T-LEVELS | Institute for Apprenticeships & Technical Education

T Level Technical Qualification in Science

Occupational specialism assessment (OSA)

Laboratory Sciences

Assignment 1 – task 2

Assignment brief

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Contents

Scenario

In 2011 an ocean floor earthquake, measuring a magnitude of 9.0, triggered a tsunami that struck the eastern shore of Japan. Much of the infrastructure for power was interrupted because of the earthquake.

Fukushima Daiichi nuclear power station is situated in the Fukushima Prefecture (district), which is north of Tokyo on the east coast of Japan. The earthquake and tsunami caused the power supply to the cooling systems to fail. A meltdown followed and radioactive material was released.

This was rated a level 7 incident, which is as high as that of the 1984 Chernobyl disaster.

The Japanese government created exclusion zones around the Fukushima Daiichi nuclear power station and evacuated citizens.

Following the incident, the Japanese government declared a ban on the shipment and sale of spinach leaves from the area. To this day, many Japanese consumers prefer not to purchase produce from this area.

Produce is regularly tested to determine radioactive isotope content. Samples are sent to private testing facilities to ensure scientific rigour and reproducibility. These samples are tested independently and current data is either confirmed or challenged.

Your laboratory has received numerous samples of spinach from the Fukushima Daiichi area. It is the responsibility of the laboratory to:

- test the samples
- determine the radioactive levels
- identify the isotopes present
- contest or confirm whether the data supports use of these products within the human food chain

You will need to complete the following tasks:

- task 1: writing a literature review (that includes a literature search)
- task 2: writing the standard operating procedure (SOP) for measuring radioactive count rate
- task 3: writing a risk assessment for the SOP

Task 2

You have been asked to determine the radioactive count rate in spinach leaves collected from the Fukushima Daiichi prefecture in the laboratory.

Use the sources in the literature list to evaluate the most effective method by comparing standard operating procedures (SOPs) from the literature resource pack.

From the evaluation, write a SOP that will allow you to determine the radioactive count rate of samples of spinach leaves.

Your SOP should:

- contain a hypothesis in the introduction
- describe how results may be collected and recorded, including how to set up and calibrate apparatus
- name the relevant statistical techniques that can be used to process the data
- justify using these techniques in a meaningful interpretation of the collected data

Your SOP should follow safe working practices. You will be writing a full risk assessment in task 3.

Consider the number of significant figures or decimal places you are using and make sure you state this in your SOP.

(58 marks)
(3 hours)

Literature list

An article by Greenpeace on the on-going situation

www.greenpeace.org/international/story/46720/since-fukushima-disaster-decade/

An article on levels of Cs 134 Cs 137

www.seafish.org/trade-and-regulation/contaminants/radionuclides/

An article on the disaster area

www.worldnomads.com/travel-safety/eastern-asia/japan/how-dangerous-is-the-radiation-in-japan

An explanation of units of measurement of radiation/ non scientific

www.mysteryofascension.com/becquerels-grays-and-sieverts/

A radiation dosage chart

www.informationisbeautiful.net/visualizations/radiation-dosage-chart/

Experiments with Geiger counters. Politecnico di Torino

www.core.ac.uk/download/pdf/76522239.pdf

World Nuclear Association: Fukushima Daiichi Accident

www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-daiichi-accident.aspx

National Geographic: Fukushima's Tragic Legacy

www.nationalgeographic.com/environment/article/fukushima-tragic-legacy-radioactive-soil

IAEA: Fukushima Daiichi Status Update

www.iaea.org/newscenter/focus/fukushima/status-update

World Nuclear News: Monitoring Fukushima

www.world-nuclear-news.org/Articles/Monitoring-Fukushima-radiation-on-land-and-sea

An APR article documenting the radioactivity levels in food grown near Fukushima Daiichi

www.npr.org/2011/03/21/134714332/japanese-document-radioactivity-in-food?t=1633425251090

Soil Science and Plant Nutrition: Changes in concentration of radioactive isotopes

www.tandfonline.com/doi/full/10.1080/00380768.2014.989541

The Geiger counter

www.spark.iop.org/geiger-muller-tube

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