

BP Oil Spill

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1 Introduction

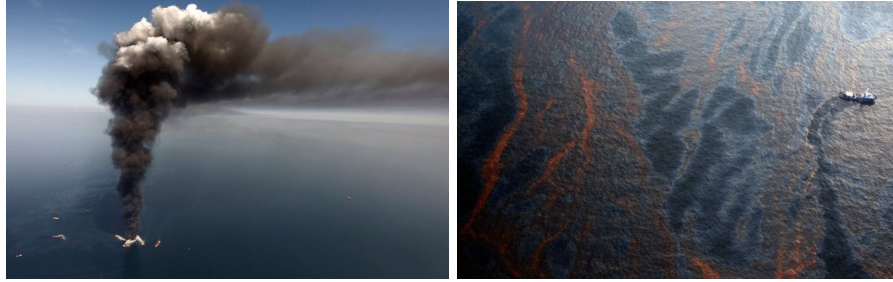


Figure 1: BP Oil spill (source: <http://thefoxisblack.com/2010/05/02/the-bp-oil-spill-in-the-gulf-of-mexico/>)

Last year, there was a major oil spill caused major damage to the environment. The White House ultimately found BP, Halliburton, and Transocean were all at fault for not only not taking adequate measures to prevent blowouts but also failing to develop techniques to minimize the threat once it happened.

What kind of damage would an oil spill like this cause? The most obvious case is in the death of many marine animals such as crabs, turtles, fish, and even seagulls. This not only threatens to kill off already endangered species, but also killing fish that people eat, such as tuna.

During the crisis, one question I had was “how far will the spill reach before it is sealed?” Can we predict how fast the oil will spread? You will estimate the radius of the spread given some basic assumptions. It will probably not be accurate because of many factors such as ocean currents, the changing rate of oil being spilled, etc. Nevertheless, calculus can give us some idea of the rate of growth of the spill.

2 Problem Statement

Let's simplify the problem by saying that the oil spill will stay on the surface of the water and as a circle (thin cylinder). Let us also say that the oil is increasing in volume at a rate of 190 cubic meters an hour. Also assume that the thickness of the oil is a 5 centimeters.

$$V = \pi H r^2 \quad (1)$$

$$\frac{d}{dt}V = \frac{d}{dt}(\pi H r^2) \quad (2)$$

$$\frac{dV}{dt} = 2\pi H r \frac{dr}{dt} \quad (3)$$

$$190 = 2\pi(0.05)r \frac{dr}{dt} \quad (4)$$

$$\frac{1900}{\pi r} = \frac{dr}{dt} \quad (5)$$

However, notice that we do not have a number for an answer.

- If not, why is there an r in the denominator of the left hand side?
- Clearly, we do not know what r is. But we can think of it as a function $r()$. What would its dependent variable be?
- What does this extra factor r tell us about the rate of the increase of radius of the oil spill ?