

Assessment of Safecast bGeigie Nano Monitor.



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Introduction

- Safecast is a volunteer centred group involved internationally in supporting and furthering open source science and citizen science
- Safecast was set up after the Fukushima Daiichi Nuclear Power Plant disaster, which occurred in Japan on the 11th of March 2011.
- The aim of Safecast is to allow the public, through its citizen science projects, access to accurate and easy to use tools that will both measure and record radiation and pollutant levels in the air.
- One of the devices designed for this purpose is the bGeigie Nano Monitor.

Objectives Of This Assessment

- Construct the bGeigie Nano Monitor from the individual parts that it was packaged in.
- Calibrate the bGeigie Nano Monitor in the EPA's calibration facility.
- Compare the bGeigie Nano Monitor to other dose monitors.
- Test the stabilisation time of the bGeigie Nano Monitor.

The assembled bGeigie Nano Monitor

- The bGeigie Nano Monitor is built for the purpose of measuring dose rates of radioactivity; this includes alpha, beta and gamma radiation.
- The dose is measured using an LND 7317 Pancake mica window alpha-beta-gamma detector.
- The bGeigie Nano Monitor has two modes of taking measurements.
- The first mode is “Survey mode” which records measurements every five seconds, including the time and location. This is recorded on an inserted SD card.
- The second mode, “xGeigie mode”, measures without recording.

The assembled bGeigie Nano Monitor

- In figure 1, the left picture shows the front view of the monitor, where the CPM and the dose rate can be seen being counted on the LCD screen. The picture on the right shows the LND 7317 Pancake sensor that measures the CPM.

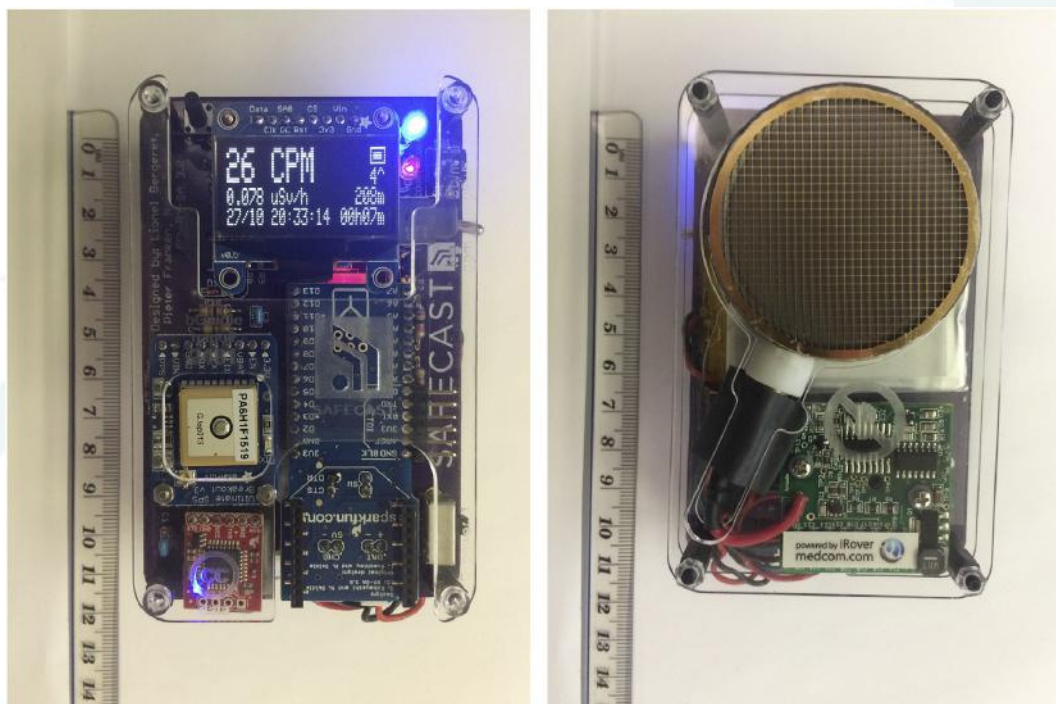


Figure 1: Shows the assembled bGeigie Nano Monitor

Calibration of the bGeigie Nano Monitor

- The stated operating range of the monitor is 0 – 1,000 $\mu\text{Sv/hr}$ and 0 to 350,000 CPM.
- The test was carried out in the EPA's calibration facility.
- The EPA provide a calibration service which is accredited to the Irish National Accreditation Board (INAB) to ISO17025.
- The test was carried out using a Hopewell GC60 irradiator Cs-137 (662keV) source with an ambient dose range of 5 $\mu\text{Sv/hr}$ – 220mSv/hr. The range of the test went from 5 $\mu\text{Sv/h}$ to 1000 $\mu\text{Sv/hr}$.

Calibration of the bGeigie Nano Monitor

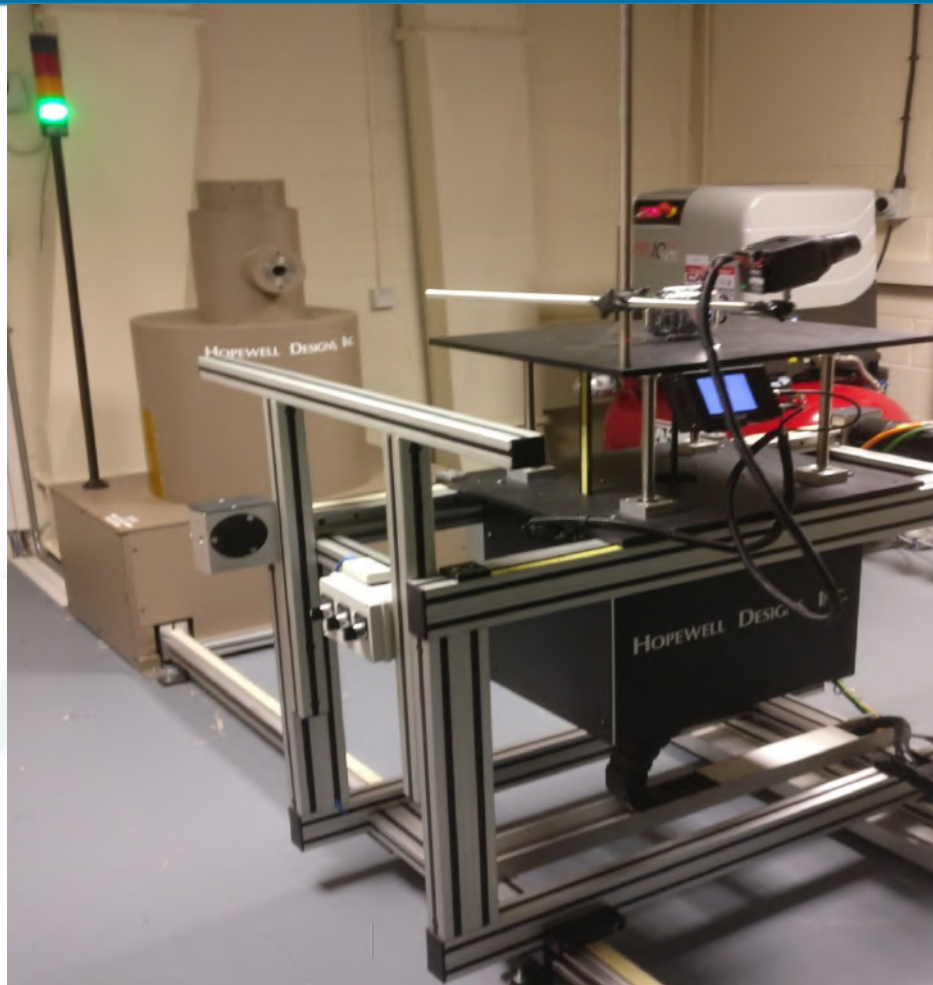


Figure 2: Shows the setup of the calibration of the monitor in the EPA's calibration facility.

Calibration of the bGeigie Nano Monitor Measured data

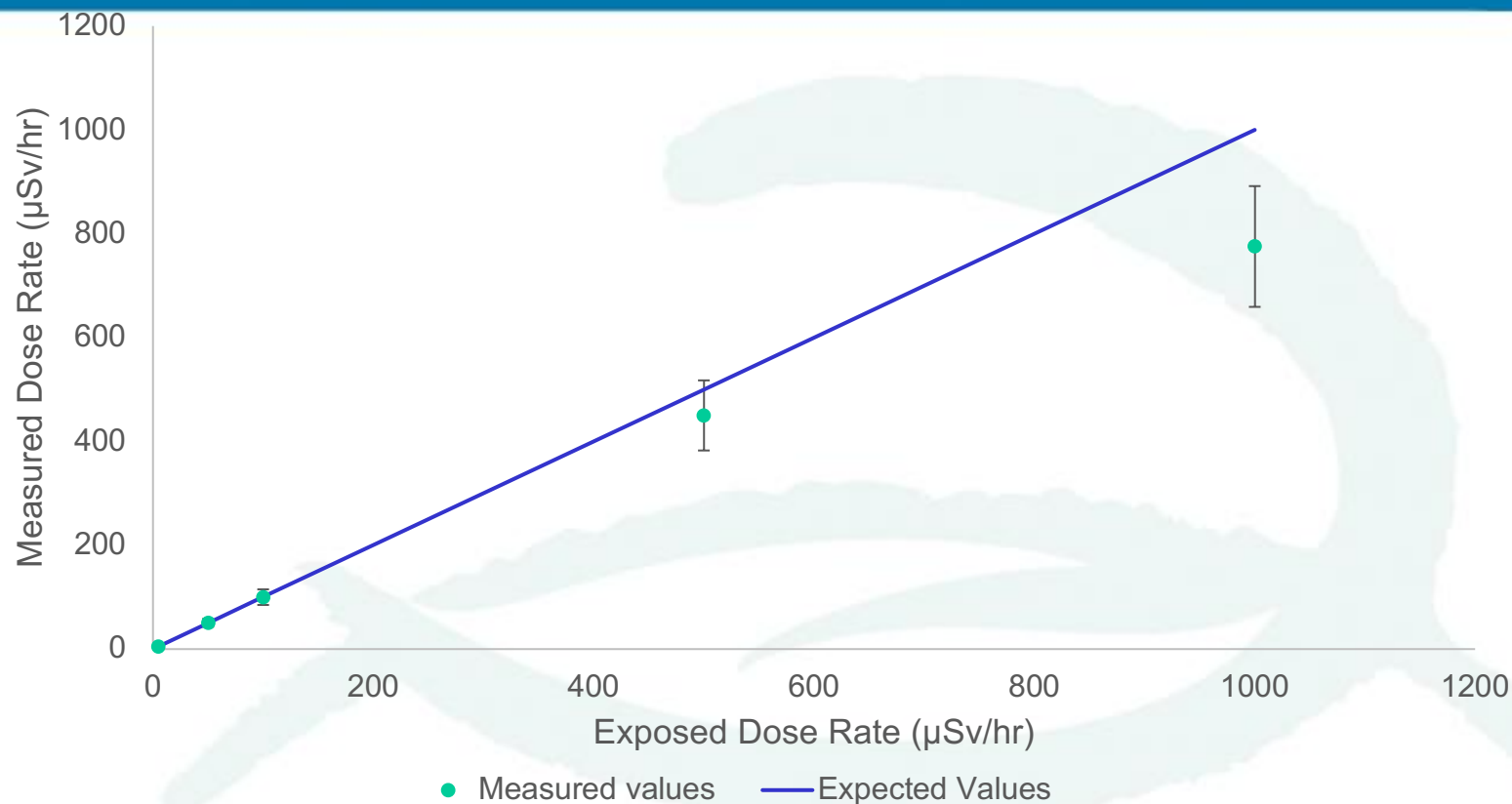


Figure 3: Shows the comparison between the measured dose rate and the exposed dose rate.

Comparison of Monitors

- To compare the bGeigie Nano Monitor at ambient dose levels that are typical for the south Dublin area, the monitor was set up in a fixed area 1 metre above the ground alongside another two dose monitors.
- The monitors used in this intercomparison were the “Mini Instruments 6-80-002066” with a “GM Type MC71-1008” probe and the ENVINET “IGS421B-H” both calibrated and used by the EPA.
- A Zeta test was carried out on the average results of the monitors to examine the agreement between the measurements.

Comparison of Monitors

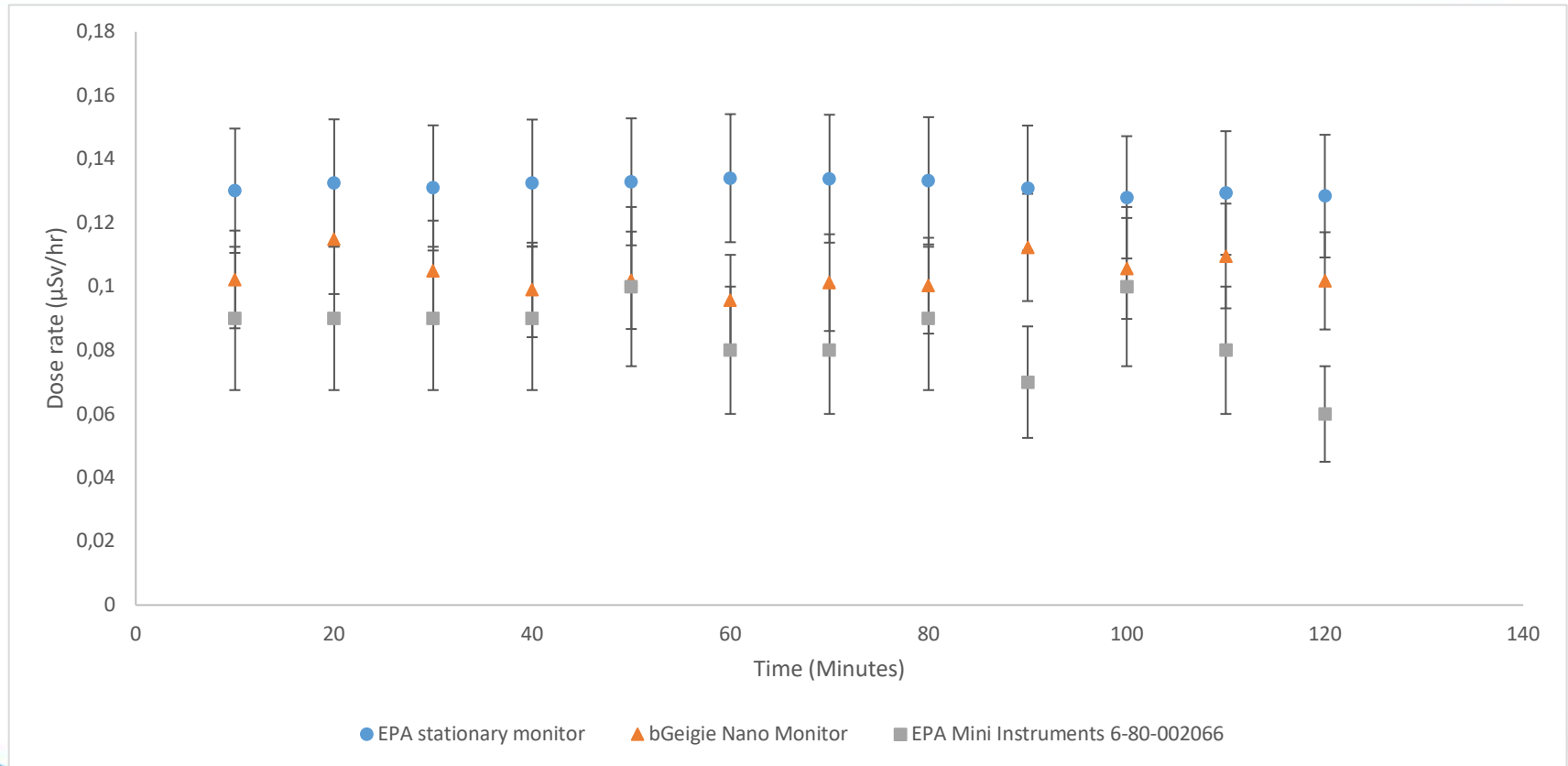


Figure 4: Shows the results of the comparison between the three monitors.

Comparison of Monitors

- The comparison between the monitors showed a good agreement between the measured dose rates.
- The Zeta tests in Table 1 show that the bGeigie Nano Monitor is in good agreement with the EPA's calibrated monitors, as both tests produce a Zeta test value below 2, which indicates good agreement.

Between the bGeigie Nano monitor and EPA stationary monitor using manufacturers uncertainties	Between the bGeigie Nano monitor and EPA Mini Instruments using manufacturers uncertainties
1.224	0.809

Table 1: Shows the results of the zeta test between the bGeigie Nano Monitor and the EPA monitors.

Test the stabilisation time of the bGeigie Nano Monitor.

- It was noted that, when in contact and after being in contact with a large activity Cs-137 source, the bGeigie Nano Monitor would take a varying amount of time to stabilise after the removal of the source.
- To evaluate the time it took the bGeigie Nano Monitor to stabilise during and after exposure of the Cs-137 source, the bGeigie Nano Monitor was placed in “Survey Mode” which then recorded the entire exposure every five seconds.
- The results of this measurement can be seen in Figure 5.

Test the stabilisation time of the bGeigie Nano Monitor.

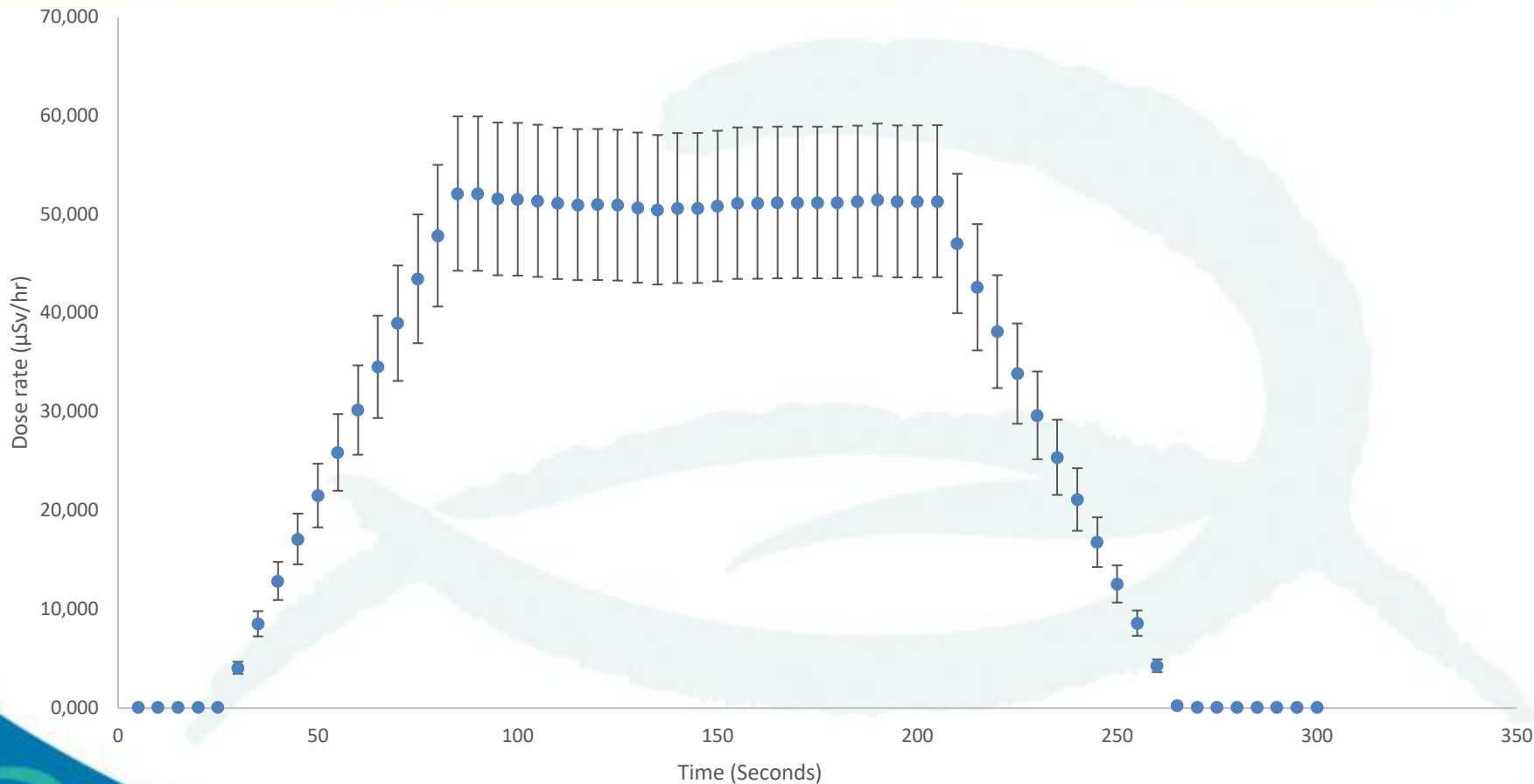


Figure 5: Shows the exposure time of the bGeigie Nano Monitor to the Cs-137 source at a dose rate of $50\mu\text{Sv/hr}$

Measurements taken around the Irish Environment

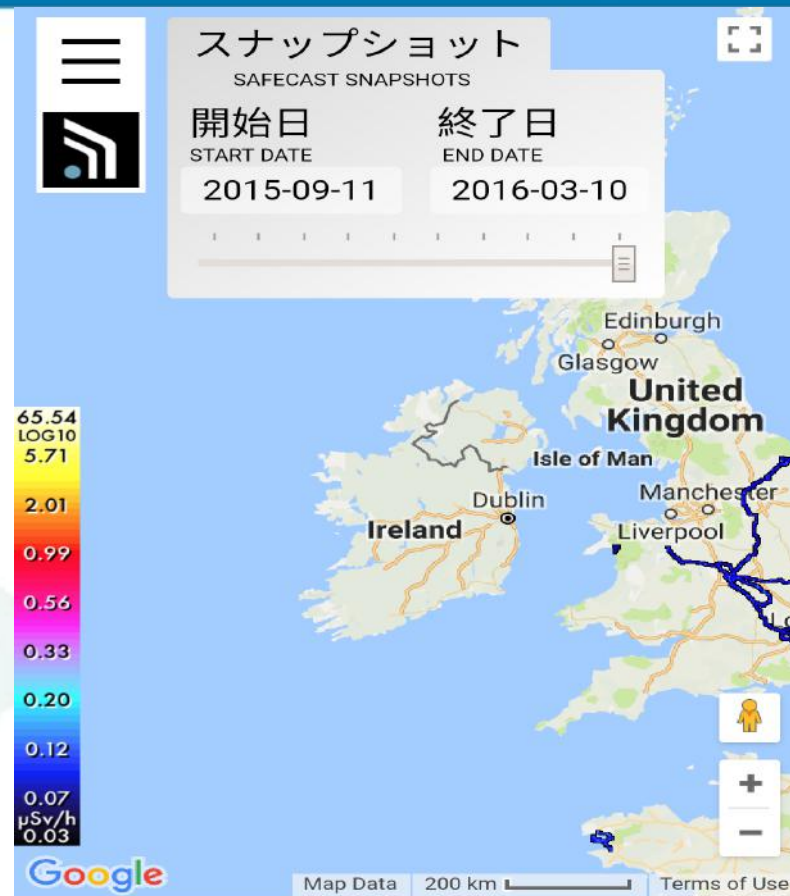


Figure 6: shows the Safecast API map of Ireland. In this image, it can be seen that there are no measurements at all in the country

Measurements taken around the Irish Environment



Figure 7: shows the Safecast API map of Ireland taken on the 25/04/18 which shows the measurements taken by the bGeigie Nano Monitor in blue around the country

Conclusion

- bGeigie Nano Monitor is an affordable and lightweight dose monitor. Experience may be needed to fully assemble the kit
- bGeigie Nano Monitor has shown to be accurate at measuring background radiation dose rates in a stationary position when compared to other monitors.
- It can be accurate up to 500 $\mu\text{Sv/hr}$. It is less accurate at dose rate levels up to 1000 $\mu\text{Sv/hr}$.
- The monitor was capable of measuring not only gamma radiation, but also alpha and beta when the case of the monitor is removed.
- The main concern with the monitor was that for dose rate measurements higher than background levels, the measurements took longer to stabilise.

Questions?

- Thank you for your attention. If you have any questions, please go ahead and ask.

