DEVELOPMENT OF OIL SPILL BURNING EQUIPMENT

by

DAVE ROBERTS, P.Eng.
BENNETT POLLUTION CONTROL LIMITED
NORTH VANCOUVER, B.C.

Bennett Pollution Control Limited had two objectives in its contract: the first, to confine oil that is already burning or is to be burned; and the second, to enhance the burning of oil once is has been contained. A set of criteria was developed, indicating that a floating barrier for oil containment and burning has to be continuous, oil tight, flexible, buoyant, and fire resistant, with sufficient skirt depth to stop oil passing underneath and sufficient freeboard to prevent overtopping. The containment device must be readily towed, handled and deployed. Some of the forces involved are very large, requiring a strength of 50-60 tons. A large number of materials were considered. Of the materials investigated for boom covering, almost all were either too heavy or not fire resistant. This finding tended to point to a "one-shot" boom or one that would not necessarily require retrieval after every firing.

All types of material, including foam glass, were considered. Floating concrete will not float unless waterproofed, which results in a loss of fire resistance. Providing the best boom floatation was Ethafoam, a polyethelene foam with a melting temperature of around 300-350^{o}F. Cork, also a good material in many ways, is ablative: it formed a charred layer, retarding further burning for a period of time. Pumice is a good material; however, it is not available in large enough pieces to enable proper testing. Tests with some pieces showed that this product floated without much freeboard.

Also investigated were fire-retardant coatings of various types with the idea of coating and testing known floatation materials; water-resistant coatings were not to be found. Nearly all coatings work on the principle of forming a foam layer when heated. The foam layer is cohesive and clings to the substrate long enough to protect. A piece of Ethafoam

Environment Canada. Arctic and Marine Oilspill Program (AMOP) Technical Seminar, 1st. Proceedings. March 15-17, 1978, Edmonton, Alberta, Canada, Environment Canada, Ottawa, Ontario, 191-193 pp, 1978.

with a coating will sustain direct flame from a propane torch; when put in water, however, the coating will fall off. It was decided that one of the alternatives would be to produce a boom much like Bennett's regular boom and provide fire protection for a significant period. The main problem was defining the design criteria; for example, the temperature to which the boom would be subjected was not known. Therefore, it was decided that a boom would be constructed from the materials tested, instrumented with thermocouples, and put in a fire.

Subsequently, a boom was constructed with a cross-section of regular Ethafoam seven inches in diameter, enveloped with a blanket made of ceramic felt called Cerawool. Cerawool is good for about 2700 degrees. An aluminized asbestos fabric, which is used for making fire suits, was applied for an external coat. Based on what happened to this material in the test fire, going into a fire in one of these suits certainly cannot be recommended.

The other factors to be considered were ignition and sustained burning. A material, Seawich, which is now being patented, and which is presently distributed by Bennett Pollution Control Limited, was considered in light of these factors. The material is crisp like a dry break and is hydrophobic, oleophilic and works very effectively, even though its density in the initial state is slightly more than that of water. It wicks extremely well once burned; one just fires it and it burns off the material that holds the particles together and ends up with a very light produce just like burnt toast. If this material is dropped on an oil spill, a series of little holes form throughout the material which, upon filling with oil, act like wicks and help to sustain combustion. Because the material provides very good insulation, it protects the wicked oil from the heat sink of the underlying water.

In a test which was carried out a week ago, the wick was used to burn a mixture of water and Bunker C oil which had been stored for five to eight years in a one-gallon aluminum pail. The oil was so thick it had to be scraped from the can. A piece of the wick burned for two and one half hours. The material is impregnated with wax; and after the initial binding agent is fired off, it starts about as easily as a candle. If sufficient heat is obtained, some of the oil particles on the wick will spit and help spray the oil up into the flames and generate more heat. In subsequent tests a 45-gallon barrel was used and burned down until the water surface was nearly clean. This observation emphasizes the importance of the material's insulating capabilities. As an insulating wick, this material literally draws the oil until just about all of the oil is consumed.

A test boom was constructed for testing at the Vancouver International Airport fire department training area. The test boom was placed on a small creek. For temperature measurement six points of reference were utilized on the downwind side of the boom. Two points were located at 90 degrees of the circle with one of the thermocouples inside the boom standing ¼ inch outside the fabric. The next thermocouple was inside the fabric, and another was inside the ceramic fibre insulation directly in the middle of the foam. This was done to provide an idea of the temperature gradient across the materials. Five gallons of gasoline were spread and ignited on the containment area. The thermocouple tubing melted and disappeared shortly after the start. The aluminum foil lasted about 10 seconds in the first burning. The plastic Mylar material, which is the binding agent between the aluminum and asbestos backing, melted down the side of the boom and burned for quite some time.

The temperature at the surface of the boom on the downwind side was 1650°F, while a 10 mile per hour wind blew. As there are very few alloys that can withstand such temperatures, concern was expressed that the aluminum connector on the boom was not going to be satisfactory, and that a new one would have to be found. The aluminum foil didn't do very much as it burned off very rapidly. Although the asbestos material stayed together very well, there is a fabric made of silicon dioxide which is good for 2500°plus; it is available and it is much cheaper than asbestos. Because the termperature at the surface of the foam did not go much over 700° to 800°, it is believed that foam glass would be a better material than Ethafoam. Foam glass is brittle and breaks down over 900°, but could possible increase the life of the boom.