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PROJECT NO. US OIL SANDS
SUBJECT REVISED PROXY APPROACH
BY WCH DATE 4/26/12
CHECKED BY _____ DATE _____
SHEET NO. 1 OF 2

JUST TO COMPARE A DIFFERENT APPROACH TO THE DR. JOHNSON RESULTS, USING THE SAME 2003 SCHWARZENBACH TEXT:

- USING THE SAME B(a)P SOLUBILITY FOR A SOLID, AS PRESENT IN DR. JOHNSON'S ORIGINAL TESTIMONY:

$$C_{iw}^{SAT}(s) = 1.52 \text{ mg/L}$$

- ALSO, USING HIS SAME SOLUBILITY FOR B(a)P DISSOLVING FROM A LIQUID, PER DR. JOHNSON'S ORIGINAL TESTIMONY:

$$C_{iw}^{SAT}(L) = 49.19 \text{ mg/L}$$

- THE FOLLOWING ASSUMES (AS DR. JOHNSON DID) THAT B(a)P IS A PROXY FOR ALL BITUMEN COMPOUNDS

- USING THE SAME VALUES AS PER PAGE 5 OF MY 2/27/2012 REPORT, THE SPENT SANDS WILL CONTAIN AROUND 1.8 PARTS BY WEIGHT OF D-LIMONENE TO 0.84 PARTS BY WEIGHT OF BITUMEN (B(a)P AS PROXY). ASSUMING ALL B(a)P DISSOLVES INTO THE D-LIMONENE THE MOLE FRACTION CAN BE CALCULATED, USING MOLECULAR WEIGHTS OF B(a)P = 252.3 g/MOL & D-LIMONENE MW = 136.2 g/MOL:

$$x_{i,d-l} = \frac{\frac{.84}{252.3}}{\frac{.84}{252.3} + \frac{1.8}{136.2}} = .201 = \text{MOL FRACTION OF BITUMEN (AS B(a)P) IN SOLUTION WITH D-LIMONENE}$$

DEPOSITION EXHIBIT 18

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BY E-LA DATE 3/22/12
CHECKED BY _____ DATE _____
SHEET NO. 2 OF 2

NOW, WE CAN CALCULATE THE BITUMEN (B(a)P AS PROXY) CONCENTRATION IN WATER THAT IS IN EQUILIBRIUM WITH D-LIMONENE: (EQ 7-21, SCHWARZENBACH, 2003)

$$C_{iw} = \chi_{i,d-1} * V_{i,d-1} \circ C_{iw}^{SAT}(L)$$

WHERE $V_{i,d-1}$ IS THE ACTIVITY COEFFICIENT OF B(a)P IN THE LIMONENE, WHICH CAN BE APPROXIMATED AS 1.0 (SCHWARZENBACH, 2003, PAGE 237)

THIS THEN YIELDS:

$$C_{iw} = .201 \times 1.0 \times 49.19 \text{ ug/L}$$

$$C_{iw} = 9.89 \text{ ug/L}$$

SO THE SOLUBILITY INCREASE FACTOR IS

$$\frac{C_{iw}}{C_{iw}^{SAT}(s)} = \frac{9.89 \text{ ug/L}}{1.52 \text{ ug/L}} = \underline{6.51}$$

THIS IS CONTRASTED TO THE FACTOR OF 1500 OBTAINED BY DR JOHNSON !!