T Level Technical Qualification in Science

Occupational specialism assessment (OSA)

Laboratory Sciences

Assignment 3

Assignment brief

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Contents

Scenario

Since the earthquake and tsunami in 2011, the Japanese nuclear authority has collected vast amounts of information on possible contamination of air, water sources, soil, plants, fish and other animals.

A team of scientists has been tasked with travelling to various spinach farming sites within the Fukushima prefecture. At each site they are expected to take samples of spinach for transporting and testing in the main laboratory just outside the Fukushima prefecture. Whilst at each site they are also expected to take readings using field laboratory equipment. They can then compare the accuracy of the field equipment with the laboratory standard equipment.

The scientists store the spinach samples collected in cool boxes, lined with aluminium foil and frozen ice packs. They are then transported to the main laboratory the same day and stored in a fridge at a temperature below 4°C.

To carry out the tests in the field, scientists use battery powered, hand-held Geiger counters. Background radiation is accounted for in the data provided. All readings were taken at a distance of 3 cm between the sample and the hand-held Geiger counter, measured using a 30 cm ruler.

In the main laboratory, the same readings were taken but traditional, mains-powered Geiger counters were used.

You have been provided with data collected in the field laboratories and also the main laboratory just outside of the Fukushima Prefecture. This data is in the form of a laboratory information management system (LIMS) spreadsheet.

The data relates specifically to Caesium 134 and 137 and is given in Becquerels per kilogram (Bq/kg).

Task 1

Using the information provided, without carrying out calculations, evaluate the reliability of the data obtained from the field laboratories at the sites of origin compared to the main laboratory outside the Fukushima prefecture in 2017.

Use the LIMS data on the 2017 spinach samples to inform your judgement.

(8 marks)
(30 minutes)

Evidence to be submitted:

A word processed/written statement

Task 2

Using the LIMS data, identify the type(s) of error in the raw data on the 2017 spinach samples.

Explain the evidence for the type(s) of error identified. Use the information provided on the 2017 spinach samples tab found in the LIMS system to inform your explanation.

(6 marks)
(30 minutes)

Evidence to be submitted:

A word processed/written statement

Task 3

Identify factors that could cause data errors in measurement of the 2017 spinach samples.

Justify which factors are likely to cause the data errors measured.

Use the information provided on the 2017 spinach samples tab found in the LIMS system, as well as your own knowledge, to help you.

(8 marks) (30 minutes)

Evidence to be submitted:

A word processed/written table containing potential sources of error and associated justifications

Task 4

Describe the steps that should be taken to find out what is causing the error in the 2017 spinach samples data found in the LIMS system.

You should also describe the actions that should be taken to improve techniques when working in field laboratories in order to minimise future errors.

Use the information provided, as well as your own knowledge, to help you.

(8 marks) (30 minutes)

Evidence to be submitted:

A word processed/written statement

Task 5

Consumers in Japan are wary of eating produce, such as spinach, taken from the Fukushima Daiichi Prefecture as they are concerned about the risk of radiation poisoning.

Plot a suitable graph, with a line of best fit. You may plot this by hand or using digital technology, using the data on the Count rate of Cs in spinach tab found in the LIMS system.

There is some research that claims it is safe to eat produce that has a lower count rate than 150 counts per minute. Draw a line to show this on your graph and explain whether you think the spinach is safe to eat.

(11 marks)

(1 hour)

Evidence to be submitted:

Hand drawn graph or a copy of the graph drawn using digital technology

A word processed / written statement

Document information

Owner: Head of Assessment Design