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BIOENVIRONMENTAL ENGINEERING

Trend Analysis

QUALIFICATION TRAINING PACKAGE

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STS Line Item 4.16.2: Develop trend analyses from results of Environmental Health Data

TRAINER GUIDANCE

Proficiency Code:	2b
PC Definition:	Can do most parts of the task. Needs help only on hardest parts. Can determine step-by-step procedures for doing the task.
Prerequisites:	N/A
Training References:	4B051 CDC
Additional Supporting References:	EPA, *Data Quality Assessment: Statistical Methods for Practitioners*, EPA QA/G-9S, 2006
CDC Reference:	4B051
Training Support Material:	None
Specific Techniques:	None
Criterion Objective:	Given a data set of environmental samples, perform trend analysis successfully completing all checklist items with limited trainer assistance on only the hardest parts.

Notes:

Scenario:

You are concerned about water quality on base and have been asked to review the chlorine residual results from CE for the past week. CE measures chlorine residual at the same time each day to ensure consistency in treatment.

Time	Day 1	Day 2	Day 3	Day 4	Day 5
700	0.28	0.26	0.38	0.41	0.31
900	0.31	0.32	0.45	0.49	0.35
1200	0.35	0.32	0.48	0.53	0.38
1400	0.24	0.22	0.39	0.47	0.31
1600	0.18	0.16	0.28	0.32	0.22

TASK STEPS

1. Determine method for trend analysis.[1]
2. Determine type of analysis you are performing.[2]
3. Identify trends.
4. Determine what trend indicates.

LOCAL REQUIREMENTS:

NOTES:

1. Methods are statistical or visual. Visual is recommended for scenario provided. Visual is most useful for tracking/visualizing significant changes over time and is generally used with several data points are collected over time from the same location. Statistical is most useful when looking for minor differences between samples and is generally used with several samples taken from various locations.

2. If multiple samples at a single location over time were collected, you will most likely be interested in identifying changes over time. Visual statistical analysis can be done with several methods including histograms, graphs, time series plot, and spatial data plots. A histogram reflects data by separating them into groups such by location, type of sample, or another identifying characteristic. This graphical technique provides a visual method of identifying the underlying distribution of the data and is commonly shown as a bar graph. It is generally used to shown extremes and get assess the shape and spread of data, but details are lost. Time Series plot reflects data over time. This is useful for tracking both large and small trends and is the recommended visual statistical analysis tool for this scenario, since our scenario is attempting to identify trends over time. Spatial data plots, also called a posting plot, compare data values to map locations. It is used to mark the highest and lowest values of the data to identify any obvious trends. This is useful when tracking trends across multiple sampling locations.

TRAINEE REVIEW QUESTIONS

STS Line Item 4.16.2: Develop trend analyses from results of Environmental Health Data

1. Why was visual statistical analysis better for this scenario?
2. List two reasons why you should perform environmental health data trend analysis.
3. What is a histogram?
3. What is a time series plot?
5. What is another name for a map of data locations along with corresponding data values?

PERFORMANCE CHECKLIST

STS Line Item 4.16.2: Develop trend analyses from results of Environmental Health Data

Proficiency Code:	2b
PC Definition:	Can do most parts of the task. Needs help only on hardest parts. Can determine step-by-step procedures for doing the task.

DID THE TRAINEE…		YES	NO
1. Determine method for trend analysis?			
2. Determine type of analysis being performing?			
3. Identify trends?			
4. Determine what trend indicates?			
Did the trainee successfully complete the task?			

TRAINEE NAME (PRINT)

TRAINER NAME (PRINT)

ANSWERS

1. Why was visual statistical analysis better for this scenario?

   A: If multiple samples at a single location over time were collected, you will most likely be interested in identifying changes over time.

   (Source: 4B051 CDC)

2. List two reasons why you should perform environmental health data trend analysis.

   A: A trend analysis is useful for identifying changes in COCs over time and/or spatial variations in COCs over an area of concern.

   A trend analysis can assist with answering questions about site contamination like: Is the environment of the site clean overall? Are there problem areas or hot spots? Has there been any change to the drinking water quality?

   Trend analysis allows BE to be proactive by identifying problems before they become too big.

   A graphical representation of the problem can help you to communicate the hazards.

   Trend analysis can help determine if engineering controls or process changes are effective at reducing overall exposures.

   Without tracking and trending data it is difficult to show that measures taken to reduce exposures are effective.

   (Source: 4B051 CDC)

3. What is a histogram?

   A: A visual representation of the data collected into groups.

   (Source: 4B051 CDC)

4. What is a time series plot?

   A: A plot of the data over time.

   (Source: 4B051 CDC)

5. What is another name for a map of data locations along with corresponding data values?

   A: A spatial plot, also called a posting plot.

   (Source: 4B051 CDC)

STS Line Item 4.16.3: Develop trend analyses from Occupational Health Data

TRAINER GUIDANCE

Proficiency Code:	2b
PC Definition:	Can do most parts of the task. Needs help only on hardest parts. Can determine step-by-step procedures for doing the task.
Prerequisites:	None
Training References:	N/A
Additional Supporting References:	IHSTAT Excel program; available for free from AIHA at https://www.aiha.org/get-involved/VolunteerGroups/Pages/Exposure-Assessment-Strategies-Committee.aspx
CDC Reference:	4B051
Training Support Material:	*A Strategy for Assessing and Managing Occupational Exposures, 3rd Edition* (AIHA) Chapter 5, Appendix IV
Specific Techniques:	N/A
Criterion Objective:	Given a data set of occupational samples, perform trend analysis successfully completing all checklist items with only limited trainer assistance.

Sample mg/m^3
0.003
0.002
0.004
0.001

Notes:

Scenario:

Air sampling at corrosion control has shown exposures to Hexavalent Chromium. You have four samples and all of them show results below the OEEL. Using the IHSTAT program, determine the exposure profile and make a recommendation.

Additional Notes: Trainee must use statistical trend analysis in the IHSTAT program to calculate the 95th Percentile and make an exposure determination/recommendation.

TASK STEPS

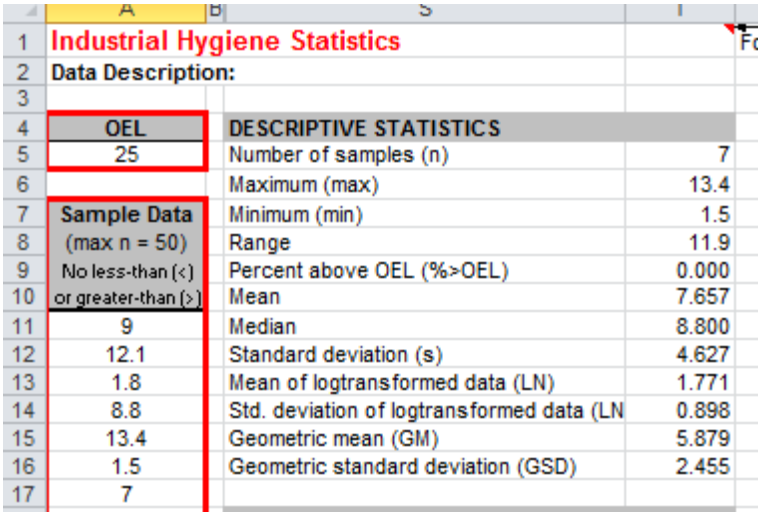
1. Determine reason for trend analysis.[1]
2. Enter the data into the OEL and sample data windows.[2]
2. Determine lognormal 95th percentile.[3]
3. Determine exposure profile and make recommendation.[4]

LOCAL REQUIREMENTS:

NOTES:

1. Review the sampling strategy and methodology used to collect the data and conduct a preliminary data review.

2. Calculations will be done using IHSTAT excel program. This is done automatically by entering results into the "Sample Data" block of IHSTAT, shown below.



	A	B	S	T
1	Industrial Hygiene Statistics			
2	Data Description:			
3				
4	OEL		DESCRIPTIVE STATISTICS	
5	25		Number of samples (n)	7
6			Maximum (max)	13.4
7	Sample Data		Minimum (min)	1.5
8	(max n = 50)		Range	11.9
9	No less-than (<)		Percent above OEL (%>OEL)	0.000
10	or greater-than (>)		Mean	7.657
11	9		Median	8.800
12	12.1		Standard deviation (s)	4.627
13	1.8		Mean of logtransformed data (LN)	1.771
14	8.8		Std. deviation of logtransformed data (LN	0.898
15	13.4		Geometric mean (GM)	5.879
16	1.5		Geometric standard deviation (GSD)	2.455
17	7			

3. The 95th Percentile is automatically calculated under the Lognormal Parametric Statistics window.

LOGNORMAL PARAMETRIC STATISTICS	
Estimated Arithmetic Mean - MVUE	8.194
$LCL_{1,95\%}$ - Land's "Exact"	4.889
$UCL_{1,95\%}$ - Land's "Exact"	30.729
95th Percentile	25.764
$UTL_{95\%,95\%}$	124.520
Percent above OEL (%>OEL)	5.354
$LCL_{1,95\%}$ %>OEL	0.549
$UCL_{1,95\%}$ %>OEL	27.476

4. The 95th Percentile is then compared to the OEEL to make an exposure determination of Acceptable exposure, Unacceptable exposure, or Uncertain exposure. The following classifications and actions are recommended:

   95th Percentile less than 10% of the OEEL- **Acceptable** Exposure; verify every 5 years
   95th Percentile between 10% and 50% of the OEEL- **Acceptable** Exposure; verify every 2 years
   95th Percentile between 50% and 100% of the OEEL- **Uncertain** Exposure; collect more data and/or control the hazard
   95th Percentile above 100% of the OEEL- **Unacceptable** Exposure; control the hazard

TRAINEE REVIEW QUESTIONS

STS Line Item 4.16.3: Develop trend analyses from Occupational Health Data

1. What are the six steps for basic trend analysis?

   1)

   2)

   3)

   4)

   5)

   6)

2. List two areas that should be covered during a preliminary data review.

   1)

   2)

3. Six sample results were entered for a process involving toluene. The OEEL for Toluene is 20 ppm. The 95th percentile was 12.5 ppm. What is the exposure determination and recommendation?

PERFORMANCE CHECKLIST

STS Line Item 4.16.3: Develop trend analyses from Occupational Health Data

Proficiency Code:	2b
PC Definition:	Can do most parts of the task. Needs help only on hardest parts. Can determine step-by-step procedures for doing the task.

DID THE TRAINEE…		YES	NO
1. Determine reason for trend analysis?			
2. Enter the data into the OEL and sample data windows?			
3. Determine lognormal 95th percentile?			
4. Determine exposure profile and make recommendation?			
Did the trainee successfully complete the task?			

TRAINEE NAME (PRINT)

TRAINER NAME (PRINT)

ANSWERS

1. What are the six steps for basic trend analysis?

   A:
   1) **Review** the sampling strategy and methodology used to collect the data.
   2) **Conduct** a preliminary data review.
   3) **Calculate** basic descriptive statistics.
   4) **Check** the exposure profile distribution.
   5) **Determine** the 95th percentile exposure.
   6) **Compare** the 95th percentile exposure to the OEEL.

   (Source: 4B051 CDC)

2. List two areas that should be covered during a preliminary data review.

   A:
   1) Check for sufficient sampling data (i.e., six or more sample results to characterize an exposure profile)
   2) Check for non-detectable results (i.e., results reported as less than the limit of detection)

   (Source: 4B051 CDC)

3. Six sample results were entered for a process involving toluene. The OEEL for Toluene is 20 ppm. The 95th percentile was 12.5 ppm. What is the exposure determination and recommendation?

   A:
   This exposure is Uncertain, 95th percentile greater than 50% of the OEEL (10 ppm) and less than 100% of the OEEL (20 ppm). Therefore, you should collect more data and/or control the hazard.

   (Source: 4B051 CDC)