Vancouver Energy
NPDES Engineering Report

EFSEC Application for Site Certification No. 2013-01
Docket No. EF131590

Appendix G
Oil-Water Separator Sizing Calculations

Oil Water Separator Design
Coalescing Plate Style

Design Flow	$Q := 880gpm$
Specific Gravity Water	$SGw := 1$
Specific Gravity Oil	$SGoil := 0.986$
Specific Gravity Benzene	$SGben := 0.876$
Density of Water @ 50° F/10° C	$\rho w := 62.41 \frac{lb}{ft^3}$
Density of Oil (API 12)	$\rho oil := SGoil \cdot \rho w = 985.716 \frac{kg}{m^3}$
Density of Benzene	$\rho ben := SGben \cdot \rho w = 875.748 \frac{kg}{m^3}$
Viscosity of Water @ 50° F/10° C	$\upsilon w := 0.013poise = 0.013 \cdot \frac{gm}{cm \cdot sec}$
Acceleration due to Gravity	$g = 980.665 \cdot \frac{cm}{sec^2}$
Design Oil Droplet Size	$Doil := 60micron = 6 \times 10^{-3} \cdot cm$
Design Benzene Size	$Dben := 20micron = 2 \times 10^{-3} \cdot cm$

Stokes Law
Vertical Rise Rate of Oil

$$ORR := \frac{\left[g\cdot(\rho w - \rho oil)\cdot Doil^2\right]}{18\cdot \upsilon w} = 2.112\times 10^{-3}\cdot\frac{cm}{sec}$$

$$ORR = 4.157\times 10^{-3}\cdot\frac{ft}{min}$$

Stokes Law
Vertical Rise Rate of Benzene

$$BRR := \frac{\left[g\cdot(\rho w - \rho ben)\cdot Dben^2\right]}{18\cdot \upsilon w} = 2.078\times 10^{-3}\cdot\frac{cm}{sec}$$

$$BRR = 4.091\times 10^{-3}\cdot\frac{ft}{min}$$

Design Flow Rate

$$Q = 117.639\cdot\frac{ft^3}{min}$$

Required Horizontal Area

$$Ah := \frac{Q}{ORR} = 2.83\times 10^4\cdot ft^2$$

OWS Volume (VLC 80-3)

$$Vows := 192 ft^3$$

MPAK (Horizontal Area/Volume)

$$Dpak := 93\frac{ft^2}{ft^3}$$

# of Required OWS Units
(VLC 80-3)

$$Units := \frac{Ah}{(Vows\cdot Dpak)} = 1.585$$