Study On Tanker Ship Evacuation Simulation Due to Oil Spill Accident in Indonesia

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1. INTRODUCTION

This research takes a case study of oil spill marine accident occurred around Surabaya strait and some places are assumed as place of refuge. Even though, a catastrophic oil spill accident never occurred around East Java. The government has to decide what it has to do in case the oil spill marine accident happens in its territory and decide which one of the places of refuge is appropriate with the accident, and then conducts an emergency response and evacuation to the ship and oil spills. This research describes the dynamic simulation of tanker ship evacuation considering some scenarios. There is no doubt that inappropriate decision can cause negative impact to marine environment; longer time of evacuation; high cost in recovery; and higher economic loss [1].

2. THE MODEL OF SIMULATION

2.1 MT Sun Pine

MT Sun Pine is a kind of oil tanker ship which performs loading-unloading in port of Gresik. The principal dimension of the ship is as follows; Length between Perpendicular (Lpp) = 107 meter, Breadth (B) = 19 meter, Draft (D) = 5.9 meter. The volume of leakage tank is 800 m³ located in parallel middle bodies.

2.2 Location of Place of Refuge

It is already explained before that any place may be considered as place of refuge depending on some condition. Places assumed as place of refuge is a bay around Gresik area, a tide-subside area about 4.514 square kilometers, located in around coordinate of 7° 4' 4" South Latitude and 112° 38' 38" East Longitude.

3. SIMULATION

3.1 Oil Gushing Theoretical Calculation

Calculation of gushing oil during simulation uses Bernoulli derivation [2]. The scenarios are based on the differences of hole in the hull of tanker. There are three kinds of holes as the following; hole of 1 square meters, hole of 1.5 square meters, and hole of 2 square meters. All located on the lowest bottom side of the hull of the ship. The result of theoretical calculation of cumulative amount of spilling oil shown in Fig. 1:

![Cumulative Amount of Spilling Oil](image)

Fig. 1 Cumulative amount of oil spills

3.2 The Evacuation Simulation

The ship data needed for simulation is obtained from port of Tanjung Perak Indonesia that record automatic identification system (AIS) data around Surabaya strait. The evacuation simulation process is shown in the Fig. 2:

![Simulation modeling using MicroSaint Sharp 2.5](image)

Fig. 2 Simulation modeling using MicroSaint Sharp 2.5

The evacuation process is described as follow; when an accident happens, the ship will contact the port state control about its condition. Then the port state control will report it to the responsibility stakeholder to take an appropriate action to combat such kind of accident. In this paper, the scenario is using booms to prevent the spreading of oil, transfer the remaining oil to the nearby tanker and tugging MT Sun Pine to place of refuge. Taking decision procedure time which is needed is omitted, since it is difficult to predict such assessment and each country has own policy to carry out it.

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4. RESULT AND ASSESSMENT

4.1 Time Needed for Oil Spill Prevention
The result of simulation is shown in Fig. 3:

![Time Needed until Boom Deployment](image)

Fig. 3 Time needed until boom deployment

The dotted line means the total time needed before the oil transferring process is conducted including cruising time and boom deployment time. Simulation result shows that total time before boom deployment is around 3.96 hours with the standard deviation is about 40.71 minutes. During that time, hole of 1 square meters; hole of 1.5 square meters; and hole of 2 square meters will spread the oil in the amount of about 12.166 cubic meters; 18.225 cubic meters; and 24.267 cubic meters respectively.

4.2 Total Time for Evacuation
The total time of evacuation for each scenarios of hole shown below:

![Evacuation Time of Hole of 1 sq meter](image)

Fig. 4 Total time in scenario of hole of 1 sq meters

![Evacuation Time of Hole of 1.5 sq meter](image)

Fig. 5 Total time in scenario of hole of 1.5 sq meters

4.3 Oil Pollution Prediction Assessment
Assumed that the thickness of spilled oil is about 1 centimeter, so the 12.166 cubic meters of oil will pollute the total area of about 1216.62 square meters, 18.225 cubic meters of oil will pollute the total area of about 1822.486 square meters, and 24.267 cubic meters of oil will pollute the total area of about 2426.72 square meters.

5. CONCLUSION

The evacuation time will be longer than the real condition because the time needed for taking decision is omitted. The evacuation time will be longer if there is no disaster preventive management system. The longer time of evacuation means that the much oil will be spilled to the sea; as a result the large resources will be damaged; and the high probability of economic loss. The government should make the marine contingency plan in order to decrease the time needed to take decision of taking action and evacuation time itself.

REFERENCES

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