pressures and kPa(g) or some other obvious gauge designator is used with gauge pressures. However, since this is far from standardized, a prudent author would indicate if kPa alone represented absolute or gauge pressure. The shift to kPa reporting in D323 makes matters worse because when most Chemical Engineers see kPa, they assume it

unambiguous method to report the values. Since the vast majority of vapor pressure reporting is absolute pressure, the reader of D323 is lead to believe that the psi/kPa means psia/kPa (absolute) when in fact it means psig/kPa(g). In this context, it is only acceptable to report pressures as psi or kPa if a pressure difference is being reported. Again, this fact must be made clear if this is the intent.

Finally, the comparison to true vapor pressure with RVP in Note 1 provides additional confusion. While the statement is true, the presence of air at atmospheric pressure in the chamber means that there is approximately one atmosphere difference in RVP and TVP for less volatile substances, and greater differences for volatile substances where the sample vaporization is more significant. Interaction with our customers indicates that Note 1 leads many readers to assume that the difference in the results is insignificant.

In other engineering disciplines, it is frequent to omit the gauge or absolute designation from pressure units. However, in many of these cases the value is actually a difference where this would be correct, or the value is very large where one atmosphere does not make a significant difference in the results. With vapor pressure, the pressures are usually small and a one atmosphere shift is quite significant.

We frequently have to clarify this issue with our customers who only read Note 1 of the D323 standard, or who simply see the unspecific psi or kPa reporting of the RVP and assume it is an absolute pressure since vapor pressures are customarily reported as absolute pressure. However, once they understand the D323 procedure, they usually realize that the value is actually a gauge pressure. I feel if the standard were revised with more specific wording, we would not be required to waste time so frequently with this clarification.

Please feel free to contact me if you have questions are would like further background on my comments.

Sincerely,

Michael Hlavinka

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means an absolute pressure unless otherwise designated. In the D323 standard, it actually means gauge pressure or kPa(g).