Analysis of how earthquakes in California can affect nuclear power plants which can affect the population in the region.

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Problem:

California is one of the most earthquake-prone regions in the US. The region has several fault lines that may cause earthquakes. Initially, California had six working nuclear reactors-Diablo Canyon Nuclear Power Plant, Humboldt Bay Nuclear Power Plant, The San Onofre Nuclear Generating Station, The Rancho Seco Nuclear Power Plant, The Vallecitos Nuclear Power Plant and the other one: The Santa Susana Sodium Reactor was just an experimental reactor to perform initial experiments (considered US's first nuclear reactor) to generate nuclear power, out of which only one is currently in use [1]. Five nuclear reactors have been shut down of which The San Onofre Nuclear Generating Station was recently shut down. Currently, only one nuclear plant is functional- Diablo Canyon. This can be dangerous if it lies in a fault line region and causes huge catastrophes like the one that happened in the Fukushima plant in 2011 killing hundreds of people after a powerful earthquake that struck the place and destroyed the nuclear power plant that led to the release of radioactive substance into the atmosphere.

Goals/Objectives:

The main goal of this project is a) to determine if the nuclear plant is located in any of California's fault line region, b) to determine how the population of that region can be affected, for example- in terms of population involving more of the younger generation (ages between 0 and 35), nuclear materials might affect their DNA (causing repair) and might affect future generations as well [2]. In terms of population involving elderly people (ages between 70 to 85 years or over), evacuation might get a little difficult if a lot of older people live within the affected radius. c) What are the other effects of radioactive radiation and what measures could

be taken in such a situation. Additionally, I will be analyzing Chernobyl nuclear disaster dataset to determine the distance up to which the radiation spread in Chernobyl's case to show how far radiation might spread during a nuclear disaster.

Peer-Reviewed Literature Summary:

The Great East Japan earthquake that occurred in 2011 was estimated to be a 9.0 magnitude earthquake that caused damage to the electric supplied in Fukushima nuclear site which in turn resulted in a failure of cooling agents present in a reactor. This caused a rupture of the plant releasing a huge number of radioactive substances into the atmosphere, thus killing more than 15000 people [3]. There were about 30000 people within 272 sq. km area (closer to the plants) in Fukushima and about 52000 people within 495 sq. km area [4]. This was the case in a small town in Japan and Japan has a population less than that of the USA. Moreover, the radiation has a long-term effect as it contaminates the soil for many years like the contamination in Chernobyl [4].

Methods and Datasets:

Objective 1: I will be researching Chernobyl and Fukushima nuclear disaster case studies especially GIS-related papers to get a detailed idea about it.

URL: https://link.springer.com/chapter/10.1007/978-981-13-8218-5_20

URL: https://archive-ouverte.unige.ch/unige:122532

Objective 2: I will be acquiring data sets from different sites to analyze nuclear disasters and how it could affect surrounding populations and I will acquire data sets required for my research topic.

URL: https://data.census.gov/cedsci/

URL: https://www.arcgis.com/home/item.html?id=062d4ea518174021b3520b88dd4270d7

URL: https://data-package.ceh.ac.uk/data/782ec845-2135-4698-8881-b38823e533bf.zip

I will be using GIS techniques like Spatial Distance Calculator tools to calculate the extent to which the radiation might spread. I will be analyzing the populations in the area of how the population might get affected in case of a nuclear disaster.

Anticipated Analysis Outputs:

I am expecting to show the results of different categories of the population getting affected and the diameter of radiation spread. I am also expecting to show evacuation plans and measures that could be taken during such a disaster.

Project Revisions Based on Peer Feedback:

I initially planned on showing two nuclear reactors (due to misleading data in a website) in the California area but my peer pointed out to me that the other one is currently shut down. So, I have reduced to one nuclear reactor and I am working on two case studies (Fukushima and Chernobyl) to get a better idea of my research topic.

Peer-Reviewed Literature References:

[1] State of California, Energy Commission: Nuclear Power Reactors in California, Available at: https://www.energy.ca.gov/

[2] Reisz J.A., Bansal N., Qian J., Zhao W., and Furdui M.C. (2014 July 10). Effects of Ionizing Radiation on Biological Molecules—Mechanisms of Damage and Emerging Methods of Detection
Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4060780/

[3] Amano, Y. 2014. The Fukushima Daiichi Accident- Report by the Director General Available at: https://www.iaea.org/publications/10962/the-fukushima-daiichi-accident

[4] Imanaka, T. (11 November 2019) Comparison of Radioactivity Release and Contamination from the Fukushima and Chernobyl Nuclear Power Plant Accidents. Available at: https://link.springer.com/chapter/10.1007/978-981-13-8218-5_20