Uranium Contamination and the Health Effects

New Mexico
Supercomputing Challenge
Final Report
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Summary

The focus of our project is on the uranium contamination in city drinking water and the risks it presents to the residents of Espanola. We have found the estimated intake rate of uranium which is about 1.5 micrograms (0.8 picocuries) of natural uranium for every liter of water they drink. We have figured out what the long term effects are without applying a solution to the uranium problem. We have modeled the sickness rate, what the population will look like, and the death rate.

Introduction

The water that we drink here in Rio Arriba County has levels of uranium that are nine times higher than the national average which 0.009 parts per billion and Rio Arriba county is at 0.25 parts per billion. Uranium is a radioactive, metallic element that can be naturally occurring or concentrated by man. The uranium that is found in Rio Arriba County is naturally occurring due to volcanic activity that took place millions of years ago. This uranium presents a problem in both private and city wells.

The two wells that we obtained data on uranium contamination are wells five and six of Española's Water System. They provide water for the entire city, yet they exceed maximum Environmental Protection Agency (EPA) standards by about 60 picocuries per liter of water (pCi/L). EPA suggests the levels to be at 0 pCi/L; however, the maximum EPA standard is 30 pCi/L. Uranium presents negative health effects when ingested. Uranium can be ingested through drinking water, homegrown foods, and using it for cooking. Natural uranium cannot cause major health effects but increases your risks of contracting major illnesses. Here are a few of the health effects that uranium can increase your risks of developing: kidney toxicity, cancer, organ damage, and damage to both the immune system and the nervous system.

At this point, we do not know if there is a way to mitigate the risks uranium presents. Some people are more prone to fall ill because of the genetic weaknesses and other health problems that they might currently have. Our daily uranium intake could lead to problems in the not so distant future. There are a few possible solutions for depleting the uranium in the water. These solutions include: (a) having the city purchase a filtering system that will filter the water for the entire city, (b) for Española residents to purchase a reverse-osmosis system to install at their homes, and (c) to drill additional wells which could have the same problem or an even greater problem. Also, the new wells might not produce as much water as the original wells which have a production rate of 2,100 gallons per minute.

Reverse-Osmosis Filtering System

Waste water from the reverse osmosis system would have concentrated solution of uranium and should not be dumped into the Española sewage system.

Purpose

The purpose of our project was to analyze and further understand the uranium problem in Española including the risks and health effects the uranium may present to the people who ingest the water. Further, we investigated possible solutions and how they might be implemented. Our project enables us to become more knowledgeable about the problem and then to suggest possible solutions.

Results

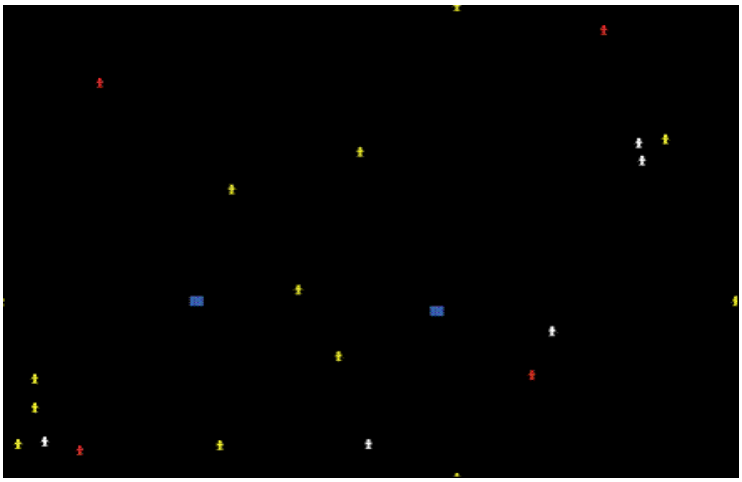
The results, data, and sources of our project have shown that the uranium contaminant in Española does exceed national standards and may

increase the risk of contracting serious illnesses. Some of these illnesses include kidney toxicity, damage to the immune system, and damage to the nervous system. We have cited three possible scenarios for reducing the negative effects of uranium contamination of Española water.

Significant Achievements

One of the significant achievements of our project is that after speaking to the city water director, Marvin Martinez, the city decided to take action about the high levels of uranium contamination in the water supply.

Model



Net Logo Code

```
turtles-own [sick]


to setup
ca
crt people
ask turtles
  [
  set shape "person"
  set color white
  set sick 0
  ]
end


to move
fd 1
wiggle
sickness
multiply
end


to wiggle
rt random 20
```

```
lt random 20
end

to sickness
if pcolor = blue
  [
  set sick sick + 1
  ]
if sick > 0
  [
  set color yellow
  ]
if sick > sickness_level / 2
  [
  set color red
  ]
if sick = sickness_level
  [
  die
  ]
end

to multiply
```

```
if random 10000 < birthrate
  [
  hatch 1
    [
    set sick 0
    set color white
    ]
  ]
end


to create_wells
setxy random world-width random world-height
set pcolor blue
setxy 0 0
end
```

Project References

- Heidi Krapfl (Health Department Environmental Epidemiology Bureau Chief for the State)
- Marvin Martinez (Water Services Director, Española)
- Melanie Delgado (Community Services Director for the State)
- Adrian Garcia (Environmental Field Technician, Santa Clara Pueblo)

Websites:

- www. city-data.com/city/Española-New-Mexico.html
- www.cdc.gov/nchs/fastats/lifexpec.htm
- www.mayoclinic.com/health/water/NU00283
- en.wikipedia.org/wiki/Española_New_Mexico
- www.astdr.cdc.gov/toxprofiles/phsl50
- www.google.com/search?q=natural+sources+of+uranium&ie=utf-8&oe=utf 8&aq=t&rls=org.mozilla:en-US:official&client=firefox-a
- www.nmenv.state.nm.us
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- cityofespanola.org/public-works-water.html