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Oil Spill Response Cost-Effectiveness Analytical Tool (Osrceat): Application In The Canary Islands

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ABSTRACT

The main objective of this work is the adaptation and implementation of the analysis tool OSRCEAT (Oil Spill Response Cost-Effectiveness Analytical Tool) in the coastal environment of the Canary Islands (Spain). The purpose of the Oil Spill Response Cost-Effectiveness Analytical Tool its to compare the costs that would be applied for different types of responses for different potential scenarios. First, we must input on main spill parameters location factors, and response options for Canary Islands, OSRCEAT calculates the cost of response operations, as well as enviromental cost (natural resources) and socio economics impacts for each oil spill type. It is also important to determine the economic costs of the intervention itself on oil spill. Then we can simulate previously and compare the damage caused by the oil spill if there is no response, in contrast to the results obtained if the response mechanisms contemplated for contingency plans are properly implemented.

1. Introduction

With the tool SIROCO (Sistemas Insulares de Respuesta y Operaciones ante Contaminantes Oceánicos - Insular Systems for Response and Operations for Ocean Pollution) we have proceeded with the adaptation and implementation of the analysis tool OSRCEAT (Oil Spill Response Cost-Effectiveness Analytical Tool) in the coastal environment of the Canary Islands

OSRCEAT is based on available data from main oil spill, field studies, tank and laboratory tests, observations of oil spill responders and researchers, as well as modeling of hypothetical oil spills (Bergueiro, 2001).

The purpose of the cost-effectiveness analysis tool (OSRCEAT) into oil spills is to perform a comparison of the costs involved the application of different types of responses to be made, for multiple different scenarios; for an oil spill or another derivatives, simulated (or real) (Etkin, 2005).

2. Results And Discussion

The development of the Insular Systems for Response and Operations for Ocean Pollution (SIROCO - Sistemas Insulares de Respuesta y Operaciones ante Contaminantes Oceánicos) allows us to reproduce, analyze and explain the behavior and evolution of pollutants in the marine environment. This integrated system can be used operationally in emergency planning and response into contaminant spills at sea and drills. It will allow us to make decisions in emergencies and for the training of all staff involved in the cleaning and restoration of the contaminated coastal environment (Figure 1).

Through SIROCO we have made the adaptation and implementation of the analysis tool OSRCEAT (Oil Spill Response Cost - Effectiveness Analytical Tool) analysis, in the coastal environment of the Canary Islands. The tool is developed as a series of mathematical algorithms implemented through a set of matrices that have been modified to adapt to the Canary Islands the OSCREAT (Table 1).

The user can enter the main parameters of the spill, location and response options, then OSRCEAT calculates the cost of response operations, the environmental costs (natural resources) and socio-economic impacts of the oil spill and the impact of

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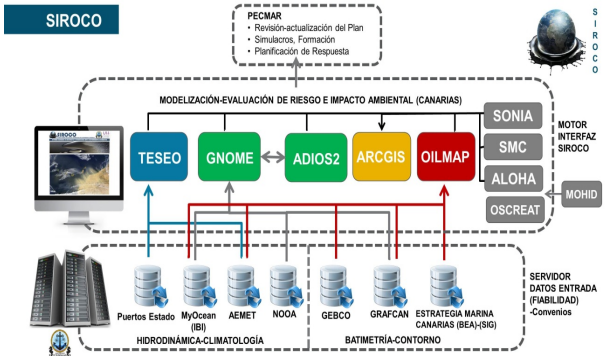
Table 1: Cost matrix considering a medium Oil spill environmental sensitivity as indexes.

Coastal Type	Spilled Product or Fuel: Medium Crude Cleaning Costs: €/m^2				
	Contamination Type				
	Surface 'pooled' < $1cm$	**Cover of HC Between** $0,1-1cm$	**With a layer of HC** < $0,1cm$	**HC Spots**	**HC Film**
ESI 1. Exposed Rocky Shores	600	250	125	75	50
ESI 2. Exposed Rocky Platforms	600	250	125	75	50
ESI 3. Fine-grained Sand Beaches	600	250	125	75	50
ESI 4. Coarse-grained Sand Beaches	600	250	125	75	50
ESI 5. Mixed Sand and Gravel Beaches	750	250	125	75	50
ESI 6A. Gravel Beaches	750	250	125	75	50
ESI 6B. Riprap Structures	750	250	125	75	50
ESI 7. Exposed Tidal Flats	1100	400	190	90	115
ESI 8A. Sheltered Rocky Shores	600	250	125	75	50
ESI 8B. Sheltered Man-made Structures	500	250	125	75	50
ESI 9. Sheltered Tidal Flats	1000	375	175	125	100
ESI 10. Salt to Brackish Marshes, Freshwater Marshes, Swamps, Mangroves	1000	375	175	125	100

Figure 1: Diagram of SIROCO - Sistemas Insulares de Respuesta y Operaciones ante Contaminantes Oceánicos.



Source: Authors

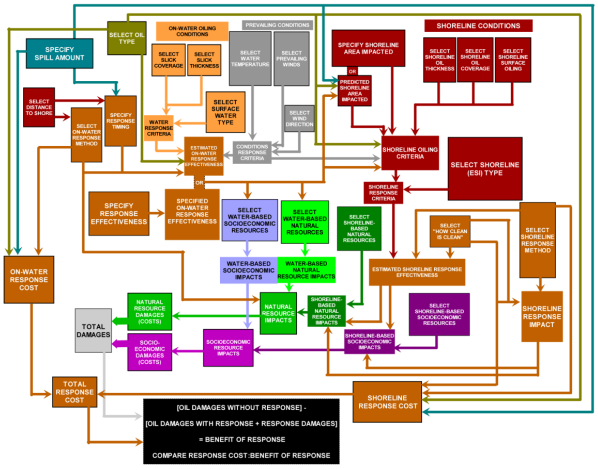
the intervention itself. This allows us to make a comparative analysis of the damage caused by the spill if there were no response, in contrast to the results obtained if the response mechanisms are applied according to the Canary Islands contingency plan for ocean pollution, in order to minimize the impact.

If the cleaning and restoration of a coastline polluted by hydrocarbons was necessary, the analysis tool OSRCEAT, it will assess the socio-economic costs and impact on natural resources, depending on the type of response and the affected area (Figure 2).

Despite all efforts in the event of an oil spill are focused on containment and recovery of oil at sea, at least a substantial part of the spill reaches the coast.

Cleaning costs associated with an oil spill, are always high and if we consider what happens when it reaches shore, they are divided into two groups: first cleaning and restoration costs and secondly costs due to damage. The main objective of any action to combat marine pollution is to prevent and reduce the impact. Under this assumption, we can calculate the costs associated with cleanup and restoration of coastal environment polluted by oil spill. Cleaning costs are influenced by many factors, such as the location of the spill, the type of oil spilled and how the natural degradation of hydrocarbons contributes to total removal.

Figure 2: Application Operating Diagram: Oil Spill Response Cost-Effectiveness Analytical Tool (OSRCEAT).



Source: D. SCHMIDT ETKIN. OSRCEAT. Environmental Research Consulting. 2005.

I.T.O.P.F (International Tanker Owners Pollution Federation Ltd.) assumes that it is virtually impossible to give a fixed value for the cost per tonne, because every oil spill is different and it depends on the conditions and characteristics of the spill. Studies published in JRP Report [JRP, 2013], indicates that the average costs associated with cleanup and restoration of the coast are displayed on Table 2.

Applying the study to oil spills of different sizes, we can see the associated costs for each spill in Table 3.

The Environmental Impact Assessment (EIA) of Repsol oil exploration in Canary Islands considered a hypothetical accidental event of loss of control (blowout) with an average rate of 1,000 bbl/day during the period of 30 days. OSRCEAT model adapted to the Canary Islands, estimates the costs of a similar oil spill in a coastal area of great environmental sensitivity it

Table 2: Caused oil spill costs. Source: Connections. Report of the Joint Review Panel for the Enbridge Northern Gateway Project. Volume 1. Canadian Environmental Assesment Agency. 2013.

	Costs per m^3 ($)	Costs per barrel ($)
Cleaning	94.500	15.000
Damage	141.750	22.500
Total	236.250	37.500

Table 3: Cost oil spills at sea. Source: Concerned Professional Engineers (CPE).

Costs for diferent oceanic oil spills (Costs m^3 – 236.250($))		
Amount spilled (m^3)	**Amount spilled (bbl)**	**Costs (cleaning - damage) ($)**
5.000	31.500	1.181.250.000
10.000	63.000	2.362.500.000
20.000	126.000	4.725.000.000
50.000	315.000	11.812.500.000
100.000	630.000	23.625.000.000
300.000	1.890.000	70.875.000.000

is like Fuerteventura and Lanzarote. After entering the parameters for landfilling, characteristics of the coast, as well as natural and socioeconomic resources, we find that the estimated cost is 1,150 million euros (Figure 3, 5).

Figure 3: Screen 1. OSRCEAT adapted to Canarias

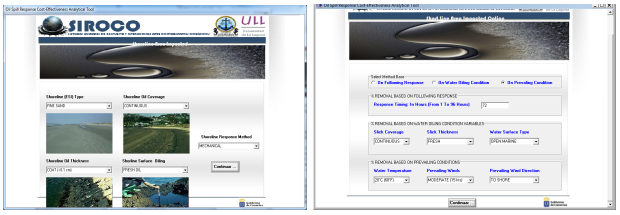
Source: Authors.

3. Conclusions

In any action to combat pollution we must prevent and reduce damage and the impact of the spill. In addition, the costs associated are usually always very high and difficult to quantify. However they are mainly associated with two types: cleaning and restoration of the coast and damage the environment. The tool OSRCEAT-SIROCO OSRCEAT allows to compare the cost of oil slick for oil spill responders and planners.

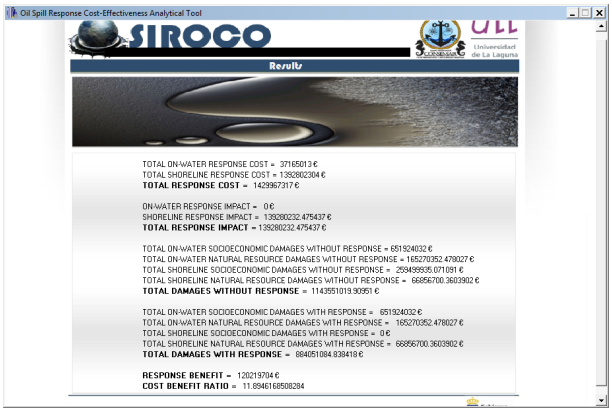
In cleaning costs are taken into account many factors, including the location of the spill, type of oil or pollutant, media used, etc. In addition, we must also consider the natural degradation of hydrocarbons whose intensity is difficult to predict in

Figure 4: Screen 2 and Screen 3. OSRCEAT adapted to Canarias



Source: Authors.

Figure 5: Screen 4. OSRCEAT adapted to Canarias



Source: Authors.

advance. To estimate the total costs of cleaning, we must know the cost of equipment, materials, labor, and complementary services.

The first thing to consider when quantifying the costs of the equipment is to know if the country where the spill occurred has specialized equipment and personnel to combat marine pollution, or if you have limited resources. To overcome the deficiencies of material is necessary to establish regional agreements between countries, especially with those closest to combine resources and reduce costs. We must also take into account the response time and operability.

In the recent case of spill from the Deepwater Horizon, BP has had to invest 14,000 million of dollars in the coast of the Gulf of Mexico in spill response operations and it was necessary almost 20,000 million dollars to pay for economic demands and actions to restore natural resources.

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