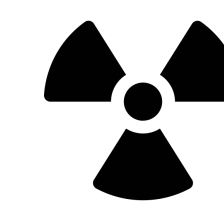


Background radiation and its sources in Dundalk



Introduction

Many people in Ireland, especially in Dundalk, are talking about the threat of radiation. Some people even say that it causes higher rates of cancer in the area. They blame high levels of Radon gas and the radioactive fallout from a major accident at Sellafield that happened 50 years ago.

Is the background radiation in Dundalk threatening to human beings? What are the sources of the background radiation? We can find out using statistics.

Aims

- Measure radiation around the town of Dundalk and see if it is safe for humans.
- Find out what are the main sources of background radiation and if they affect the radiation measured.
- Find out if Sellafield nuclear leak still affects Dundalk.

Collecting and Analysing Data

To measure the radiation, we used Frederiksen Geiger-Muller Counter 5136.00 (picture below). At each location we measured radiation for one minute. The device counted the number of radioactive particles hitting its GM tube, and that is why the unit is counts per minute (cpm). The result was written down and the current location was recorded. In total, we measured radiation in 277 different locations around the town of Dundalk and Blackrock coastal area.



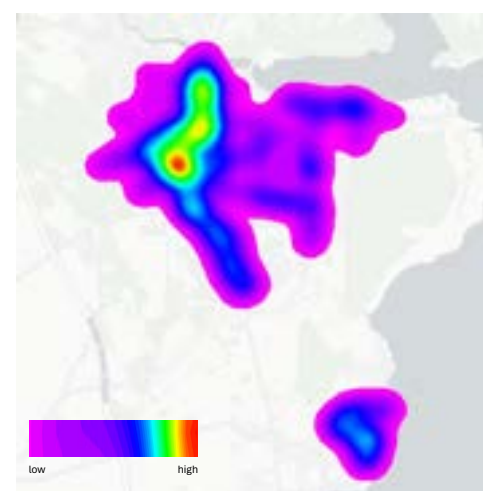
All the data was transferred to an Excel workbook, where it was formatted and prepared for analysis.

Using Google Earth, we got the elevation (altitude) of each point, as we thought it could affect the radiation.

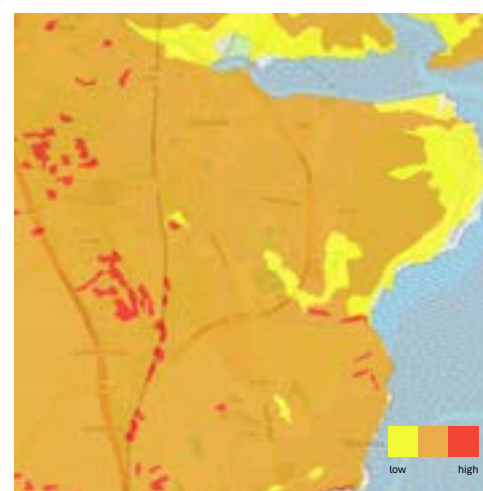
All the graphs and charts were also created in Excel. To generate the heatmap we used a free tool heatmapper.ca.

To ensure that the measurements are accurate, we collected data at the same time of the day for 2 weeks.

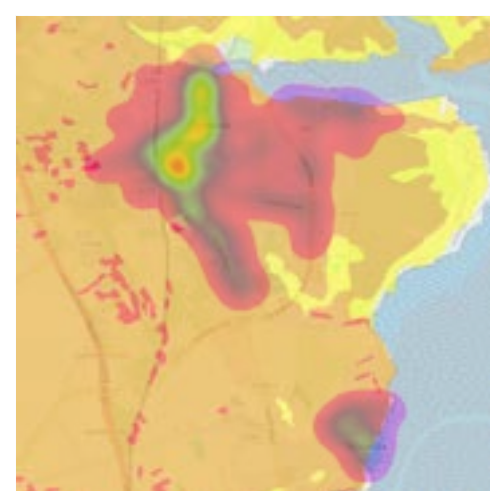
Radon map and radiation heatmap



Radiation Heatmap of Dundalk and Blackrock

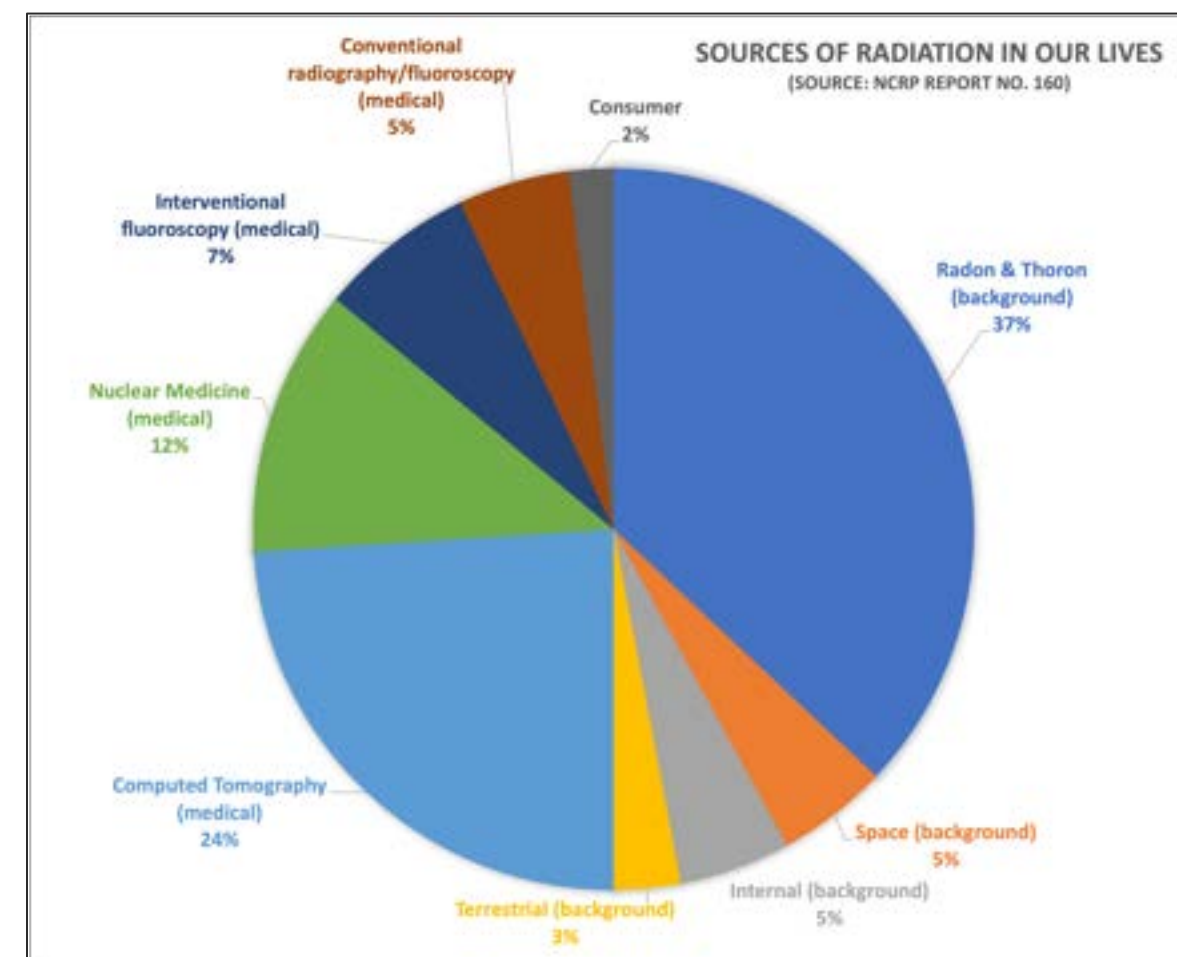


Radon Map of Dundalk and Blackrock
(Source: gis.epa.ie)



Radiation Heatmap layered on top of Radon Map

Radon Gas and Radiation



Let's look at the main sources of background radiation according to NCRP Report No. 160.

It appears that radon and thoron gas are main sources.

According to the data, radon and thoron gas are main sources.

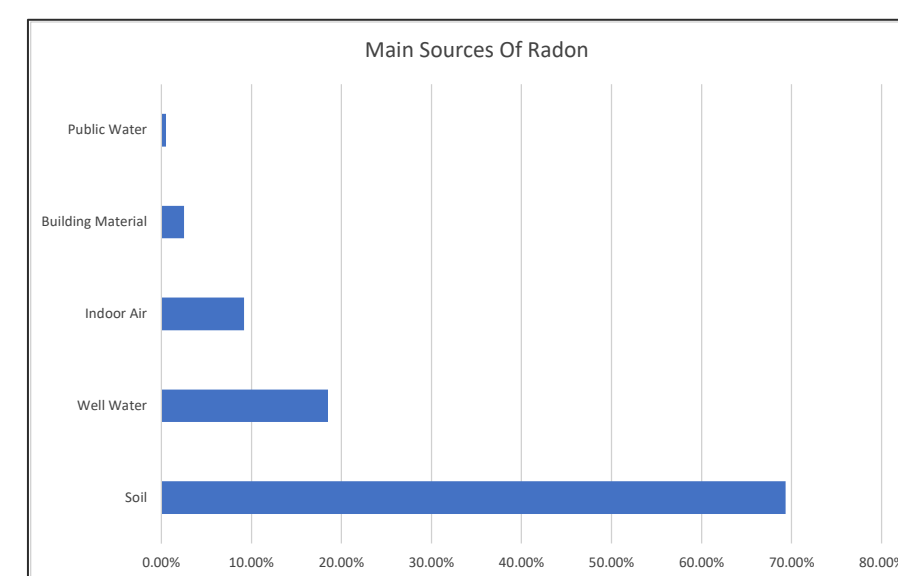
We can use our **heatmap and a radon map** provided by gis.epa.ie and compare the two. (bottom left corner)

On the radon map red colour represents the highest levels of radon, and yellow represents the lowest. There appears to be no relationship between the two maps.

What are the main sources of radon?

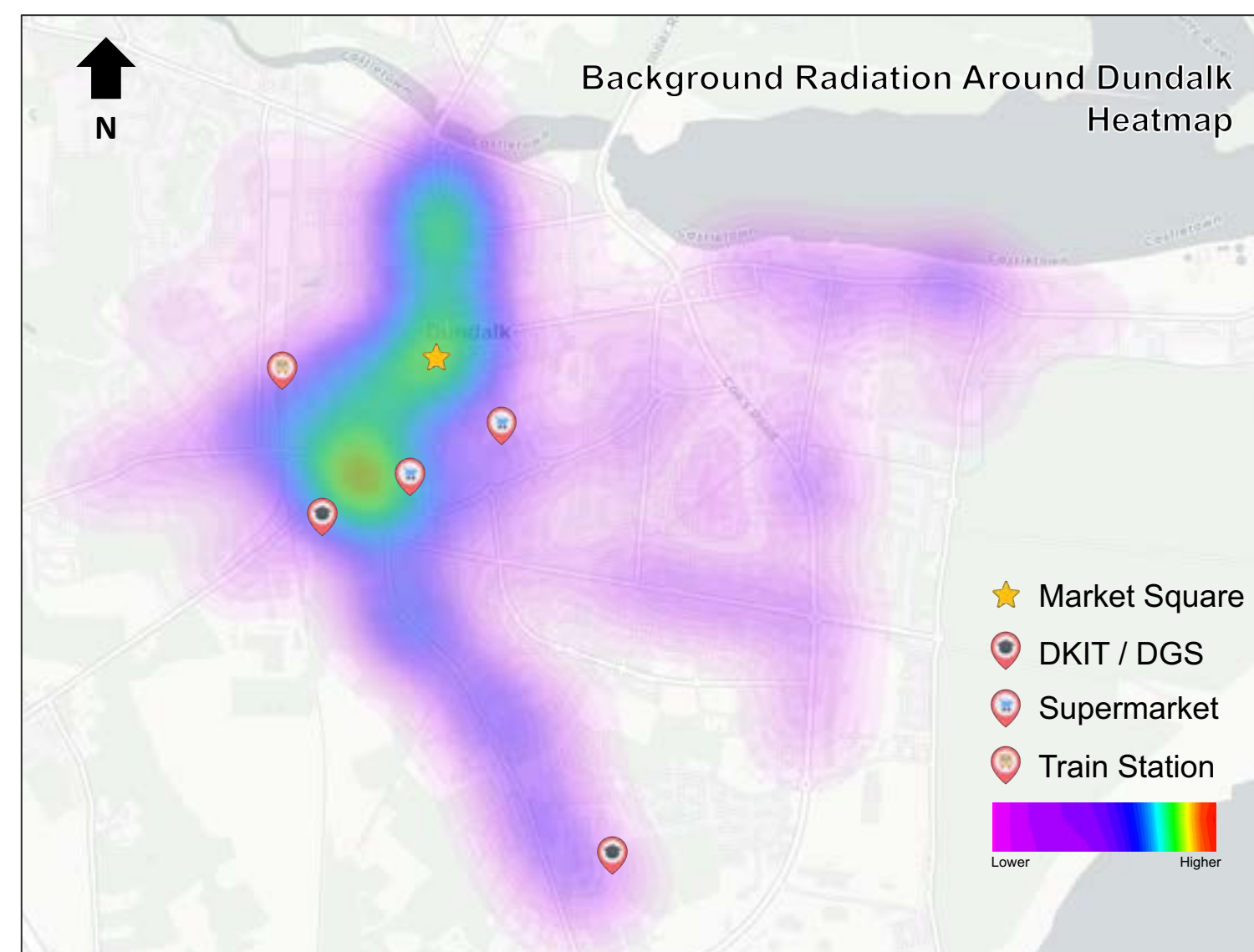
According to **National Radon Defence**, building material and indoor air are among the sources, so we can assume that the radiation inside of a building is higher than outside. To support this assumption, we measured radiation inside and outside of multiple buildings.

	Radiation Inside (cpm)	Radiation Outside (cpm)
House 1	25	20.7
House 2	23.3	19.3
House 3	21.3	20
Store 1	22	22.3
Store 2	23	15
Mean	22.92	19.46



According to our collected data, radiation inside of a building is slightly higher than outside. But the difference is only 18%, and the radiation is in no way harmful.

Radiation in Dundalk



There is a higher level of background radiation near Dundalk Grammar School, the Market Square and on Clanbrassil street.

The average radiation in the red area is 21.7 cpm, while the average radiation around the town is only 18.3 cpm, which is 19% higher. There is no clear explanation to why radiation in the area is higher. However, none of this radiation levels are threatening in any way and are completely normal levels of background radiation.

We can also see that the radiation in the Market Square and on Clanbrassil street is substantially higher. This can be explained by many buildings built out of granite, and at some places the ground is covered in granite tiles. Granite releases a lot of radon gas, which is why the radiation is higher in the area.

Sellafield nuclear leak

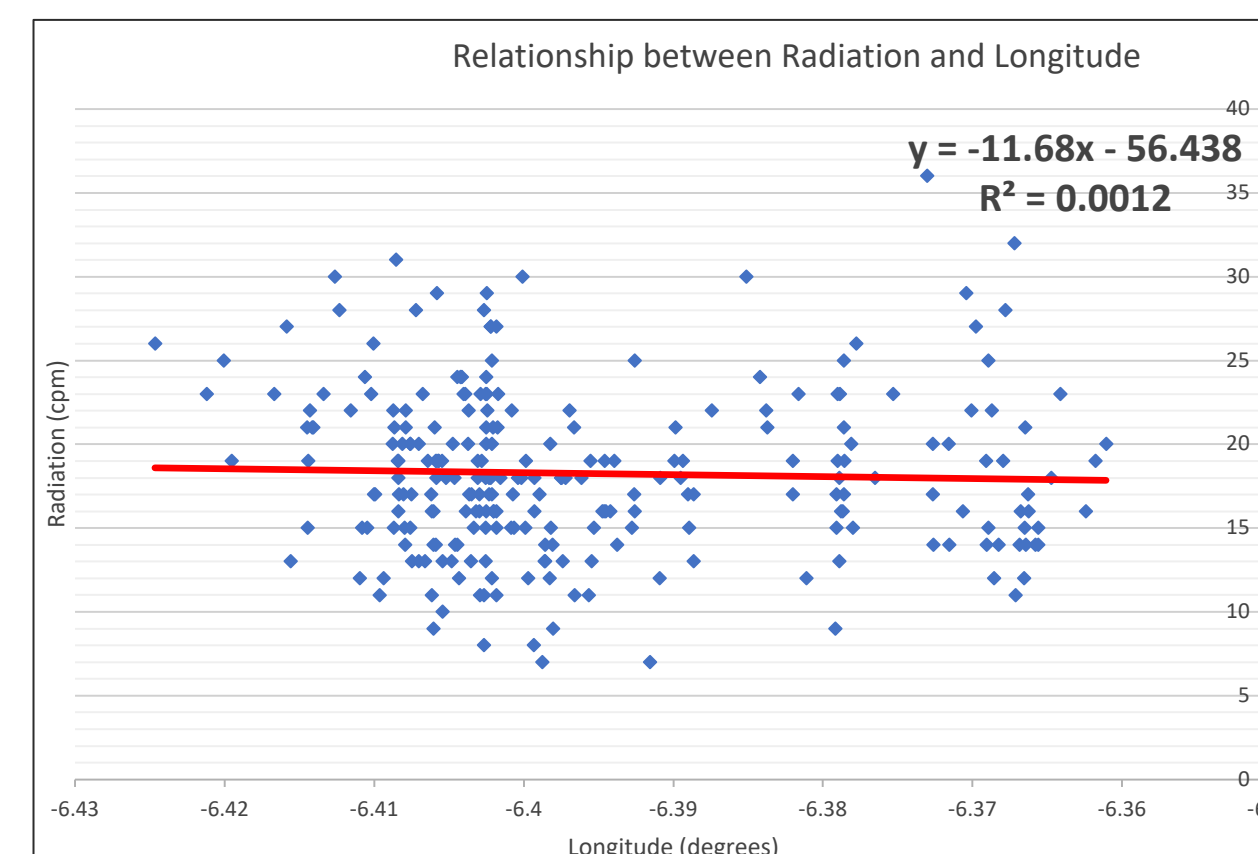


"In 1957, a fire at the Windscale nuclear reactor in Cumbria -- which has since been renamed Sellafield -- led to a release of radioactive material that spread across the UK and Europe."

"New research claims the incident generated twice as much radioactive material and caused dozens more cancers than was previously thought."

"But residents of Dundalk, Co Louth, which was the nearest Irish town, point out that people in the immediate area had higher instances of cancer than other regions. It has been claimed that a cluster of Down Syndrome births and cancer cases in the area were caused by radiation."

Are the claims true? Is the radiation in Dundalk high enough to cause cancer?



Assumption 1: The closer we are to the source of the leak, the higher the radiation.

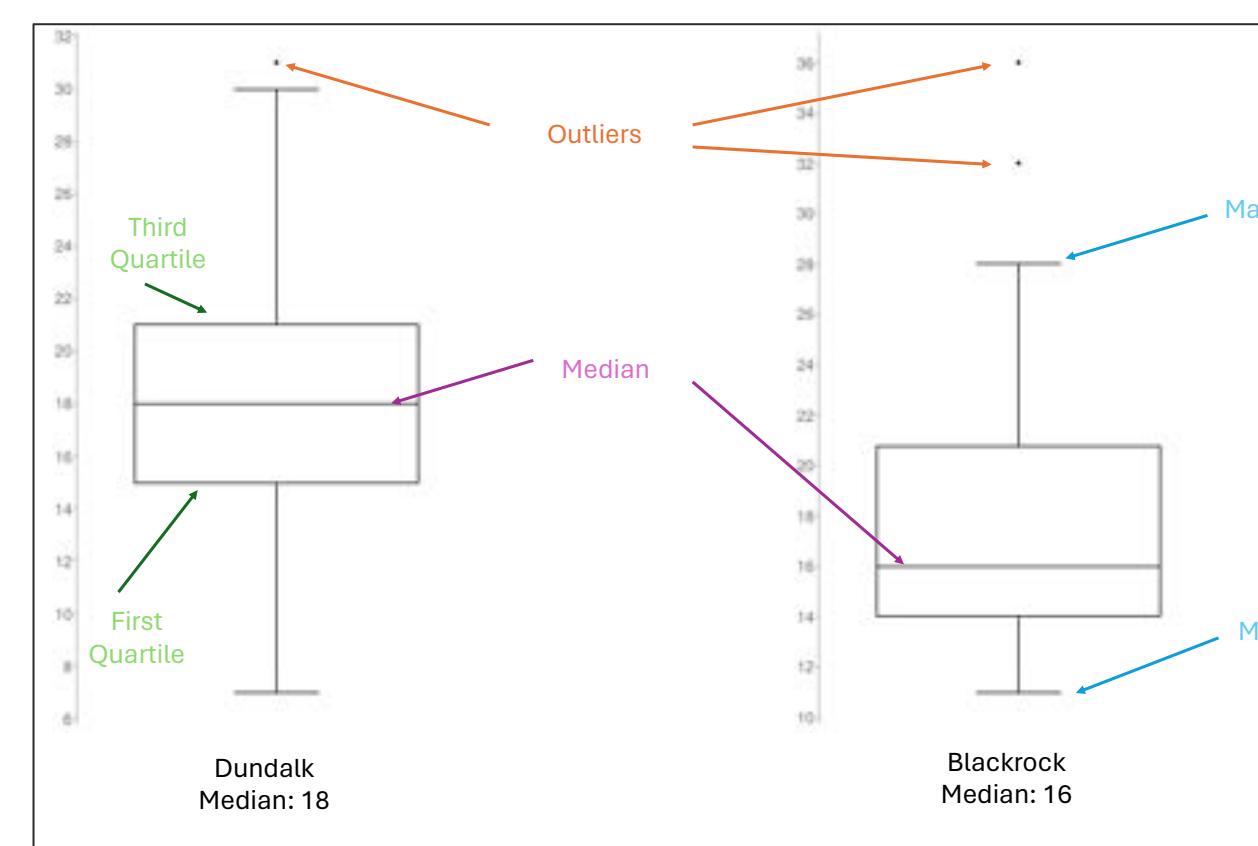
We can create a scatter plot where the x axis represents the longitude (degrees), and the y axis represents the radiation (cpm). According to the graph, there appears to be no correlation between the longitude and the radiation, which can be seen by the low value of R^2 .

Assumption 2: Radiation in Dundalk is higher than in Blackrock due to the leak.

To compare the radiation between the towns, we can use a boxplot.

From the boxplots we can see that the median radiation in Dundalk is 18 cpm, while the median in Blackrock is 16 cpm. Radiation in Dundalk is slightly higher, but the difference is not impactful.

According to our results, the levels of radiation between Dundalk and Blackrock aren't significantly different, and that the leak may not have caused higher radiation in Dundalk.



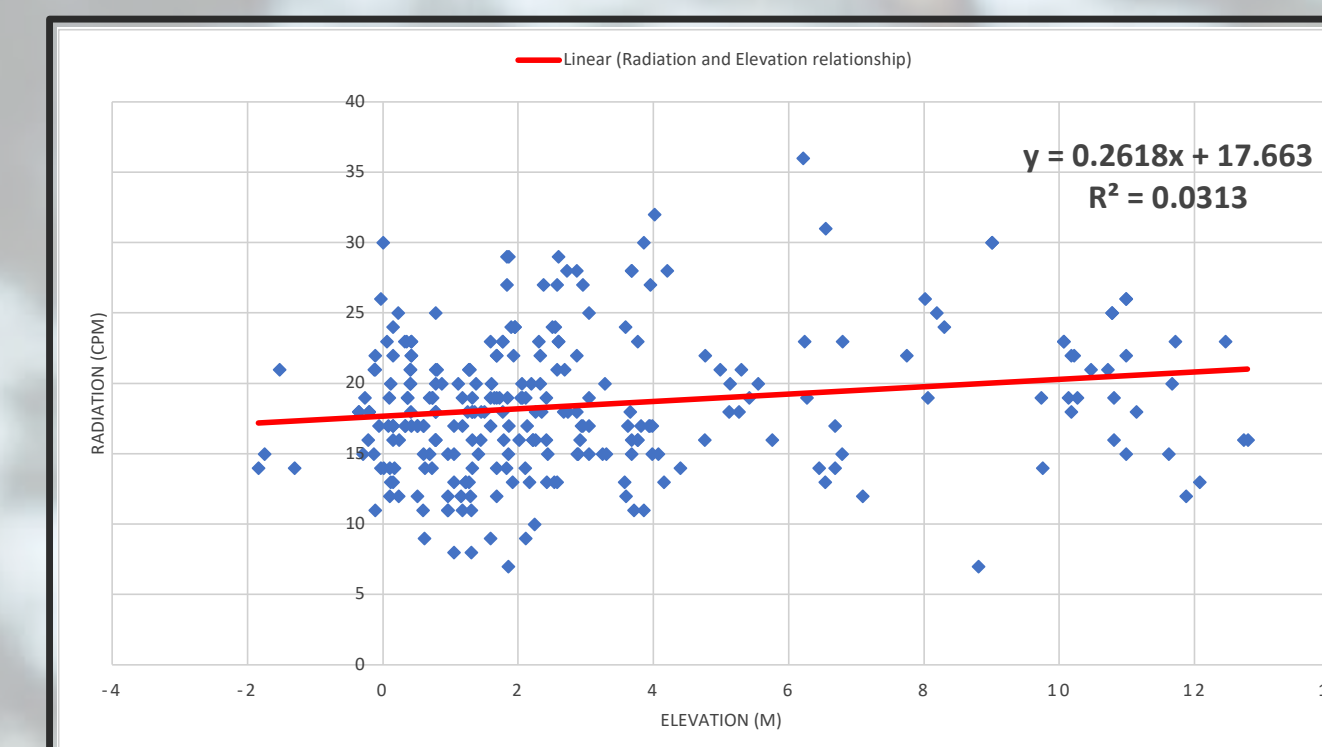
Radiation and Elevation

Another source of background radiation is space. Which means that background radiation might be higher the less atmosphere protects us from space.

Assumption: The higher the elevation, the higher the radiation.

To support the assumption, we can construct a scatter plot, and we can apply a linear regression model to the data.

According to the graph and the value of R^2 , we can see that there is no strong correlation, but the model still predicts slightly higher radiation at a higher altitude.



Conclusion

In conclusion, radiation around the town of Dundalk varies a lot, from as low as 7 cpm and up to as high as 31 cpm. The highest levels of radiation were around the Market Square, Clanbrassil street and Stapleton Place near Dundalk Grammar School. First two can be explained by high amount of granite buildings and granite tiles, as granite contains a lot of radon gas. However, there is no clear reason to why radiation near Dundalk Grammar School is significantly higher than in the other parts of the town. There appears no correlation between our radiation map and the radon map provided by gis.epa.ie. The Sellafield nuclear leak does not appear to have any noticeable effect on the town of Dundalk. Radiation inside of buildings is slightly higher than outside due to the amount of radon gas accumulating indoors. None of the radiation levels we collected are in any way threatening to humans or other living organisms.