

Science & Technology 404
Worksheet - Drinking Water & ppm

Maximum Drinking Water Concentrations for Selected Chemicals		
Benzene: 0.005 ppm	Arsenic: 0.05 ppm	Lead: 0.05 ppm
2,4-D (a weed killer): 0.10 ppm	1,1,1,-Trichloroethane (TCE): 0.2 ppm	Fluoride: 4 ppm

Volumes of Bodies of Water	
Clear Lake	3 083 704 272 L
Swimming Pond	12 342 911 L
Deep Rock Aquifer	233 100 000 000 L

1. Local health authorities have been advised that 18.9 L of herbicide 2,4-D have been dumped in Swimming Pond. If local residents use the pond for their drinking water, should the health authorities advise them the water is unsafe?
2. The Sureté du Quebec has been notified that 22.7 L of benzene were accidentally spilled into Clear Lake. If it is evenly dispersed, should the residents who depend on the lake for drinking water be notified?

3. An old rusted, unmarked 208.2 L drum was discovered on a property of a resort near Clear Lake. Although the manager suspects it may contain a hazardous chemical, he asks his assistant to get rid of it any way he can.
- a) Calculate the concentration of contaminant in the ground water if a 208.2 L drum of the chemical were illegally disposed of in an old well and dispersed evenly throughout the Deep Rock Aquifer. Should local residents be advised?
 - b) What if the same quantity of the chemical were disposed of in Clear Lake?
 - c) What if the same quantity of the chemical were disposed of in Swimming Pond?
4. If a 18 927 L truck loaded with the chemical arsenic ran off the highway and spilled its entire load into Clear Lake, would the concentration of arsenic in the lake be within acceptable levels?

1. Local health authorities have been advised that 18.9 L of herbicide 2,4-D have been dumped in Swimming Pond. If local residents use the pond for their drinking water, should the health authorities advise them the water is unsafe?

Calculate concentration of herbicide: $\frac{18.9 \text{ L}}{12\,342\,911 \text{ L}} = \frac{x}{1\,000\,000}$

$$\frac{18.9 \text{ L} \times 1\,000\,000}{12\,342\,911 \text{ L}} = 1.53 \text{ ppm}$$

Since the maximum allowable concentration is 0.10 ppm, local residents must be informed of the unsafe water quality.

2. The Sureté du Quebec has been notified that 22.7 L of benzene were accidentally spilled into Clear Lake. If it is evenly dispersed, should the residents who depend on the lake for drinking water be notified?

Calculate concentration of benzene: $\frac{22.7 \text{ L}}{3\,083\,704\,272 \text{ L}} = \frac{x}{1\,000\,000}$

$$\frac{22.7 \text{ L} \times 1\,000\,000}{3\,083\,704\,272 \text{ L}} = 0.0074 \text{ ppm}$$

Since the maximum allowable concentration of benzene is 0.005 ppm, residents must be notified.

3. An old rusted, unmarked 208.2 L drum was discovered on a property of a resort near Clear Lake. Although the manager suspects it may contain a hazardous chemical, he asks his assistant to get rid of it any way he can.

a) Calculate the concentration of contaminant in the ground water if a 208.2 L drum of the chemical were illegally disposed of in an old well and dispersed evenly throughout the Deep Rock Aquifer. Should local residents be advised?

Calculate the concentration in ppm:
$$\frac{208.2 \text{ L}}{233\,100\,000\,000 \text{ L}} = \frac{\text{ } \times}{1\,000\,000}$$
$$\frac{208.2 \text{ L} \times 1\,000\,000}{233\,100\,000\,000 \text{ L}} = 0.00089 \text{ ppm}$$

Since this falls within the allowable concentrations for all listed chemicals, the water is still safe to drink.

b) What if the same quantity of the chemical were disposed of in Clear Lake?

Calculate the concentration in ppm:
$$\frac{208.2 \text{ L}}{3\,083\,704\,272 \text{ L}} = \frac{\text{ } \times}{1\,000\,000}$$
$$\frac{208.2 \text{ L} \times 1\,000\,000}{3\,083\,704\,272 \text{ L}} = 0.068 \text{ ppm}$$

This is above the allowable concentration for some listed chemicals, the water should be considered unsafe.

c) What if the same quantity of the chemical were disposed of in Swimming Pond?

Calculate the concentration in ppm

$$\frac{208.2 \text{ L}}{12\,342\,911 \text{ L}} = \frac{\quad \times}{1\,000\,000}$$
$$\frac{208.2 \text{ L} \times 1\,000\,000}{12\,342\,911 \text{ L}} = 16.87 \text{ ppm}$$

This is well above the allowable concentration for all listed chemicals and is therefore extremely unsafe.

4. If a 18 927 L truck loaded with the chemical arsenic ran off the highway and spilled its entire load into Clear Lake, would the concentration of arsenic in the lake be within acceptable levels?

Calculate the concentration in ppm:

$$\frac{18\,927 \text{ L}}{3\,083\,704\,272 \text{ L}} = \frac{\quad \times}{1\,000\,000}$$
$$\frac{18\,927 \text{ L} \times 1\,000\,000}{3\,083\,704\,272 \text{ L}} = 6.14 \text{ ppm}$$

The concentration is well above acceptable levels.