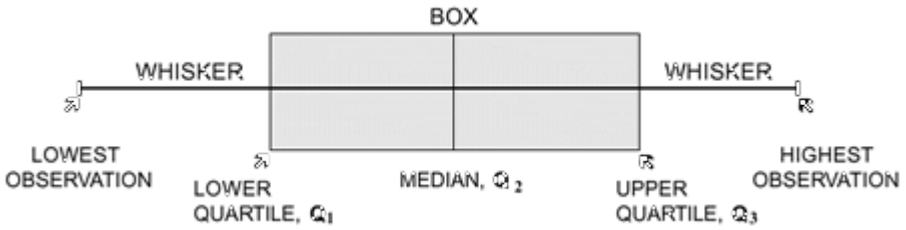
Conference for Food Protection

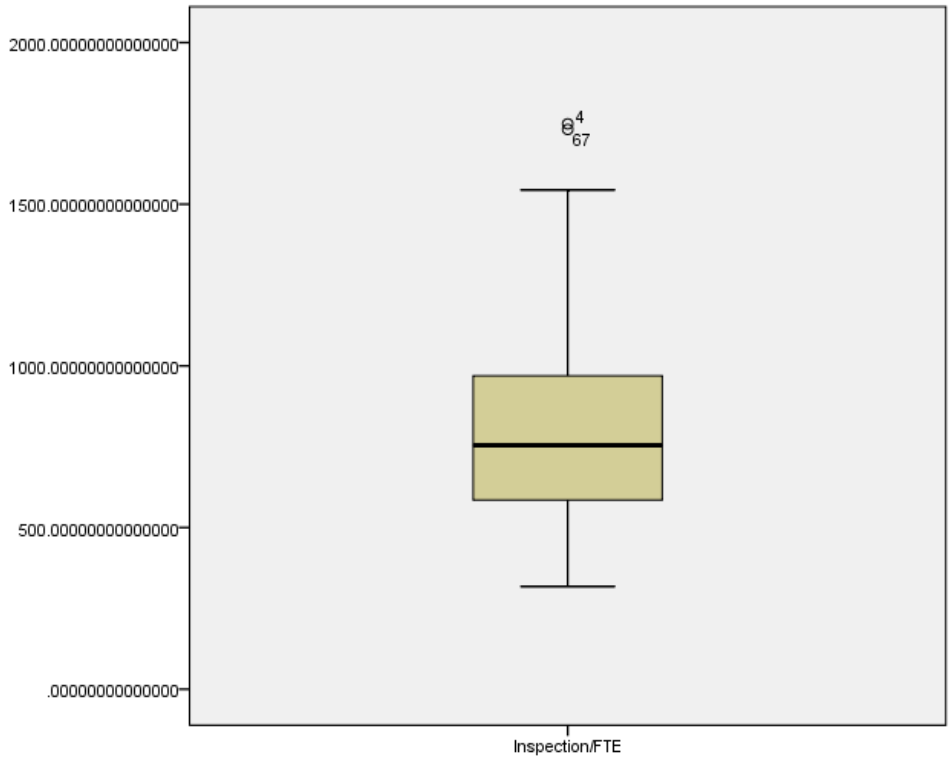
Standard 8 Subcommittee

- **Box Plot:**
- Box Plot is a graph that is useful for indicating whether there are potential unusual observations (outliers) in the data set.



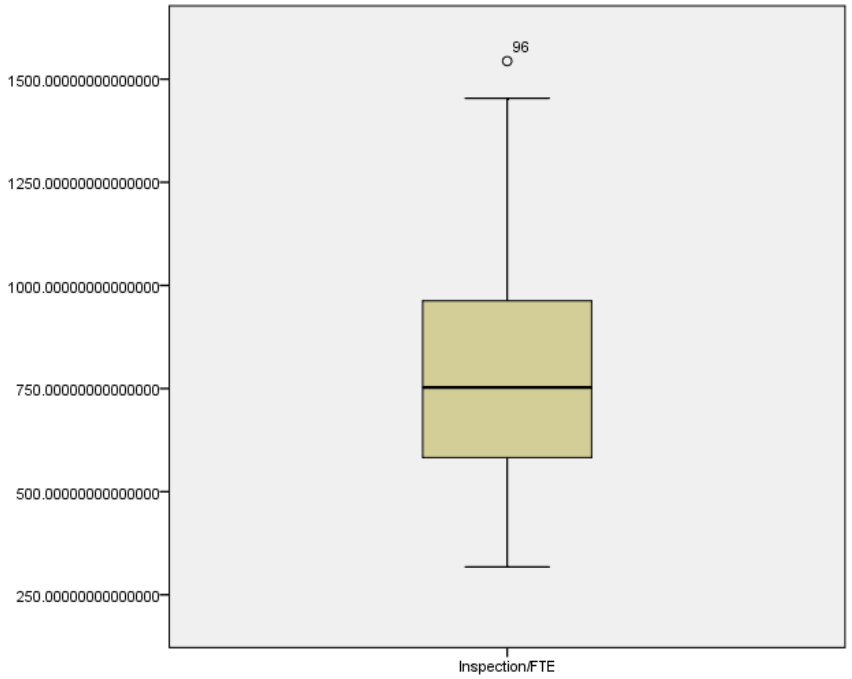
In a box and whisker plot:
The ends of the box are the upper and lower quartiles, so the box spans the interquartile range
The median is marked by a vertical line inside the box
The whiskers are the two lines outside the box that extend to the highest and lowest observations.
IQR (Inter Quartile Range) = Q3 – Q1
Any value below Q1 – 1.5×IQR or above Q3 + 1.5×IQR is an outlier.

- Box Plot for Inspection/FTE variable in the data:



Based on the above graph, following observations are outliers:
Observation number 4 (City of Plano Environmental Health Department)
Observation number 67 (Town of Topsfield)

After removing Observation number 4 (City of Plano Environmental Health Department), observation number 67 (Town of Topsfield), observation number 96 (Cochise County Health Department) was an outlier as shown in the graph (Box Plot) below.



After removing 3 outliers, there were no more outliers in the data.

After removing 3 outliers, final dataset has sample size n = 98

Local Health Departments = 83

State Health Departments = 15

- ## Descriptive Statistics:

  Inspection/FTE:

  Mean = Average

  Standard Deviation (Standard deviation measures the spread of a data distribution)

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Inspection/FTE	98	320.41536050156740	1466.62902315076240	778.758664626517400	273.497636523841440
Valid N (listwise)	98				

Inspection/FTE ratio = Mean ± Standard Deviation

= 779 ± 273

= 506 to 1052

- **Pearson Correlation:**
- It is a measure of the strength of the linear relationship between two variables.
- The correlation coefficient is between -1 and 1.
- Interpretation:
    - Coefficient between -1 and 0 = negative linear relationship (one increases, other decreases)
    - Coefficient 0 = No linear relationship
    - Coefficient between 0 and 1 = positive linear relationship (one increases, other increases OR one decreases, other decreases)

- P value (seen as "Sig." in the SPSS result tables) is the probability of getting the results you got, given that the null hypothesis is true.
- Null hypothesis always assumes that there is no relationship/association.
- Interpretation of P value ("Sig."):
    - P value ≤ 0.05 = we reject the null hypothesis
    - P value > 0.05 = we do not reject (accept) the null hypothesis

- **To test the linear relationship <u>between Inspection/FTE ratio and number of standards met by the department</u>, we first write the null hypothesis, check the Pearson Correlation (positive or negative) and check whether it is significant or not by observing P value ("Sig." in SPSS table).**

1) **Null Hypothesis**: There is no linear relationship between Inspection/FTE ratio and number of standards met by the department.

   Variables:
   Inspection/FTE = Inspection/FTE ratio
   Standards_Met = Number of standards met by the department.

Correlations

		Inspection/FTE	Standards_Met
Inspection/FTE	Pearson Correlation	1	-.034
	Sig. (2-tailed)		.743
	N	98	98
Standards_Met	Pearson Correlation	-.034	1
	Sig. (2-tailed)	.743	
	N	98	98

<u>Interpretation</u>: Pearson Correlation Coefficient = -0.034, indicates that there is a negative relationship between Inspection/FTE ratio and number of standards met by the department. If the number of standards met by the department increases, the ratio decreases, vice versa. However, based on the P value = 0.743 (which is >0.05 set value), we do not reject (accept) the null hypotheses. It indicates that there is <u>no statistical significant correlation</u> between Inspection/FTE ratio and number of standards met by the department.

- **Two Sample T-test:** This test is done to compare the means between two groups.

- To test the mean inspection/FTE ratio between two groups of departments who meet less or more than 6 standards.

Departments who meet less than 6 standards: n1 = 91
Departments who meet more or equal to 6 standards: n2 = 7

Null Hypothesis: The mean Inspection/FTE ratio is not different between two groups of departments who meet less than 6 and those who meet more or equal 6 standards.

Group Statistics

	Stds_Meet	N	Mean	Std. Deviation	Std. Error Mean
Inspection/FTE	1.00	91	780.789708568792300	277.491499805676000	29.089013156551328
	2.00	7	752.355093376941100	231.048154196920760	87.327993840793840

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Inspection/FTE	Equal variances assumed	.546	.462	.264	96	.793	28.434	107.792	-185.532	242.401
	Equal variances not assumed			.309	7.399	.766	28.434	92.045	-186.859	243.728

Interpretation:

Based on the P value = 0.793 (>0.05), we do not reject (accept) the null hypothesis. It indicates that the mean Inspection/FTE Ratio is not significantly different between two groups of departments who meet less than 6 and those who meet more or equal 6 standards.