Environment Canada   Environnement Canada

SPILL TECHNOLOGY NEWSLETTER

An informal newsletter published bi-monthly by the Technical Services Branch
Environmental Protection Service, Ottawa, Canada.

VOLUME 8 (6)   ISSN 0381-4459   November - December 1983

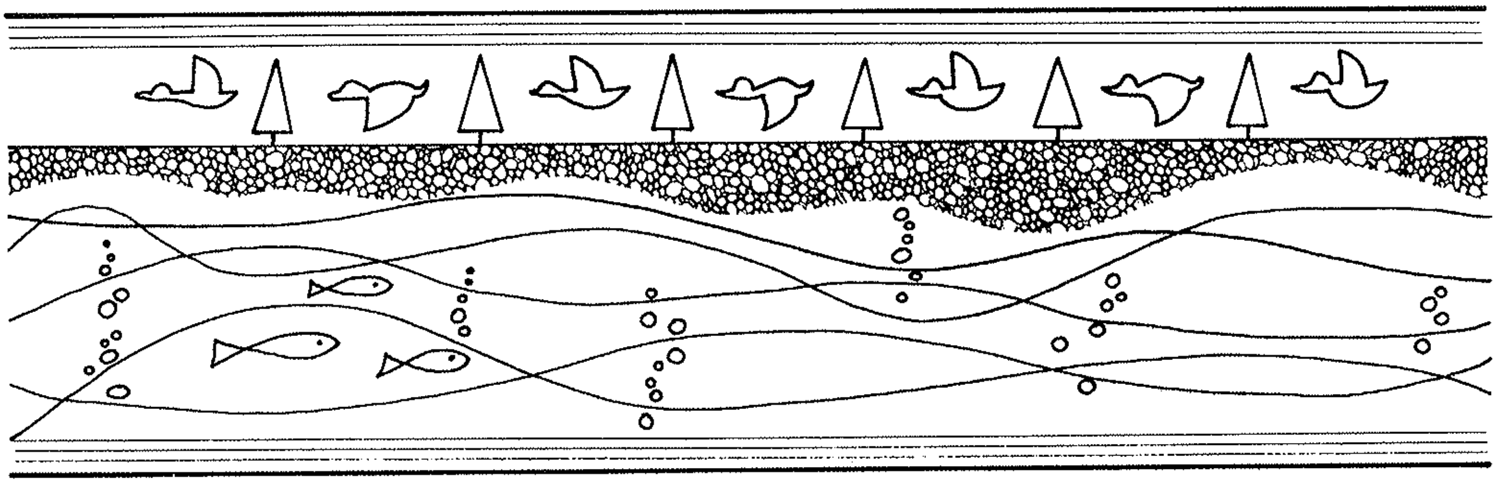


Table of Contents

Disponible en français — voir au verso

Mr. M.F. Fingas and Mr. K.M. Meikle
Technical Editors
Environmental Emergencies Technology Division
Technical Services Branch
Environment Canada - EPS
River Road Labs
Ottawa, Ontario
K1A 1C8

Phone: (613) 998-9622

Mr. Chris Banwell
Publisher and Coordinator
Technical Services Branch
Environment Canada - EPS
Ottawa, Ontario
K1A 1C8

Phone: (819) 997-3405

The Spill Technology Newsletter was started with modest intentions in 1976 to provide a forum for the exchange of information on oil spill countermeasures and other related matters. We now have over 2,600 subscribers in over 40 countries.

To broaden the scope of this newsletter, and to provide more information on industry and foreign activities in the field of oil spill control and prevention, readers are encouraged to submit articles on their work and views in this area.

Disponible en français, s'adresser à la:

Section des publications
Division du transfert technologique et de la formation
Service de la protection de l'environnement
Environnement Canada
Ottawa, Ontario
K1A 1C8

et demandez Bulletin de la lutte contre les déversements

Canada

INTRODUCTION

In this issue we have two brief articles. The first, by Fred Baechler, describes the areal and volumetric requirements for land disposal of recovered oil. Using historical data such as that from the ARROW and KURDISTAN incidents, Fred calculates that a five-fold increase in actual spill volume occurs because of the inclusion of debris, beach material, etc. Also, one cubic foot of disposed material requires 0.11 square foot of surface area above the disposal trench. The second article by Don Ince describes tests of trash pumps for oil spill recovery. Four pumps were tested and found to be satisfactory. The Gorman Rupp was judged to be the best suited to immediate needs.

REPORTS AND PUBLICATIONS

- CONCAWE (The oil companies' international study group for Conservation of Clean Air and Water - Europe) has recently released two reports. These may be obtained from: CONCAWE, Babylon-Kantoren A, Koningin Julianaplein 30-9, 259AA The Hague, Netherlands. The reports are:

  "Characteristics of Petroleum and its Behavior at Sea" (report no. 8183)
  "A Field Guide to Inland Oil Spill Clean-Up Techniques" (report No. 10183)

A working report on the Baffin Island Oil Spill project has recently been released, and it can be obtained from:

Publications Coordinator, Technical Services Branch, Environment Canada, Environmental Protection Service, Ottawa, Ontario, K1A 1C8. It reports on three studies for which the citations are as follows:

Cross, W.E. and C.M. Martin, 1983, In Situ Studies of Effects of Oil and Chemically Treated Oil on Primary Productivity of Ice Algae and on Under-ice Meiofaunal and Macrofaunal Communities. Special Studies - 1982 Study Results. (BIOS) Baffin Island Oil Spill Working Report 82-7.

Mackay, D., Hossain, K., Chau, E., Poblete, B. and Nilsson, U., 1983, Behaviour of Subsurface Discharges of Oil, Gas and Dispersants. Special Studies - 1982 Study Results. (BIOS) Baffin Island Oil Spill Working Report 82-7.

Engelhardt, R., Mageau, C. and Trucco, R., 1983, Behavioural Responses of Benthic Invertebrates Exposed to Dispersed Crude Oil. Proceedings of the Sixth Arctic Marine Oilspill Program Technical Seminar. pg. 32-51.

- The Environmental Emergency Technology Division has recently released two manuscript reports, the titles of which appear below. These reports are unedited and have not undergone rigorous technical review but will be distributed on a limited basis to transfer the results to people working in related fields. For copies of these reports contact: Publications Coordinator, Technical Services Branch, Environment Canada, Environmental Protection Service, Ottawa, Ontario, K1A 1C8.

"Evaporation Rate of Spills of Hydrocarbons and Petroleum Mixtures" EE-49.

"State-of-the-Art Survey of Oil Spill Detection, Tracking and Remote Sensing in Cold Climates" EE-50.

- The following reports are available from the U.S. Department of Commerce, National Technical Information Service, Springfield, Virginia, 22161, Telephone (703) 487-4650. Most reports are also availabe on Microfiche at $4.00 each (U.S.A. Price). Canadian buyers add $2.50 to each paper copy and $1.50 for each microfiche report. Prices are quoted in U.S. dollars.

"Oil-Water Separators. 1970 - May 1983 (Citations from the Engineering Index Data Base)." National Technical Information Service, Springfield, Virginia. June, 1983. 201 p. PB83-807024 $28.00.

"Oil Pollution Detection and Sensing. 1976 - April 1983 (Citations from the NTIS Data Base)." National Technical Information Service, Springfield, Virginia. May, 1983. 278 p. PB83-806380 $28.00.

"Design and Feasibility Study for a Portable Oil Recovery Turbo Pump." IMA Resources Inc., Washington, D.C. May, 1982. 65 p. N83-15628/1.

"Hydrocarbon Spills, Their Retention in the Subsurface and Propagation into Shallow Aquifers." H.C. Pfannkuck, Minnesota University, St. Paul. April, 1983. 55 p. PB83-196 477.

"Aerial Photographic Surveys Analyzed to Deduce Oil Spill Movement During the Decay and Breakup of Fast Ice, Prudhoe Bay, Alaska." I.M. Lissauer and D.A. Baird. Coast Guard Research and Development Centre, Groton, Connecticut. September, 1982. 59 p. AD-A126 395/3.

"Development of a Flaring Burner Disposal System." R.L. Beach and W.T. Lewis, Seaward International Inc., Falls Church, Virginia. May, 1983. 95 p. AD-A129 402/4.

"Oil Spills: Legal Aspects. 1977-June 1983 (Citations from the Selected Water Resources Abstracts Data Service Data Base)." National Technical Information Service, Springfield, Virginia. June, 1983. 200 p. PB83-864447. $28.00.

"Experimental Investigation of The Effects of Crude Oil on Two Freshwater Lake Ecosystems." M.D. Werner, V.D. Adams, and V.A. Lamarra, UTAH Water Research Lab, Logan. April, 1983. 220 p. PB83-219774.

- Three new publications, the titles and abstracts of which appear below, may be obtained upon request from: Publications Coordinator, Technical Services Branch, Environment Canada, Environmental Protection Service, Ottawa, Ontario, K1A 1C8.

A Catalogue of Oil Skimmers (EPS 3-EP-83-1)

This report provides information concerning various types of mechanical oil recovery devices for the purpose of spill cleanup. These are listed in alphabetical order according to the manufacturer, distributor and/or developer to facilitate use of the document as a guide.

The Arctic Marine Oilspill Program (AMOP) Remote Sensing Study (EPS 4-EC-83-3)

The Arctic Marine Oil Spill Program (AMOP) remote sensing project was undertaken to evaluate the capability of state-of-the-art sensors to detect oil in ice-infested waters. This report outlines the experimental plan for, and results obtained from, four remote sensing missions (Montreal Island, Scott Inlet, Wallops Island, and the KURDISTAN) involving 12 different sensors.

Oil detection systems currently in use in Canada and abroad are examined. Recommendations are given for an integrated sensor package together with a real-time display system. The recommended sensors include: a side-looking radar (SLR); a UV-IR dual channel line scanner; a laser fluorosensor; a low-light-level television (LLLTV); and annotated photographic cameras. A real-time display system allows operator interaction with the sensors for the presentation of oil spill imagery and analysis. Hard copy can be obtained for presentation to those responsible for oil spill management.

A Winter Evaluation of Oil Skimmers and Booms (EPS 4-EP-84-1)

Five mechanical oil recovery devices and six oil containment barriers were evaluated in the vicinity of St. John's, Newfoundland, during March and April of 1980. Testing was conducted in a refinery settling pond, in St. John's Harbour, and in the coastal waters immediately beyond the harbour entrance. The performance of a sixth skimmer was assessed during March in Mulgrave, Nova Scotia, while evaluation of one of the six oil booms originally tested was resumed in October of the same year in a test tank in the United States. Operational handling characteristics were determined and effectiveness was qualitatively assessed.

UPCOMING CONFERENCES

- The Sixth International Conference and Exhibition on the Marine Transportation, Handling and Storage of Bulk Chemicals (MARICHEM 85) will be held in Kensington, London, from June 25 to 27, 1985. For further information contact: MariChem 85 Secretariat, 2 Station Road, Rickmansworth, Herts WD3 10P, England, or phone (0923) 776363.

- The Eleventh Annual Aquatic Toxicity Workshop will be held in Vancouver, British Columbia, November 13-15, 1984. The workshop will include a plenary session on the effects of mine wastes on aquatic systems and contributed and invited papers and poster sessions. For further information contact: Dr. Glen H. Geen, Department of Biological Sciences, Simon Fraser University, Burnaby, B.C., V5A 1S6, phone (604) 291-4475.

- The "Ninth Conference on the Prevention, Behaviour, Control, and Clean-up of Oil Spills" will be held February 25-28, 1985, at the Westin Bonaventure Hotel in Los Angeles, California. For further information contact: 1985 Oil Spill Conference, Suite 300, 655-15th Street, N.W., Washington, D.C., 20005, phone (202) 639-4202.

- The "5th National Conference and Exhibition on Management of Uncontrolled Hazardous Waste Sites" will be held November 7-9, 1984 at the Sheraton Washington Hotel, Washington, D.C. For further information contact: Hazardous Materials Control Research Institute, 9300 Columbia Blvd., Silver Spring, Maryland, 20910, phone (301) 587-9390.

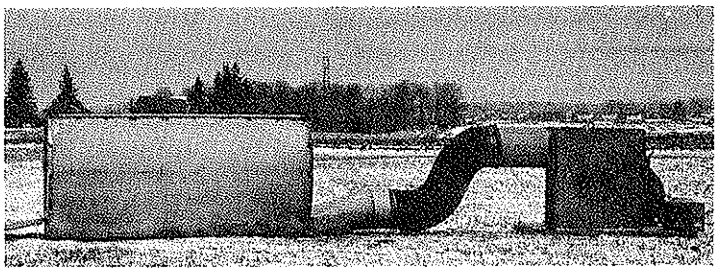
- The second "Technical Seminar on Chemical Spills" will be held February 5-7, 1985 at The Sheraton Centre in Toronto, Ontario. Abstracts for papers are invited and are due August 31, 1984. The Seminar will again include a poster session and a commercial display. For further information contact: Chris Banwell, Technical Services Branch, Environment Canada, Environmental Protection Service, Ottawa, Ontario, K1A 1C8, phone (819) 997-3405.

- The 7th Symposium on Wastewater Treatment will be held in Montreal, November 20-21, 1984. The theme of this year's symposium is the design and operation of wastewater treatment plants. For further information contact: Alain Jolicoeur, Technical Services Branch, Environment Canada, Environmental Protection Service, Ottawa, Ontario, K1A 1C8, phone (819) 997-3405.

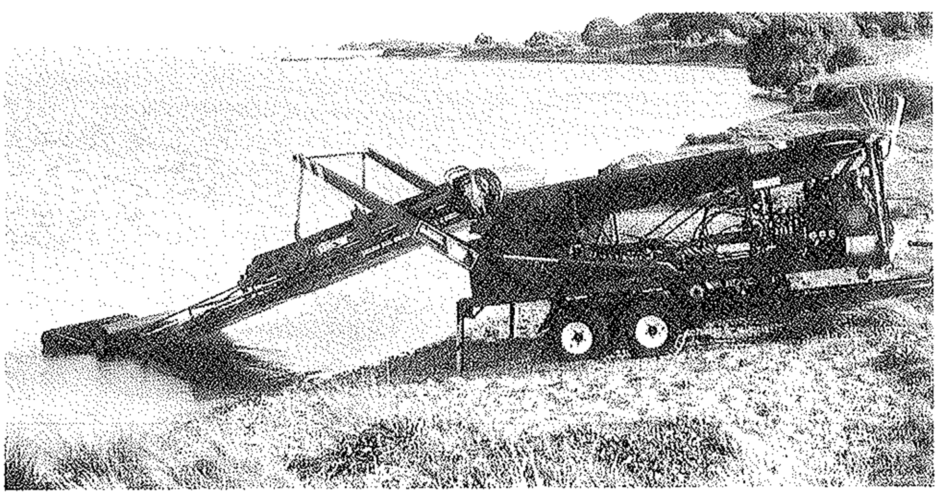
- Hazardous materials training will be the featured topic of the National Environmental Training Association's 6th National Conference and Workshop, "Surviving in the '80s." The conference is scheduled for August 8-11, 1984, in Washington, D.C. For further information contact: Julie Wheeland, National Environmental Training Association, 970 Mill Pond Road, Suite A, Valparaiso, Indiana, 46383, phone: (219) 465-1744.

NEW PRODUCTS

- Energetex Engineering has developed a portable incinerator for the disposal of oily waste and debris. Specially designed for Arctic operations, the incinerator is helicopter-transportable in two 850 kg loads. The stainless steel walls are cooled by air from a motor-driven fan which also supplies combustion air. Set-up involves connecting the flexible air duct between the fan and the incinerator and can be done in five minutes. Capacity of the unit is about 1 tonne per hour. For further information contact: Energetex Engineering, 498 Albert Street, Suite No. 7, Waterloo, Ontario, N2L 3V4, phone (519) 743-7191.



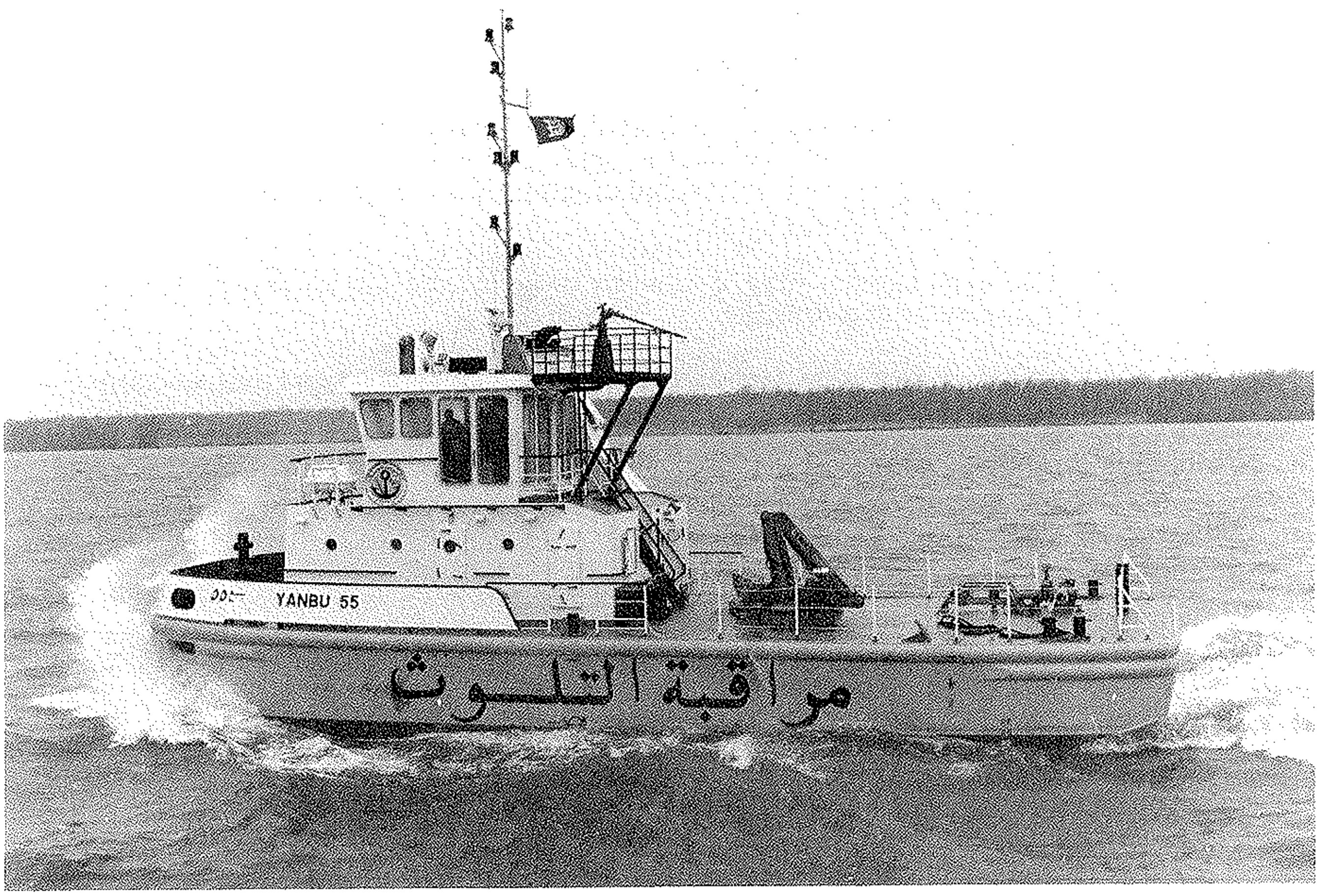
- Oil Recovery International has recently introduced the SHARK 5000, a heavy oil recovery unit which uses a chain-link belt to recover viscous oil at rates claimed to be as much as 30 tonnes per hour. The unit is powered by a 2-cylinder air-cooled diesel engine. For further information contact: Oil Recovery International, Tuckton Bridge, Christchurch, Dorset BH23 1J5, England, phone (0202) 486666.



BRIEF NOTES

- The contact given for the Pelican Skimmer on page 178 of the recent report EPS 3-EP-83-1, entitled "A Catalogue of Oil Skimmers" is no longer correct. Those interested should contact Scanazur, 174 Avenue de Saint-Exupery, 06130 Grasse, France, for up-to-date model and performance details.

- Eimbcke Trading and Shipping have announced that they have supplied 6 oil recovery vessels and 2 oil separation barges for the Saudi port authorities. The 22-metre recovery vessels, as illustrated below, are self-propelled and are equipped with sweeping arms, hydraulic crane, portable skimmers, emergency off-loading pumps, power packs for skimmers and pumps, oil containment booms and fire-fighting monitors. For further information contact: Eimbcke Trading and Shipping, Raboisen 5-13 (Eimbcke-Haus), 2000 Hamburg 1, West Germany, phone (040) 33351.



AREAL AND VOLUMETRIC REQUIREMENTS FOR LAND BASED DISPOSAL SITES RECEIVING OIL FROM A MARINE SPILL

Submitted by: Fred Baechler, Ground/Surface Water Hydrologist
NOLAN, DAVIS & ASSOCIATES LIMITED
Sydney, Nova Scotia

As a result of experience generated by past major marine oil spills, it is apparent that pre-spill selection of land-based disposal sites should be undertaken to provide adequate time for selection, testing and design.

The following suggestions deal with the areal and volumetric requirements which should be considered in the pre-spill selection and design of such land-based disposal sites. These are based upon field experience with the 1979 "Kurdistan" oil spill disposal operations (Baechler, 1980) and an investigation of the disposal sites utilized for the 1970 Arrow oil spill (Baechler et al, 1976).

In determining the requirements, it must be initially noted that:

A. Not all the oil released into the sea will come ashore:

1) Depending upon current and wind conditions, some percentage may be taken out to sea i.e. in the Arrow spill, 2.6 million gallons were released into Chedabucto Bay but only approximately 1.3 million gallons (50%) came ashore (T.F.O.O., 1971).

2) The lead agency may decide to disperse the oil at sea or recover it and reprocess it in a refinery.

B. Of the oil that does wash ashore, not all will be cleaned up and sent to disposal sites:

1) In remote areas, portable incinerators may be utilized to burn the oil.

2) On rocky shorelines, the oil may be cleaned off with steam or chemical dispersants.

3) Those shorelines which experience high wave energy and/or consist of bedrock are usually not cleaned.

4) Shorelines composed of large clasts are generally not cleaned (unless heavily contaminated) as the clasts are too heavy for the bags and massive removal of beach gravel was shown to increase erosion rates of wave-cut cliffs (Owens, 1973). Shorelines lightly affected and in unused, inaccessible areas will probably not be cleaned.

5) If pure oil comes ashore in large enough volumes, it is possible that it will be sent to a refinery for reprocessing.

Therefore, the length of shoreline which is cleaned will only form a percentage of the total shoreline contaminated. Of the 1.3 million gallons from the Arrow spill that washed ashore and contaminated approximately 190 miles of shoreline, only 30 miles (16%) were cleaned and approximately 0.5 million gallons (39%) were placed in disposal sites (T.F.O.O., 1971).

C. A high percent of the volume utilized in the disposal site will not be oil.

1) Depending upon type of machinery on site and the plan of trenches, the amount of fill added per trench will vary.

2) The time of year during cleanup operations will cause variations in the amount of sediment incorporated with the oil in the bags. During the winter, the oil temperature is less than its pour point and will not flow into the sediment. As a result, bags are nearly entirely filled with oil. During the summer, once the oil is ashore, solar heating can cause the pour point to be reached, resulting in downward migration and contamination of large volumes of sediment. The percent of oil per bag decreased substantially during this time in the Kurdistan spill to values as low as 5% (Williams, CCG, personal communication).

The volumetric and areal disposal requirements are therefore difficult to assess. However, an order-of-magnitude figure can be arrived at using the Kurdistan data.

The 6926 long tons of Bunker C that were spilled in the Kurdistan incident would have required 260,319 ft^3 of space in the tanker as a pure product (6.695 U.S. barrels = 1 long ton oil; 5.614 ft^3 = 1 U.S. barrel).

The total volume required for the subsurface disposal of the oil which came ashore in the Cape Breton area was approximately 1,115,300 ft^3, forming approximately 91% of the oil spilled. Where bags were incorporated with domestic garbage (4 sites), or disposed of in an active strip mine, it was assumed that one bag utilized 1 ft^3 of space.

Of the 71,360 bags received on mainland Nova Scotia, most were disposed of with garbage. Therefore, at 1 ft^3/bag, this involved 71,360 ft^3 of space. In Newfoundland, 1,000 bags were incinerated. The remainder were buried with domestic garbage or in special pits with just one surface cover cap. The assumption of 1 ft^3/bag is still valid; the resultant volume is 12,662 cubic feet.

The estimated total volume required for subsurface disposal of oil picked up is then 1,199,322 ft^3. This is approximately a 5-fold increase over the space required for the pure product. Canadian Coast Guard officials believe that all of the oil spilled came ashore. It is not known how much of the oil that came ashore was cleaned up. This is, therefore, a conservative figure.

The subsurface burial design developed for the "containment" type disposal sites at Hadleyville, St. Peters, and Fourchu, involved trenches; each having an approximately 24,600 ft^3 capacity. The resultant average areal extent required per cubic foot of disposal is 0.11 ft^2 (range from 0.10 ft^2 to 0.12 ft^2). This incorporates not only the area covered by the trench but also 1/2 the area separating it with adjacent trenches.

To exemplify the determination of the extent of area and volume required for disposal sites in the pre-spill planning process the worst case scenario for the Canso Strait, Nova Scotia is utilized below.

With supertanker traffic into the Strait, the worst scenario would involve the complete breakup of a fully-loaded supertanker, with the entire cargo subsequently released into the sea, coming ashore, and requiring disposal. This is exemplified by the Amoco Cadiz spill at 55 million imperial gallons. The volume required for the cargo in pure form would be 8,828,978 cubic feet. The 5-fold increase for disposal would necessitate a total volume of 44,144,890 ft^3 in disposal sites. Using the 0.11 ft^2/ft^3 conversion, this means 4,855,938 ft^2 or 112 acres would be required for disposal. If trenches were kept a similar size to the three earlier referred to then a total of 1,795 trenches would be required.

References

Baechler, F.E., 1980, Kurdistan Oil Spill: Land-Based Disposal Operations for Cape Breton Island and Chedabucto Bay - Report and Implications, Nova Scotia Department of the Environment Internal Report, 209 pages.

Baechler, F.E.; LeBlanc, H.; Quinn, Jr. O., 1976, A Proposed Hydrogeological Investigation of the "Arrow" Oil Dumpsites, Nova Scotia Department of the Environment Internal Report, 119 pages.

Owens, E.; and Drapeau, G., 1973 Changes in Beach Profiles at Chedabucto Bay, Nova Scotia Following Large-Scale Removal of Sediments, Canada Journal Earth Science, V10, p. 1226-1232.

Task Force Operation Oil, 1970, Report of the Task Force - Operation Oil (Cleanup of the Arrow Oil Spill in Chedabucto Bay) to the Ministry of Transport, Vols. 1-4.

EVALUATION OF TRASH PUMPS FOR OIL SPILL RECOVERY

Submitted by: D.F. Ince
Chairman, Equipment Subcommittee
PROSCARAC
Canadian Petroleum Association
Calgary, Alberta

Introduction

Trash pump evaluation tests were held on January 5, 1984 by the Prairie Regional Oil Spill Containment and Recovery Advisory Committee (P.R.O.S.C.A.R.A.C.). The tests were held at Nisku, Alberta and were conducted in an enclosed environment.

The four models of pumps listed in Table 1 were tested for their self priming, discharge, suction and trash capabilities. Each pump employed a gasoline engine and came as a single unit either on wheels or on skids.

Test Procedures and Findings

The functional performance of each pump was evaluated by pumping fresh water through various conditions of discharge head and by observing the flow rates and pressures developed. At the same time, the tests provided "hands-on" experience with each pump design and allowed assessment of the design with respect to the dysfunctional criteria.

Figure 1 is a schematic of the test arrangements.

Discharge head was varied using a gate valve and restricting the opening on the discharge side of the pump. Suction lift was not varied but was measured using a suction meter. Once the flow in a test had been established, the delivery rate was measured by timing the filling of an auxilary tank to a level marked on the side. Pressures were recorded at the discharge point. Pump speed was measured using a tachometer; it was not possible to measure the speed of the QP pump as it did not have an accessible rotating part.

The test conditions applied to each pump are shown in Table 2. Number 1 was a self-priming test. The priming port on each pump was filled, the pump was started and the time until full flow emerged from the downspout was recorded. Two test runs were conducted for Number's 1, 2 and 3 and an average figure was recorded.

The trash capacity of each pump was tested and is shown in Table 3. For test No. 1, a sorbent pad was "pushed" through the pump followed by handfuls of dry straw. For test No. 2, only straw was used.

Each pump was also tested for emulsification tendencies by pumping a medium gravity oil skim off fresh water through a Pedco Skimmer. Each pump displayed excellent capabilities to control the speed of the pump and therefore no visible emulsification was evident in the pumped product.

TABLE 1

Pump Make/ Model	Size	Type	Motor	Horse-Power Rating	Starting Mechanism	Weight	Distributor
1) QP, QP-4 OT	4"	Centrifugal	Robin-Wisconsin	10.5	electric	N/A	Polyquip of Canada Ltd. Calgary
2) Homelite, 160TP4-1	4"	Centrifugal	Briggs & Stratton	16	manual (rope pull)	310	Supervisory Consultants Nisku
3) Gorman Rupp, 14D-S14D	4"	Centrifugal	Wisconsin	14	manual (auto. recoil)	360	Purvis Ritchie Edmonton
4) Honda, WT30	3"	Centrifugal	Honda	7.0	manual (auto. recoil)	137	Renfrew Sports Calgary

TABLE 2

Pump	RPM	Suction in Inches of mercury	(1) Priming	(2) Discharge	(3) Back-pressure (approx.)	Flow
QP	N/A	21.0	*Test 1: 35 sec. *Test 2: 15 sec.	4 min. 15 sec. 9 min. 20 sec.	3 psi 25 psi	Steady
Homelite	3300	23.5	Test 1: 14 sec. Test 2: 12 sec.	3 min. 13 sec. 8 min.	5 psi 25 psi	Steady
Gorman Rupp	3100	24.0	Test 1: 10 sec. Test 2: 13 sec.	2 min. 45 sec. 6 min. 45 sec.	5 psi 35 psi	Steady
Honda	3500	23.0	Test 1: 36 sec. Test 2: 55 sec.	5 min. 14 sec. 8 min. 48 sec.	3 psi 22 psi	Steady

* Test 1 was with the gate valve wide open - no restriction.
* Test 2 was with 11 turns in on the gate valve - restriction of flow by approximately 80%.

TABLE 3

	QP	Homelite	Gorman Rupp	Honda
Trash Test No. 1 (sorbent pad and straw)	a small amount of sorbent and straw was caught in catch basin, impeller clean	a small amount of sorbent and approx. one handful of straw caught in impeller	a small amount of sorbent and approx. one handful of straw caught in impeller	small pieces of sorbent and small quantity straw caught in impeller
Trash Test No.2 (straw only)	catch basin clean impeller clean	same as Test No. 1	same as Test No. 1	same as Test No. 1

Table 4 is a summary of the ease of repair and handling of each pump. The Honda pump was clearly the easiest pump to handle but being a smaller pump from the others this was expected.

TABLE 4

Pump	Ease of Repair and Maintenance	Ease of Handling	Comments
QP	G	P	- inexpensive - frame around pump
Homelite	A	G	- on pneumatic wheels
Gorman Rupp	VG	A	- on wheels
Honda	G	VG	- inexpensive - frame around pump

VG - very good
G - good
A - acceptable
P - poor

Conclusions

The purpose of the pump trial was to test different models of trash pumps mainly for their performance capabilities. Pump performance is considered top priority when dealing with an oil spill emergency situation, therefore it was considered that the Gorman Rupp Model 14D-S14D was best suited for the needs of P.R.O.S.C.A.R.A.C.

All pumps performed reasonably well. The Honda pump worked very well under load conditions however since it was only a 3" size (4" is not available as yet by Honda Manufacturers) it was never really considered as a replacement for the 4" models that P.R.O.S.C.A.R.A.C. has already in stock. The QP pump had the least capacity under load conditions but it's trash capabilities were the best of all the pumps tested.

Epilogue

The pump trail would have been a greater success if:

- more pump models had been available.
  At least 4 dealers turned down the invitation to have their pump in the trial. One dealer had a pump available, however it did not arrive in time for the trial.

- a new model of the Homelite pump had been available.
  Homelite was represented with a pump that had been used and was clearly a few years old.
  Its performance could not have been representative of that of a new Homelite.

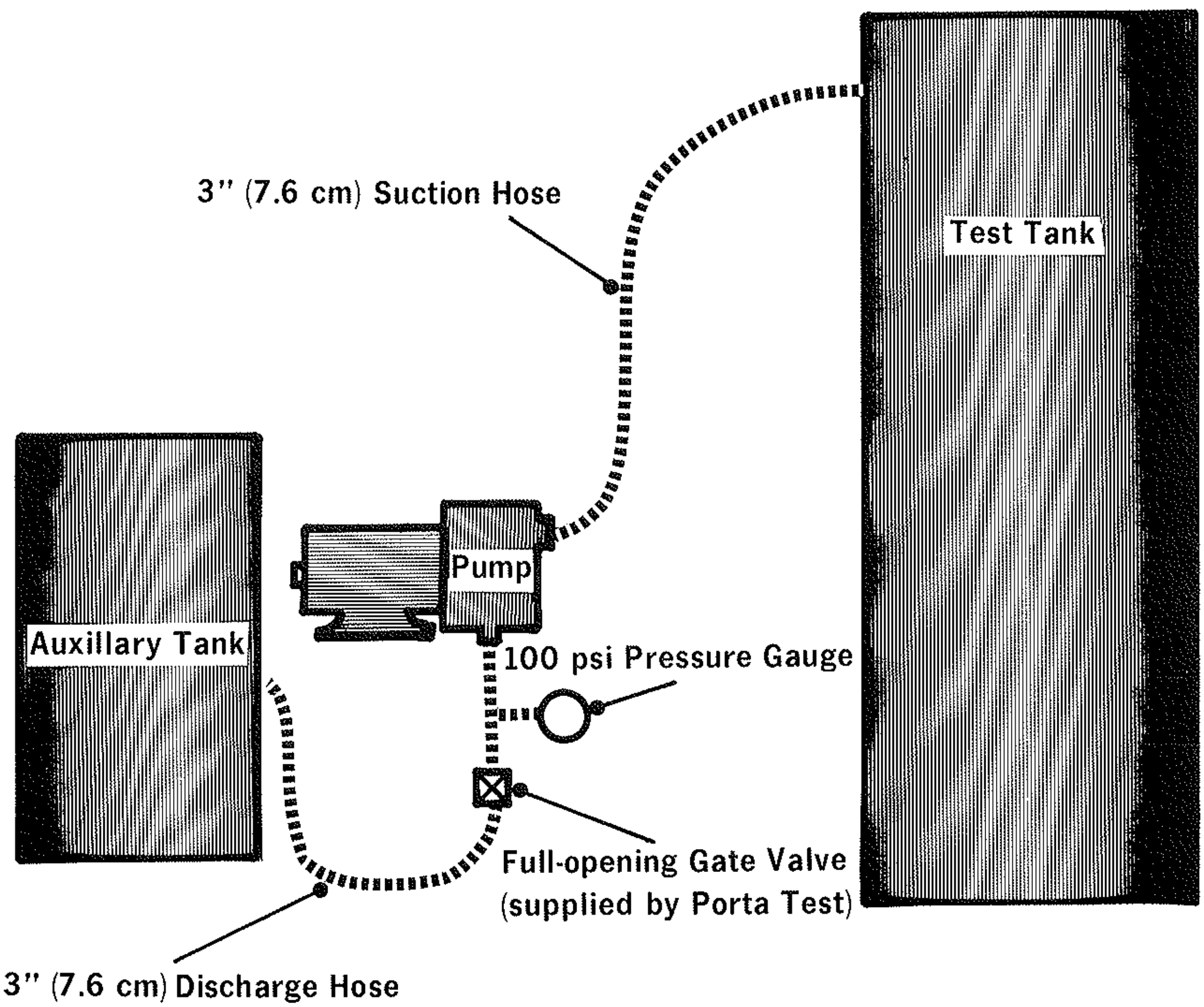


FIGURE 1 SCHEMATIC OF PUMP TEST RIG