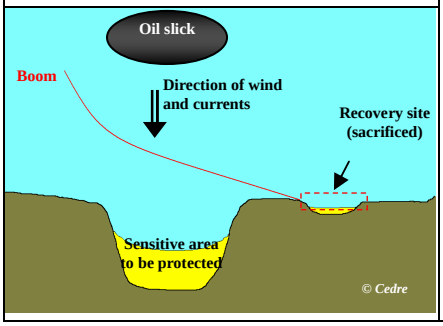
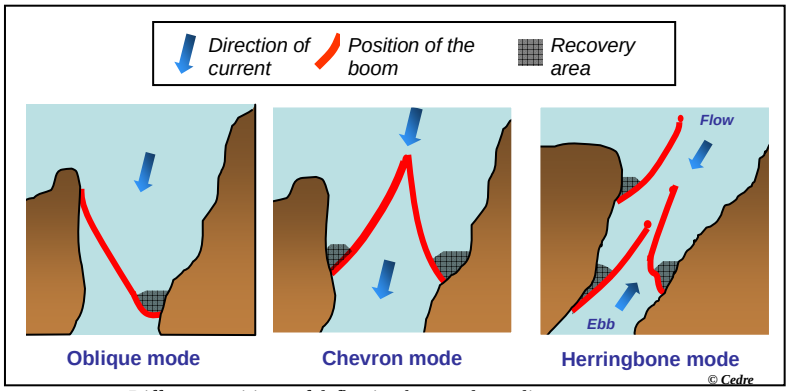
PROTECTING SENSITIVE COASTAL AREAS USING DEFLECTION BOOMS

SCOPE

Pollution: all types
Pollutant: fluid to highly viscous
Coastline, estuary, inland waters



Protection of a sensitive site using a deflection boom.



Different positions of deflection booms depending on current.

EQUIPMENT NEEDED

Response equipment: containment boom, shore-sealing boom
Vessels: picket boat, small tugboat, skiff or paravane device with specific skimmer and boom unit
Anchorage: sinkers, piles or anchors, chains and mooring buoys, cables and pulleys.

Land equipment:
- front end loader, digger or a farmer's tractor

Extra equipment:
- Walky-talkies, VHF sets, mobile phones

DESCRIPTION/PRINCIPLE

The objective is to deflect the pollutant to an area where the oil can be recovered so as to protect sensitive sites (ecological or economic). Two strategies can be adopted:

- deflection–protection: deflection booms are used to prevent drifting slicks from impacting very sensitive sites (ecological or economic). They are laid so as to deflect the oil upstream to a recovery site.
- deflection-recovery: the main aim is to channel a pollutant to an area where it will be far easier to recover and in so doing spare sensitive coastal areas nearby that would not be easy to provide direct protection for. The boom is placed at an angle to the current (cf following page) so as to deflect the oil to a coastal location where it can accumulate and be easier to recover by a strike team.

The response strategy will have to be worked out in advance when drafting the contingency plan commensurately with possible pollution risks (drift probability). In this instance, anchoring locations (for mooring buoys and sinkers) will have to be planned (the boom laying plan will need to factor in current direction and speed) or be installed in advance. In the event of a spill, boom can be stored on a barge or on a drum and one end of the boom can be tied to the mooring buoy that is the furthest away from the coast. Then let the boom unravel in the current and tie it to intermediate mooring buoys. This kind of specific skimmer and boom system may well turn out to be efficient on some sites and will not require prepositioning sinkers or picket boats for deployment.
Do not try to tow the boom against the current and ensure you do not stretch it too much otherwise it will tear. When deploying the last section of boom, use a picket boat to get the rope ashore and slip it through a pulley system then use the appropriate equipment to stretch the boom. (cf data sheet on "*Onshore containment at source*"). Install the shore-sealing boom on the foreshore (if there is a slight slope) and ensure it will be oiltight at the top end of the foreshore even at spring tides. Ideally, use a boom that has a towing strap to avoid tearing the boom when towing.
When currents are likely to reverse, the best solution will be to install double reversable anchorages.

CONDITIONS OF USE

Pollution: fluid (fresh oil) to viscous pollutants (HFO) and soiled debris
Site: coast/estuary/harbour. Current speeds should usually be less than 0.7 knots but this can vary depending on the kind of boom and how it should be laid in relation to the current (cf next page).
Inefficient if current speeds top 2 knots. Specific boom and skimmer configurations designed for use in high current speed conditions can be efficient for current speeds of up to 3 knots.

IMPACT ON THE ENVIRONMENT

Physical: temporary changes to hydrological patterns such as local turbulence at outcroppings depending on current speed and the size of the water area.
Biological: limited to high depending on the nature of the containment area. So called "sacrificial" sites will require appropriate restoration.

PERFORMANCE

Yield: the efficiency of a deflection boom varies according to how well the boom laying plan fits in with local weather and sea state conditions in addition to factoring in current reversals and the assets to be used for collecting the oil.
Implementation: prepositioning boom anchorage points before the oil "beaches" and ensuring correct oiltightness between the mooring buoys and the booms, deflection boom, shore-sealing boom.
Waste: pollutant and soiled macro waste.

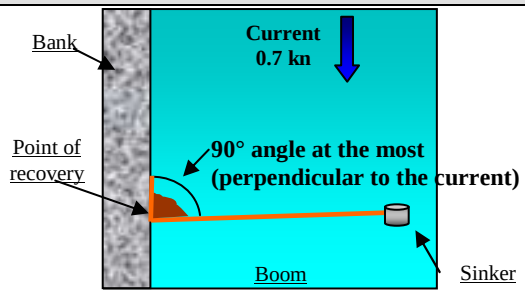
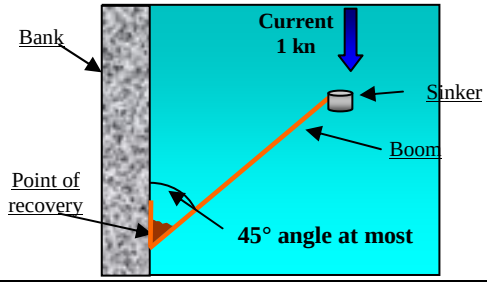
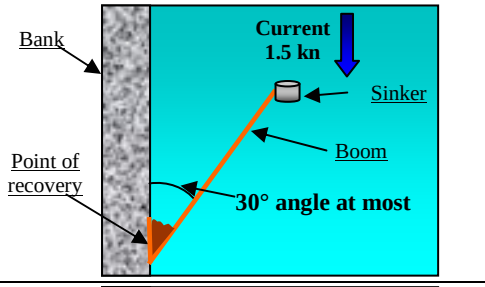
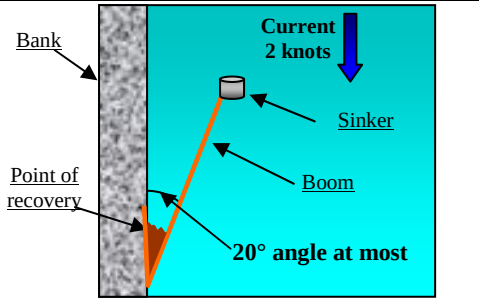
PTO

OBSERVATIONS
- This is a tricky job to do in choppy water especially if there are heavy waves or sizeable swell. - Operational efficiency will be dependent on whether a prior study has been conducted for boom laying and whether it has been validated by a deployment exercise involving all of the response assets to test the entire boom laying plan. - Laying the boom in chevron mode will facilitate shipping. - At the end of the response operation, always clean the equipment (cf data sheet on "*Cleaning, repairing and reconditioning booms after use*").

- BOOM LAYING ANGLES IN RELATION TO A CURRENT -

If the current speed perpendicular to a section of boom is more than a given amount, oil will begin to slip under the boom. For most booms, that speed (VNE) is about 0.7 knot. Beyond that, the boom will have to be angled so as to reduce the component speed of the current perpendicular to the boom. The figures below list some angles for a number of current speeds.
For current speeds other than those shown here, we can easily work out the angle of the boom (alpha) to the current with the following formula :

$$\sin\alpha \le \left(\frac{0.7}{current\ \_\ speed\ (knots)}\right) \quad \text{or} \quad \sin\alpha \le \left(\frac{0.35}{current\ \_\ speed\ (m/s)}\right)$$

CURRENT SPEED		MAXIMUM BOOM DEPLOYMENT ANGLE (in degrees in relation to current direction)	
in knots	in m/s		
Up to 0.7	**Up to 0.35**		Up to 0.7 knot the boom can theoretically be laid front end on to the current, but usually the laying angle is slightly less than 90°, either to deflect the oil to the recovery area or to push it away from the site to be protected.
1	**0.5**		Over and above 0.7 kn, the boom must always be laid at an oblique angle in relation to the current, so as to deflect the oil to an area where oil can accumulate and/or be recovered (calm water area, current lower than 0.7 kn), sufficient draught, ability to stockpile equipment nearby.
1.5	**0.75**		
2	**1**		Over and above 2 knots, the recommended laying angles are smaller and require much longer boom sections. In this instance, booms can be laid in cascade mode.

- Avoid the formation of a pocket between two anchor points and plan for intermediary anchorage.
- The less the boom is laid at right angles to the current, the less stress will be exerted on it and the more efficient it is going to be.
- Ensure oil cannot escape at the anchorage point on the bank (cf data sheet on "*Anchorage and oiltightness of booms against a quay wall*").