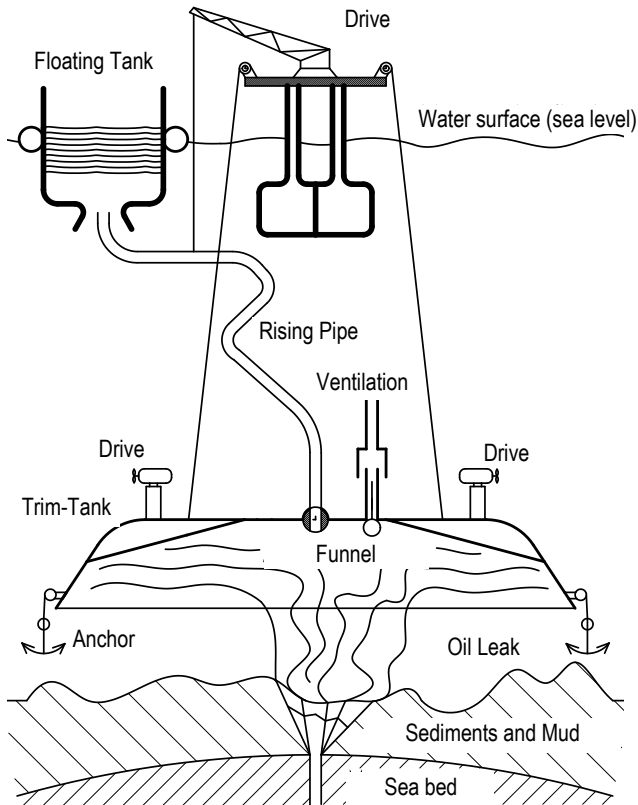


## Oil recovery during submerged oil leaks and prevention of water pollution

Accidents in exploration, production and transport of oil can never be completely ruled out with absolute certainty. Spectacular events such as "Xtoci" or the explosion of the platform "Deepwater Horizon" often allow the leak to be sealed only after many months. Meanwhile the oil flows unstoppable into the water, rises to the surface and pollutes huge areas. The consequential damages are often billions. But it is also cheaper: The fastest way to solve the problem is shown below, where instead of trying to stop the leak, the very first step should be the controlled collection of the oil before it can get to the surface.



### Example 1

It shows an uncontrollably bubbling large area leak on the seabed over a borehole (because of a torn drill rod), which due to the thick and porous sediment and sludge layer and the large oil pressure cannot to be simply sealed with weights. The only way to stop the flow of oil is to drill a deep hole across the hard crust, which takes many months. So a quick intermediate solution is offered by a floating platform, under which hangs a large funnel, which is driven over the leak. Such platforms are usually semi-dives, in order to ensure a position as calm as possible even at wild sea.

Since oil is lighter than water, it rises in the funnel and will be collected there without mixing with the water in the funnel environment. The water pressure pushes the oil out of the funnel via a riser pipe into a floating tank, which is open at the top and at the bottom. There, the oil is then removed, disposed of or further processed. In this collection tank the water is gradually displaced with increasing oil quantity. When it is full, it can be replaced or empty-pumped by tankers. This collection tank - whether oil- or water-filled - is always equally heavy and does not need trimming. Groundwater, spray, or rain flows out downwards by itself, while the oil remains in the upper part. Gas bubbles are vented through the water and oil layer; thus minimizing the risk of explosions.

Due to the different density of oil and water, the collecting funnel becomes increasingly lighter with increasing filling and must therefore always be kept at the same weight by means of trimming tanks, since otherwise the platform would rise out of the water. Alternatively, the funnel can also be firmly anchored to the seabed. Probably natural gas also leaks from the leak, it must be removed from the funnel by an automatic ventilation in order to avoid excessive uplift forces. In the event that the platform cannot be positioned exactly above the leak location (for example because in that position is still a burning or damaged platform), the funnel can also make a short lateral travel path by means of its own remote-controlled drive.

This collecting device can already be provided as a precautionary measure and, since it is floating, it can be brought on site relatively quickly. Parallel the efforts to stop the leak-flow can be done with less pressure of time.

### More Examples:

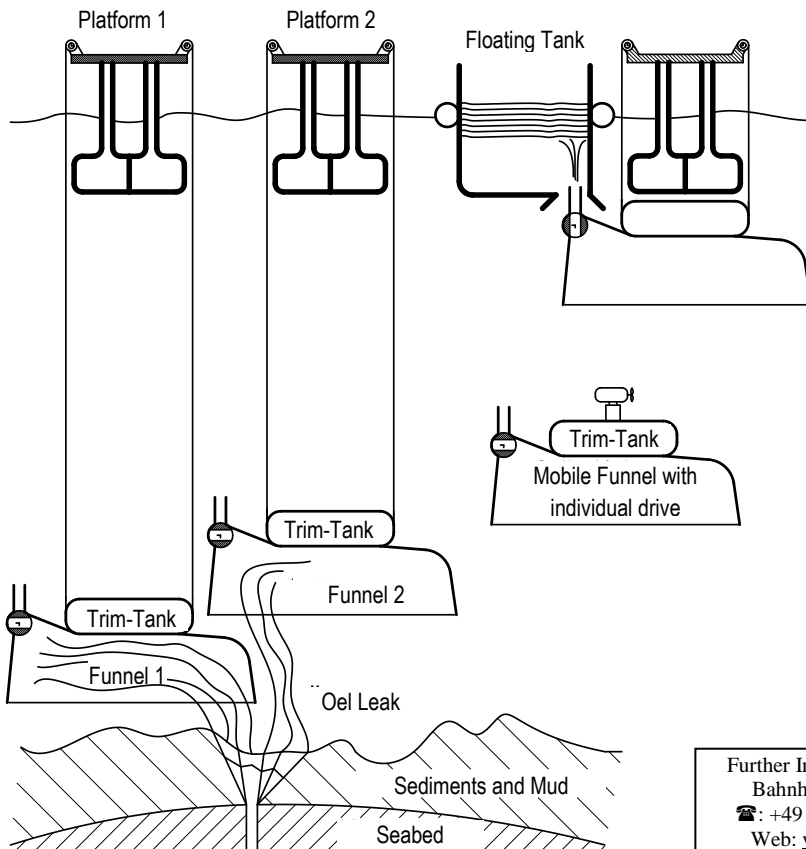
The further examples shown here do not require a riser. When the collecting funnel is sufficiently filled, the platform carrying it moves to the side and a second platform lowers its funnel over the leak in an overlapping alternation. The filled funnel is pulled upwards and by opening the funnel valve its content pours into the collecting tank from below. After this, the interplay with at least two funnels begins again.

The method is very flexible and can also be used in combination with Example 1 if the collecting funnel is already firmly anchored on site. Then a single platform can place its funnel over the permanently installed funnel according to Example 1. The valve of the fixed lower funnel is opened, fills the upper mobile funnel and is closed again after the filling is completed. In the time required to fill the funnel installed firmly on the ground, the mobile funnel empties its contents into the collecting tank and then returns for a new cycle.

Even more elegant the problem is solved with one or more self-propelled funnels, which can approach their positions by remote control.

If the accident site is very large, e.g. because the seabed is very porous, or a pipeline or a drill rod is bent in several places or oil escapes from the tank of a sunken vessel, a complete excavated ship hull could be used placed keel-up over the leakage area.

Although almost every effort to eliminate a large oil spill is legitimated by using the possibilities presented here, much money can be saved to deal with the consequences of oil spills. A prophylactic investment in this technology will pay off sooner or later.



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