Reece Theakston

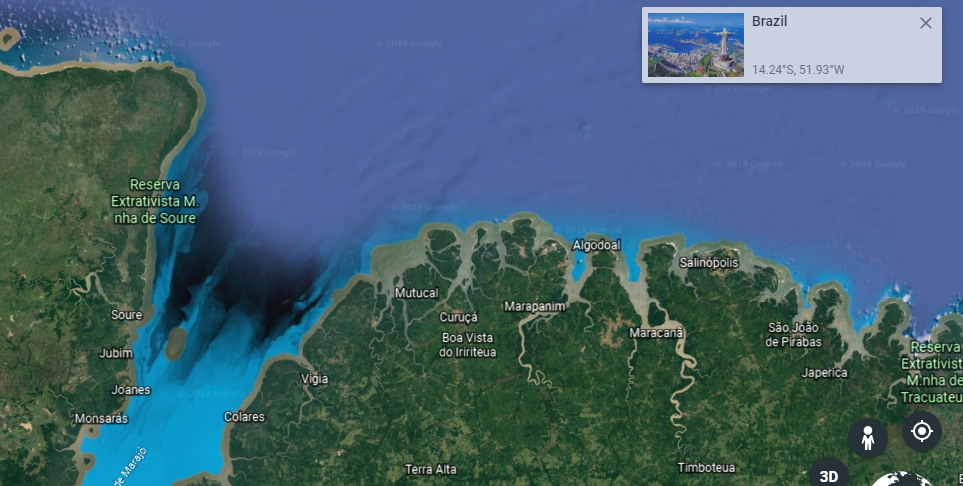
Toxicology

Dr.Shanle

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**Risk Assessment**

**Site**

The contaminated site that I have chosen for my risk assessment is the ongoing oil spill occurring in the northeast region of Brazil. The first account of the oil spill was on September 2nd. The oil spill has covered more than 1,240 miles of Brazilian Coastline. One of the most toxic chemicals in crude oil is hydrogen sulfide which is a strong neurotoxin. Crude oil is used for a lot of products mainly transportation fuels. The land that is being affected by the oil spill is owned by the Brazilian government and the oil that was spilt is owned by a Greek oil company. Currently over 2,000 tonnes of oil have been cleaned up. Some other chemicals that have been found in the crude oil besides hydrogen include benzene and toluene. 



**Hazard Identification**

One of the toxins that are commonly found within crude oil and currently all over the Northeast region of Brazil is hydrogen sulfide. Hydrogen sulfide is made up of two hydrogen molecules and one sulfide molecule. Hydrogen sulfide is a strong neurotoxin which means that when exposed to hydrogen sulfide will attack the nervous system. If inhaled the lungs will rapidly absorb the toxin and it will start to attack the nervous system. When exposed to the skin the toxin will cause itchy, burning skin inflammations and possibly frostbite. Also, when exposed to the eye’s victims will experience burning sensations in the eyes. Due to the fact that hydrogen sulfide typically a gas it is unlikely to be exposed via ingestion but may cause nausea and vomiting. Hydrogen sulfide has also been reported to cause developmental defects in infants.

Another toxin that is commonly found in crude oil is benzene. Benzene is made from six carbon molecules and six hydrogen molecules. Benzene affect the blood system, nervous system, and immune system, it is also considered to be a carcinogen meaning that it has the potential to form cancer. If inhaled Benzene can cause dizziness, tremors, headaches, unconsciousness, and for chronic level of exposure even death. If Benzene is ingested it can cause vomiting, convulsions, and at high levels death. The worst affect that benzene has from long term exposure is that it attacks bone marrow causing a reduction in red blood cells, anemia, and it can result in an increase in infection.

**Dose Response Assessment**

According to the IRIS, base off of a study on pigs, Hydrogen sulfide has an RfD o 3x10-3 mg/kg-day (Wetterau,1964). As for the RfC, the IRIS got their data from a study on mice the gave an RfC for Hydrogen sulfide of 1x10-3 mg/m3. According to one study Hydrogen sulfide was used to attempt to sustain tissue viability in low cardiac, critically ill patients. This was believed to have an effect due to a prior study which showed suspended animation like state in mice (Zhang,2008). Seven piglets (5.9 ± 0.4 kg) were exposed to 20, 40, 60, and 80 ppm of H2S and 17.5% oxygen (Zhang,2008). The experiment did not produce the desired effects, the scientist stated that while it may have worked on mice, larger mammals may have a different dose-response in cooling rate. Another study looked at acute Hydrogen sulfide poisoning by measuring brain sulfide levels. The hydrogen sulfide was administered via inhalation and injection. This study concluded that the brainstem absorbs the most amount of Hydrogen sulfide after exposure around one quarter of Hydrogen sulfide exposed to (Waryencia, 2012).

When looking at the IRIS for Benzene, the IRIS says that the RfD for Benzene is 4x10-3 mg/kg/day and the RfC is 8.2mg/m3. One study examined the health risk resulting from benzene exposure in petroleum refineries. The result of this experiment showed an increase of cancer risk to 95% of petroleum refinery workers especially those who have exposure via inhalation (Edokpolo, 2015). Another group of scientists completed an experiment that completed a risk assessment for Benzene exposure in oil refineries. In order to conduct this, experiment the scientists measured three different sites with varying amount of Benzene exposure. The study came to the conclusion that site one had the highest risk of cancer due to a lack of modern safety equipment (Hosny, 2017).

**Description of the surrounding community**

As of now the oil spill has affected more than 250 beaches and estuaries and an estimated 1,400 miles of coastline. Not only does this affect the beaches and coastlines but it affects the wildlife in the area such as birds, fish, sea turtles and other marine life with around 2,000 tons of crude oil washing up on the coast (Avila, 2019). Also, because it has such an impact on marine life it also has an economic impact on the people who make their living and survive off of the water and coast. When looking at the amount of wealth in the area affected, the majority of the community in Brazil is in poverty which only makes the situation worse. Due to the toxins in in this oil spill and the amount of oil washing up the increase for cancer has increased drastically.

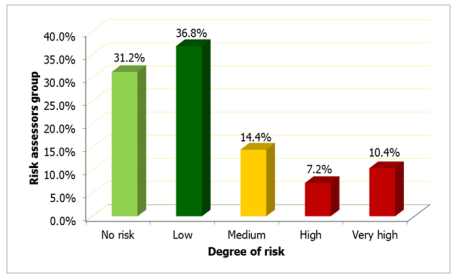
**Assessment of the risks for exposure to the surrounding community**

The people at risk for this oil spill are all of the people who live on and near the coast along with all of the people who will try to clean up the oil spill along with all of the wildlife in the area. The target populations are definitely the people who live on the coast and the people who make a living off of the coast. The possible routes of exposure would more than likely be inhalation of fumes coming off the oil spill and if eating food or attempting to clean the spill there is a chance of ingestion. The exposure of these chemicals to the surrounding population will kill wildlife, starve people, and put people out of jobs. I believe that regardless of age, income, or racial/ethnic background that this is environmental injustice due to the impact the spill has on the environment and the surrounding communities.

**Develop an action plan**

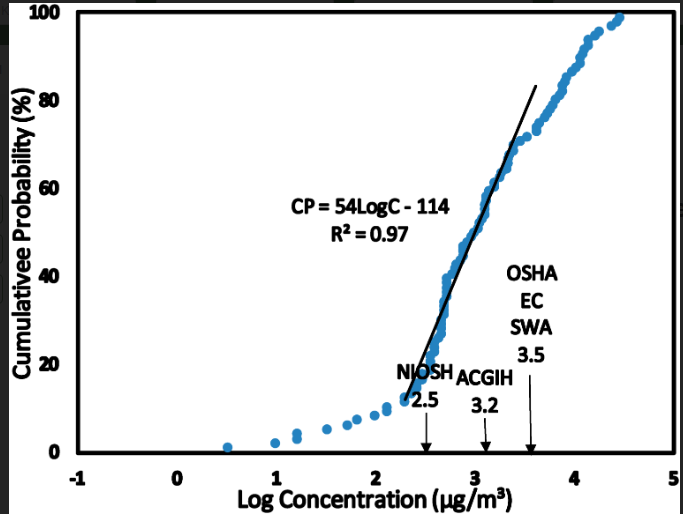
When thinking about what the community needs to take back the site that has been contaminated, I believe that a grocery store would be beneficial at least aid to those who lost jobs or depend on the water for food. Some issues that the community faces include poverty and poor government aid. My idea for a redevelopment of the area starts with the total cleanup of the oil. I believe that there needs to be two major teams, one taking care of the oil clean up, another taking care of helping the wildlife, and a third team helping people who are being affected by this. Once that is all taken care of we can start thinking about where the park and grocery store can go. I do hate to say it but I don’t believe that these changes will be made anytime soon due to the poverty level and governmental aid.

**Figures and Tables**



**Figure 1. Workers’ perception of benzene risk, using risk calculator of Kinney and**

**Fine method (Edokpolo,2015).**



**Figure 2. Exposure to Benzene as Base Estimates for Petroleum Refinery Workers. Retrospective exposure to benzene concentrations as base estimate concentrations for petroleum refinery workers in Australia (1940 to 1989), Canada (1902 to 1996) and United Kingdom (1906 to 1989) (Hosny,2017)**

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