HUMAN HEALTH METHODOLOGY
Exercise 1
Blue Team Answer

The answer sheet follows the steps outlined in the instruction sheet. The appropriate data or information needed to solve the problem is identified for each step.

1. Select the approach to be used based on the data on the health effects risk.

Carcinogen (mutagenic or unknown mode of action: linear approach

$$AWQC = RSD \cdot \left(\frac{BW}{DI + \sum_{i=2}^{4} (FI_i \cdot BAF_i)} \right)$$

Gibberite is a known human carcinogen with a mutageic mode of action

2. Select the appropriate health risk value.

- Risk Specific Dose
  - Risk Level: one in a million (10^{-6})
  - Slope Factor: 1.8 x 10^{-3} $(mg/kg/day)^{-1}$
  - Risk specific dose: 5.6 x 10^{-4} mg/kg/day

3. Determine the exposure parameters for the population of concern.

- Body Weight
  - Adults: 70 kg
- Drinking water intake
  - Adults: 2 L/day
- Fish intake.
  - 300 g/day (given in the problem)

4. Determine the bioaccumulations factor.

- 40 L/kg (given in the problem)

5. Calculate the RSC if using the noncancer or nonlinear carcinogen approach.

- Not needed in the equation for a mutagenic carcinogen

6. Solve the Equation; QC the calculation.

Water and Organisms

$$AWQC = 5.6 \times 10^{-4} \text{ mg/kg/day} \times \frac{70 \text{ kg}}{2 \text{ L/day} + [0.3 \text{ kg/day} \times 40 \text{ L/kg}]} = 0.0028 \text{ mg/L} = 2.8 \text{ µg/L}$$

Organisms only (not part of the problem)

$$AWQC = 5.6 \times 10^{-4} \text{ mg/kg/day} \times \frac{70 \text{ kg}}{[0.3 \text{ kg/day} \times 40 \text{ L/kg}]} = 0.0033 \text{ mg/L} = 3.3 \text{ µg/L}$$

Exercise 2
Yellow Team Answer

The answer sheet follows the steps outlined in the instruction sheet. The appropriate data or information needed to solve the problem is identified for each step.

1. Select the approach to be used based on the data on the health effects risk

- Noncarcinogen

$$AWQC = RfD \cdot RSC \cdot \left(\frac{BW}{DI + \sum_{i=2}^{4} \left(FI_i \cdot BAF_i \right)} \right)$$

Unisol has an RfD based on developmental toxicity. There is suggestive evidence of toxicity but the data do not support quantification of a slope factor.

2. Select the appropriate health risk value.

- RfD: 0.03 mg/kg/day

3. Determine the exposure parameters for the population of concern.

- Body Weight
  - Pregnant woman: 67 kg
- Drinking water intake
  - Adults and pregnant women: 2 L/day
- Fish intake.
  - 150 g/day (given in the problem)

4. Determine the bioaccumulations factor.

- 120 L/kg (provided in the problem)

5. Calculate the RSC if using the noncancer or nonlinear carcinogen approach

- Contaminant intake contributed by fish from the ambient water body : 40 µg/day (given by the problem)
- Contaminant from all other dietary components: 3 µg/day
- Contaminant intake from drinking water: 2 L/day x 10 µg/L = 20 µg/day

$$\text{RSC (water + organism)} = \frac{40\ \mu g/day + 20\ \mu g/day}{40\ \mu g/day + 3\ \mu g/day + 20\ \mu g/day} = 0.95 \text{ (use 80\% default)}$$

$$\text{RSC (organism only)} = \frac{40\ \mu g/day}{40\ \mu g/day + 3\ \mu g/day + 20\ \mu g/day} = 0.63$$

6. Solve the Equation; QC the calculation.

Water and Organisms

$$\text{AWQC} = 0.03\ mg/kg/day \times 0.80 \times \frac{67\ kg}{2\ L/day + [0.15\ kg/day \times 120\ L/kg]} = 0.08\ mg/L$$

Organisms only

$$\text{AWQC} = 0.03\ mg/kg/day \times 0.63 \times \frac{67\ kg}{[0.15\ kg/day \times 120\ L/kg]} = 0.07\ mg/L$$

Exercise 3
Red Team Answer

The answer sheet follows the steps outlined in the instruction sheet. The appropriate data or information needed to solve the problem is identified for each step.

1. Select the approach to be used based on the data on the health effects risk.

   - Noncarcinogen

$$AWQC = RfD \cdot RSC \cdot \left(\frac{BW}{DI + \sum_{i=2}^{4} \left(FI_i \cdot BAF_i \right)} \right)$$

Wonderside is a likely human carcinogen. However, the mode of action indicates that tumors will only develop if hemosiderin deposits accumulate in the liver. Since the RfD is protective against hemosiderin deposition, the RfD is used in calculating the AWQC.

2. Select the appropriate health risk value.

   - RfD: 0.01 mg/kg/day

3. Determine the exposure parameters for the population of concern.

   - Body Weight
     - Adult: 70 kg
   - Drinking water intake
     - Adults: 2 L/day
   - Fish intake.
     - 142.2 g/day (given in the problem)

4. Determine the bioaccumulations factor.

   - 300 L/kg (provided in the problem)

5. Calculate the RSC if using the noncancer or nonlinear carcinogen approach.

- Contaminant intake contributed by fish from the ambient water body : 0.2 µg/g x 142.2 g/day = 28.44 µg/day (concentration in fish and grams fish consumed are provided in the problem)
- Contaminant from all other dietary components: 30 µg/day
- Contaminant intake from drinking water: 2 L/day x 7 µg/L = 14 µg/day

$$\text{RSC* (water plus organisms)} = \frac{28.44\ \mu g/day + 14\ ug/day}{28.44\ \mu g/day + 30\ \mu g/day + 14\ \mu g/day} = 0.59$$

$$\text{RSC (organisms only)} = \frac{28.44\ \mu g/day}{28.44\ \mu g/day + 30\ \mu g/day + 14\ \mu g/day} = 0.39$$

6. Solve the Equation; QC the calculation.

Water and organism*

$$\text{AWQC} = 0.01\ mg/kg/day \times 0.59 \times \frac{70\ kg}{2L/day + [0.1422\ kg/day \times 300\ L/kg]} = 0.009\ mg/L$$

Organisms only

$$\text{AWQC} = 0.01\ mg/kg/day \times 0.39 \times \frac{70\ kg}{[0.1422\ kg/day \times 300\ L/kg]} = 0.006\ mg/L$$

* Not part of the class problem

Exercise 4
Green Team Answer

The answer sheet follows the steps outlined in the instruction sheet. The appropriate data or information needed to solve the problem is identified for each step.

1. Select the approach to be used based on the data on the health effects risk.
   - Carcinogen (unknown mode of action) : Linear approach

$$AWQC = RSD \cdot \left(\frac{BW}{DI + \sum_{i=2}^{4} (FI_i \cdot BAF_i)} \right)$$

Organometron is likely human carcinogen with an unidentified mode of action.

2. Select the appropriate health risk value.

- Risk Specific Dose
  - Risk Level: one in a million (10^{-6})
  - Slope Factor: 8 x 10^{-4} $(mg/kg/day)^{-1}$
  - Risk specific Dose: 1.25 x 10^{-3} mg/kg/day

3. Determine the exposure parameters for the population of concern.

- Body Weight
  - Adults: 70 kg
- Drinking water intake
  - Adults: 2 L/day
- Fish intake.
  - 17.5 g/day (default and value for recreational fishers)

4. Determine the bioaccumulations factor.

- 3000 L/kg (given in the problem

5. Calculate the RSC if using the noncancer or nonlinear carcinogen approach.

- Not needed in the equation for a carcinogen with an unidentified mode of action.

6. Solve the Equation; QC the calculation.

Water and Organisms (not part of the class problem)

$$AWQC = 1.25 \times 10^{-3} \text{ mg/kg/day} \times \frac{70 \text{ kg}}{2 \text{ L/day} + [0.0175 \text{ kg/day} \times 3000 \text{ L/kg}]} = 0.0016 \text{ mg/L}$$

Organisms Only

$$AWQC = 1.25 \times 10^{-3} \text{ mg/kg/day} \times \frac{70 \text{ kg}}{[0.0175 \text{ kg/day} \times 3000 \text{ L/kg}]} = 0.0017 \text{ mg/L}$$