Weldon Spring Bounding Radon Model

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Approach

- **January 2011 WG meeting: NIOSH presents bounding radon exposure scenario conditions for process workers**
  - **All radon released during processing was re-circulated back into the process areas**
  - **Assume steady state; minimum ventilation**
- **Approach establishes a bounding intake to perform dose reconstruction**

History of ABRWH WG Discussions

- January 2011: NIOSH presented a scenario in which ALL radon released during processing was re-circulated into the facility as bounding
  - The maximum concentration of radon, based on release estimate, to be assigned for intake
- May 2011: discussion and clarification, but no change in proposed direction
- June 2012: WG asked for additional detail to be added to these slides and for presentation of same to full ABRWH

Bounding Conditions

- Some sources describe annual uranium-bearing material throughput as 14,500,000 kg per year, while others describe it as 5,000,000 kg per year
- Radon release estimated based on amount of uranium processed
  - 5 million kg uranium/yr processed = 12 Ci radon
  - 14.5 million kg uranium/yr processed = 34 Ci radon
- Assume 70% of material was uranium
- Estimated radium activity as 1% of uranium activity (a conservative, upper end estimate)

Bounding Conditions—cont.

- Equilibrium between radium and radon
- Radon release estimated between 12 to 34 Curies/year (Meshkov et al. 1986, pp 47-48)
  - NIOSH selected the upper bound value of 34 Ci/yr
- No surrogate data used

Scenario Parameters

- Building 103 volume: 2.6×10^4 m^3
- Ventilation rate: 1 air change per hr
- 34 Ci/yr = 3.9×10^9 pCi/h
- 1 WL = 100 pCi/L of Ra-222 in full equilib. with short lived alpha emitting progeny
- Hours in a WLM = 170
- Equilibrium factor = 0.5
- Number of occupational work hours = 2,000/yr

Calculations

- ***Ceq*** **is the radon-222 equilibrium conc. (pCi/L) in a ventilated room**

$$C_{eq} = \frac{I}{ach * V}$$

- ***I*** **is the influx of radon-222 in pCi/h = 3.9 x 10^9 pCi/h**
- ***V*** **is the volume of the space in L**
- ***ach*** **is the number of air changes per hour**

$$C_{eq} = \frac{3.9 * 10^9 \ \frac{pCi}{h}}{1 \ ach * 2.6 * 10^7 \ell} = 150 \ pCi/\ell$$

Radon Exposure in WLM/y

$$\frac{WLM}{y} = \frac{C_{eq}\ pCi}{\ell} * \frac{\ell\ WL}{100\ pCi} * \frac{M}{170\ h} * \frac{2000\ h}{y} * \frac{EqF}{}$$

so

$$\frac{WLM}{y} = \frac{150\ pCi}{\ell} * \frac{\ell\ WL}{100\ pCi} * \frac{M}{170\ h} * \frac{2000\ h}{y} * \frac{0.5}{} = 8.8$$