

PROBLEMS

1. Compute the TWA for the following respirable dust exposures:

| Hours | mg/m ³ |
|-------|-------------------|
| 2 | 3.0 |
| 1 | 3.5 |
| 3 | 2.0 |
| 2 | 2.5 |

Has the TLV for respirable dusts been exceeded?

2. Air contains xylene at 60 ppm (TLV=100 ppm), toluene at 40 ppm (TLV=50 ppm), and trimethylbenzene at 15 ppm (TLV=25 ppm). What is the combined exposure? Is the TLV of the mixture exceeded?

3. If the vapor pressure of #2 diesel fuel is 1 torr at 70°F, what is the maximum concentration that will occur in an enclosed space?

What about for naphthalene, TLV=10 ppm, VP=0.08 torr?

What about for p-dichlorobenzene, TLV=10 ppm, VP=0.4 torr?

4. A gas cylinder contains 0.10% carbon monoxide in nitrogen. What is the concentration of CO in ppm?

5. An air stream containing 100 ppm of CCl₄ is metered at 50 ml/min and is mixed with clean air at 4950 ml/min. What is the concentration of CCl₄ in the final mixture?

6. A dental office had small but visible amounts of liquid mercury in every examination room. If the vapor pressure of mercury is 0.0029 mm, and assuming no make-up air, what is the concentration of mercury in ppm and mg/m³? How does this compare to the TLV? (MW=201; TLV=0.025 mg/m³)

7. A 10 liter sample of air was found to contain 1 mg of carbon tetrachloride (MW=154). What is the concentration in ppm?

8. A cylinder of chlorine gas was damaged and released one pound of Cl₂ gas into a closed room of 60'x 30'x 15'. What is the concentration in ppm? (MW=70.9; 454 g/lb; 28.32 L/ft³)

9. An air sample (200 ml/min for 8 hours) was taken for benzene in Denver (air temperature 40°F and barometric pressure 638 mmHg). The lab reported 100 µg of benzene in the sample. What was the concentration of benzene at NTP and how does that compare with the TLV?

10. Xylene spilled onto the floor of a lab. The vapor pressure of xylene is 7 mmHg, the flash point occurs at 90° F, and the flammable limits are 0.9-6.7% by volume. The PEL is 900 ppm. What is the maximum concentration of xylene vapor that will occur in an enclosed space? Is the atmosphere hazardous? Why?

11. How can the OEL for 1,3-dichloropropene (1 ppm) be modified for a 10 hour work day, 4 day work week?

12. How should the TLV be modified for exposure 10 hours/day, 4 day work week to 1,3-dichloropropene with an estimated biological half-life of 17 hours?

13. Describe the preparation of a 100 ppm standard of acetone using a 10 liter gas bag. How many microliters of liquid acetone are required? MW = 58.1, density = 0.7972

14. How many microliters of liquid solvent are required to prepare the following standards in a 10 liter gas bag?

| | | | | |
|-----------|---------|---------|---------|---------|
| SOLVENT | Acetone | Benzene | Ethanol | Toluene |
| MW | 58 | 78 | 46 | 92 |
| DENSITY | 0.7972 | 0.8794 | 0.7893 | 0.8660 |
| VP (mmHg) | 180 | 100 | 57 | 37 |
| TLV (ppm) | 750 | 0.3 | 1000 | 50 |

CONCENTRATION
(ppm)

1.0

5.0

10

50

100

500

1000

15. A direct reading organic vapor analyzer was used to monitor for methyl acrylate (PEL = 10 PPM). Ten randomly selected values obtained: 8.4, 10.1, 12.5, 7.6, 6.1, 9.3, 8.5, 10.5, 7.0, 4.3.

A. Calculate the mean.

B. Calculate the standard deviation.

C. Calculate the 95% confidence interval for the mean.

D. Classify the exposure status.

16. A charcoal tube and personal pump were used to sample for toluene (PEL = 100 PPM, MW = 92). The flow rate was 200 mL/min for 8 hours. The laboratory reported 50 mg of toluene and gave a CV of 0.09 for sampling and a CV of 0.11 for analysis.

A. What is the concentration of toluene in PPM?

B. Compute the cumulative coefficient of variation.

C. Compute the 95% confidence interval for the sample.

D. Classify the exposure status.

17. A charcoal tube and personal pump were used to sample for benzene. A flowrate of 100 ml/min. was used for 8 hours. The result was 1.25 ppm with a coefficient of variation of 0.10. The standard is 1.0 ppm. What is the compliance status?
18. If in the above example the sample time was 6 hours, what is the compliance status?
19. An oxygen sensor indicates 20.2% oxygen concentration in a tank that stored petroleum distillates (PEL = 400 ppm, LEL = 1100 ppm, IDLH = 10,000 ppm). (5 points)
- A. Is the tank safe for entry? Why or why not?
- B. What approximate concentration of displacing gases are in the tank that could produce an oxygen reading of 20.2%?

20. For the following benzene exposure data in ppm, compute the mean, standard deviation and 95% confidence interval for the mean. Plot the cumulative percent frequency on probability paper. What percent of the time would you expect the exposure to exceed the standard (PEL = 1.0 ppm)? Repeat the above with the log-transformed data.

| | | | | | | | |
|------|------|------|------|------|------|------|------|
| 0.68 | 0.73 | 0.31 | 0.46 | 0.61 | 1.52 | 0.48 | 0.30 |
| 0.34 | 0.36 | 0.47 | 0.63 | 1.35 | 0.34 | 0.39 | 1.04 |
| 0.60 | 0.60 | 1.29 | 0.52 | 0.95 | 0.98 | 0.69 | 0.50 |
| 0.91 | 0.80 | 2.45 | 0.55 | 0.29 | 0.44 | 0.26 | 0.35 |
| 0.54 | 0.34 | 0.42 | 0.88 | 0.41 | 0.90 | 0.74 | 1.56 |
| 1.07 | 1.09 | 1.03 | 0.43 | 1.16 | 1.00 | 1.36 | 0.71 |
| 1.21 | 1.37 | 0.85 | 0.49 | | | | |

