# Laboratory Quality Systems Homework # 3 – Measuring Uncertainty & Identifying Outliers Due by Midnight on Monday, February 24, 2025 Instructions: Include one MS Word file with answers for all questions and one Excel file with

an individual spreadsheet for each question (if applicable).

### **Question #1: Measuring Uncertainty**

A lab is running a stability test on a batch of fumonisin reference material. The results from a previous homogeneity test performed 6 months ago is going to be used as a control sample. Five samples are tested now as an experimental subset to determine if the material is still stable. Using the data in the HW3 1.xlsx file and answer the following questions:

- 1. What is the standard uncertainty for the experimental subset?
- 2. What is the standard uncertainty for the homogeneity control subset?
- 3. What is the combined uncertainty?

# Question # 2 – Dixon Q-Test

A Dixon Q-Test is used to find a single outlier in a set of data. An outlier is a data point that differs significantly from other observations. An outlier may be due to variability in the measurement or it may indicate experimental error; the latter are sometimes excluded from the data set. Using the data in the HW3 2.xlsx file and answer the following questions:

- 1. Calculate the Gap, Range and Q-statistic of the dataset. (See Dixon Outlier Presentation)
- 2. Does the set have any outliers? Which sample is the outlier (Include Value)?

#### **Question # 3: Analyst Qualification Tests**

All laboratory analysts should attempt and pass gualification tests prior to analyzing samples independently. The criteria used for qualification will depend on our laboratory and the fit-for-purpose of the test. The OTSC conducts qualification workshops in Africa on aflatoxin test kits. To qualify, an analyst is assigned 7 samples to analyze using a test kit and the results are compared to reference materials results. (See Dixon Outlier Presentation) An analyst passes the qualification test if the following criteria (discussed in the analyst qualification presentation) are met:

- 1. Only one outlier exists; If more than one outlier exists, discuss data set with lab supervisor
- 2. the P value of the t-test is greater than 0.05 indicating that there is no significant difference between the data pairs and/or the mean difference is < 2 times the standard deviation of the control data. (The SD of the Control data is found on the "OTSC Uncertainty of Measurement Estimation" Excel Sheet that is attached)

The attached excel files contain data for 2 analysts who are being gualified. For each set of data,

1. Complete the following Table for each analyst:

(5 pts)

(2.5 pts)

(2.5 pts)

Dataset Name (File Name)	
P-value of T-test	
Mean Difference	
Sd of the Control Data you will use for Mean	
Difference Comparison	

2. Answer the following questions for each anaylst:

- a. Was there a Dixon outlier?
- b. What is paired t-test result with and without (if applicable) the outlier?
- c. Does the analyst pass based on the paired t-test? Explain
- d. Does the analyst pass based on the mean difference result? (Use control chart data from OTSC contained in the file "uncertainity.xlsx") Explain

Make sure you indicate which dataset your answers are addressing

Data/other files to use to complete Question # 3:

Analyst\_1 data

Analyst\_2 Data

**OTSC Uncertainty of Measurement Estimation** 

See Unit Activity Sheet for other resources