TOOL FOR COST ANALYSIS FOR THE MARITIME ENVIRONMENTAL CLEANUP STUDY CASE: OIL SPILL IN THE ROMANIAN BLACK SEA COAST

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Abstract: *Black Sea, considered one of the sensitive marine ecosystems of the planet, in recent years record a high volume of shipping oil ever higher. In future in this area is projected onshore and offshore activity in increasingly diverse and complex. Sustainable economic development in the Black Sea region requires substantiation and implementation plans in case of marine pollution. In this logistic effort and determination quantify the costs associated with oil pollution in case of an extreme event is required. This paper proposes a tool for analysis of marine pollution costs associated with operations and highlights the results of the calculation in the case of oil pollution in the Romanian Black Sea coast.*

Key-words: *oil pollution, Black Sea, environmental impact, cost-benefits analysis.*

1. INTRODUCTION

The literature indicates that currently over 80% of the international trade is done through shipping, which is still the cheapest way of transportation and also constitutes an essential factor of meeting the demand for goods and services (UNCTAD, 2012). In this context the Black Sea is a real opportunity, insufficiently exploited in the economic relations between Europe-Asia-Africa (Kosteletou and Liargovas, 2011). Meanwhile the Black Sea is one of the most sensitive marine ecosystems and human activities and the most isolated in Europe. The impact of human activities on the environment in the Black Sea was approached from different perspectives: oil pollution in coastal area (Rusu, 2010), quantifying the contribution of shipping to air pollution (Apetroaei year Nicholas, 2012), introduction of invasive species (Mikhailovich , 2011).

Although the Black Sea area, major pollution cases were rare (tanker "Independence", 1979, in the Bosporus, tanker VOLGONEFT, Kerch Strait in November 2007) the risk of major oil pollution is increasing. Tanker traffic is more intense and kilometers of subsea pipelines to transport crude oil are multiplying. In the future are projected increasingly onshore and offshore activities and more diverse and complex.

Sustainable economic development in the shipbuilding industry, the Black Sea countries, requires, in addition to promoting environmentally friendly technologies, funding and implementation contingency plans in case of marine pollution. In this logistic effort and determination quantify the costs associated with oil pollution in case of an extreme event is required (Etkin and Welch, 2005; Kontovas, C., 2010). This report proposes an analysis tool of marine pollution costs associated with operations and highlights the results of calculation referring to the case of oil pollution in the Romanian Black Sea coast.

2. THEORETICAL CONSIDERATIONS

Pollution is the contamination of the environment with materials that interfere with human health, quality of life or function of natural ecosystems.

Human activities related to energy production and oil products such as drilling/extraction, processing/refining, transportation, from which fuels are obtained, occupies an extremely important place in the global economy and they are directly responsible for the effects of environmental pollution surroundings.

Oil pollution are diverse with different characteristics, both in terms of quantity discharged (major, medium, minor pollution), the location (offshore, onshore, dry zone), the type of hydrocarbon (such as pollutant) and the source of coming (shipping, drilling and production platforms, atmosphere, rainfall discharges, oil terminals, industrial units).

3. INTERVENTION ELEMENTS FOR OIL POLLUTION CASE

Essential elements underpinning of response to marine pollution are:

- ✓ The existence of a coordinating and organization national organism (legally constituted);
- ✓ Specialized staff and trained for emergency situations;
- ✓ Specialized equipment and reliable;
- ✓ A national contingency plan, a national strategy to intervence in accordance with UE.

Preparation of intervention is essential to quickly and efficiently limiting damage and environmental impact size, consisting of: monitoring the progress of pollutant; plan intervention operations; choice of equipment depending on the severity of pollution; establishing the intervention teams.

The main objectives of the intervention are: protecting the shoreline, limiting pollution sensitive areas (economic, tourism); recovery of pollutants and other wastes from pollution; rehabilitation of polluted areas. Methods of intervention in case of marine pollution are: natural recovery (no steps); pollutant transfer from damaged tanks in barges, storage; burn in situ; cleaning agents; concentration and collection of oil on the water and ashore.

4. DEVELOPMENT OF CALCULATION TOOLS

The proposed model represent a transposition of a calculation methodology that aims analyzing the costs of the remediation in case of spills from hydrocarbons. In the current context of the Western Black Sea, with its interest in the area's mineral resources (especially oil and gas) development of such a tool is useful for sizing supply chain related emergencies (accidents on offshore platforms and terminals oil type collision and failure tanker ships, and so on). For this model we used Excel platform because it is an easy to use and accessible to all. The operation of this program is as follows: user enter input data, application performs calculations according to the scenario created by the user, providing information necessary to value intervention costs and costs associated with its implementation and socio-economic impact on the environment. The program is easy to update data in real time which gives a high degree of flexibility and usability.

5. RESULTS

Easy to understand how this board is used we created a scenario for oil pollution in the Black Sea.

USER INPUT (Dispersant Option):

Oil Type: Medium crude
Spill Amount: 24000 barrel
Distance to Shore: 5-15 km
Slick Coverage: Continuous
Surface Water Type: Marine
Water Temperature: 20°C
Prevailing Winds: Moderate (15 kts)
Response Timing: 4 hours (to shoreline)
Shoreline Type: 6A: Gravel Beach
Shoreline Response: Manual
HCIC = Medium
On-Water Socioeconomic Resources: Fisheries
On-Water Natural Resources: Birds
Shoreline Socioeconomic Resources: Medium Value
Shoreline Natural Resources: Moderate Sensitive
Predicted Shoreline Area Impacted SELECTED
RESPONSE TYPE = Dispersant

USER INPUT (Mechanical Recovery Option):

Oil Type: Medium crude
Spill Amount: 24000 barrel
Distance to Shore: 5-15 km
Slick Coverage: Continuous
Surface Water Type: Marine
Water Temperature: 20°C
Prevailing Winds: Moderate (15 kts)
Response Timing: 4 hours (to shoreline)
Shoreline Type: 6A: Gravel Beach
Shoreline Response: Manual
HCIC = Medium
On-Water Socioeconomic Resources: Fisheries
On-Water Natural Resources: Birds
Shoreline Socioeconomic Resources: Medium Value
Shoreline Natural Resources: Moderate Sensitive
Predicted Shoreline Area Impacted SELECTED
RESPONSE TYPE = Mechanical

The results obtained are as follows:

Option 1 (Dispersant Use):
TOTAL ON-WATER RESPONSE COST = $26,994,871
TOTAL SHORELINE RESPONSE COST = $59,986,299
TOTAL RESPONSE COST = $86,981,170

ON-WATER RESPONSE IMPACT = $65,451,906
SHORELINE RESPONSE IMPACT = $2,999,315
TOTAL RESPONSE IMPACT = $68,451,221

TOTAL DAMAGES *WITHOUT* RESPONSE = $802,221,030

TOTAL DAMAGES *WITH* RESPONSE = $734,926,728

RESPONSE BENEFIT = -$1,156,919

Option 2 (Mechanical Recovery):
TOTAL ON-WATER RESPONSE COST = $34,766,210
TOTAL SHORELINE RESPONSE COST = $45,789,555
TOTAL RESPONSE COST = $80,555,765

ON-WATER RESPONSE IMPACT = 0
SHORELINE RESPONSE IMPACT = $2,279,479
TOTAL RESPONSE IMPACT = $2,279,479

TOTAL DAMAGES *WITHOUT* RESPONSE = $802,221,030

TOTAL DAMAGES *WITH* RESPONSE = $737,493,344

RESPONSE BENEFIT = $62,448,207

The proposed algorithm, the results provided, highlights the benefits of intervention (when they exist), the amount of pollutant reached the shore, the damage caused by it. To maximize the benefits of the intervention, with the help of different scenarios can value the intervention, trough the various remediation methods which are used. In this direction, the choice is up to the user considering the optimal intervention, the appropriate minimum ratio and cost / benefit. I tried to make the formulas used to estimate costs, impact, efficiency and benefits more representative for a real situation, but this is difficult because of situations that may occur in unexpected situations of oil pollution.

6. CONCLUSIONS AND RECOMMENDATIONS

This article comes to help reduce the impact that has on our marine pollution. Efforts made in the Black Sea littoral state to find where pollution intervention strategies are supported by the European Union which amplify this problem in the shortest time possible. The main conclusions drawn from this article are: each accident is unique and so pollution differ from case to case; for each pollution apply a different strategy depending on its features; there is a solution for each case; depth of accidents requires a national approach to the need for a National Response Plan; there is no single effective system to cover all situations that may arise practically at sea; means mechanical recovery systems are the only truly "clean"; in most cases, major oil pollution, use of all equipment with technical means necessary, any way to shorten the duration of the intervention.

Optimization work in this area involves a compromise between the results obtained from the application of remediation technologies and financial efforts, material and human resources that these results were obtained.

Comparative analysis of the advantages and disadvantages of each type of remediation technologies should be made in relation to a list of priority objectives determined by the actual conditions specific to each case. The results of such analyzes must steer the final solution to the version that corresponds in most respects, in a certain context.

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