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DEPLOYMENT CONFIGURATIONS FOR IMPROVED OIL CONTAINMENT WITH SELECTED SORBENT BOOMS

by

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FOREWORD

The U.S. Environmental Protection Agency was created because of increasing public and government concern about the dangers of pollution to the health and welfare of the American people. Noxious air, foul water, and spoiled land are tragic testimonies to the deterioration of our natural environment. The complexity of that environment and the interplay of its components require a concentrated and integrated attack on the problem.

Research and development is that necessary first step in problem solution; it involves defining the problem, measuring its impact, and searching for solutions. The Municipal Environmental Research Laboratory develops new and improved technology and systems to prevent, treat, and manage wastewater and solid and hazardous waste pollutant discharges from municipal and community sources, to preserve and treat public drinking water supplies, and to minimize the adverse economic, social, health, and aesthetic effects of pollution. This publication is one of the products of that research and provides a most vital communiations link between the research and the user community.

This report describes full-scale testing of three sorbent commerical oil spill booms. Based on the results presented here, more efficient operating techniques for booms used in water currents can be developed. The methods, results, and techniques described are of interest to those interested in specifying, using, or testing such equipment. Further information may be obtained through the Solid and Hazardous Waste Research Division, Oil and Hazardous Materials Spills Branch, Edison, New Jersey.

Francis T. Mayo, Director
Municipal Environmental Research Laboratory
Cincinnati

ABSTRACT

Performance tests on three catenary oil containment configurations using sorbent booms sections alone and in conjuction with a conventional containment boom, were conducted at the U.S. Environmental Protection Agency's Oil and Hazardous Materials Simulated Environmental Test Tank (US EPA OHMSETT). Other test variables included wave condition, tow speed, and oil quantity encountered. Maximum no-oil-loss containment tow speed was determined for each wave and oil quantity tested.

The use of an all sorbent boom with a multi-layer sorbent raft at the apex exhibited average increases in no-oil-loss tow speed of 0.13 m/s over previous results using a single layer boom in calm water.

Use of a sorbent raft inside the apex of a conventional containment boom increased turbulence and caused oil loss at lower speeds than use of the conventional boom alone. No-oil-loss tow speeds using the sorbent boom raft at the boom apex also decreased from previous results using a single layer sorbent boom in the 0.3-m harbor chop wave. Loss was due to increased turbulence from raft sections striking each other from the wave action.

Recovery of sorbed fluid and regeneration of the boom sections was unsuccessfully attempted using a commercially available sorbent and wringer.

This report was submitted in fulfillment of Job Order No. 49, Contract No. 68-03-2642, by Mason & Hanger-Silas Mason Co., Inc., under the sponsorship of the U.S. Environmental Protection Agency. This report covers the period 12 through 16 June 1978 with work completed 22 September 1978.

CONTENTS

FIGURES

TABLES

LIST OF CONVERSIONS

METRIC TO ENGLISH

To convert from	to	Multiply by
Celsius	degree Fahrenheit	$t_C = (t_F - 32)/1.8$
joule	erg	1.000 E+07
joule	foot-pound-force	7.374 E-01
kilogram	pound-mass (lbm avoir)	2.205 E+00
metre	foot	3.281 E+00
metre	inch	3.937 E+01
$metre^2$	$foot^2$	1.076 E+01
$metre^2$	$inch^2$	1.549 E+03
$metre^3$	gallon (U.S. liquid)	2.642 E+02
$metre^3$	litre	1.000 E+03
metre/second	foot/minute	1.969 E+02
metre/second	knot	1.944 E+00
$metre^2$/second	centistoke	1.000 E+06
$metre^3$/second	$foot^3$/minute	2.119 E+03
$metre^3$/second	gallon (U.S. liquid)/minute	1.587 E+04
newton	pound-force (lbf avoir)	2.248 E-01
watt	horsepower (550 ft lbf/s)	1.341 E-03

ENGLISH TO METRIC

To convert from	to	Multiply by
centistoke	$metre^2$/second	1.000 E-06
degree Fahrenheit	Celsius	$t_C = (t_F - 32)/1.8$
erg	joule	1.000 E-07
foot	metre	3.048 E-01
$foot^2$	$metre^2$	9.290 E-02
foot/minute	metre/second	5.080 E-03
$foot^3$/minute	$metre^3$/second	4.719 E-04
foot-pound-force	joule	1.356 E+00
gallon (U.S. liquid)	$metre^3$	3.785 E-03
gallon (U.S. liquid)/minute	$metre^3$/second	6.309 E-05
horsepower (550 ft lbf/s)	watt	7.457 E+02
inch	metre	2.540 E-02
$inch^2$	$metre^2$	6.452 E-04
knot (international)	metre/second	5.144 E-01
litre	$metre^3$	1.000 E-03
pound force (lbf avoir)	newton	4.448 E+00
pound-mass (lbm avoir)	kilogram	4.535 E-01

ABBREVIATIONS AND SYMBOLS

ABBREVIATIONS

m	—metre
HC	—harbor chop (confused sea) wave
m/s	—metre per second
cm	—centimetre
kg	—kilogram
kg/m	—kilograms per metre
m^2/s	—square metres per second
N/m	—Newtons per metre
m^3	—cubic metres

SYMBOLS

V_c	—Critical No Oil Loss Tow Speed
%	—percent
JO	—Job Order
X	—times
^{o}C	—degrees Celsius
$>$	—more than

SECTION 1

INTRODUCTION

This study is a continuation of sorbent boom testing previously carried out at the U.S. Environmental Protection Agency's Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT) under Job Order 41. The test objectives were performance evaluation of the use of a sorbent raft at the apex of a catenary oil containment boom and to try to recover oil from saturated sorbent boom sections by squeezing the boom between two rollers. Rafts made of sorbent boom sections were placed at the apex of conventional and sorbent oil containment booms.

SECTION 2

CONCLUSIONS AND RECOMMENDATIONS

Use of a sorbent raft inside the apex of a catenary, conventional oil-containment boom failed to increase the maximum no-oil-loss tow speed of the conventional boom. Maximum no-oil-loss tow speed decreased from 0.43 m/s to 0.33 m/s in calm water, and from 0.46 m/s to 0.30 m/s in the 0.3 m HC wave for the B.F. Goodrich PFX-18 boom used.

Increases in maximum no-oil-loss tow speeds were found using sorbent raft apex sections. Conventional boom sides coupled with a sorbent raft apex section increased no-oil-loss tow speed in calm water and 100% oil capacity from 0.25 m/s[2] for a single layer totally sorbent boom to 0.29 m/s for a four-layer sorbent raft apex section. Similar tests in the 0.3 m HC wave exhibited a no-oil-loss tow speed increase from 0 m/s[2] to 0.22 m/s. Oil no longer was splashed over the sorbent raft at the apex as occurred with the single layer sorbent boom. Loss of oil occurred mainly at the attachment points of the sorbent raft to the conventional boom sides. Vortices formed at these attachment points, causing oil drops to be lost under the sorbent raft.

Tests using an all sorbent boom with a five layer sorbent raft apex again caused increases in no-oil-loss tow speeds over those of a single layer sorbent boom. Calm water results increased from the 0.25 m/s[2] for the single layer sorbent boom to 0.33 m/s, while an increase from 0 m/s[2] for the single layer sorbent boom to 0.17 m/s was found in the 0.3 m HC wave.

Tests using apex raft sections varying from one to five layers showed little effect until three layers were used in the raft. No-oil-loss tow speed increased 0.05 m/s for each layer added to the apex raft for layers three, four, and five.

Regeneration of the used sorbent boom sections and recovery of the sorbed fluid was attempted using a Petro-Trap wringer with a powered roller. The Petro-Trap wringer (Figure 1) is designed to squeeze oil from sorbent pads. The rollers are smooth, and tension is provided by springs on the top roller. Saturated boom sections

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1. McCracken, W.E. Performance Testing of Selected Inland Oil Spill Control Equipment. EPA-600/2-77-150, U.S. Environmental Protection Agency, Cincinnati, Ohio, 1977. 113 pp.

2. Smith, G.F. Performance Testing of Selected Sorbent Booms. EPA-600/7-78-219, U.S. Environmental Protection Agency, Cincinnati, Ohio, 1978. 35 pp.

were weighed and then fed (pulled) between the rollers, and samples of the fluid squeezed from the boom were taken. These attempts at boom regeneration were futile; the opening between the squeeze rollers was too small for the boom to pass through easily, and the smooth rollers could not grip the oily boom sufficiently to feed the boom between the rollers. Fluid-saturated boom sections contained 6 to 12 times dry boom weight of an 85% oil content fluid. It should be noted that only the medium viscosity, naphthenic oil was used in these tests; different oils will yield different results.

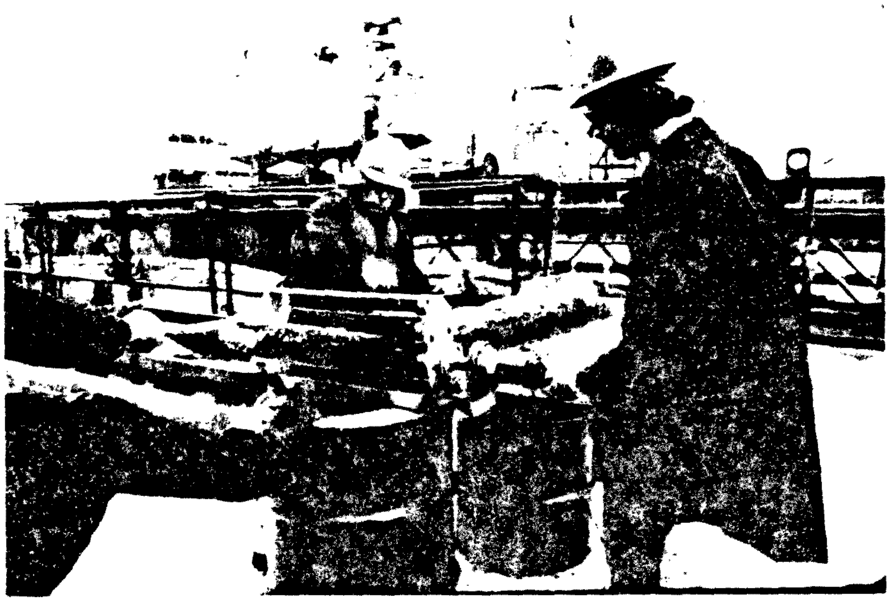

Figure 1. Regeneration of saturated boom sections using a Petro-Trap wringer.

SECTION 3

MATERIALS

The two sorbent booms tested during this program are listed in Table 1.

TABLE 1. SORBENT BOOM SPECIFICATIONS

Manufacturer	Sorbent type	Boom section dimensions diameter (cm)	Boom section dimensions length (m)	Weight (kg/m)	Sorbed oil capacity (multiples of boom weight)
3M Company 3M Center 53-4 St. Paul, MN	Polypropylene	20	2.4	1.6	13-25
Conwed Corporation 332 Minnesota St. St. Paul, MN	Vegetable fiber	20	3.0	1.6	15-22

The 3M Company Type 270 Sorbent Boom (Figure 2) is an open-weave polypropylene mesh bag filled with polypropylene fiber. The tension member consists of a 0.95 cm diameter polypropylene rope connected by shackles and steel rings so that the boom ends overlap.

The Conwed Corporation Heavy Duty Sorbent Boom (Figure 3) is made of a vegetable fiber mat and a foam floatation strip sealed inside a polypropylene mesh bag. Steel rings and snaps connect sections so that the ends overlap. A 0.95 cm polypropylene rope is the tension member.

A straight grade naphthenic lubricating oil was used as the test fluid for this test program. Ambient temperature during this program ranged from 20°C to 22.2°C. Test fluid properties are shown below:

Viscosity	262 centistokes @ 19.8°C 39 centistokes @ 53.3°C
Specific Gravity	0.927
Surface Tension	33.5 dynes/cm

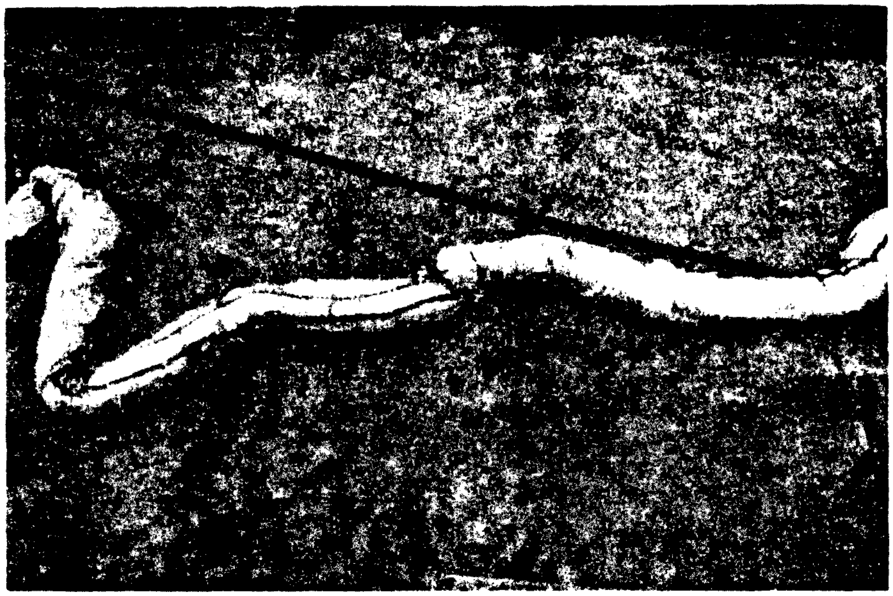

Figure 2. 3M Company Type 270 sorbent boom.

Figure 3. Conwed Corporation heavy duty sorbent boom.

Interfacial Tension	9.37 dynes/cm with OHMSETT tank water of 14 ppt salinity
% Water and Sediment	0.1%

Regeneration of oil soaked boom sections was attempted by using a Petro-Trap wringer available from Petro-Trap, Westport, MA 02790. The wringer is shown in Figure 4 and 5.

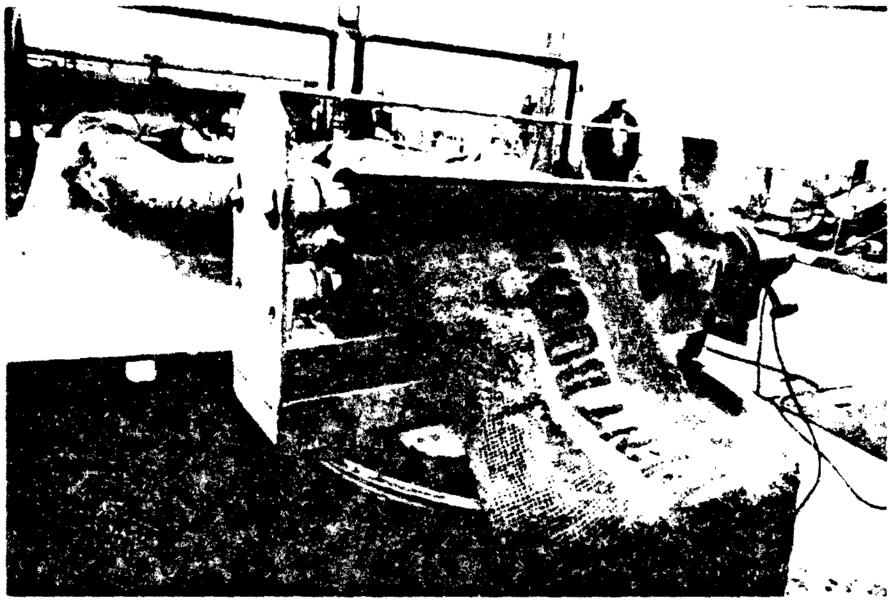

Figure 4. Regeneration of oil-soaked boom sections.

Wringer unit was welded to a barrel top. Holes were cut in the barrel top, allowing the liquid squeezed from the boom sections to drain into the barrel. An overhead, 454 kg jib crane placed the saturated booms on a plywood table leading to the wringer. A rope was tied to boom section end and threaded between the rollers. Pulling on the rope started each boom section through the rollers. A 447 kw, 12 volt electric motor is attached to the lower, tapered roller and was used in addition to four people on the rope to pull each boom section through the regenerator.

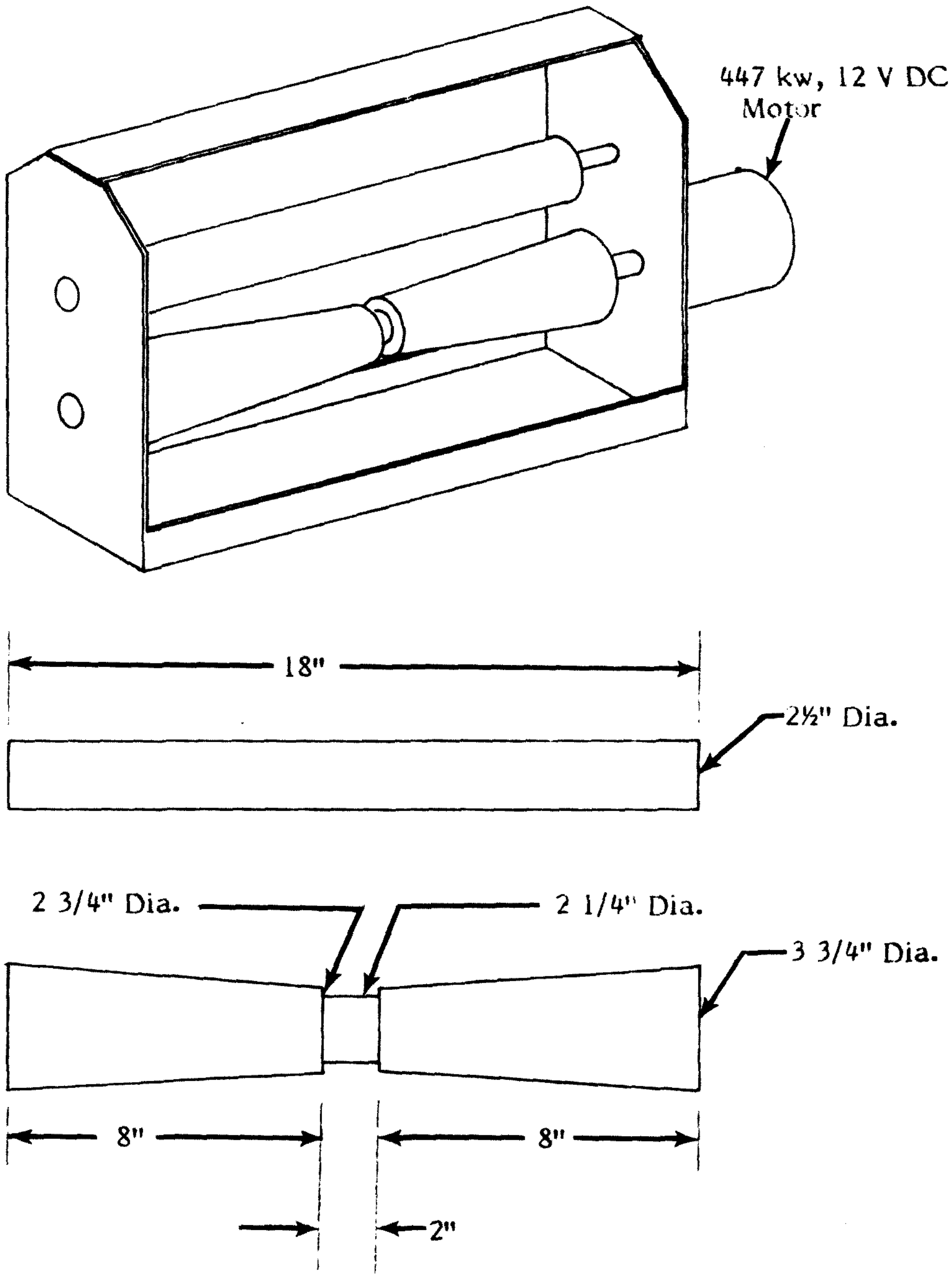

Figure 5. Typical assembly of Petro-Trap wringer rollers.

SECTION 4

EXPERIMENTAL PROCEDURES

BOOM PERFORMANCE TESTS

Tests were conducted without oils first, to find the upper tow speed stability limit for each boom. After establishing the wave conditions (if any) on the tank surface, the boom was towed at increasing speed until the apex of the boom either submerged enough so that water flowed over the boom. Tow speed was increased and decreased 0.05 m/s around the limit to reconfirm its magnitude.

Tow tests with oil were similar to stability tests. An oil slick was placed on the tank surface equivalent to twenty-five percent of the boom's maximum recommended capacity. Oil was pumped from storage tanks on the main bridge through a meter to an overflow weir distribution manifold. The manifold is a 15 cm pipe, 4.6 m long with a 2.5 cm wide longitudinal slot near the top. Oil fills the pipe and flows out of the slot onto a slash plate. A cloth flap attached to the splash plate allows the oil to flow gently onto the water surface regardless of wave condition. The boom was then towed at increasing speed until failure, first in calm water and then in waves. Failure was defined to occur when oil loss was observed under, through, or over the boom sections. If other modes of oil loss such as loss between sorbent sections at the attachment points or at the points where the sorbent boom attached to the B.F. Goodrich boom were observed; they were noted, but not used to determine critical tow speed. Additional oil was then added to the slick to obtain 50%, 75%, 100%, and 125% of the boom's recommended capacity. Both calm water and wave tests were conducted for each oil and load level. Photographic documentation included 16-mm color movies and 35-mm color slides.

PHASE A

Phase A tests determined the effect of placing a raft made of sorbent boom sections inside the apex of a conventional oil containment boom and increasing tow speed until the oil preload began to be lost. A raft of ten sorbent boom sections (3.05 m per section) was tied inside the apex of a 63.1 m long B.F. Goodrich PFX-18 boom deployed in a catenary configuration (Figure 6).

PHASE B

A sorbent raft replaced the conventional boom section at the catenary apex in Phase B testing. This left four 6.09 m long conventional boom sections on each side. Fourteen sorbent boom sections (42.7 lineal metres) as shown in Figure 7 were used to make the raft. Four sorbent boom rows were tied together with 10 mm polypropylene rope. The first and third layer were made of four sorbent boom sections connected end to end and the second and fourth rows were made of three sections. Polypropylene

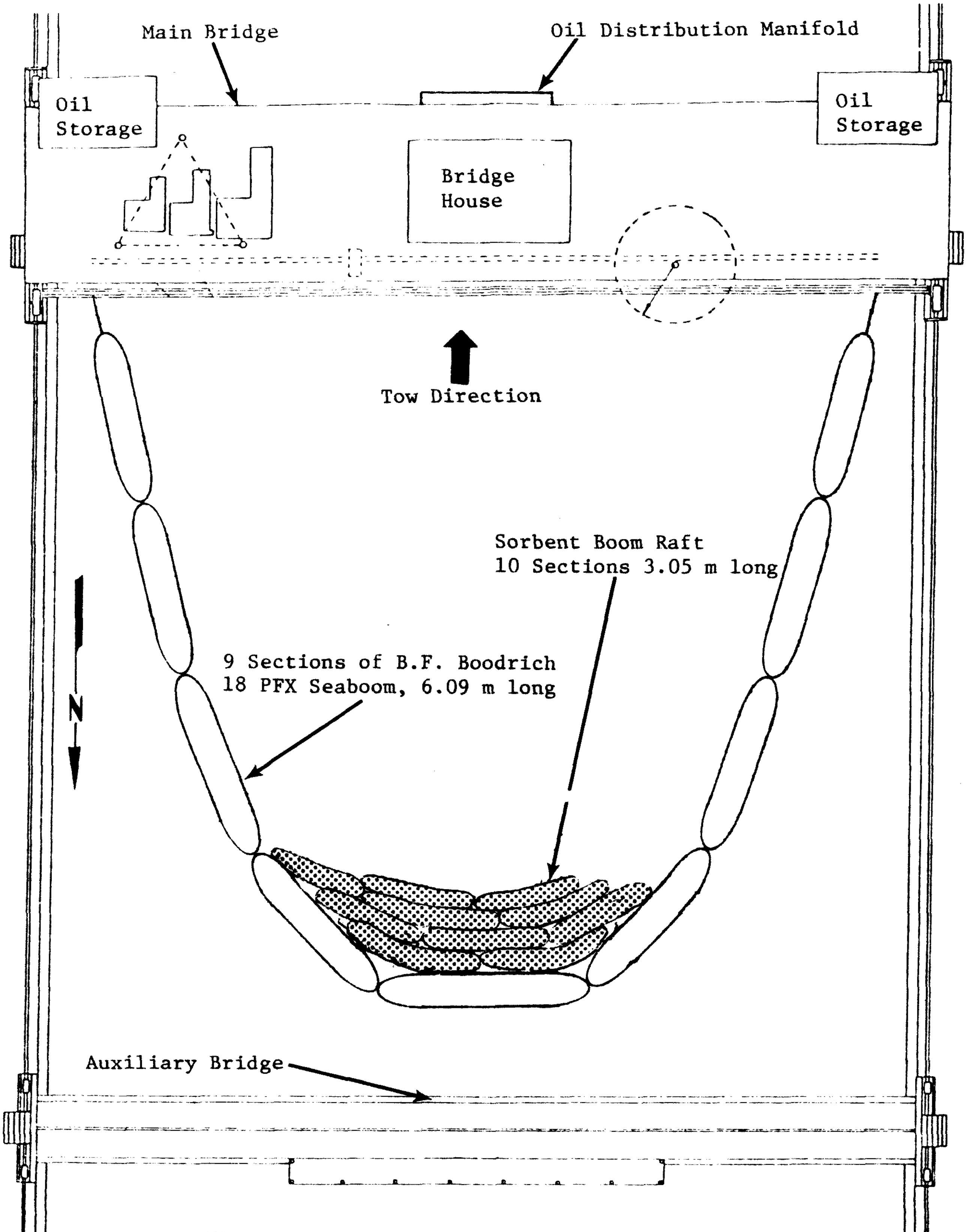

Figure 6. Boom configuration for Phase A testing.

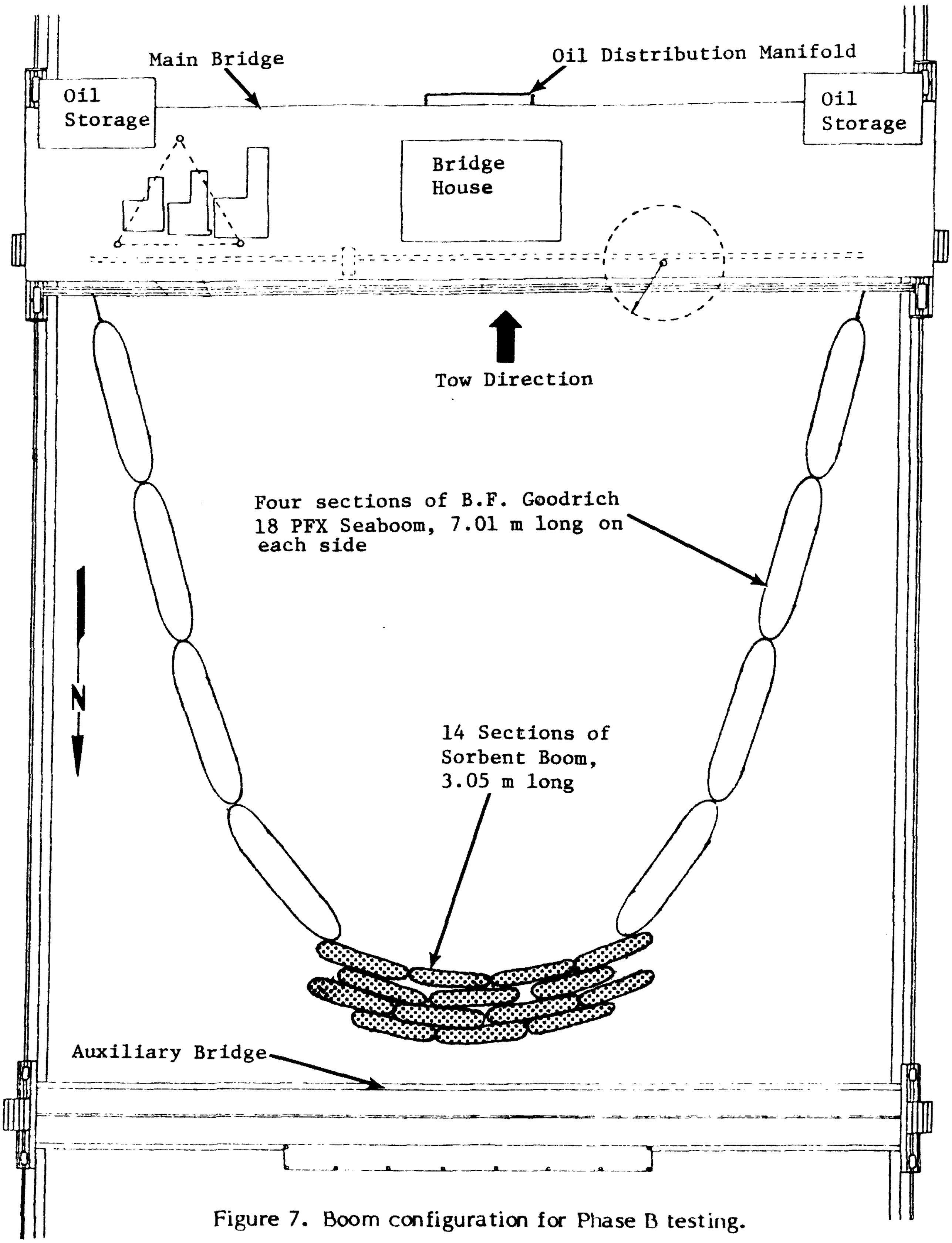

Figure 7. Boom configuration for Phase B testing.

rope was also used to attach the first row of the sorbent raft to the conventional boom ends. The first row of the sorbent boom raft overlapped the down current side of the conventional boom by 0.6 meter to minimize joint leakage.

PHASE C

Phase C tests were performed using a 64 m long, single row, sorbent boom in a catenary configuration. An eighteen section sorbent boom raft was attached to the back of the apex as shown in Figure 8.

BOOM REGENERATION TESTS

Upon completion of the towing tests, those sections of each sorbent boom judged to be most highly saturated were weighed and then pulled through the Petro-Trap wringer. The fluid recovered was analyzed to determine the percent of recoverable oil. The weight of the dry boom was subtracted from the weight of the saturated boom to determine the weight of fluid picked up.

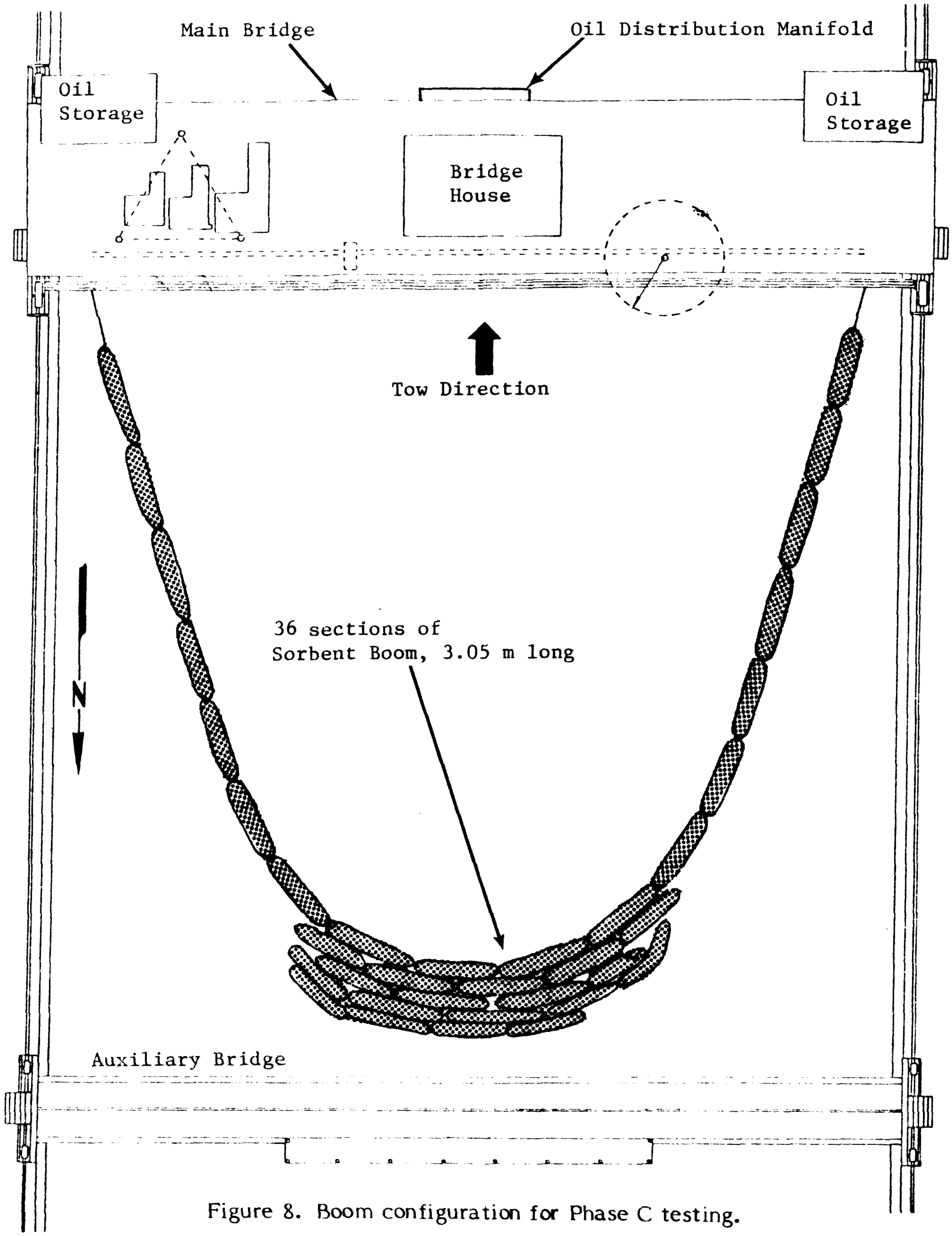

Figure 8. Boom configuration for Phase C testing.

SECTION 5

RESULTS AND DISCUSSION

Results for all tests are shown in Tables 3 through 8. Oil loss generally occurred as oil droplets entrained in the water passing under the boom in Phase A testing and all harbor chop tests. Calm water tests in Phases B and C exhibited oil losses as a surface slick. Oil appeared on the downstream side not as droplets rising to the surface, but as a surface slick passing under the boom sections.

Phase A testing, utilizing sorbent rafts in conjunction with the B.F. Goodrich PFX-18 containment boom, showed an overall decrease in maximum no-oil-loss tow speed in both calm water and the HC wave when compared to results for the B.F. Goodrich boom alone.[2] The sorbent raft generated oil drops when it struck the B.F. Goodrich boom. These drops were then swept under the sorbent raft and the B.F. Goodrich boom.

Phase B tests using B.F. Goodrich containment boom sides and a sorbent raft at the apex exhibited increased no-oil-loss tow speeds in calm water, but no change in HC waves.[2] Using a raft of Conwed Corporation Heavy Duty Sorbent Boom as the apex section caused an average increase of 0.08 m/s in calm water and a 3M Company Type 270 Sorbent Boom raft showed an average increase of 0.03 m/s. Oil loss generally occurred at the points where the sorbent raft apex section was attached to the conventional boom sides. Sorbent boom sections of the raft were overlapped on the aft side of the conventional boom for 3 metres, but turbulence from currents near the end of the conventional boom caused oil droplets to be driven down into the water and under the boom.

Tests in Phase C using sorbent boom for the sides along with a sorbent raft at the boom apex showed increased no-oil-loss tow speeds in calm water and decreased no-oil-loss tow speeds in the HC wave. Conwed Heavy Duty Sorbent Boom used in Phase C effected an average increase of 0.13 m/s in calm water with the 3M Type 270 boom generating an average increase of 0.14 m/s, also in calm water. In the 0.3-m HC wave, decreases of 0.05 m/s were found with both booms. Oil was lost by sorbent boom sections in the raft section striking each other in the harbor chop wave. Oil drops were squeezed out of the sorbent sections and driven down into the water by the turbulence caused by the waves and the boom sections colliding.

Tests were performed to determine the effect of changes in the number of rows added to the sorbent raft. Table 2 gives the results obtained in Phase C testing, using Conwed Sorbent Boom, calm water, and 0.97 m^3 of oil. No-oil-loss tow speed increased only after more than three rows were used to form the raft. Up to five rows were used to form the raft, and the fourth and fifth rows increased the maximum no-oil-loss tow speed by 0.05 m/s for each row.

TABLE 2. RESULTS OF ADDED ROWS TO SORBENT RAFT

Raft rows	No-oil-loss tow speed (m/s)	
1	0.20	
2	0.10	- poorly rigged
3	0.20	
4	0.25	
5	0.30	

Regeneration of saturated boom sections was unsuccessfully attempted using the Petro-Trap wringer. Difficulty was encountered in forcing the boom sections between the wringer rollers. No more than one metre of any boom section could be pulled through the wringer rollers at a time, and then only with several people assisting the regenerator's motor to pull the boom through the rollers (Figure 1). Samples of the fluid recovered by this operation were analyzed for oil and water content. Conwed Sorbent boom sections contained 18.3 kg/m or 2.03 m^3/m of fluid containing 84% oil and 3M Sorbent boom contained 11.2 kg/m or 1.2 m^3/m of fluid containing 85% oil. Due to the small amount of sorbent boom squeezed, these results cannot and should not be considered to represent the oil content or total fluid volume of the entire sorbent boom or sorbent raft.

TABLE 3. 3M COMPANY TYPE 270 SORBENT BOOM RESULTS

Test no.	Wave	Oil quantity m^3	Oil quantity % of capacity	Maximum no loss tow speed - V_c m/s	Type of failure	Comments
1A	Calm	0	0	0.89	submergence.	
2A	0.3 m HC	0	0	0.89	submergence.	
3A	Calm	0.38	25	0.48	droplet shed.	Turbulence caused by sorbent raft sections causes oil to form droplets and be swept under boom skirt.
4A	0.3 m HC	0.38	25	0.41	droplet shed.	
5A	Calm	0.76	50	0.43	droplet shed.	
6A	0.3 m HC	0.76	50	0.41	droplet shed.	
7A	Calm	1.17	75	0.36	droplet shed.	
8A	0.3 m HC	1.17	75	0.43	droplet shed.	
9A	Calm	1.51	100	0.30	droplet shed.	
10A	0.3 m HC	1.51	100	0.30	droplet shed.	
11A	Calm	1.89	125	0.33	droplet shed.	
12A	0.3 m HC	1.89	125	0.30	droplet shed.	

TABLE 4. 3M COMPANY TYPE 270 SORBENT BOOM RESULTS

Test no.	Wave	Oil quantity m^3	Oil quantity % of capacity	Maximum no loss tow speed - V_c m/s	Type of failure	Comments
1B	Calm	0	0	1.02	submergence.	Ends of Goodrich boom submerged
2B	0.3 m HC	0	0	1.02	splashover.	
3B	Calm	0.38	25	0.23	slick under boom.	
4B	0.3 m HC	0.38	25	0.20	droplet shed.	
5B	Calm	0.76	50	0.25	slick under boom.	
6B	0.3 m HC	0.76	50	0.25	droplet shed.	Vortices formed at end of Goodrich boom throwing droplets under raft
7B	Calm	1.17	75	0.28	slick under boom.	
8B	0.3 m HC	1.17	75	0.28	droplet shed.	
9B	Calm	1.51	100	0.28	slick under boom.	
10B	0.3 m HC	1.51	100	0.28	droplet shed. slick under boom.	
11B	Calm	1.89	125	0.25	slick under boom.	
12B	0.3 m HC	1.89	125	0.25	droplet shed. slick under boom.	

TABLE 5. 3M COMPANY TYPE 270 SORBENT BOOM RESULTS

Test no.	Wave	Oil quantity m^3	Oil quantity % of capacity	Maximum no loss tow speed - V_c m/s	Type of failure	Comments
1C	Calm	0	0	over 1.02		
1C	0.3 m HC	0	0	over 1.02		
3C	Calm	0.38	25	0.46	slick under boom.	
4C	0.3 m HC	0.38	25	0.15	droplet shed.	Waves cause raft sections to hit each other producing turbulence and driving oil droplets under boom.
5C	Calm	0.76	50	0.33	slick under boom.	
6C	0.3 m HC	0.76	50	0.15	droplet shed.	
7C	Calm	1.17	75	0.33	slick under boom.	
8C	0.3 m HC	1.17	75	0.10	droplet shed.	
9C	Calm	1.51	100	0.41	slick under boom.	
10C	0.3 m HC	1.51	100	0.10	droplet shed.	
11C	Calm	1.89	125	0.38	slick under boom.	
12C	0.3 m HC	1.89	125	0.13	droplet shed.	

TABLE 6. CONWED SORBENT BOOM RESULTS

Test no.	Wave	Oil quantity m^3	Oil quantity % of capacity	Maximum no loss tow speed - V_c m/s	Type of failure	Comments
13A	Calm	---	---	0.81	raft driven under Goodrich Boom.	
14A	0.3 m HC	---	---	0.71	raft driven under Goodrich Boom.	
15A	Calm	0.27	25	0.43	droplet shed.	
16A	0.3 m HC	0.27	25	0.36	droplet shed.	
17A	Calm	0.54	50	0.36	droplet shed.	
18A	0.3 m HC	0.54	50	0.36	droplet shed.	
19A	Calm	0.81	75	0.36	droplet shed.	
20A	0.3 m HC	0.81	75	0.36	droplet shed.	
21A	Calm	1.08	100	0.36	droplet shed.	
22A	0.3 m HC	1.08	100	0.30	droplet shed.	
23A	Calm	1.35	25	0.36	droplet shed.	
24A	0.3 m HC	1.35	25	0.36	droplet shed.	

TABLE 7. CONWED SORBENT BOOM RESULTS

Test no.	Wave	Oil quantity m^3	Oil quantity % of capacity	Maximum no loss tow speed - V_c m/s	Type of failure	Comments
13B	Calm	---	---	0.91	ends of Goodrich Boom Submerge.	
14B	0.3 m HC	---	---	0.86	ends of Goodrich Boom Submerge.	
15B	Calm	0.38	25	0.36	droplet shed.	
16B	0.3 m HC	0.38	25	0.25	droplet shed.	
17B	Calm	0.76	50	0.33	droplet shed.	
18B	0.3 m HC	0.76	50	0.25	droplet loss	
19B	Calm	1.14	75	0.36	droplet shed.	
20B	0.3 m HC	1.14	75	0.25	droplet shed.	
21B	Calm	1.51	100	0.30	droplet shed.	
22B	0.3 m HC	1.51	100	0.15	droplet loss	
23B	Calm	1.89	125	0.36	droplet shed.	
24B	0.3 m HC	1.89	125	0.15	droplet shed.	

TABLE 8. CONWED SORBENT BOOM RESULTS

Test no.	Wave	Oil quantity m^3	Oil quantity % of capacity	Maximum no loss tow speed - V_c m/s	Type of failure	Comments
13C	Calm	---	---	0.91	raft folds over.	five layer raft.
14C	0.3 m HC	---	---	0.86	raft submarines.	
15C	Calm	0.97	25	0.30	slick under boom.	
16C	0.3 m HC	0.97	25	0.20	droplet shed.	
17C	Calm	1.93	50	0.36	droplet shed.	
18C	0.3 m HC	1.93	50	0.20	droplet shed.	
19C	Calm	2.89	75	0.25	slick under boom	
20C	0.3 m HC	2.89	75	0.25	droplet shed.	
21C	Calm	3.86	100	---	boom sections totally saturated after test 20C.	
22C	0.3 m HC	3.86	100	---	boom sections totally saturated after test 20C.	
23C	Calm	4.83	125	---	boom sections totally saturated after test 20C.	
24C	0.3 m HC	4.83	125	---	boom sections totally saturated after test 20C.	
25C	Calm	---	---	0.91	raft folds over.	two layer raft.
26C	0.3 m HC	---	---	0.86	raft submarines.	two layer raft.
27C	Calm	0.62	25	0.10	slick under boom.	failure due to poor rigging - rerigged, two layer raft.
28C	Calm	0.72	25	0.20	slick under boom.	three layer raft.
29C	Calm	0.86	25	0.25	slick under boom.	four layer raft.

APPENDIX A

OHMSETT TEST FACILITY

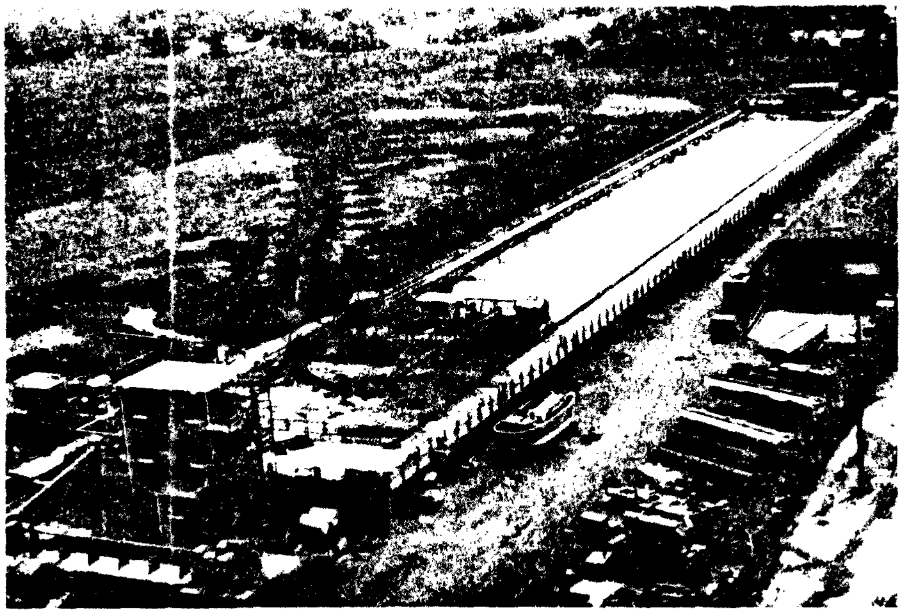

Figure A-1. OHMSETT Test Facility.

GENERAL

The U.S. Environmental Protection Agency is operating an Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT) located in Leonardo, New Jersey (Figure A-1). This facility provides an environmentally safe place to conduct testing and development of devices and techniques for the control of oil and hazardous material spills.

The primary feature of the facility is pile-supported, concrete tank with a water surface 203 meters long by 20 meters wide and with a water depth of 2.4 meters. The tank can be filled with fresh or salt water. The tank is spanned by a bridge capable of exerting a force up to 151 kilonewtons, towing floating equipment at speeds to 3 meters/second for at least 45 seconds. Slower speeds yield longer test runs. The towing bridge is equipped to lay oil or hazardous materials on the surface of the water several meters ahead of the device being tested, so that reproducible thicknesses and widths of the test fluids can be achieved with minimum interference by wind.

The principal systems of the tank include a wave generator and beach, and a filter system. The wave generator and adsorber beach have capabilities of producing regular waves to 0.7 meter high and to 28.0 meters long, as well as a series of 1.2 meters high reflecting, complex waves meant to simulate the water surface of a harbor or the sea. The tank water is clarified by recirculation through a 0.13 cubic meter/second diatomaceous earth filter system to permit full use of a sophisticated underwater photography and video imagery system, and to remove the hydrocarbons that enter the tank water as a result of testing. The towing bridge has a built-in skimming barrier which can move oil onto the North end of the tank for cleanup and recycling.

When the tank must be emptied for maintenance purposes, the entire water volume, or 9842 cubic meters is filtered and treated until it meets all applicable State and Federal water quality standards before being discharged. Additional specialized treatment may be used whenever hazardous materials are used for tests. One such device is a trailer-mounted carbon treatment unit for removing organic materials from the water.

Testing at the facility is served from a 650 square meters building adjacent to the tank. This building houses offices, a quality control laboratory (which is very important since test fluids and tank water are both recycled), a small machine shop, and an equipment preparation area.

This government-owned, contractor-operated facility is available for testing purposes on a cost-reimbursable basis. The operating contractor, Mason & Hanger-Silas Mason Co., Inc., provides a permanent staff of fourteen multi-disciplinary personnel. The U.S. Environmental Protection Agency provides expertise in the area of spill control technology, and overall project direction.

For additional information, contact: Richard A. Griffiths, OHMSETT Project Officer, U.S. Environmental Protection Agency, Research and Development, MERL-Ci, Edison, New Jersey 08837, 201-321-6629.

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

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7. AUTHOR(S) Gary F. Smith		8. PERFORMING ORGANIZATION REPORT NO.
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15. SUPPLEMENTARY NOTES

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16. ABSTRACT

Performance tests on three catenary oil containment configurations using sorbent booms sections alone and in conjuction with a conventional containment boom, were conducted at the U.S. Environmental Protection Agency's Oil and Hazardous Materials Simulated Environmental Test Tank (U.S. EPA OHMSETT). Other test variables included wave condition, tow speed, and oil quantity encountered. Maximum no-oil-loss containment tow speed was determined for each wave and oil quantity tested.

The use of an all-sorbent boom with a multi-layer sorbent raft at the apex exhibited average increases in no-oil-loss tow speed of 0.13 m/s over previous results using a single layer boom in calm water.

Use of a sorbent raft inside the apex of a conventional containment boom increased turbulence and caused oil loss at lower speeds than use of the conventional boom alone. No-oil-loss tow speeds using the sorbent boom raft at the boom apex also decreased from previous results using a single layer sorbent boom in the 0.3-m harbor chop wave. Loss was due to increased turbulence from raft sections striking each other from the wave action.

Recovery of sorbed fluid and regeneration of the boom sections was unsuccessfully attempted using a commercially available sorbent and wringer.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Performance Tests Booms (equipment) Sorbents Water Pollution Oils	Spilled Oil Cleanup Sorbent Oil Booms Sorbent Regeneration	

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