Final Exam Reference Sheet

Lesson 5: EPA PAGs – Dose, Exposure, and Effects

Weighting Factors

Organ	Weighting Factor
Gonads	0.25
Breast	0.15
Red bone marrow	0.12
Thyroid	0.03
Bone surface	0.03
Other organs	0.30
Whole body	1.00

Lesson 9: FDA PAGs – Implementation Guidance

Recommended Derived Intervention Levels (DILs)

Radionuclide Group	DILs
Sr-90	160
I-131	170
Cs-134 + 137	1200
Pu-238 + 239 + Am-241	2
Ru-103 + 106	$\frac{C_{103}}{6800} + \frac{C_{106}}{450} < 1$

Lesson 12: International System of Units

Metric Prefixes:

Prefix	Symbol	Factor
tera	T	1×10^{12}
giga	G	1×10^{9}

Prefix	Symbol	Factor
mega	M	1×10^{6}
kilo	k	1×10^{3}
milli	m	1×10^{-3}
micro	μ	1×10^{-6}
nano	n	1×10^{-9}
pico	p	1×10^{-12}

Radiological Units:

Customary Unit	SI Unit	Conversion Factors
curie (Ci)	becquerel (Bq)	• 27 pCi = 1 Bq • 1 Ci = 37 GBq
rad	gray (Gy)	• 100 rad = 1 Gy
rem	sievert (Sv)	• 100 rem = 1 Sv

Other Common Units:

Quantity	Customary Unit(s)	SI Unit	Conversion Factor(s)
Length	• inch (in) • foot (ft) • yard (yd) • mile (mi)	meter (m)	• 1 in = 2.540 cm • 1 ft = 12 in = 30.48 cm • 1 yd = 0.9144 m • 1 mi = 5280 ft = 1.609 km
Velocity	• mile per hour (mph) • knot (kt)	meter per second (m/sec)	• 1 mph = 0.4469 m/sec • 1.467 ft/sec = 1.609 km/h • 1 kt = 1.151 mph • 1 m/sec = 3.281 ft/sec = 2.237 mph = 3.6 km/h
Area	• in^2 • ft^2 • yd^2 • mi^2	square meter (m^2)	• 1 in^2 = 6.452 cm^2 • 1 ft^2 = 144 in^2 = 929.0 cm^2 • 1 yd^2 = 0.836 m^2 • 1 mi^2 = 2.59 km^2
Volume	• gallon (gal) • in^3 • ft^3 • liter (l)	cubic meter (m^3)	• 1 gal = 3.785 l • 1 in^3 = 16.387 cm^3 (cc) • 1 ft^3 = 28.32 l
Flow Rate	• cubic foot per minute (cfm)	liters per minute (lpm)	• 1 cfm = 28.32 lpm
Weight	• ounce (oz) • pound (lb)	gram (g)	• 1 oz = 28.32 g • 1 lb = 0.4536 kg
Density	• lb/in^3 • lb/ft^3	kilogram per cubic meter (kg/m^3)	• 0.03613 lb/in^3 = 1 g/cm^3 • 62.43 lb/ft^3 = 1000 kg/m^3
Pressure	• atm • psi • millimeters of mercury (mm Hg)	pascal (Pa)	• 1 atmosphere (atm) = 14.696 lb/in^2 = 101.33 kiloPascals (kPa) = 760 mm mercury (Hg) = 29.92 in. Hg • 1 pound per square inch (psi) = 6.8947 kPa

Temperature Conversions:

Customary Unit	Conversion
Fahrenheit (F)	$°F = (1.8 \times °C) + 32$
Celsius (C)	$°C = \frac{(°F - 32)}{1.8}$

SI Unit	Conversion
Kelvin (K)	$°K = °C + 273$
**Note: To convert °F to °K, you must first convert °F to °C.*	

Detector Readings

Steps for Calculating Activity
1. gross cpm – background cpm = net cpm
2. $\frac{\text{net cpm}}{\text{detector efficiency}} = \text{dpm}$
3. $\frac{\text{dpm}}{2.22 \times 10^6 \text{ dpm}/\mu\text{Ci}} = \mu\text{Ci}$

Lesson 13: Equations

Stability Classes

Surface Wind Speed (at 10 m), m/sec	Day			Night	
	Incoming Solar Radiation				
	Strong	Moderate	Slight	Thinly Overcast Or ≥4/8 Low Cloud	≤3/8 Cloud
<2	A	A-B	B		
2-3	A-B	B	C	E	F
3-5	B	B-C	C	D	E
5-6	C	C-D	D	D	D
>6	C	D	D	D	D
The neutral class, D, should be assumed for overcast conditions during day or night.					

Reduction Factors

RF	Stability Class					
	A	B	C	D	E	F
1	1.0	1.0	1.0	1.0	1.0	1.0
2	1.3	1.4	1.5	1.6	1.6	1.7
3	1.6	1.7	1.8	2.1	2.2	2.3
4	1.7	2.0	2.2	2.5	2.7	2.9
5	1.9	2.2	2.5	2.9	3.2	3.5
6	2.1	2.5	2.7	3.3	3.6	4.0
7	2.2	2.7	3.0	3.7	4.0	4.5
8	2.3	2.8	3.2	4.0	4.4	5.0
9	2.4	3.0	3.4	4.3	4.8	5.4
10	2.5	3.2	3.6	4.6	5.2	5.9

Determining Airborne Concentration from Air Sample

Determining Airborne Concentration from Air Sample
$$C = \frac{GC - BC}{(ASV)(CE)(DE)(2.22 \times 10^6 \frac{dpm}{\mu Ci})}$$
C = concentration (in µCi/cm^3) GC = gross count (in cpm) BC = background count (in cpm) CE = collector efficiency (expressed as a decimal) DE = detector efficiency (expressed as a decimal) ASV = air sample volume

Determining Air Sample Volume
$$ASV = ASR\ (t)(2.83 \times 10^4\ \frac{cm^3}{ft^3})$$
ASV = air sample volume (cm^3) ASR = air sampler rate *t* = sample time in minutes

Determining Air Sampler Rate
$$ASR = \frac{\text{volume (cubic feet)}}{\text{sample time (minutes)}}$$
ASR = air sampler rate