Supporting Information material to accompany ES&T Research Article

“Submersible optical sensors exposed to chemically-dispersed crude oil: wave tank simulations for improved oil spill monitoring”

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Table S1. Experimental design for Dilution and Stepwise Addition treatments.

CORE EXPERIMENTS				STEPWISE ADDITION EXPERIMENTS			
Oil State	Dispersant Treatment	Oil Volume	Experiments Conducted	Oil State	Dispersant Treatment	Oil Volume	[Oil] in fully mixed tank
fresh	no dispersant	100 ml	duplicate	fresh	1:25 DOR	10 ml	300 ppb
fresh	1:25 DOR	100 ml	duplicate	fresh	1:25 DOR	20 ml	600 ppb
weathered	no dispersant	100 ml	duplicate	fresh	1:25 DOR	50 ml	1.5 ppm
weathered	1:25 DOR	100 ml	triplicate	fresh	1:25 DOR	100 ml	3 ppm
				fresh	1:25 DOR	200 ml	6 ppm
				fresh	1:25 DOR	400 ml	12 ppm

Table S2. Submersible sensor configuration and dynamic range provided by manufacturers. FWHM represents Full Width at Half Max.

Manufacturer	Instrument	Light source	Excitation λ (nm)	Emission λ (nm)	Detector	Dynamic Range
Chelsea Technologies Group	UV AQUAtracka (Refined oil)	Xenon lamp	239, 26 FWHM	360, 70 FWHM	PMT	0.001- 10 $\mu\text{g/L}$ Carbazole
	UV AQUAtracka (Crude oil)	Xenon lamp	239, 26 FWHM	440, 110 FWHM	PMT	0.001 - 10 $\mu\text{g/L}$ Perylene
Turner Designs	Cyclops (Crude oil)	LED	320, 130 BP	510, 180 BP	Photodiode	0 - 2700 ppb PTSA Salt
WET Labs Inc	ECO	LED	370, 10 FWHM	460, 120 FWHM	Photodiode	0.01 - 500 ppb Quinine Sulfate
Satlantic	SUNA	Deuterium	210-370 abs	n/a	Spectrometer	0.07 - 28 μM Nitrate

Figure S1. Schematic representation of the wave tank facility. Sampling location options are represented by open circles. Discrete samples were collected 10 m downstream of addition of oil to tank, coincident with sensor location. Plunging breaking waves were produced with a 12 cm stroke and alternating trains of high-frequency waves (0.85 Hz producing a wave length of 2.16 m and wave height 26 cm with a duration of 20 s) and low-frequency waves (0.5 Hz producing a wave length of 6.24 m and a wave height of 9 cm with a duration of 5 s) (Li et al., 2010).

Figure S2. Fluorescence intensity (Cyclops and AQUA_{239/440 nm}) and absorption (SUNA) of sensors exposed to chemically-dispersed MC252 crude oil during EXP_{ADD} within the wave tank.

Figure S3. Response of TPH and BTEX-calibrated sensors exposed to chemically-dispersed weathered crude oil. TPH and BTEX values from discrete samples are represented by open and gray circles, respectively. Wave tank was operated in flow-through mode (EXP_{DIL}) to observe fluorescence values during the dilution of an oil spill.