II. SUMMARY OF CARBON ISOTOPE RATIO RESULTS

USADA brings this case primarily based upon the carbon isotope ratio results ("CIR")[2], which USADA alleges provides evidence of the use of exogenous testosterone. A good summary of the CIR theory is provided at Maitre et al., Urinary Analysis of Four Testosterone Metabolites and Pregandiol by Gas Chromotography-Combustion-Isotope Ratio Mass Spectrometry After Oral Administration of Testosterone, 28 Journal of Analytical Toxicology (Sept. 2004) [attached hereto as Exhibit 1]:

> "IRMS allows measurements of slight differences in the carbon isotope ratio ($^{13}C/^{12}C$) of the exogenous and endogenous testosterone. Synthetic testosterone is produced from precursors derived from plants with low ^{13}C content, whereas the ^{13}C and ^{12}C content in the natural endogenous form depends on the isotopic carbon composition of the food diet and is influenced by additional effects of human biological processing."

Carbon isotope ratios are expressed in terms of delta units per mil. Maitre went on to describe this calculation as follows:

> The symbol δ is the standard notation for expressing carbon isotope ratios. It is defined as parts per thousand deviation of isotopic compositions from that of Pee Dee Belemnite (PDB), and is calculated according to:
>
> $$\delta^{13}C/‰ = \frac{(^{13}C/^{12}C)\ \text{sample} - (^{13}C/^{12}C)\ \text{standard}}{(^{13}C/^{12}C)\ \text{standard}}$$

Once the $\delta^{13}C‰$ value for the testosterone metabolites is calculated, the positivity criteria mandated by WADA requires that this value be compared between metabolites that are believed to be affected by exogenous testosterone use and those metabolites that are not so affected. See WADA Technical Document TD2004EAAS (attached hereto as Exhibit 2), p.3:

> "**3. Isotope ratio mass spectrometry:**

[2] This CIR method is also referred to as Isotope Ratio Mass Spectrometry, or "IRMS."