"M" in "MD" Stands for "Mathematician"

In the spring 2009 newsletter, I had an article on interpreting lab reports for metal exposure. The article referenced an article in the Journal of Occupational and Environmental Medicine (Schwerha 2007). That article contained a chart with ACGIH's BEI standard threshold values. These values are in the US metric system. So the challenge for the physician is to convert micro-mol (µmol) or nano-mol (nmol) to µg.

This article reviews the math using chromium as the example. If you would prefer someone else to do the math, call a WorkSafeNB Medical Advisor. We will be glad to help.

Chromium comes in two forms: trivalent, which is essential to glucose metabolism; and hexavalent, which can be toxic. In the home, it can be found in paints, dyes, printer inks, treated wood, cigarette smoke and venison. Testing for chromium is done using 24-hour urine collection – get the volume and creatinine as well.

In the example, urine volume was 1200 ml, creatinine was 16.3 mmol/day and chromium was 62.5 nmol/day. The BEI for chromium is < 25 µg/L in the ACGIH book and < 25 µg/gm creatinine in the Schwerha article. BEI stands for "Biological Exposure Index". It is the biological equivalent of the environmental 8-hr TLV-TWA airborne exposure standard. The 8-hr TLV-TWA (Threshold Limit Value-Time Weighted Average) is average airborne concentration of a substance to which it is believed most workers can repeatedly be exposed over 8-hour day and 40-hour workweek without adverse health effects.

The 62.5 nmol/day value for chromium in 1.2 L of urine becomes 52.08 nmol/L. Conversion multipliers can be found at www.sydpath.stvincents.com/au/other/Conversions/-ConversionMasterF3.htm – "0.052". Alternately, one can locate the molecular weight of chromium – 51.996 gm/mol = 0.052 µg/nmol. 52.08 nmol/L x 0.052 = 2.71 µg/L, which is well below the BEI of 25 µg/L. Unfortunately, the lab mislead the physician and patient by flagging the value of 62.5 nmol/day as "H".

To relate the chromium to gm of creatinine, some additional calculations are necessary. The 16.3 mmol/day value for creatinine becomes 13.58 mmol/L = 13,580 nmol/L. Multiply this by 0.0113 to convert to 153 mg/dl = 1.53 gm/L. Divide 2.71 µg chromium /L by 1.53 gm creatinine /L = 1.77 µg chromium per gm creatinine. This is well below the BEI standard of 25 µg/gm creatinine.

Reference:

Schwerha, J. J. (2007). "How do you interpret these lab results based on the following case presentation?" J Occup Environ Med **49**(11): 1291-4.