

Appendix A:
CROSERF Meeting Summaries

Meeting 1
August 9-10, 1994
Santa Cruz, CA

This was the first meeting of the research coordinating group named the Chemical Response to Oil Spills: Ecological Effects Research Forum (CROSERF). The working group will consist of individuals from federal and state government, academia, and industry, and is dedicated to improving laboratory and mesocosm research on the ecological effects of chemical agents used in oil spill response. The emphasis of the group is on dispersants, however other agents such as shoreline cleaners and emulsion breakers are also of interest. The forum provides a platform for the exchange of ideas and coordination of research.

The meeting was held on the campus of the University of California, Santa Cruz and hosted by the California Office of Oil Spill Prevention and Response. The primary purpose was to discuss in detail the objectives of the forum and determine if future meetings were warranted. In order for participants to make an informed decision regarding the future of the forum, the majority of time at this first meeting was devoted to various presentations and discussions on the current toxicity research on dispersants and dispersed oil being conducted by the University of California, Santa Cruz and Exxon Biomedical Sciences, Inc. and related issues. These included a discussion of the issues related to the use of scientific information in oil spill decision-making, and a special presentation by Dr. James Payne on the use of oil spill weathering data in toxicity studies for chemically and naturally dispersed oil slicks. The purpose of this presentation (available in full in Kucklick, 1994) was to assist in the development of ecologically relevant toxicity test exposure protocols.

At the conclusion of the two-day meeting, participants unanimously agreed that the forum was and will continue to be an excellent mechanism to discuss and encourage standardization of laboratory toxicity test procedures. In addition, the forum will provide the opportunity to foster cooperative laboratory and mesocosm ecological research programs on oil spill response issues. Because the forum includes researchers and regulators, both groups benefit from the interaction. Scientists can determine what the regulators see as research needs and regulators can get a better perspective on ongoing ecological effects studies.

Meeting 2
March 21-22
Baton Rouge, LA

This meeting focused on progress reports from participating research teams, and definition of high priority research needs. The University of California, Santa Cruz research team has been evaluating methods to characterize both oil and dispersed oil used in flow-through tests. While gas chromatography is best for initial quantification and characterization, it is too expensive and time-consuming to be used to monitor hourly decline rates. The alternative of using Total Organic Carbon analysis for these measurements was investigated and appears useful. Initial toxicity testing of the water accommodated fraction (WAF) resulting from physically dispersed oil was conducted using abalone larvae.

Exxon Biomedical Sciences, Inc. reported on efforts to characterize WAFs using various gas chromatography techniques. They have also completed a series of spiked and constant exposure tests using both physically and chemically dispersed oil on two species of mysids. Testing is continuing with both types of WAFs using additional species.

Environment Canada participants reported on their efforts to evaluate the effects of various parameters on WAF preparation. Preliminary data on the effects of glass versus nalgene containers, headspace or no headspace, loading rates, oil type, mixing energy, permeation through containers, equilibration time and cross contamination were presented.

The Marine Spill Response Corporation reported on the results of the August, 1994 dispersant field trials in the North Sea. While weather conditions interfered with the collection of some of the water samples, a portion of the program was completed.

At the conclusion of the meeting the participants identified a list of research needs, which was intended to help focus future work. The highest priority items were: definition of the purpose of various types of toxicity tests, definition of analytical methods required, standardization of the WAF protocols, and standardization of dispersed oil mixing protocols.

Meeting 3 September 13-14, 1995 East Millstone, NJ

The third CROSERF meeting opened with progress reports from the University of California, Santa Cruz (UCSC), Exxon Biomedical Sciences, Inc. (EBSI), Texas A&M University (TAMU), the Florida Department of Environmental Protection (FL DEP), the University of Maryland (UMD) and Environment Canada (EC).

UCSC reported on 3 activities, development of a WAF protocol, dispersed oil preparation methods, and presented preliminary results for WAF toxicity testing with abalone and mysids. They reported observing initial narcosis with the mysids. This was the first time that they had observed this phenomenon. EBSI had been conducting toxicity tests with Forties and Kuwait crude oil. TAMU was just beginning to establish its testing facilities. FL DEP did not, as yet, have a program in place. UMD reported on setting up the facilities to conduct dispersant-only testing under contract to MSRC. EC reported on efforts to standardize the preparation of WAF solutions.

The issue of possible biological monitoring strategies for dispersant use was raised by the EPA Risk Reduction Laboratory. Both Regional Response Teams (RRT) 2 and 4 were working on possible monitoring programs, and it was felt that CROSERF might function in an advisory capacity. Initial discussion indicated that there was little support for real-time biological testing, because of the time constraints, and that unless people will except extrapolation from chemical exposure (i.e. water column concentration) to biological consequences as the basis for monitoring, then making real-time contributions to decisions may not be possible. The potential role of Microtox[®] was also discussed.

Individuals then made reports on assignments from the last meeting. Jim Clark of EBSI reviewed the basics related to petroleum chemistry and the problems that has created in terms of measuring and expressing the concentration of "oil" during toxicity testing. He concluded that the minimum acceptable analysis would appear to be GC-FID for paraffins and non-paraffins, with explicit documentation of sample extractions and processing methods. Alexis Steen of API and Sandra Blenkinsopp of EC reviewed current protocols for the storage of oil, and recommended that samples be stored in small containers, without headspace and refrigerated. Once opened, discard any unused oil. Don Aurand of MSRC reviewed standard industry approaches to characterizing chemical and physical properties of crude oil. It was recommended that each test oil should initially be chemically characterized in detail using GC-MS (because of the toxicity testing requirements) and possibly also using a standard fractional distillation (typical for oils entering the refining process). Density and API gravity, viscosity, and pour point should also be measured using standard ASTM (American Society for Testing and Materials) methods. The participants also began the initial discussions concerning the development of a standardized protocol for the preparation of water accommodated fractions (WAF) and chemically dispersed oil fraction (note- the latter ultimately became referred to as chemically enhanced WAF). Topics discussed included the time to achieve stable WAF solutions, serial loading versus dilution of test solutions, and standardization of container size. No final decisions were made.

The only remaining major discussion topic was the future of CROSERF itself. With the announcement of MSRC's decision to terminate their research program eliminated a major financial supporter of the program. Industry representatives indicated that some future

support might be available through the American Petroleum Institute (API). Ultimately, a decision was made to plan for a fourth meeting and hope that the funding situation would clarify by that time.

Meeting 4
April 24-25, 1996
Santa Cruz, CA

The agenda for this meeting focused on research updates, and on assignments from the third meeting. The primary objective was to discuss, and then finalize standard protocols for WAF and CE-WAF preparation and use in toxicity tests. A secondary objective was to standardize protocols for hydrocarbon analysis in support of biological studies.

At the end of the last meeting, it was unclear if additional funding would be available. Since then, the American Petroleum Institute indicated that it would support the program, and several other sponsors indicated their ability to also contribute, either in cash or kind.

UCSC reported that they had begun toxicity testing with CE-WAF using Prudhoe Bay crude oil. They noted that in their earlier work (prior to CROSERF) the method of estimating total hydrocarbon concentrations (summing the total area of the resolved peak in a GC-FID chromatogram) results in higher values than if they only sum the peaks of specific target analytes. They provided additional details on the occurrence of narcosis, which was seen in mysid tests with both WAF and CE-WAF, although the patterns were not identical.

EC submitted a written summary of their progress in developing standards for WAF preparation in fresh and salt water, as well as protocols for exposing fish. They are planning on a paper on methods development at the 1996 Arctic and Marine Oilspill Program (AMOP) meeting.

The University of South Florida (USF) participated for the first time and reported that they had been informed that they would be receiving funding from API and FL DEP and would begin work shortly. They indicated that they will use Venezuelan crude oil and presented a list of six species they would like to work with.

TAMU has completed initial tests using Arabian Medium crude oil, but did not have detailed chemistry results for the initial tests.

EBSI is continuing their work with Kuwaiti crude oil using both WAF and CE-WAF solutions.

The University of Maryland completed the first round of dispersant testing using the CROSERF chambers.

After the progress reports were completed, there were several special discussion topics and presentations. The group was very interested in the narcosis results observed by UCSB, and agreed that all of the laboratories should be sensitive to that end point. The group also began working on standardized definitions for CROSERF terminology. These will be incorporated into future testing protocols.

The group then discussed the issue of volatilization of hydrocarbons, at all phases of the preparation of test solutions as well as during exposure. It was reiterated that the goal was to minimize variability in this regard. The group also discussed the issue of mixing time for preparation of solutions, but did not reach a final decision. Protocols for oil storage and oil weathering were reviewed and finalized for storage. A decision on a weathering protocol was deferred for further review.

The meeting concluded with an overview of Norwegian field and laboratory experiments, possible risk assessment models to integrate the CROSERF results into the decision process as they become available, and the need for a long-range plan for CROSERF, now that at least some future funding was available.

Meeting 5
September 18-19, 1996
Corpus Christi, TX

This meeting was primarily focused on the continuing discussions of the proposed standard protocols for hydrocarbon chemical analyses, protocols for round-robin testing of a reference crude oil, the order in which tests should be conducted, and the multi-year objectives.

The meeting began with progress reports from the toxicity research teams at UCSB, TAMU, EBSI, and USF. All of the groups were making good progress on their testing. The University of Maryland completed their initial dispersant toxicity testing since the last meeting, but was unable to obtain funding to continue with the program. Additional reports from Environment Canada and SINTEF focused on chemical and physical property studies underway in those facilities.

Additional topics included briefing the participants on how to conduct the round-robin reference oil test, which should be completed by the next meeting, a review of all existing CROSERF data, and artificial weathering protocols. Final definitions were accepted for a number of specific terms to be used in the standard protocols. The protocol for hydrocarbon characterization of test solutions was discussed for the second time, and will be finalized at the next meeting. The participants also decided to end any efforts to develop complete conceptual models for dispersants in the various habitats of concern, and concentrate on the definition and documentation of appropriate exposure regimes to simulate open water systems. The initial discussions were held to define the test matrix for the long-range plan.

Meeting 6
April 3-4, 1997
Fort Lauderdale, FL

The meeting began with the standard activity reports from participants. All of the laboratories are making good progress. UCSC has added a 1-hour narcosis end point to their protocols, based on the observations they made in their mysid testing. The results of the round-robin testing for the reference oil were reviewed and were quite good, indicating reproducible results at the laboratories.

There was some discussion about variability of batches of dispersants, based on some anomalous results obtained by USF. It was agreed that this needed to be examined. In preparation for round-robin toxicity testing the organism, *Menidia beryllina* was selected as the standard test organism. A list of approved CROSERF definitions was accepted, as were protocols for the preparation of WAF and CE-WAF solutions, chemical characterization of test solutions, and round-robin chemical characterization of a reference oil. All are included in the report.

Meeting 7
November 13-14, 1997
Santa Cruz, CA

The meeting began with progress reports from the laboratories. All of the groups have begun to develop much more complete results. The University of Alaska, Fairbanks joined the group for the first time and will be conducting tests on cold water species. Participants discussed the need for dissemination of all of the results, now that more data was becoming available. The possibility of a CROSERF web page was introduced for consideration by TAMU, but it was unclear who would host it or bear the expense. The draft long-range plan was distributed for review. The draft contained four sections, laboratory testing, mesocosm testing, field research and outreach. During discussion, it was decided that the final plan would be limited to laboratory testing, since the funding situation for any other activities appeared poor.

Meeting 8
March 17, 1998
Anchorage, AK

This meeting was focused on the future of the program. Participant progress reports were not needed since it had only been 3 months since the last meeting. The participants did, however, review and make final changes to the basic toxicity testing work plan, defining the desired data set.

Sponsors and government agencies met and discussed the future of the program. It was agreed that the program needed to focus on completing the minimum data set by the end of 1999, because of the decreasing availability of funds. Dissemination of information and a final CROSERF report remain critical issues. The technical participants focused on streamlining the toxicity testing matrix to be completed over the next two years.

Meeting 9
March 4-5, 1999
Seattle, WA

This was the last official meeting of the research group and no Proceedings were prepared. The meeting was primarily occupied with planning for the completion of the existing research projects, and a combined presentation at the next International Oil Spill Conference.

Appendix B:
Experimental Data Sheet Templates

Data Sheet for Flow-Through Toxicity Tests

GENERAL EXPERIMENT INFORMATION

Experiment Name/Number: _____

Date: _____

Person Conducting Test: _____

TEST CONDITIONS

Duration of Test: _____

Exposure Type (spiked, constant): _____

Toxicity Endpoint (lethality, abnormal development, etc.): _____

CHEMICAL INFORMATION

Dispersant: _____

Oil: _____

Diluent: _____

Planned Solution Range: _____

Number of Concentrations: _____

Number of Replicates: _____

Solution Temperature: _____

Mixing Type: _____

Mixing Time: _____

Settling Time: _____

BIOLOGICAL INFORMATION

Species: _____

Lifestage: _____

Pre-Experimental Animal Conditions- Temperature: _____ Salinity: _____ pH: _____

Food Source: _____

Other Notes: _____

GENERAL EXPERIMENT INFORMATION

Experiment Name/Number: _____ Date: _____ Person Conducting Test: _____

SOLUTION PREPARATION DETAILS

	Planned Concentration	Mass of Dispersant	Mass of Oil	Volume of Diluent	Calculated Nominal Concentration	Measured Concentration	Analytical Method Used	Notes
Conc. 1								
Conc. 2								
Conc. 3								
Conc. 4								
Conc. 5								
Conc. 6								

GENERAL EXPERIMENT INFORMATION

Experiment Name/Number: _____ Date: _____ Person Conducting Test: _____

DAILY EXPERIMENTAL OBSERVATIONS

	T=24 hrs				T=48 hrs				T=72 hrs				T=96 hrs							
Date:																				
Amount of Food:																				
Room Temp:																				
	T	Sal	dO	pH	#	T	Sal	dO	pH	#	T	Sal	dO	pH	#	T	Sal	dO	pH	#
Control Rep 1																				
Control Rep 2																				
Control Rep 3																				
ppm Rep 1																				
ppm Rep 2																				
ppm Rep 3																				
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ppm Rep 3																				

Appendix C:
Detailed Data Tables from the API/California Study

Table C.1 CE-WAF #1 Fresh Oil for the Topsmelt *Atherinops affinis*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	2770		0	87.9	0	0.067	0.115	0	0.000	0.000
						0			0		
						0.2			0		
0.047	611	-170		178	-21.9	0	0.133	0.231	0	0.000	0.000
						0.4			0		
						0			0		
0.097	1310	2040	3350	282	169.1	0.2	0.200	0.000	0	0.000	0.000
						0.2			0		
						0.2			0		
0.196	2190	9430	11620	398	858.1	0.2	0.200	0.200	0.2	0.067	0.115
						0.4					
						0					
0.402	3760	25830	29590	784	2312.1	1	0.867	0.231	0.4	0.200	0.200
						0.6			0.2		
						1			0		
0.781	4870	42730	47600	838	3592.1	1	1.000	1.000	1	1.000	0.000
						1			1		
						1			1		

Table C.2 CE-WAF #2 Fresh Oil for the Topsmelt *Atherinops affinis*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	3850		0	94.9	0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
0.048	559	380	939	493	-15.6	0.2	0.067	0.115	0.2	0.067	0.115
						0			0		
						0			0		
0.104	1230	1160	2390	508	172.1	0.2	0.267	0.115	0	0.067	0.115
						0.2			0		
						0.4			0.2		
0.149	1440	6550	7990	327	734.1	0.4	0.200	0.200	0	0.000	0.000
						0.2			0		
						0			0		
0.298	2700	9950	12650	500	1025.1	0.6	0.867	0.231	0.2	0.533	0.306
						1			0.8		
						1			0.6		
0.589	4390	41350	45740	643	3605.1	1	1.000	0.000	0.8	0.600	0.200
						1			0.6		
						1			0.4		

Table C.3 CE-WAF #3 Fresh Oil for the Topsmelt *Atherinops affinis*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
						0	0.133	0.115	0	0.000	0.000
						0.2			0		
						0.2			0		
0.048	672	1200	1872			0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
0.101	1356	4500	5856			0	0.067	0.115	0	0.000	0.000
						0			0		
						0.2			0		
0.152	1890	7300	9190			0	0.200	0.200	0	0.000	0.000
						0.2			0		
						0.4			0		
0.299	3058	13000	16058				0.800	0.283	0	0.000	0.000
						1			0		
						0.6			0		
0.597	4864	18000	22864			1	1.000	0.000	0	0.533	0.503
						1			0.6		
						1			1		

Table C.4 CE-WAF #1 Weathered Oil for the Topsmelt Atherinops affinis

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	399				0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
0.074	55.8	3541	3596.8	199.97	26.38	0	0.067	0.115	0	0.000	0.000
						0			0		
						0.2			0		
0.208	109.4	6851	6960.4	370.196	168.63	0	0.067	0.115	0	0.000	0.000
						0.2			0		
						0			0		
0.423	24.7	12201	12225.7	501.81	520.25	0.2	0.067	0.115	0	0.000	0.000
						0			0		
						0			0		
0.806	226	22401	22627	832.231	1728.32	0.6	0.800	0.200	0.2	0.133	0.115
						0.8			0		
						1			0.2		
1.555	261.4	30901	31162.4	699.873	1442.93	1	1.000	0.000	1	1.000	0.000
						1			1		
						1			1		

Table C.5 CE-WAF #2 Weathered Oil for the Topsmelt *Atherinops affinis*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
						0	0.133	0.115	0	0.000	0.000
						0.2			0		
						0.2			0		
0.048	672	1200	1872			0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
0.101	1356	4500	5856			0	0.067	0.115	0	0.000	0.000
						0			0		
						0.2			0		
0.152	1890	7300	9190			0	0.200	0.200	0	0.000	0.000
						0.2			0		
						0.4			0		
0.299	3058	13000	16058				0.800	0.283	0	0.000	0.000
						1			0		
						0.6			0		
0.597	4864	18000	22864			1	1.000	0.000	0	0.533	0.503
						1			0.6		
						1			1		

Table C.6 CE-WAF #3 Weathered Oil for the Topsmelt *Atherinops affinis*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
	0.000	0.000				0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
0.099	61.9	3500	3561.9			0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
0.194	98.6	5800	5898.6			0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
0.290	130.6	7900	8030.6			0	0.067	0.115	0	0.000	0.000
						0.2			0		
						0			0		
0.642	187.8	15000	15187.8			0	0.067	0.115	0	0.000	0.000
						0.2			0		
						0			0		
1.003	219.9	11000	11219.9				1.000	0.000	0	0.000	0.000
						1			0		
						1			0		

Table C.7 WAF Fresh Oil Constant Exposure for the Topsmelt *Atherinops affinis*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
						0	0.067	0.115			
						0.2					
						0					
0.010	54.6	140	194.6			0	0.000	0.000			
						0					
						0					
0.018	94.5	310	404.5			0	0.067	0.115			
						0					
						0.2					
0.029	151.4	420	571.4			0.2	0.133	0.115			
						0					
						0.2					
0.054	359	950	1309			0.6	0.733	0.231			
						1					
						0.6					
0.085	427.1	1200	1627.1			1	1.000	0.000			
						1					
						1					

Table C.8 WAF #1 Fresh Oil for the Topsmelt *Atherinops affinis*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	666		0	2.5	0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
1	5580	974	6554	258	-2.5	0.4	0.333	0.306	0	0.000	0.000
						0.6			0		
						0			0		
5.01	8960	974	9934	245	0	0	0.200	0.200	0	0.000	0.000
						0.4			0		
						0.2			0		
10.02	10510	1574	12084	271	21.1	0.6	0.467	0.115	0	0.067	0.115
						0.4			0		
						0.4			0.2		
15.02	12680	1504	14184	284	0.99	0.8	0.800	0.000	0.2	0.267	0.115
						0.8			0.4		
						0.8			0.2		
25.05	16100	2394	18494	259	89.4	0.8	0.667	0.231	0	0.267	0.306
						0.8			0.6		
						0.4			0.2		

Table C.9 WAF #2 Fresh Oil for the Topsmelt *Atherinops affinis*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	790		0	2.43	0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
1.01	6190	1090	7280	244	6.45	0.4	0.600	0.346	0	0.000	0.000
						0.4			0		
						1			0		
5.08	11270	740	12010	260	0.64	0.6	0.400	0.200	0.2	0.133	0.115
						0.2			0		
						0.4			0.2		
10.01	12580	1500	14080	285	6.16	0.6	0.533	0.115	0.2	0.067	0.115
						0.6			0		
						0.4			0		
15.01	14000	1750	15750	283	6.62	0.2	0.533	0.306	0	0.200	0.200
						0.8			0.4		
						0.6			0.2		
25.01	14830	2130	16960	310	13.17	0.4	0.333	0.306	0.4	0.333	0.306
						0.6			0.6		
						0			0		

Table C.10 WAF #1 Weathered Oil for the Topsmelt *Atherinops affinis*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	456				0	0.067	0.115	0	0.000	0.000
						0.2			0		
						0			0		
1.016	208.6	854	1062.6	358.855	2.75	0.2	0.067	0.115	0	0.000	0.000
						0			0		
						0			0		
5.145	267.4	874	1141.4	430.238	2.76	0.2	0.067	0.115	0	0.000	0.000
						0			0		
						0			0		
9.984	338.5	1264	1602.5	365.607	0	0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
15.688	350.3	894	1244.3	482.115	11.93	0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
25.059	337.6	754	1091.6	458.685	2.43	0	0.067	0.115	0	0.000	0.000
						0.2			0		
						0			0		

Table C.11 WAF #2 Weathered Oil for the Topsmelt *Atherinops affinis*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	728		0	0	0	0.067	0.115	0	0.000	0.000
						0			0		
						0.2			0		
1	207.3	522	729.3	353.932	0	0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
5.2	286.2	442	728.2	400.408	0	0	0.200	0.200	0	0.000	0.000
						0.2			0		
						0.4			0		
10	336.9	512	848.9	370.171	0	0.2	0.133	0.115	0	0.000	0.000
						0			0		
						0.2			0		
15.01	329.1	442	771.1	301.403	0	0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
24.99	345.7	1102	1447.7	324.06	0	0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		

Table C.12 CE-WAF #1 Fresh Oil for the Kelp Forest Mysid *Holmesimysis costata*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	661		0	5.4	0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
0.048	583	2219	2802	132	107.6	0.250	0.167	0.072	0	0.000	0.000
						0.125			0		
						0.125			0		
0.095	1132	6819	7951	228	525.6	0.125	0.333	0.260	0	0.000	0.000
						0.250			0		
						0.625			0		
0.162	2010	18139	20149	376	1724.6	0.750	0.708	0.191	0.250	0.292	0.072
						0.500			0.250		
						0.875			0.375		
0.282	2630	27939	30569	594	2514.6	1	0.958	0.072	1	1.000	0.000
						0.875			1		
						1			1		
0.474	3730	42839	46569	843	4354.6	1	1.000	0.000	1	1.000	0.000
						1			1		
						1			1		

Table C.13 CE-WAF #2 Fresh Oil for the Kelp Forest Mysid *Holmesimysis costata*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	671		0	0	0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
0.048	636	2319	2955	125	145	0	0.083	0.072	0	0.000	0.000
						0.125			0		
						0.125			0		
0.096	1139	4559	5698	188	227	0.500	0.458	0.072	0	0.042	0.072
						0.375			0.125		
						0.500			0		
0.165	1750	5609	7359	257	436	0.250	0.375	0.331	0	0.000	0.000
						0.750			0		
						0.125			0		
0.283	2800	19329	22129	371	1300	0.750	0.750	0.250	0.500	0.583	0.072
						0.500			0.625		
						1			0.625		
0.476	5140	37729	42869	710	3850	1	1.000	0.000	1	1.000	0.000
						1			1		

Table C.14 CE-WAF #1 Weathered Oil for the Kelp Forest Mysid *Holmesimysis costata*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	329				0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
0.080	63.4	6111	6174.4	252.62	26.9	0.125	0.125	0.000	0	0.000	0.000
						0.125			0		
						0.125			0		
0.206	104.7	10071	10175.7	344.614	221.86	0.125	0.125	0.000	0	0.000	0.000
						0.125			0		
						0.125			0		
0.301	84.8	15271	15355.8	422.043	690.06	0.125	0.083	0.072	0.125	0.042	0.072
						0			0		
						0.125			0		
0.404	164.3	34071	34235.3	690.481	2077.43	0.500	0.375	0.125	0	0.042	0.072
						0.250			0		
						0.375			0.125		
0.809	264.5	47971	48235.5	887.351	3034.1	1	0.917	0.144	0.250	0.208	0.072
						0.75			0.250		
						1			0.125		

Table C.15 CE-WAF #2 Weathered Oil for the Kelp Forest Mysid *Holmesimysis costata*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0		423		0	0	0	0.042	0.072	0	0.000	0.000
						0			0		
						0.125			0		
0.099	77.2	3057	3134.2	220	29.94	0.125	0.417	0.315	0	0.000	0.000
						0.750			0		
						0.375			0		
0.126	90.3	4837	4927.3	199	38.14	0.500	0.417	0.072	0	0.000	0.000
						0.375			0		
						0.375			0		
0.342	175.1	10177	10352.1	480	442.72	0.625	0.833	0.191	0	0.042	0.072
						1			0		
						0.875			0.125		
0.577	210.3	12877	13087.3	396	378.47	1	0.875	0.217	0	0.000	0.000
						0.625			0		
						1			0		
1.012	329.6	28477	28806.6	950	3302.02	1	1.000	0.000			
						1					
						1					

Table C.16 CE-WAF #3 Weathered Oil for the Kelp Forest Mysid *Holmesimysis costata*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	329				0	0.000	0.000			
						0					
						0					
0.105	77.3	1800	1877.3			0.2	0.067	0.115			
						0					
						0					
0.138	92.3	3800	3892.3			0.6	0.267	0.306			
						0					
						0.2					
0.161	93.4	5800	2892.4			0.4	0.333	0.306			
						0.6					
						0					
0.332	158.8	12000	12158.8			0.6	0.733	0.231			
						1					
						0.6					
1.004	277	27000	27277			1	0.933	0.115			
						0.8					
						1					

Table C.17 WAF #1 Fresh Oil for the Kelp Forest Mysid *Holmesimysis costata*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	877		0	10.1	0	0.042	0.072	0	0.000	0.000
						0			0		
						0.125			0		
0.301	2770	1583	4353	197	38.5	0.250	0.250	0.000	0	0.083	0.144
						0.250			0		
						0.250			0.250		
1.01	5750	863	6613	184	-2.26	0.125	0.083	0.072	1	1.000	0.000
						0.125			1		
						0			1		
3	9310	1753	11063	218	-7089	0.125	0.375	0.250	1	1.000	0.000
						0.625			1		
						0.375			1		
10	13060	3433	16493	228	-4.3	0.625	0.500	0.125	1	1.000	0.000
						0.500			1		
						0.375			1		
25	14710	2673	17383	250	14.7	0.750	0.708	0.072	1	1.000	0.000
						0.75			1		
						0.625			1		

Table C.18 WAF #2 Fresh Oil for the Kelp Forest Mysid *Holmesimysis costata*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	734		0	0	0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
0.301	2580	906	3756	163	7.44	0.375	0.292	0.144	0.125	0.083	0.072
						0.375			0.000		
						0.125			0.125		
1.01	5350	1066	6416	117	2.46	0.125	0.167	0.072	0.625	0.625	0.000
						0.250			0.625		
						0.125			0.625		
3	8980	2476	11456	210	7	0.750	0.486	0.324	1	1.000	0.000
						0.583			1		
						0.125			1		
10	13520	2106	15626	241	2.24	0.625	0.375	0.250	1	1.000	0.000
						0.125			1		
						0.375			1		
25	14440	3060	17500	208	0	0.375	0.625	0.354	1	1.000	0.000
						0.875			1		

Table C.19 WAF #1 Weathered Oil for the Kelp Forest Mysid *Holmesimysis costata*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0		278				0.125	0.042	0.072	0	0.000	0.000
						0			0		
						0			0		
0.301	135.6	314	449.6	195.1.4	0	0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
1	194.3	432	626.3	291.13	0	0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
3	209.5			210.926	0	0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
10.01	264.1	494	758.1	252.938	0	0.125	0.167	0.072	0	0.000	0.000
						0.250			0		
						0.125			0		
25	277.9	752	1029.9	226.074	0	0.125	0.208	0.072	0	0.000	0.000
						0.250			0		
						0.250			0		

Table C.20 WAF #2 Weathered Oil for the Kelp Forest Mysid *Holmesimysis costata*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0		420		0	0	0	0.125	0.125	0	0.000	0.000
						0.125			0		
						0.250			0		
0.371	163.4	320	483.4	213	0	0	0.208	0.260	0	0.000	0.000
						0.500			0		
						0.125			0		
1.005	236.8	1070	1306.8	199	54.5	0.125	0.417	0.402	0	0.000	0.000
						0.250			0		
						0.875			0		
3.005	285.1	548	833.1	312	0	0.375	0.458	0.260	0	0.000	0.000
						0.750			0		
						0.250			0		
10.04	348.3	402	750.3	306	0	0.625	0.667	0.191	0	0.000	0.000
						0.875			0		
						0.500			0		
25.005	354.2	468	822.2	282	0	0.5	.0583	0.072	0	0.000	0.000
						0.625			0		
						0.625			0		

Table C.21 WAF #3 Weathered Oil for the Kelp Forest Mysid *Holmesimysis costata*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0						0	0.000	0.000			
						0					
						0					
0.296	114.9	290	404.9			0.2	0.067	0.115			
						0					
						0					
1.016	191	350	541			0	0.200	0.200			
						0.2					
						0.4					
3.011	269.2	400	669.2			0	0.133	0.231			
						0.4					
						0					
9.995	287.7	510	797.7			0.6	0.333	0.306			
						0.4					
						0					
25.005	307.4	510	817.4			0.2	0.133	0.115			
						0					
						0.2					

Table C.22 CE-WAF #1 Fresh Oil for the Silverside Minnow *Menidia beryllina*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	678		0	0	0.2	0.067	0.115	0	0.000	0.000
						0			0		
						0			0		
0.047	697	2232	2929	183.75	27.04	0	0.000	0.000	0	0.000	0.000
						0			0		
						0			0		
0.088	1400	9922	11322	341.946	468.07	0	0.00	0.00	0.200	0.200	0.000
						0			0.200		
						0			0.200		
0.197	2246	17722	19968	635.686	974.25	0	0.067	0.115	0	0.000	0.000
						0			0		
						0.2			0		
0.536	5261	41522	46783	1109.32	3615.87	1	0.800	0.200	0.200	0.467	0.231
						0.800			0.600		
						0.800			0.600		
1.012	7284	42122	49406	868.477	2273.68	1	1.000	0.000	1	1.000	0.000
						1			1		
						1			1		

Table C.23 CE-WAF #1 Weathered Oil for the Silverside Minnow *Menidia beryllina*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	894		0	0	0.400	0.267	0.231	0	0.000	0.000
						0.400			0		
						0			0		
0.157	90.8	6076	6166.8	314.195	467.69	0.500	0.433	0.208	0.200	0.133	0.115
						0.600			0		
						0.200			0.200		
0.239	128.2	11706	11834.2	331.831	836.67	0.600	0.267	0.306	0	0.067	0.115
						0			0.2		
						0.200			0		
0.318	134.1	13206	13340.1	333.618	866.75	0.400	0.400	0.000	0	0.067	0.115
						0.400			0.2		
						0.400			0		
0.835	272.2	17206	17478.2	496.367	715.2	0.500	0.433	0.208	0.6	0.333	0.231
						0.200			0.2		
						0.600			0.2		
1.62	296.3	29206	29502.3	615.573	1471.99	1	1.000	0.000	1	1.000	0.000
						1			1		
						1			1		

Table C.24 WAF #1 Fresh Oil for the Silverside Minnow *Menidia beryllina*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	340		0	0	0.400	0.133	0.231	0	0.000	0.000
						0			0		
						0			0		
0.098	1405	415	1820	176.897	0	0.200	0.133	0.115	0	0.000	0.000
						0			0		
						0.200			0		
0.495	5022	291	5313	411.424	0	0	0.067	0.115	0	0.000	0.000
						0			0		
						0.200			0		
2.52	10698	700	11398	278.434	0	0.800	0.533	0.231	0.6	0.533	0.115
						0.400			0.4		
						0.400			0.6		
10.05	14109	1160	15269	296.121	0	0.600	0.733	0.231	0.6	0.467	0.115
						1			0.4		
						0.600			0.4		
25.03	23734	1440	25174	332.987	0	0.400	0.667	0.306	0.8	0.667	0.115
						0.600			0.6		
						1			0.6		

Table C.25 WAF #1 Weathered Oil for the Silverside Minnow *Menidia beryllina*

loading	BTEX (ppb)	TPH (PPB)	TOT-OIL	PAH (ppb)	ALK	%mort	MEAN	SD	%narcosis	MEAN	SD
0	0	883		0	0	0	0.267	0.231	0	0.000	0.000
						0.400			0		
						0.400			0		
1.03	209.9	1017	1226.9	254.78	0	0.200	0.267	0.115	0	0.000	0.000
						0.400			0		
						0.200			0		
5.01	306.1	747	1053.1	279.56	0	0.800	0.700	0.173	0	0.000	0.000
						0.500			0		
						0.800			0		
10.01	346.5	1457	1803.5	254.49	0		0.400	0.283	0	0.000	0.000
						0.200			0		
						0.600			0		
15.07	334.6	1077	1411.6	291.7	0	0.800	0.667	0.115	0	0.000	0.000
						0.600			0		
						0.600			0		
25.06	339.1	1357	1696.1	295.08	0	0.500	0.567	0.208	0	0.000	0.000
						0.800			0		
						0.400					

Appendix D:
Detailed Data Tables from the API/Florida Study

Table D.1 Toxicity Test Data for Tests Carried Out During Year 1. WAF = Water-Accommodated Fraction. CE-WAF = Chemically-Enhanced Water-Accommodated Fraction. Concentrations of Dispersant are Given in ppm. Concentrations of Oils are Given in ppb. Number Tested = Number of Organisms Tested per Chamber.

Type of Test	Organism	Age (Days)	Number Tested	Temp. (°C)	Salinity	Exposure	Toxicant	Concentrations of Toxicant
Dispersant-Only	<i>Mysidopsis bahia</i>	6	5	25	20	Continuous	Corexit® 9500	0, 16.2, 33.2, 61.2, 89.2
		6	5	25	20	Spiked	Corexit® 9500	0, 224, 449, 853, 1000, 1127
	<i>Menidia beryllina</i>	12	5	25	20	Continuous	Corexit® 9500	0, 16.2, 33.2, 61.2, 89.2
		12	10	25	20	Spiked	Corexit® 9500	0, 16.5, 34, 52, 74, 93
WAF	<i>Mysidopsis bahia</i>	6	5	25	20	Continuous	Venezuelan crude oil	0, 83, 85.7, 211, 255.7, 737
		6	5	25	20	Spiked	Venezuelan crude oil	0, 79, 192, 400, 737, 1260
		6	5	25	20	Continuous	Kuwait crude oil	0, 138, 234, 572, 834, 874
	<i>Menidia beryllina</i>	12	5	25	20	Continuous	Venezuelan crude oil	0, 107, 187, 274, 1260
		12	5	25	20	Spiked	Venezuelan crude oil	0, 79, 192, 400, 737, 1700
CE-WAF	<i>Mysidopsis bahia</i>	6	5	25	20	Continuous	Venezuelan/ Corexit® 9500	0, 255, 445, 741, 2554
		6	5	25	20	Spiked	Venezuelan/ Corexit® 9500	0, 251, 1443, 2762, 8496
	<i>Menidia beryllina</i>	12	5	25	20	Continuous	Venezuelan/ Corexit® 9500	0, 255, 445, 741, 2554
		12	5	25	20	Spiked	Venezuelan/ Corexit® 9500	0, 251, 1443, 2762, 8496

Table D.2 Toxicity Test Data for Tests Carried Out During Year 2. WAF = Water-Accommodated Fraction. CE-WAF = Chemically-Enhanced Water-Accommodated Fraction. Concentrations of Dispersant are Given in ppm. Concentrations of Oils are Given in ppb. Number Tested = Number of Organisms Tested per Chamber.

Type of Test	Organism	Age (Days)	Number Tested	Temp (°C)	Salinity	Exposure	Toxicant	Concentrations of Toxicant
Dispersant-Only	<i>Sciaenops ocellatus</i>	16	5	25	25	Spiked	Corexit® 9500	0, 545, 1016, 1520, 2007
WAF	<i>Mysidopsis bahia</i>	6	5	25	20	Continuous	Venezuelan crude oil	0, 325, 347, 556, 651
		6	5	25	20	Continuous	Venezuelan crude oil	0, 123, 155, 213, 271
		6	5	25	20	Spiked	Venezuelan crude oil	0, 925, 962, 1436, 2171
		6	5	25	20	Spiked	Venezuelan crude oil	0, 217, 236, 289, 392
		6	5	25	20	Spiked	Prudhoe Bay crude oil	0, 1640, 1745, 1767, 4470, 6863
	<i>Menidia beryllina</i>	12	5	25	20	Spiked	Prudhoe Bay crude oil	0, 1640, 1745, 1767, 4470, 6863
	<i>Sciaenops ocellatus</i>	16	5	25	25	Spiked	Venezuelan crude oil	0, 446, 503, 820, 874
CE-WAF	<i>Mysidopsis bahia</i>	6	5	25	20	Continuous	Venezuelan/ Corexit® 9500	0, 483, 717, 1271
		6	5	25	20	Continuous	Venezuelan/ Corexit® 9500	0, 539, 989, 1271
		6	5	25	20	Spiked	Venezuelan/ Corexit® 9500	0, 7239, 12485, 39468
		6	5	25	20	Spiked	Venezuelan/ Corexit® 9500	0, 13149, 22005, 39468
		6	5	25	20	Spiked	Prudhoe Bay/ Corexit® 9500	0, 1339, 6993, 84876, 126035, 350185
	<i>Menidia beryllina</i>	12	5	25	20	Spiked	Prudhoe Bay/ Corexit® 9500	0, 1339, 6993, 84876, 126035, 350185
	<i>Sciaenops ocellatus</i>	16	5	25	25	Spiked	Venezuelan/ Corexit® 9500	0, 1250, 14327, 17029, 28295, 31654

Table D.3 Toxicity Test Data for Tests Carried Out During Year 3. WAF = Water-Accommodated Fraction. CE-WAF = Chemically-Enhanced Water-Accommodated Fraction. Concentrations of Oils are Given in PPB. Number Tested = Number of Organisms Tested per Chamber.

Type of Test	Organism	Age (Days)	Number Tested	Temp (°C)	Salinity	Exposure	Toxicant	Concentrations of Toxicant
WAF	<i>Mysidopsis bahia</i>	6	5	25	20	Spiked	Weathered Venezuelan crude oil	0, 434, 676, 827, 835
		6	5	25	20	Spiked	Weathered Venezuelan crude oil	0, 128, 208, 224, 265, 627
	<i>Menidia beryllina</i>	12	5	25	20	Spiked	Weathered Venezuelan crude oil	0, 475, 671, 680, 1061
CE-WAF	<i>Mysidopsis bahia</i>	6	5	25	20	Spiked	Weathered Venezuelan crude oil	0, 10921, 18841, 48390, 62575, 75197
		6	5	25	20	Spiked	Weathered Venezuelan crude oil	0, 521, 29706, 56255, 102316, 131118
	<i>Menidia beryllina</i>	12	5	25	20	Spiked	Weathered Venezuelan crude oil	0, 19815, 51633

Table D.4 Alkanes Found in Venezuelan Crude Oil (VCO), VCO Water-Accommodated Fraction (WAF) and VCO Chemically-Enhanced Water-Accommodated Fraction (CE-WAF).
nd = none detected.

Alkane	Venezuelan Crude Oil (mg/g oil)	WAF (ppm) (Loading Rate = 4.8 g/L)	CE-WAF (ppm) (Loading Rate = 5.0 g/L)
nC ₁₀	5.86	nd	0.39
nC ₁₁	5.17	nd	0.42
nC ₁₂	4.59	nd	0.40
nC ₁₃	4.21	nd	0.43
nC ₁₄	3.93	nd	0.22
nC ₁₅	2.29	nd	0.28
nC ₁₆	3.45	nd	0.26
nC ₁₇	3.45	nd	0.27
nC ₁₈	3.10	nd	0.24
nC ₁₉	2.24	nd	0.18
nC ₂₀	2.63	nd	0.20
nC ₂₁	2.50	nd	0.19
nC ₂₂	2.56	nd	0.18
nC ₂₃	2.45	nd	0.21
nC ₂₄	2.70	nd	0.20
nC ₂₅	2.56	nd	0.20
nC ₂₆	2.53	nd	0.20
nC ₂₇	2.37	nd	0.19
nC ₂₈	1.98	nd	0.16
nC ₂₉	1.77	nd	0.15
nC ₃₀	1.23	nd	0.10
nC ₃₁	0.98	nd	0.08
nC ₃₂	0.53	nd	0.03
nC ₃₃	0.34	nd	0.02
nC ₃₄	0.05	nd	nd
Total Alkanes	65.5 mg/g oil	nd	4.8 ppm

Table D.5 Polycyclic Aromatic Hydrocarbons (PAH) Found in Venezuelan Crude Oil (VCO), VCO Water-Accommodated Fraction (WAF) and VCO Chemically-Enhanced Water-Accommodated Fraction (CE-WAF). nd = none detected.

PAH	Venezuelan Crude Oil (mg/g oil)	WAF (ppm) (Loading Rate = 4.8 g/L)	CE-WAF (ppm) (Loading Rate = 5.0 g/L)
naphthalene	1.36	0.15	0.43
C-1 naphthalenes	2.43	0.10	0.25
C-2 naphthalenes	3.33	0.04	0.35
C-3 naphthalenes	2.29	0.01	0.23
C-4 naphthalenes	1.42	nd	0.15
fluorene	0.13	<0.01	0.02
C-1 fluorenes	0.27	<0.01	0.03
C-2 fluorenes	0.44	<0.01	0.04
C-3 fluorenes	0.52	0.00	0.04
dibenzothiophene	0.08	<0.01	0.01
C-1 dibenzothiophenes	0.33	<0.01	0.04
C-2 dibenzothiophenes	0.54	<0.01	0.07
C-3 dibenzothiophenes	0.78	nd	0.05
C-4 dibenzothiophenes	0.46	nd	0.03
phenanthrene	2.92	0.01	0.04
C-1 phenanthrenes	0.61	<0.01	0.06
C-2 phenanthrenes	0.78	<0.01	0.08
C-3 phenanthrenes	0.64	nd	0.05
C-4 phenanthrenes	0.36	nd	0.02
fluoranthene	0.00	nd	nd
pyrene	0.02	nd	nd
C-1 pyrenes	0.01	nd	nd
C-2 pyrenes	0.07	nd	nd
C-3 pyrenes	0.09	nd	nd

Table D.5 Continued.

<u>PAH</u>	<u>Venezuelan Crude Oil (mg/g oil)</u>	<u>WAF (ppm) (Loading Rate = 4.8 g/L)</u>	<u>CE-WAF (ppm) (Loading Rate = 5.0 g/L)</u>
C-4 pyrenes	0.08	nd	nd
benzo(a,h)anthracene	0.02	nd	nd
Chrysene	nd	nd	nd
C-1 chrysenes	0.03	nd	nd
C-2 chrysenes	0.03	nd	nd
C-3 chrysenes	0.03	nd	nd
C-4 chrysenes	nd	nd	nd
benzo(b)fluoranthene	nd	nd	nd
benzo(k)fluoranthene	nd	nd	nd
benzo(e)pyrene	nd	nd	nd
benzo(a)pyrene	nd	nd	nd
perylene	nd	nd	nd
indeno(g,h,i)pyrene	nd	nd	nd
dibenzo(a,h)anthracene	nd	nd	nd
benzo(1,2,3- cd)perylene	nd	nd	nd
Total PAH's	20.5 mg/g oil	0.3 ppm	2.0 ppm

Table D.6 Volatile Hydrocarbons Found in Water-Accommodated Fraction (WAF) and Chemically-Enhanced Water-Accommodated Fraction (CE-WAF) of Venezuelan Crude Oil.

<u>Compound</u>	<u>WAF (ppm)</u> <u>(Loading Rate = 0.41 g/L)</u>	<u>CE-WAF (ppm)</u> <u>(Loading Rate = 0.11 g/L)</u>
benzene	0.08	0.10
toluene	0.42	0.41
ethylbenzene	0.05	0.06
m+p-xylene	0.37	0.43
o-xylene	0.12	0.14
C ₃ -benzenes	0.15	0.21
C ₄ -benzenes (butyl only)	0.12	0.04
Total Volatiles	1.2 ppm	1.4 ppm

Table D.7 Alkanes Found in Weathered Venezuelan Crude Oil (WVCO), WVCO Water-Accommodated Fraction (WAF) and WVCO Chemically-Enhanced Water-Accommodated Fraction (CE-WAF). nd = none detected.

Alkane	Venezuelan Crude Oil (mg/g oil)	WAF (ppm) (Loading Rate = 9.6 g/L)	CE-WAF (ppm) (Loading Rate = 5.0 g/L)
nC ₁₀	nd	nd	nd
nC ₁₁	0.19	nd	nd
nC ₁₂	2.03	nd	0.02
nC ₁₃	4.36	nd	0.14
nC ₁₄	5.43	nd	0.19
nC ₁₅	5.16	nd	0.23
nC ₁₆	4.58	nd	0.24
nC ₁₇	5.27	nd	0.27
nC ₁₈	4.35	nd	0.23
nC ₁₉	3.02	nd	0.23
nC ₂₀	3.21	nd	0.25
nC ₂₁	3.61	nd	0.26
nC ₂₂	3.54	nd	0.22
nC ₂₃	3.83	nd	0.27
nC ₂₄	3.67	nd	0.27
nC ₂₅	3.84	nd	0.30
nC ₂₆	4.02	nd	0.29
nC ₂₇	3.82	nd	0.32
nC ₂₈	3.50	nd	0.24
nC ₂₉	3.45	nd	0.23
nC ₃₀	2.84	nd	0.15
nC ₃₁	2.48	nd	0.13
nC ₃₂	1.49	nd	0.07
nC ₃₃	0.58	nd	0.03
nC ₃₄	0.36	nd	0.01
Total Alkanes	78.6 mg/g oil	nd	4.6 ppm

Table D.8. Polycyclic Aromatic Hydrocarbons (PAH) Found in Weathered Venezuelan Crude Oil (WVCO), WVCO Water-Accommodated Fraction (WAF) and WVCO Chemically-Enhanced Water-Accommodated Fraction (CE-WAF). nd = none detected.

PAH	Weathered Venezuelan Crude Oil (mg/g oil)	WAF (ppm) (Loading Rate = 9.96 g/L)	CE-WAF (ppm) (Loading Rate = 5.0 g/L)
naphthalene	0.28	0.03	0.02
C-1 naphthalenes	3.15	0.12	0.21
C-2 naphthalenes	5.94	0.08	0.38
C-3 naphthalenes	4.04	0.02	0.26
C-4 naphthalenes	1.91	nd	0.16
fluorene	0.32	nd	0.02
C-1 fluorenes	0.38	nd	0.04
C-2 fluorenes	0.59	nd	0.06
C-3 fluorenes	0.66	nd	0.06
C-4 fluorenes	0.33	nd	0.02
dibenzothiophene	0.35	nd	0.02
C-1 dibenzothiophenes	0.52	nd	0.05
C-2 dibenzothiophenes	0.72	nd	0.10
C-3 dibenzothiophenes	0.83	nd	0.10
C-4 dibenzothiophenes	0.48	nd	0.08
phenanthrene	0.52	<0.01	0.06
C-1 phenanthrenes	1.09	nd	0.10
C-2 phenanthrenes	1.05	nd	0.12
C-3 phenanthrenes	0.86	nd	0.11
C-4 phenanthrenes	0.56	nd	0.02
fluoranthene	nd	nd	0.00
pyrene	0.26	nd	0.00
C-1 pyrenes	0.33	nd	0.00
C-2 pyrenes	0.16	nd	0.00

Table D.8. Continued.

<u>PAH</u>	<u>Weathered Venezuelan Crude Oil (mg/g oil)</u>	<u>WAF (ppm) (Loading Rate = 9.96 g/L)</u>	<u>CE-WAF (ppm) (Loading Rate = 5.0 g/L)</u>
C-3 pyrenes	0.19	nd	0.00
C-4 pyrenes	0.16	nd	0.00
benzo(a,h)anthracene	0.10	nd	0.00
Chrysene	0.06	nd	nd
C-1 chrysenes	0.11	nd	nd
C-2 chrysenes	0.10	nd	nd
C-3 chrysenes	0.06	nd	nd
C-4 chrysenes	nd	nd	nd
benzo(b)fluoranthene	nd	nd	nd
benzo(k)fluoranthene	0.05	nd	nd
benzo(e)pyrene	0.09	nd	nd
benzo(a)pyrene	nd	nd	nd
perylene	nd	nd	nd
indeno(g,h,i)pyrene	nd	nd	nd
dibenzo(a,h)anthracene	0.03	nd	nd
benzo(1,2,3-cd)perylene	nd	nd	nd
Total PAH's	26.3 mg/g oil	0.3 ppm	2.0 ppm

Table D.9 Volatile Hydrocarbons Found in Water-Accommodated Fraction (WAF) and Chemically-Enhanced Water-Accommodated Fraction (CE-WAF) of weathered Venezuelan Crude Oil (WVCO).

Compound	WAF (µg/L) (Loading Rate = 9.6 g/L)	CE-WAF (µg/L) (Loading Rate = 5.0 g/L)
benzene	1	1
toluene	5	3
ethylbenzene	<0.2	1
m+p-xylene	<0.6	<0.6
o-xylene	<0.2	0
C ₃ -benzenes	<0.3	1
C ₄ -benzenes (butyl only)	1	1
Total Volatiles	7.0 µg/L	7.0 µg/L

Table D.10 Results of Continuous Exposure 96-Hour Dispersant-Only Toxicity Test Using 6-Day Old *Mysidopsis bahia* and Corexit[®] 9500 (carried out during Year 1).

Nominal Concentration (ppm)	Measured Concentration (ppm)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
20	16.2	5/5	4/5	4/5	13/15	87
40	33.2	4/5	2/5	4/5	10/15	67
60	61.2	0/5	0/5	0/5	0/15	0
80	89.2	0/5	0/5	0/5	0/15	0

Table D.11 Results of Spiked Exposure 96-Hour Dispersant-Only Toxicity Test Using 6-Day Old *Mysidopsis bahia* and Corexit[®] 9500 (carried out during Year 1). LIP = Lost in Process During Test.

Nominal Concentration (ppm)	Measured Concentration (ppm)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
250	224	5/5	5/5	5/5	15/15	100
500	449	LIP	3/5	4/5	7/10	70
1000	853	5/5	3/5	5/5	13/15	87
1250	1000	3/5	5/5	4/5	12/15	80
1500	1127	0/5	2/5	0/5	2/15	13

Table D.12. Results of Continuous Exposure 96-Hour Dispersant-Only Toxicity Test Using 12-Day Old *Menidia beryllina* and Corexit[®] 9500 (carried out during Year 1).

Nominal Concentration (ppm)	Measured Concentration (ppm)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	4/5	5/5	5/5	14/15	93
20	16.2	4/5	4/5	5/5	13/15	87
40	33.2	4/5	4/5	4/5	12/15	80
60	61.2	2/5	3/5	5/5	10/15	67
80	89.2	2/5	3/5	1/5	6/15	40

Table D.13 Results of Spiked Exposure 96-Hour Dispersant-Only Toxicity Test Using 12-Day Old *Menidia beryllina* and Corexit® 9500 (carried out during Year 1). LIP = Lost in Process During Test.

Nominal Concentration (ppm)	Measured Concentration (ppm)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	9/10	LIP	9/10	18/20	90
25	16.5	6/10	6/10	8/10	20/30	67
50	34.0	1/10	0/10	1/10	2/30	7
75	52.0	1/10	LIP	1/10	2/20	10
100	74.0	0/10	0/10	2/10	2/30	7
125	93.0	0/10	0/10	0/10	0/30	0

Table D.14 Results of Spiked Exposure 96-Hour Dispersant-Only Toxicity Test Using 16-Day Old *Sciaenops ocellatus* and Corexit® 9500 (carried out during Year 2).

Nominal Concentration (ppm)	Measured Concentration (ppm)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
500	545	5/5	5/5	5/5	15/15	100
1000	1016	0/5	0/5	0/5	0/15	0
1500	1520	0/5	0/5	0/5	0/15	0
2000	2007	0/5	0/5	0/5	0/15	0

Table D.15 Results of Continuous Exposure 96-Hour Water Accommodated Fraction Toxicity Test (Replicate 1) Using 6-Day Old *Mysidopsis bahia* and Venezuelan Crude Oil (carried out during Year 1).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
6.2	83.0	4/5	5/5	5/5	14/15	93
30.3	85.7	3/5	4/5	2/5	9/15	60
62.3	211.0	1/5	5/5	3/5	9/15	60
119.3	255.7	3/5	3/5	4/5	10/15	67
406.0	737.0	0/5	0/5	0/5	0/15	0

Table D.16 Results of Continuous Exposure 96-Hour Water Accommodated Fraction Toxicity Test (Replicate 2) Using 6-Day Old *Mysidopsis bahia* and Venezuelan Crude Oil (carried out during Year 2).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	4/5	5/5	4/5	13/15	87
50	347	3/5	4/5	1/5	8/15	53
105	325	3/5	2/5	3/5	8/15	53
212	556	0/5	2/5	1/5	3/15	20
293	651	3/5	1/5	1/5	5/15	33

Table D.17 Results of Continuous Exposure 96-Hour Water Accommodated Fraction Toxicity Test (Replicate 3) Using 6-Day Old *Mysidopsis bahia* and Venezuelan Crude Oil (carried out during Year 2).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	4/5	5/5	14/15	93
56	123	3/5	4/5	1/5	8/15	53
107	155	5/5	0/5	2/5	7/15	47
202	271	3/5	0/5	0/5	3/15	20
298	213	0/5	1/5	0/5	1/15	7

Table D.18 Results of Continuous Exposure 96-Hour Water-Accommodated Fraction Toxicity Test Using 6-Day Old *Mysidopsis bahia* and Kuwait Crude Oil (carried out during Year 1).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	lost	5/5	10/10	100
128	138	4/5	3/5	4/5	11/15	73
327	234	3/5	4/5	1/5	8/15	53
801	572	4/5	3/5	5/5	12/15	80
1992	834	0/5	0/5	0/5	0/15	0

Table D.19 Results of Spiked Exposure 96-Hour Water-Accommodated Fraction Toxicity Test (Replicate 1) Using 6-Day Old *Mysidopsis bahia* and Venezuelan Crude Oil (carried out during Year 1).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
6.5	79	4/5	5/5	5/5	14/15	93
102	192	5/5	4/5	3/5	12/15	80
406	400	5/5	5/5	5/5	15/15	100
738	737	5/5	5/5	3/5	13/15	87
1700	1260	0/5	0/5	0/5	0/15	0

Table D.20 Results of Spiked Exposure 96-Hour Water-Accommodated Fraction Toxicity Test (Replicate 2) Using 6-Day Old *Mysidopsis bahia* and Venezuelan Crude Oil (carried out during Year 2). LIP = Lost in Process During Test.

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	LIP	5/5	5/5	10/10	100
562	925	2/5	2/5	0/5	4/15	27
957	962	0/5	3/5	1/5	4/15	27
2000	1436	3/5	2/5	3/5	8/15	53
3002	2171	1/5	1/5	0/5	2/15	13

Table D.21 Results of Spiked Exposure 96-Hour Water-Accommodated Fraction Toxicity Test (Replicate 3) Using 6-Day Old *Mysidopsis bahia* and Fresh Venezuelan Crude Oil (carried out during Year 2).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	4/5	5/5	5/5	14/15	93
293	217	5/5	5/5	5/5	15/15	100
498	236	5/5	4/5	4/5	13/15	87
705	289	5/5	4/5	4/5	13/15	87
943	392	4/5	3/5	4/5	11/15	73

Table D.22 Results of Spiked Exposure 96-Hour Water-Accommodated Fraction Toxicity Test Using 6-Day Old *Mysidopsis bahia* and Prudhoe Bay Crude Oil (carried out during Year 2).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
450	1640	5/5	5/5	5/5	15/15	100
1025	1745	4/5	5/5	5/5	14/15	93
2000	1767	4/5	4/5	5/5	13/15	87
3015	4470	5/5	3/5	3/5	11/15	73
10001	6863	3/5	4/5	4/5	11/15	73

Table D.23 Results of Spiked Exposure 96-Hour Water-Accommodated Fraction Toxicity Test Using 16-Day Old *Sciaenops ocellatus* and Venezuelan Crude Oil (carried out during Year 2). LIP = Lost in Process During Test.

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
2595	446	5/5	5/5	LIP	10/10	100
3500	503	3/5	5/5	5/5	13/15	87
4465	820	2/5	2/5	4/5	8/15	53
6045	874	3/5	3/5	1/5	7/15	47

Table D.24 Results of Continuous Exposure 96-Hour Water-Accommodated Fraction Toxicity Test Using 12-Day Old *Menidia beryllina* and Venezuelan Crude Oil (carried out during Year 1).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
8	107	0/5	0/5	0/5	0/15	0
14	187	0/5	0/5	0/5	0/15	0
45	274	0/5	0/5	0/5	0/15	0
1700	1260	0/5	0/5	0/5	0/15	0

Table D.25 Results of Spiked Exposure 96-Hour Water-Accommodated Fraction Toxicity Test Using 12-Day Old *Menidia beryllina* and Venezuelan Crude Oil (carried out during Year 1).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	4/5	5/5	5/5	14/15	93
6.5	79	5/5	5/5	5/5	15/15	100
102	192	5/5	5/5	4/5	14/15	93
406	400	3/5	5/5	4/5	12/15	80
738	737	5/5	4/5	5/5	14/15	93
1700	1260	0/5	0/5	0/5	0/15	0

Table D.26 Results of Spiked Exposure 96-Hour Water-Accommodated Fraction Toxicity Test Using 12-Day Old *Menidia beryllina* and Prudhoe Bay Crude Oil (carried out during Year 2).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
450	1640	5/5	5/5	5/5	15/15	100
1025	1745	3/5	5/5	5/5	13/15	87
2000	1767	3/5	4/5	4/5	11/15	73
3015	4470	4/5	5/5	3/5	12/15	80
10001	6863	3/5	4/5	4/5	11/15	73

Table D.27 Results of Spiked Exposure 96-Hour Water-Accommodated Fraction Toxicity Test (Replicate 1) Using 6-Day Old *Mysidopsis bahia* and Weathered Venezuelan Crude Oil (carried out during Year 3).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
1100	128	5/5	5/5	5/5	15/15	100
1820	434	5/5	5/5	5/5	15/15	100
2760	676	5/5	5/5	5/5	15/15	100
9830	827	5/5	5/5	5/5	15/15	100

Table D.28 Results of Spiked Exposure 96-Hour Water-Accommodated Fraction Toxicity Test (Replicate 2) Using 6-Day Old *Mysidopsis bahia* and Weathered Venezuelan Crude Oil (carried out during Year 3).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
1100	128	5/5	5/5	5/5	15/15	100
2500	224	5/5	5/5	5/5	15/15	100
4880	265	5/5	5/5	5/5	15/15	100
7750	208	5/5	5/5	5/5	15/15	100
9960	627	5/5	5/5	5/5	15/15	100

Table D.29 Results of Spiked Exposure 96-Hour Water-Accommodated Fraction Toxicity Test Using 12-Day Old *Menidia beryllina* and Weathered Venezuelan Crude Oil (carried out during Year 3).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	4/5	5/5	5/5	14/15	93
900	475	5/5	5/5	5/5	15/15	100
4900	671	5/5	5/5	5/5	15/15	100
7600	680	5/5	5/5	5/5	15/15	100
10180	1061	5/5	5/5	5/5	15/15	100

Table D.30 Results of Continuous Exposure 96-Hour Chemically-Enhanced Water-Accommodated Fraction Toxicity Test (Replicate 1) Using 6-Day Old *Mysidopsis bahia*, Venezuelan Crude Oil, and Corexit[®] 9500 (carried out during Year 1).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
6.2	255	5/5	5/5	5/5	15/15	100
52.5	445	5/5	4/5	2/5	11/15	73
121.3	741	0/5	0/5	1/5	1/15	7
303.0	2554	0/5	0/5	0/5	0/15	0

Table D.31 Results of Continuous Exposure 96-Hour Chemically-Enhanced Water-Accommodated Fraction Toxicity Test (Replicate 2) Using 6-Day Old *Mysidopsis bahia*, Venezuelan Crude Oil, and Corexit[®] 9500 (carried out during Year 2).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
55	483	3/5	1/5	4/5	8/15	53
90	717	0/5	0/5	0/5	0/15	0
220	1271	0/5	0/5	0/5	0/15	0

Table D.32 Results of Continuous Exposure 96-Hour Chemically-Enhanced Water-Accommodated Fraction Toxicity Test (Replicate 3) Using 6-Day Old *Mysidopsis bahia*, Venezuelan Crude Oil, and Corexit[®] 9500 (carried out during Year 2).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
65	539	1/5	3/5	3/5	7/15	47
115	989	1/5	0/5	0/5	1/15	7
220	1271	0/5	0/5	0/5	0/15	0

Table D.33 Results of Spiked Exposure 96-Hour Chemically-Enhanced Water-Accommodated Fraction Toxicity Test (Replicate 1) Using 6-Day Old *Mysidopsis bahia*, Venezuelan Crude Oil, and Corexit® 9500 (carried out during Year 1).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
6.1	251	5/5	4/5	5/5	14/15	93
310	1443	5/5	5/5	5/5	15/15	100
752	2762	5/5	2/5	4/5	11/15	73
1506	8496	3/5	0/5	5/5	8/15	53

Table D.34 Results of Spiked Exposure 96-Hour Chemically-Enhanced Water-Accommodated Fraction Toxicity Test (Replicate 2) Using 6-Day Old *Mysidopsis bahia*, Venezuelan Crude Oil, and Corexit® 9500 (carried out during Year 2).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	4/5	14/15	93
1201	7239	5/5	5/5	4/5	14/15	93
2997	12485	0/5	0/5	2/5	2/15	13
4900	39468	2/5	1/5	1/5	4/15	27

Table D.35 Results of Spiked Exposure 96-Hour Chemically-Enhanced Water-Accommodated Fraction Toxicity Test (Replicate 3) Using 6-Day Old *Mysidopsis bahia*, Venezuelan Crude Oil, and Corexit[®] 9500 (carried out during Year 2).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	4/5	14/15	93
1850	13149	5/5	5/5	2/5	12/15	80
3600	22005	1/5	1/5	2/5	4/15	27
4900	39468	2/5	0/5	2/5	4/15	27

Table D.36 Results of Spiked Exposure 96-Hour Chemically-Enhanced Water-Accommodated Fraction Toxicity Test Using 6-Day Old *Mysidopsis bahia*, Prudhoe Bay Crude Oil, and Corexit[®] 9500 (carried out during Year 2).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	4/5	14/15	93
505	1339	5/5	5/5	5/5	15/15	100
1002	6993	4/5	3/5	4/5	11/15	73
1975	84876	0/5	0/5	0/5	0/15	0
2965	126035	1/5	0/5	0/5	1/15	7
9920	350185	0/5	0/5	0/5	0/15	0

Table D.37 Results of Spiked Exposure 96-Hour Chemically-Enhanced Water-Accommodated Fraction Toxicity Test Using 12-Day Old *Menidia beryllina*, Prudhoe Bay Crude Oil, and Corexit® 9500 (carried out during Year 2).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	4/5	5/5	5/5	14/15	93
505	1339	4/5	5/5	5/5	14/15	93
1002	6993	4/5	5/5	3/5	12/15	80
1975	84876	0/5	0/5	0/5	0/15	0
2965	126035	0/5	0/5	0/5	0/15	0
9920	350185	0/5	0/5	0/5	0/15	0

Table D.38 Results of Spiked Exposure 96-Hour Chemically-Enhanced Water-Accommodated Fraction Toxicity Test Using 16-Day Old *Sciaenops ocellatus*, Venezuelan Crude Oil, and Corexit® 9500 (carried out during Year 2).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
615	1250	5/5	5/5	3/5	13/15	87
1085	14327	0/5	0/5	2/5	2/15	13
4390	17029	0/5	0/5	0/5	0/15	0
1775	28295	0/5	0/5	0/5	0/15	0
2440	31654	0/5	0/5	0/5	0/15	0

Table D.39 Results of Continuous Exposure 96-Hour Chemically-Enhanced Water-Accommodated Fraction Toxicity Test Using 12-Day Old *Menidia beryllina*, Venezuelan Crude Oil, and Corexit® 9500 (carried out during Year 1).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	4/5	5/5	14/15	93
6.2	255	5/5	4/5	5/5	14/15	93
52.5	445	3/5	5/5	2/5	10/15	67
121	741	1/5	2/5	3/5	6/15	40
303	2553	0/5	0/5	0/5	0/15	0

Table D.40 Results of Spiked Exposure 96-Hour Chemically-Enhanced Water-Accommodated Fraction Toxicity Test Using 12-Day Old *Menidia beryllina*, Venezuelan Crude Oil, and Corexit® 9500 (carried out during Year 1). LIP = Lost in Process During Test.

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
6.1	251	LIP	4/5	5/5	9/10	90
310	1443	4/5	5/5	LIP	9/10	90
752	2762	3/5	0/5	4/5	7/15	47
1506	8496	0/5	0/5	1/5	1/15	7

Table D.41 Results of Spiked Exposure 96-Hour Chemically-Enhanced Water-Accommodated Fraction Toxicity Test Using 6-Day Old *Mysidopsis bahia*, Weathered Venezuelan Crude Oil, and Corexit® 9500 (carried out during Year 3).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
540	10921	5/5	5/5	3/5	13/15	87
810	18841	5/5	4/5	3/5	12/15	80
2160	48390	5/5	5/5	4/5	14/15	93
2530	62575	5/5	5/5	4/5	14/15	93
5000	75197	1/5	2/5	3/5	6/15	40

Table D.42 Results of Spiked Exposure 96-Hour Chemically-Enhanced Water-Accommodated Fraction Toxicity Test Using 6-Day Old *Mysidopsis bahia*, Weathered Venezuelan Crude Oil, and Corexit® 9500 (carried out during Year 3). LIP = Lost in Process During Test.

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	5/5	5/5	15/15	100
630	521	5/5	5/5	3/5	13/15	87
1080	29706	4/5	5/5	5/5	14/15	93
2000	56255	4/5	4/5	LIP	8/10	80
4150	102316	3/5	LIP	5/5	8/10	80
6150	131118	2/5	3/5	0/5	5/15	33

Table D.43 Results of Spiked Exposure 96-Hour Chemically-Enhanced Water-Accommodated Fraction Toxicity Test Using 12-Day Old *Menidia beryllina*, Venezuelan Crude Oil, and Corexit[®] 9500 (carried out during Year 1).

Loading Rate (ppm)	TPH Concentration (ppb)	Number Surviving Test 1	Number Surviving Test 2	Number Surviving Test 3	Number Surviving Total	% Survival
0	0	5/5	4/5	5/5	14/15	93
960	19815	5/5	4/5	4/5	13/15	87
2400	51633	0/5	0/5	0/5	0/15	0

Appendix E:

Detailed Data Tables from the API/Texas Study

Table E.1 Results of Toxicity Test No. 1

Exposure Media	Corexit [®] 9500 (Dispersant Only)		
Exposure Regime	Continuous Exposure		
Species	<i>Menidia beryllina</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
50.3	15	15/15	100
100.2	4	4/15	27
200.2	0	0/15	0
250.1	0	0/15	0
500.4	0	0/15	0

Table E.2 Results of Toxicity Test No. 2

Exposure Media	Corexit [®] 9500 (Dispersant Only)		
Exposure Regime	Continuous Exposure		
Species	<i>Menidia beryllina</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
50.3	11	11/15	73
100.1	5	5/15	33
200.1	0	0/15	0
250.1	0	0/15	0
500.2	0	0/15	0

Table E.3 Results of Toxicity Test No. 3

Exposure Media	Corexit [®] 9500 (Dispersant Only)		
Exposure Regime	Continuous Exposure		
Species	<i>Mysidopsis bahia</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
12.3	12	12/15	100
18.1	12	12/15	80
25.4	11	11/15	73
35.4	8	8/15	53
50.6	3	3/15	20

Table E.4 Results of Toxicity Test No. 4

Exposure Media	Corexit [®] 9500 (Dispersant Only)		
Exposure Regime	Continuous Exposure		
Species	<i>Mysidopsis bahia</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
12	12	12/15	80
17.9	12	12/15	80
25.5	11	11/15	73
35.8	9	9/15	60
50.9	1	1/15	7

Table E.5 Results of Toxicity Test No. 5

Exposure Media	Corexit [®] 9500 (Dispersant Only)		
Exposure Regime	Declining Exposure		
Species	<i>Menidia beryllina</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
54.3	15	15/15	100
100.1	9	9/15	60
250	0	0/15	0
500.3	0	0/15	0
1000	0	0/15	0

Table E.6 Results of Toxicity Test No. 6

Exposure Media	Corexit [®] 9500 (Dispersant Only)		
Exposure Regime	Declining Exposure		
Species	<i>Menidia beryllina</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
48	15	15/15	100
103.5	0	0/15	0

Table E.7 Results of Toxicity Test No. 7

Exposure Media	Corexit [®] 9500 (Dispersant Only)		
Exposure Regime	Declining Exposure		
Species	<i>Menidia beryllina</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
23	12	12/15	100
54.8	6	6/15	40
112	0	0/15	0
157	0	0/15	0
254	0	0/15	0

Table E.8 Results of Toxicity Test No. 8

Exposure Media	Corexit [®] 9500 (Dispersant Only)		
Exposure Regime	Declining Exposure		
Species	<i>Mysidopsis bahia</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
26.5	15	15/15	100
54.5	15	15/15	100
102.5	12	12/15	80
256.5	11	11/15	73
257	11	11/15	73

Table E.9 Results of Toxicity Test No. 9

Exposure Media	Corexit [®] 9500 (Dispersant Only)		
Exposure Regime	Declining Exposure		
Species	<i>Mysidopsis bahia</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
104.4	15	15/15	100
252.6	11	11/15	73
504.4	11	11/15	73
752	11	11/15	73
1005.6	8	8/15	53

Table E.10 Results of Toxicity Test No. 10

Exposure Media	Weathered Oil WAF		
Exposure Regime	Continuous Exposure		
Species	<i>Menidia beryllina</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
1.579456	12	12/15	80
1.651897	12	12/15	80
3.029292	10	10/15	67
4.147102	7	7/15	47
5.180356	9	9/15	60

Table E.11 Results of Toxicity Test No. 11

Exposure Media	Weathered Oil WAF		
Exposure Regime	Continuous Exposure		
Species	<i>Menidia beryllina</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	16	16/16	100
0.825763	14	14/16	88
1.375772	10	10/15	67
2.926781	10	10/15	67
4.381876	5	5/15	33
4.788701	11	11/17	65

Table E.12 Results of Toxicity Test No. 12

Exposure Media	Weathered Oil WAF		
Exposure Regime	Continuous Exposure		
Species	<i>Mysidopsis bahia</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	16	16/16	100
1.051491	2	2/15	13
1.535521	1	1/15	7
2.852912	0	0/16	0
3.620232	0	0/17	0
5.631845	0	0/16	0

Table E.13 Results of Toxicity Test No. 13

Exposure Media	Weathered Oil WAF		
Exposure Regime	Continuous		
Species	<i>Mysidopsis bahia</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	18	18/18	100
0.634078	12	12/16	75
0.647296	8	8/16	50
0676352	4	4/16	25
0.800056	7	7/17	41
1.242017	1	1/16	6

Table E.14 Results of Toxicity Test No. 14

Exposure Media	Weathered Oil WAF		
Exposure Regime	Declining Exposure		
Species	<i>Menidia beryllina</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
2.5	15	15/15	100
5.4	15	15/15	100
6.9	15	15/15	100
9	15	15/15	100
14.5	15	15/15	100

Table E.15 Results of Toxicity Test No. 15

Exposure Media	Weathered Oil WAF		
Exposure Regime	Declining Exposure		
Species	<i>Menidia beryllina</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
11.6	15	15/15	100
14.9	15	15/15	100
17.2	15	15/15	100
18.9	15	15/15	100
32.2	15	15/15	100

Table E.16 Results of Toxicity Test No. 16

Exposure Media	Weathered Oil WAF		
Exposure Regime	Declining Exposure		
Species	<i>Mysidopsis bahia</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
6.6	15	15/15	100
8.2	14	14/15	93
11.1	13	13/15	87
13.9	13	13/15	87
14.3	12	12/15	80

Table E.17 Results of Toxicity Test No. 17

Exposure Media	Weathered Oil WAF		
Exposure Regime	Declining Exposure		
Species	<i>Mysidopsis bahia</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
2.4	15	15/15	100
3.1	14	14/15	93
4.7	14	14/15	93
11.6	13	13/15	87

Table E.18 Results of Toxicity Test No. 18

Exposure Media	Weathered Oil CE-WAF		
Exposure Regime	Continuous Exposure		
Species	<i>Menidia beryllina</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	18	18/18	100
1.194458	12	12/16	75
10.75911	0	0/15	0
50.62552	0	0/15	0
68.678994	0	0/16	0
79.18494	0	0/16	0

Table E.19 Results of Toxicity Test No. 19

Exposure Media	Weathered Oil CE-WAF		
Exposure Regime	Continuous Exposure		
Species	<i>Menidia beryllina</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
1.194458	9	9/16	56
10.75911	0	0/15	0
50.62552	0	0/15	0
68.678994	0	0/16	0
79.18494	0	0/18	0

Table E.20 Results of Toxicity Test No. 20

Exposure Media	Weathered Oil CE-WAF		
Exposure Regime	Continuous Exposure		
Species	<i>Mysidopsis bahia</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	18	18/18	100
0.978958	4	4/17	24
3.675983	0	0/17	0
16.81771	0	0/16	0
25.07683	0	0/15	0
39.9616	0	0/16	0

Table E.21 Results of Toxicity Test No. 21

Exposure Media	Weathered Oil CE-WAF		
Exposure Regime	Continuous Exposure		
Species	<i>Mysidopsis bahia</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	18	18/18	100
0.978958	4	4/16	25
3.675983	0	0/16	0
16.81771	0	0/16	0
25.07683	0	0/18	0
39.9616	0	0/15	0

Table E.22 Results of Toxicity Test No. 22

Exposure Media	Weathered Oil CE-WAF		
Exposure Regime	Declining Exposure		
Species	<i>Menidia beryllina</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
17.2	14	14/15	93
19.6	13	13/15	87
50.8	0	0/15	0

Table E.23 Results of Toxicity Test No. 23

Exposure Media	Weathered Oil CE-WAF		
Exposure Regime	Declining Exposure		
Species	<i>Menidia beryllina</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
11.2	14	14/15	93
31.9	13	13/15	87
37.7	9	9/15	60
51.2	15	15/15	100

Table E.24 Results of Toxicity Test No. 24

Exposure Media	Weathered Oil CE-WAF		
Exposure Regime	Declining Exposure		
Species	<i>Mysidopsis bahia</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
12.5	14	14/15	93
17.3	13	13/15	87
38.3	13	13/15	87
47.7	6	6/15	40

Table E.25 Results of Toxicity Test No. 25

Exposure Media	Weathered Oil CE-WAF		
Exposure Regime	Declining Exposure		
Species	<i>Mysidopsis bahia</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
8.2	15	15/15	100
41.5	14	14/15	93
54.4	12	12/15	80
58.9	7	7/15	47

Table E.26 Results of Toxicity Test No. 26

Exposure Media	Weathered Oil CE-WAF		
Exposure Regime	Declining Exposure		
Species	<i>Cyprinodon variegatus</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
9.642	13	13/15	87
21.697	10	10/10	100
24.727	10	10/15	67
115.971	0	0/15	0
123.668	0	0/15	0

Table E.27 Results of Toxicity Test No. 27

Exposure Media	Weathered Oil CE-WAF		
Exposure Regime	Declining Exposure		
Species	<i>Cyprinodon variegatus</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
22.301	15	15/15	100
34.275	15	15/15	100
50.95	15	15/15	100
30.577	0	0/15	0
78.369	0	0/15	0

Table E.28 Results of Toxicity Test No. 28

Exposure Media	Weathered Oil WAF		
Exposure Regime	Declining Exposure		
Species	<i>Cyprinodon variegatus</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	14	14/14	100
2.537	15	15/15	100
2.851	14	14/15	93
2.972	15	15/15	100
3.825	14	14/15	93
6.133	15	15/15	100

Table E.29 Results of Toxicity Test No. 29

Exposure Media	Weathered Oil WAF		
Exposure Regime	Declining Exposure		
Species	<i>Cyprinodon variegatus</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
1.768	15	15/15	100
2.615	15	15/15	100
4.82	15	15/15	100
4.724	10	10/15	67
5.736	15	15/15	100

Table E.30 Results of Toxicity Test No. 30

Exposure Media	Weathered Oil WAF		
Exposure Regime	Continuous Exposure		
Species	<i>Cyprinodon variegatus</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
3.124	15	15/15	100
5.092	3	3/15	20
4.717	0	0/15	0
5.947	0	0/15	0
6.728	0	0/15	0

Table E.31 Results of Toxicity Test No. 31

Exposure Media	Weathered Oil WAF		
Exposure Regime	Continuous Exposure		
Species	<i>Cyprinodon variegatus</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
1.985	15	15/15	100
5.42	4	4/15	27

Table E.32 Results of Toxicity Test No. 32

Exposure Media	Weathered Oil CE-WAF		
Exposure Regime	Continuous Exposure		
Species	<i>Cyprinodon variegatus</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
0.553	15	15/15	100
1.458	15	15/15	100
3.273	14	14/15	93
9.689	15	15/15	100

Table E.33 Results of Toxicity Test No. 33

Exposure Media	Weathered Oil CE-WAF		
Exposure Regime	Continuous Exposure		
Species	<i>Cyprinodon variegatus</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
1.17	15	15/15	100
2.812	15	15/15	100
3.577	12	12/15	80
10.804	15	15/15	100

Table E.34 Results of Toxicity Test No. 34

Exposure Media	Corexit [®] 9500 (Dispersant Only)		
Exposure Regime	Continuous Exposure		
Species	<i>Cyprinodon variegatus</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
102	15	15/15	100
175	3	3/15	20
376	2	2/15	13
847	0	0/15	0
1310	0	0/15	0

Table E.35 Results of Toxicity Test No. 35

Exposure Media	Corexit [®] 9500 (Dispesant Only)		
Exposure Regime	Continuous Exposure		
Species	<i>Cyprinodon variegatus</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
67	15	15/15	100
112	15	15/15	100
160	9	9/15	60
381	0	0/15	0

Table E.36 Results of Toxicity Test No. 36

Exposure Media	Corexit [®] 9500 (Dispersant Only)		
Exposure Regime	Declining Exposure		
Species	<i>Cyprinodon variegatus</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
43.6	15	15/15	100
95.159	15	15/15	100
278.45	10	10/15	67
559.88	9	9/15	60
905.86	5	5/15	33

Table E.37 Results of Toxicity Test No. 37

Exposure Media	Corexit [®] 9500 (Dispersant Only)		
Exposure Regime	Declining Exposure		
Species	<i>Cyprinodon variegatus</i>		
Conc.(ppm)	Number Surviving	Surviving/Total	% Survival
0 (Control)	15	15/15	100
50.5	15	15/15	100
107.9	15	15/15	100
251.1	15	15/15	100
516.1	15	15/15	100
940	3	3/15	20