DUE TO THE HEAVY MARINE TRAFFIC AND ASSOCIATED RISK THE OIL SPILL SCENARIOS AT KANDILLI WHICH IS THE NARROWEST POINT IN ISTANBUL STRAIT

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ABSTRACT

The Istanbul strait, which is a part of Turkish Strait System (TSS), is a narrow and navigationally risky waterway for ships. This risk increases daily due to oil transportation from Central Asia and Russia. Over 50.000 vessels, on average, annually use the Turkish Straits. This is an increasing figure that occurred in the Istanbul Strait under the heavy marine traffic.

In this study, the scenario was to run on Kandilli which is the narrowest part of the strait. This area is difficult for navigation due to inverse currents (which is referred to as Devil's Current by the locals). Simulation was run for 500 tones of oil spill at Kandilli Point and distribution of oil was determined by using GNOME™. Effective wind speed and three different wind directions were used at each scenario. As a result of these runs, risky areas were identified and necessary actions to minimize the effect of spill were discussed.

Cengelkoy, Arnavutkoy beaches and Saraybürnu were identified as the most risky areas. In order to minimize the effect on these areas, stocking enough barriers were found to be helpful for speedy action.

INTRODUCTION

The Turkish Straits System, consisting of the Strait of Istanbul (Bosphorus), the Marmara Sea and the Strait of Çanakkale (Dardanelles), are very complicated and narrow waterways connecting the Black Sea to the Mediterranean Sea. Located between the Black Sea and the Mediterranean, the Turkish Straits are 164 nautical miles in length. The Turkish Straits have unique physical, geographical, hydrological an oceanographic characteristics and complicated navigational conditions prevail in the area. The Istanbul Strait is a narrow waterway with several dangerous curves and a busy maritime traffic which together increase the risk of accident (Tan and Otay, 1999). All the dangers and obstacles characteristic of narrow waterways are present and acute in this critical sea lane. The Strait of Istanbul, in particular, presents the greatest challenge for navigation as it snakes through the heart of Istanbul, a city of over 14 million people and rich with thousands of years of history, which is declared as a "World Heritage City" by UNESCO.

The Strait of Istanbul is approximately 31 km. long, with an average width of 1.5 km. Among the straits of the world, it is the narrowest, constricting to a mere 698 meters between Kandilli and Bebek (a 45º course alteration is required), leaving only a vessel's length of free way on either side in an area densely populated (Figure 1). The Strait of Istanbul takes several sharp turns. The vessels must change courses at least 12 times. At Yeniköy, the necessary course alteration is 80º. At the turns (Kandilli and Yöniköy) where significant course alteration have to be made, the rear and forward sights are totally blocked prior to and during the maneuver. The ships approaching from the opposite direction cannot be seen round the bends. Furthermore, strong currents and counter-currents (reaching 5 to 8 knots), constant changes in their pattern, poor visibility due thick fog, snow and rain are additionally hazards in these narrow waterways. The Kandilli turn area is difficult for navigation due to inverse currents (which is referred to as Devil's Current by the locals) (Anonymous, 1990).

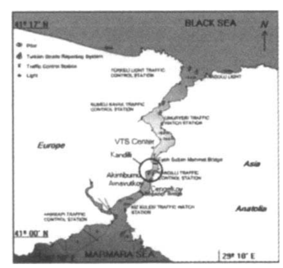

FIGURE 1. THE ISTANBUL STRAIT AND KANDILLI

Over 50.000 vessels, on average, annually use the Turkish Straits. In other words, together with the congested local traffic, on average one vessel passes through the Strait at every 10 minutes (Anonymous, 2003). More importantly, the number of tankers passing through the Straits has also reached alarming limits. In 1996, 12 tankers passed daily and 60 million tons of oil was transferred through the Strait of Istanbul. In 2002, 26 tankers passed daily and 125 million tons of oil and petroleum derivatives passed through the same waters. This is a dramatic increase (Akten, 2002).

One major accident that occurred in the southern entrance of the Istanbul Strait in 1979 was when a Romanian flag supertanker, the "M/T Independenta", collided with the freighter M/V Evriyali resulting in the tragic death of 43 crew members. This has been ranked as the 10 worst tanker accidents in the world due to the amount of oil spilt (over of 64.000 tons of oil into the water and an oil slick that burned for weeks). In 1994, another major accident occurred, this time in the northern entrance of the Istanbul Strait, when the M/T Nassia collided with the bulk carrier M/V Shipbroker. A total of 29 officers and crew members from both ships lost their lives, including the master of Shipbroker which burned totally. The fire on the tanker Nassia, fully loaded with crude oil caused serious pollution damage to the Straits and the overall marine environment. Approximately, 20.000 tonnes of crude oil, a considerable part of Nassia's cargo—and a fire, which lasted 4 days 5 hours 40 minutes, were resulting in the suspension of traffic in the Strait for several days (URL-1, 2003).

Oil pollution is the most important danger to marine ecosystem. Ever increasing need for oil resulted in increase in oil transportation through the straits via bigger tankers. As a result, the risk of accidents has increased in and around Istanbul (Ba_ar, 2003). It is obvious that increment in tanker size reduces maneuverability, and this increases the probability of accident (Plant 2000).

METHOD AND SCENERIOS

GNOME™ developed by NOAA was used to simulate spatial and temporal distribution of oil (Anonymous, 2001a). This software uses wind, tide, and current values to calculate the movement of oil at sea surface (Anonymous, 2001b). Ba_ar and Köse (2003) simulated oil pollution at loading / unloading terminals.

In order to input straits data GNOME, map with Mercator projection was digitized at 4662 latitude and longitude points. Currents data for simulation was input as 78 x 110 matrix with the especially format. Current values were u and v (m/s) at x and y directions respectively (Ba_ar, 2003). Scenarios was run for 500 tones of oil spill and coordinate 41° 04' 43" N–29° 03' 00" E at the Kandilli Turn (Figure 2). S and NW wind directions were used as effective wind directions and wind speeds were 5 and 20 knots at each simulation.

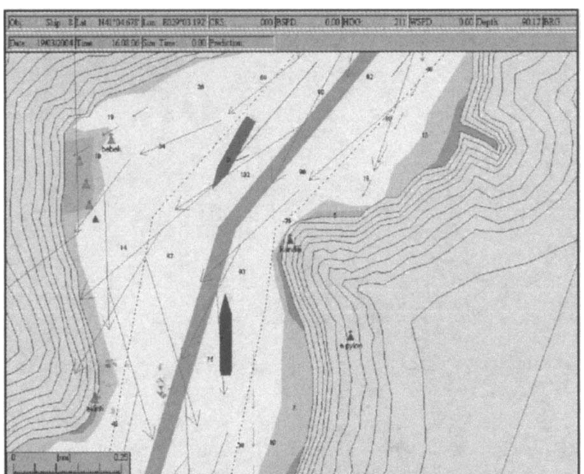

FIGURE 2. POSITION OF VLCC SHIP BEFORE ACCIDENT AT KANDILLI TURN

RESULTS

As a result of the first simulation, which used a southerly wind direction, the oil spill affected first step Arnavutkoy beach and Akintiburnu and if necessary action is not taken, oil spill reaches into 30 minutes to Sarayburnu (Figure 3 and 4). The Oil was beached 33 percent and floating 64 percent after 80 minutes (Figure 5). Second scenario was to run with a North-West wind direction. In this scenario, oil spill affected Anatolia side beaches and the first step was not a fast spill due to currents affected (Figure 6). The other of the simulation step the oil spill reached Cengelkoy beach and south of Kandilli turn (Figure 7 and 8). The Oil was beached 96 % and floating % 3.

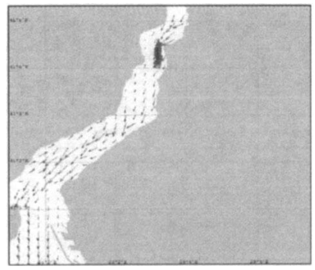

FIGURE 3. DISTRIBUTION OF OIL AT 1ST. SCENARIO 10 MIN.

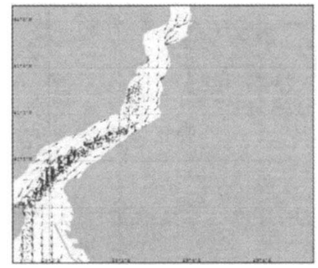

FIGURE 4. DISTRIBUTION OF OIL AT 1ST. SCENARIO 30 MIN.

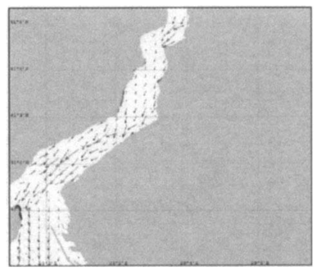

FIGURE 5. DISTRIBUTION OF OIL AT 1ST. SCENARIO 80 MIN.

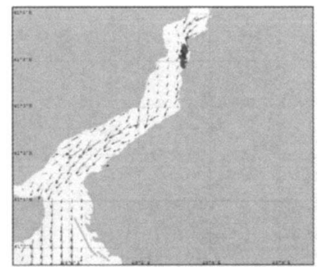

FIGURE 6. DISTRIBUTION OF OIL AT 2ND. SCENARIO 10 MIN.

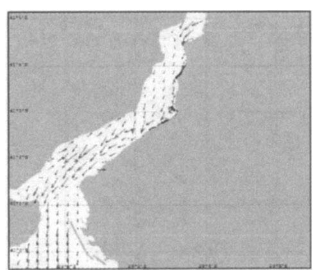

FIGURE 7. DISTRIBUTION OF OIL AT 2ND. SCENARIO 30 MIN.

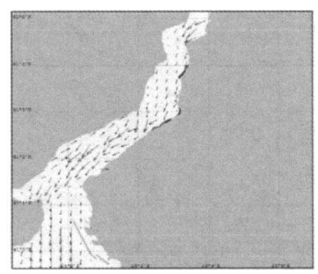

FIGURE 8. DISTRIBUTION OF OIL AT 2ND. SCENARIO 80 MIN.

CONCLUSIONS

The Istanbul Strait is under ever increasing tanker traffic. Results of simulations of tree critical areas, which are called Cengelkoy, Arnavutkoy beaches and Sarayburnu, illustrates a spill at Kandilli turn after a tanker accident. The Cengelkoy beach is a risky area better than the other area, especially those areas that are recreation or park. There are many heritage waterside houses and palaces.

It is important that necessary action is taken, if necessary action is not taken, the oil spill reaches to Sarayburnu in 30 minutes. First action has to be fast and effected with the barrier at Kandilli, so that it does not reach to Sarayburnu. In order to act fast and efficiently, stocking barriers and skimmers at risky areas is advisable and will reduce the damage and cleaning cost.

The oil spill will easily reach beaches when wind direction comes in from the west or the east. However, the oil is beached fewer when the wind is coming from the south or the north.

BIOGRAPHY

Dr.Ersan Basar is an Assistant Professor in the Faculty of Marine Sciences, Karadeniz Technical University (KTU), Turkey. He is interested in marine pollution resulting from ships and tanker accidents, and the resulting oil spills along the Turkish Straits and Coasts. Dr. Basar published scientific articles about oil spills and pollution. He teaches safety at sea and marine pollution at KTU.

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