**Deepwater Horizon Oil Spill Estimates**

**Teacher Notes**

Before your students begin to use the Deepwater Horizon Oil Spill kmz file for Google Earth, you should get acquainted with the set up of the file and the concepts in the lesson. If you haven’t used Google Earth before, consider viewing the *Managing Folders* tutorial video available on RealWorldMath.org or referring to Google Earth’s Help page.

**Managing the File**

First, make sure to drag the downloaded file from the *Temporary Places* folder to the *My Places* folder. This saves the folder for future use. The *Deepwater Horizon Oil Spill folder* contains three main folders: *Deepwater Horizon Oil Platform*, *Media*, and *Lessons*. The *Deepwater Horizon Oil Platform* folder contains an introduction to the event and the Google Earth model of the platform. The *Media* folder contains three placemark icons that link to online educational content on offshore oil drilling. The *Lessons* folder contains the main exercises for students.

The folders contain placemarks and image overlays that will appear in the Gulf of Mexico. There are redundant directions in the file on what folders should be selected and when. (Folders are selected or deselected in the left sidebar menu by checking or un-checking the box next to the titles.) The main window view will be confusing if folders that aren’t related to the task at hand are selected, so it’s very important that these directions are read and followed. Only one image overlay should be visible at a time.

Additionally, all of the folders are set to specific viewing angles in Google Earth. Double-clicking on selected folders or icons will automatically adjust the view. This also needs to be stressed because these viewing angles are important to the exercises. Take a trial run through the folder and follow the directions.

**Estimating Area**

The image overlays in the file are regions of the gulf that are closed to commercial fishing or covered in surface oil. All are irregularly shaped so basic polygon formulas won’t work. The best option for students is to make an estimate of the area. This is accomplished in Google Earth first by selecting *Grid* in the top *View* menu. If the correct viewing angles are used, the lines of longitude and latitude form boxed regions of a particular size. The area of these boxed regions is given in the placemark’s directions in square miles. I’ll list them again here:

* Federal Fishing Closure: 1,000 sq. miles
* Pick’s Theorem: 1,000 sq. miles
* April 25, 2010: 10 sq. miles
* April 29, 2010: 10 sq. miles
* June 8, 2010: 42 sq. miles
* April 25, 2010: 250 sq. miles

In the ***Federal Fishing Closure*** exercise, the students are asked to count the number of 1,000 square mile boxed regions that are full, half-full, less than half-full, and more than half-full. A student worksheet to record these numbers is included with the downloads or they can write a tally sheet on notebook paper. Encourage students to devise a strategy to combine these numbers for a reasonable estimate and to express that strategy in a short paragraph.

The ***Pick’s Theorem*** exercise also uses the *Federal Fishing Closure* overlay so both folders should be selected. Pick’s Theorem works best with a geoboard, but in this case the intersecting latitude and longitude lines are used. Pick’s Theo-rem calculates the area of an irregular polygon on a grid by counting the number of vertices that lie on intersections of the boundary or perimeter of the polygon (***b***), and the number of intersections that lie in the interior the polygon (***i***).

The formula for Pick’s Theorem is .

2

1

*b* = 8 

*i* = 26 A = 30

8

7

6

5

4

3

You can find proofs of Pick’s Theorem online.

The ***Surface Oil*** folder contains overlays for different dates in four folders. Once again, it is very important that only one date’s folder is selected at a time and that the correct viewing angles are used since they correspond to the given area of the boxed latitude/longitude lines. Students are given the option of using one or both of the previous estimation methods.

If they decide to use Pick’s Theorem for the *Surface Oil* exercises then they will have to draw the irregular polygon on the map. This can be accomplished using the *Polygon* tool available in the Google Earth tool bar. They will need to draw a polygon whose vertices lie on intersections of latitude and longitude lines. As you can see in the *Pick’s Theorem* exercise, this isn’t an exact process. In the polygon pop-up window they should choose to have the area *Outlined* in the *Style, Color* menu. A tutorial video entitled Drawing Polygons is available in <RealWorldMath.org> on the [Tutorials](http://realworldmath.org/Real_World_Math/Tutorials.html) page.

You may have another method of estimation for students to use. Encourage students to come up with original strategies for calculating the area. Even if these aren’t mathematically accurate, they will be going through a creative thought process. Analysis and synthesis are higher goals in RealWorldMath lessons. Have students to devise their own formulas for the full box, half-box, and more or less than half-box.

Perhaps, 

A related topic of discussion for these exercises is accuracy of measurement. A wide range of estimates have been given as to how much oil has spilled. How can students determine which to believe? Is any estimate or method more accurate than another? See the [Fractal Measurement](http://realworldmath.org/Real_World_Math/Fractal_Coastline.html) lesson under [Measurement](http://realworldmath.org/Real_World_Math/Measurement.html) in <RealWorldMath.org> for an extension activity.

The final content in the file is a placemark titled ***Flow Rate***. Originally, this contained a great widget from PBS NewsHour with a live feed of the oil leak and an interactive that calculates the estimate number of gallons leaked. Since the well was capped this video feed was discontinued. This is a prime example of content used in the lesson that may not exist in the future. Links to overlays and photos may also disappear. I will try to monitor this and remove absent content in the future and adjust the lesson if necessary.

***Flow Rate*** now contains a variety of estimated leak rates, and asks students to calculate how much oil was spilled from April 20 to July 15. This placemark is situated at the location where the oil rig is believed to have come to rest. A 3D model (not done by me) is in the background.

As always, feedback or suggestions are welcome. Please email me at [4RealWorldMath@gmail.com](4realworldmath%40gmail.com)