

## Homework 3 Due in one week

1. Improper waste disposal practices at an industrial site resulted in contamination of the soil on site by cadmium, a known carcinogen with a slope factor of  $6.10 \text{ (mg/kg d)}^{-1}$ . We will consider the risk to off-site residents due to inhalation of airborne soil particles that include the cadmium. Based on monitoring data, the concentration of cadmium in the air off site is  $5.4 \times 10^{-4} \text{ mg/m}^3$ .

[A] Find the  $C_{inh}$  for residents that are children 1-6 years of age and adults.

[B] Find the cancer risks due to these  $C_{inh}$  values for the children and adults.

Show all calculations and identify all parameter values used.

2. The same site also caused off-site lead concentrations that can cause non-cancer effects on the residents. The RfD for lead is  $6.90 \times 10^{-4} \text{ mg/kg d}$ . We will consider dermal exposures in this problem, with a lead concentration of  $260 \text{ mg/kg}$  in the soil, and an absorption factor of 10 percent for the young children and 5 percent for adults.

[A] Find the NCDEX for residents that are children 1-6 years of age and adults.

[B] Find the hazard quotients due to these NCDEX values for the children and adults.

Show all calculations and identify all parameter values used.

3. A contaminated groundwater that is a potential drinking water source has a manganese concentration of  $0.36 \text{ mg/L}$ . The RfD for manganese is  $0.10 \text{ mg/kg.d}$ . We will consider effects on children 6-12 (drinking 1 L/d) and adults (2 L/d).

[A] Find the NCIng for children 6-12 and adults drinking this water.

[B] Find the hazard quotients due to these NCIng values for the children and adults.

Show all calculations and identify all parameter values used.

4. An animal exposure study was performed to determine an acceptable drinking water concentration for a chemical that causes liver disease in rats and is assumed to have a nonzero threshold. The following results were obtained.

Control Group

Comparison to historical records: no evidence of premature deaths

Time of sacrifice: all surviving rats were sacrificed at 18 months

Initial number: 100

Number of rats with liver disease: 3

Test Group.

Exposure conditions (lowest observed effect):  $140 \text{ mg/L}$ ,  $30 \text{ mL/d}$  for a median of 12 months

Time of sacrifice: all surviving rats were sacrificed at 18 months

Comparison of weight and survival curves: no differences between test and control rats

Median adult weight:  $0.4 \text{ kg}$

Initial number exposed: 100

Number of rats with liver disease: 12

[A] Find the LOAEL for the rats based on this study.

[B] Find the RfD for humans by adjusting for uncertainty. This result is subchronic animal data with no human exposure data available.

[C]

[C] Convert the RfD to an acceptable drinking water concentration.

5. Go to the EPA's IRIS system website (Google EPA IRIS, select the Browse A to Z List of Chemicals link) and print out the first page of the IRIS Summary (PDF) for a toxic or carcinogenic substance of your choice. As long as you are there, wander around the site and see the types of information that are available about that substance.