Using a Radiation Monitor Names:

This activity introduces an electronic radiation monitor. You will be using this device again in future activities. Do this in groups of 3.

Note: To save batteries, please turn the LabQuest OFF when you aren't using it.

Open this pdf in Notability (one person from each group) and write responses in the blank, blue-bordered areas.

We have a web page with directions for using the different radiation monitor systems:

We have a variety of systems to detect radiation. Each one includes a "Geiger-Müller (GM) tube"—the radiation monitor--which is where the radiation detection takes place.

The GM tube is plugged in to one of these:

- A PC running Vernier "Graphical Analysis"
- A handheld "LabQuest" unit, or
- A handheld "LabQuest 2" unit.

At the different stations there are different systems for collecting data, as well as different objects nearby for you to explore. At each station you'll set things up to measure radiation for 5 minutes.

Start the radiation monitor running to collect data (as detailed in the instructions). Then move the GM tube around a bit to see if you can "detect radiation". Maybe you'll see some variation in the data measured. If so, put the end of the GM tube as close as possible to whatever you think is "radioactive".

At the end of 5 minutes, record the total number of counts you had during the 5 minutes. (Don't worry if "something radioactive" wasn't close to the end of the tube during the whole 5 minutes.)

Directions for each of the stations:

Station MW (MicroWave) – put a cup of cold water (go to the sink to get it) inside the microwave and turn on the microwave for 1 minute (sometime in the midst of your 5 minutes…Don't run it for all 5 minutes). Do not run the microwave without a cup of water inside!

Station N (Nothing) – just leave the GM tube lying on the table during the data collection

Station F (Fruit and other things on a plate) -- feel free to remove the various objects from the plate and test them individually. Put them back afterwards.

Station O (Outside) – this should be a LabQuest 2 that you can take outside. Point the GM tube at the sky, at the bricks on the Science building, in different directions.

Station LB (LightBulb) – point the GM tube towards the lightbulb. But don't get it too close/too hot.

Station FL (Fluorescent Light) – point the GM tube towards the fluorescent light. You can get close.

Part 1

Start at Part 2. Take data at one of the stations.

After you've taken data at the first station you visit (can be any station), come back here to Part 1 and answer questions 1-3 below

1. The detector is designed to detect radiation. If you are getting non-zero data, what's going on? Could there be radiation in the room already, or could your detector just be faulty? Do other people's monitors seem to be detecting something? Write down your ideas.

2. *IS THERE RADIATION IN THE ROOM RIGHT NOW??* How do you decide? (And should we evacuate?)

3. Most of the detectors give off sound as they collect data. As you listen to the detectors and examine the data coming in, try to figure out the relation of the sound and the data that's recorded. Do the radiation monitors suggest that the radiation they detect is **continuous** (arriving at the GM tube like liquid water poured in from a pitcher, or the loudness of a sound) or do they suggest that the radiation is **discrete**, existing as individual, separate events (arriving at the GM tube like ice cubes or pennies which are counted)? What are the reasons for your answer?

Part 2: Counting the radiation

Since everyone's detectors were clicking but nobody was glowing any more than usual, we might as well continue by finding out if the detectors at the different stations are clicking about the same amount or not.

Count the clicks from your detector for 5 minutes (300 s): Set the monitors to count 0.05 sample/s (20 sec / sample). (See the monitor instructions). The detector starts a new count each time it finishes 20 sec. Scroll the table if necessary to see all the counts.

For each station you visit, write down the total counts (for 5 minutes), and then the average number of counts per minute ("CPM").

Station MW

Station N

Station F

Station O

Station LB

Station FL

About how much do your results vary from minute to minute? If you find differences, between the stations, do you suppose the differences are caused by the radiation monitor not working right? Or could it be something else?

Take a picture of the graph of every-20-s-counts that you got from one of the stations, in which you were relatively sure there was no radiation source nearby. Paste it here on this page.

Part 3: Why?

At which of the stations do you think there **was** a source of radiation near by? Why do you think there was a source?

For the stations where you did not think there was a source nearby…What does this mean about counting the clicks- is there a "correct number of clicks in one minute" that everyone should get if there's no radiation source nearby?

Stepping back for a wider view

Have you thought of the possible origin of the radiation that you are detecting? Where might it be coming from? Make some guesses…

What could it mean that the radiation monitor makes individual clicks? What might each click mean?

What could it mean that sometimes the clicks are close together and other times are spread apart in time?