

## Chemistry in Politics – The bad news in Initiative 502

Initiative 502 proposed by the petitioner, New Approach Washington, (<http://newapproachwa.org>) holds much promise except for one very bad idea.

For the first time ever in Washington Law, Initiative 502 (I-502) will establish a new “**per se**” DUI threshold of “**impairment**” for THC (tetrahydrocannabinol) at 5.0 nanograms per mL (milliliter or ml).

Most people don't have a clue about what 5.0 nanograms per ml means in practical terms.

Statements about chemical concentrations are better understood by the public when expressed as “parts per million” (ppm), or “parts per billion” (ppb), or even “parts per trillion” (ppt) for extremely dilute concentrations.

This paper will outline the facts and the calculations needed to prove that

**5.0 nanograms of THC per milliliter = 286 parts per trillion. (ppt)**

In absolute terms, 286 parts per trillion is an astonishingly low concentration.

For readers wishing to verify that the calculation is done correctly and that the results are valid, the step-by-step details of the calculation with links to online reference sources are presented on page 2.

### **There Is No Scientific Consensus for the proposed per-se THC impairment threshold**

My research finds disagreement among experts over proposals equating THC “impairment” with a specific number of measured nanograms of THC in a milliliter of blood. Further research is necessary to determine the quantitative data necessary and sufficient to establish a per-se standard of impairment in the law. Until the science is established and experts agree on the numbers, the current law works just fine.

I personally contacted the public information officer for the DUI section of the Washington State Patrol. In my conversation with the trooper, I asked him if the lack of a per-se standard of impairment is in any way an obstacle to successful prosecutions for driving while impaired by marijuana. The officer said ‘no, the absence of a per-se threshold of impairment does not hamper law enforcement.’

It is premature, unwise, and unnecessary to set 5.0 ng/ml in law as the per-se impairment standard for THC. Doing so may result in unjust convictions of persons who are not impaired and therefore not guilty of DUI.

I urge the committee to amend I-502 by striking the provision that creates a per-se DUI impairment standard of 5.0 nanograms per milliliter THC in whole blood. The current DUI laws in Washington require proof of actual impairment. The current standard of proof of impairment by THC should remain undisturbed until there is wide agreement by experts in the scientific community to justify a specific per-se impairment standard.

## Details of the Calculation

### Step-by-step procedure with references

The molar mass of THC is **314.45 grams per mole**. See URL <http://en.wikipedia.org/wiki/THC>

By definition, one mole of any substance is **Avogadro's Number** of molecular particles of that substance. Avogadro's Number is  $6.022 \times 10^{23}$ . See URL [http://en.wikipedia.org/wiki/Avogadro\\_constant](http://en.wikipedia.org/wiki/Avogadro_constant).

We first **divide  $5.0 \times 10^{-9}$  grams of THC by 314.45 grams per mole** to obtain  **$1.5900 \times 10^{-11}$  mole of THC**.

One (1) mole always contains  $6.022 \times 10^{23}$  molecules.

Multiplying moles of THC by  $6.022 \times 10^{23}$  yields  **$9.575 \times 10^{12}$  molecules of THC**. Numerically this is 9,575,000,000,000 molecules of THC. ( 9 trillion, 575 billion molecules )

For simplicity, we equate blood with water because their densities are approximately equal. Blood has an average density of approximately  $1060 \text{ kg/m}^3$ , very close to pure water's density of  $1000 \text{ kg/m}^3$ . See URL <http://hypertextbook.com/facts/2004/MichaelShmukler.shtml>

Water (  $\text{H}_2\text{O}$  ) weighs **18 grams per mole**. ( $\text{O}_{16} + \text{H}_1 + \text{H}_1$ ) =  $16 + 2 = 18$ .

One Liter of Water weighs one Kilogram (1000 grams) and contains 1000 milliliters. So **1 ml weighs 1 gram**.

Therefore, one ml of water is  $\frac{1}{18}$  mole =  $\frac{6.022 \times 10^{23}}{18}$  molecules of  $\text{H}_2\text{O}$  =  **$3.345 \times 10^{22}$  molecules of  $\text{H}_2\text{O}$** .

We next calculate the **molecules of THC divided by the molecules of water** to find the THC concentration.

$9.57 \times 10^{12}$  molecules THC divided by  $3.345 \times 10^{22}$  molecules of  $\text{H}_2\text{O}$  =  $2.86200 \times 10^{-10}$  = 0.0000000002862

Multiply that small number by 1 trillion =  $1 \times 10^{12}$  and obtain **286 parts per trillion** ( 286 ppt ). Q.E.D.