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OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE US DEPARTMENT OF ENERGY

Environmental Sciences Division
Center for Radiation Protection Knowledge

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ABSTRACT

Exposure to the radioactive noble gasses, especially radon, is of high concern and poses a significant risk to humans in an indoor air environment, as it is estimated to be the second leading cause of lung cancer in the United States. To evaluate and minimize the risks posed by these gasses, it is important to understand their radiological and physical properties. The EPA's Radon Vapor Intrusion Screening Level (RVISL) calculator calculates indoor air RVISLs based on target working levels (WLs), target excess lifetime cancer risk (ELCR), and annual dose limits for the actinon (Rn-219), thoron (Rn-220), and radon (Rn-222) decay series. The RVISLs are based on inhalation and submersion in gas cloud exposure routes for residential and commercial settings. The RVISLs are analogous to preliminary remediation goals (PRGs) and dose compliance concentrations (DCCs), where the isotope-specific values are in units of activity concentration (activity per unit volume). If the concentration of a parent isotope of radon or its progeny is found to exceed the RVISL, then further action to ensure cleanup of the contaminant may be necessary. In residential and commercial settings, the RVISLs will vary based on the air exchange rate present. The EPA's Radionuclide PRG and DCC Calculators also assess the risk/dose from noble gases in the air due to household use of water like showering. In this study, a computational method in MATLAB was developed to determine the impact of the air exchange rate on the activity equilibrium factor (A_{eq}) and the inhalation fractional equilibrium factor (F_{eq}). Both factors are values that reflect the equilibrium concentrations of progeny to their parent in the air. These factors have a direct impact on the RVISL, PRG, and DCC calculations of WL, ELCR, and annual dose, respectively. This study builds on a previous report that only focused on actinon, thoron, and radon by revisiting the original A_{eq} and F_{eq} calculation methods and including the values for the Rn-207, Rn-209, Rn-210, Rn-211, Rn-215, Rn-216, Rn-217, Rn-218, Rn-223, Ne-24, Ar-42, Ar-43, Ar-44, Kr-74, Kr-75, Kr-76, Kr-77, Kr-88, Kr-89, Xe-120, Xe-121, Xe-122, Xe-123, Xe-135m, and Xe-138 decay chains, which are not currently available in literature. The EPA's RVISL calculator will be updated to include the new A_{eq} and F_{eq} values for the actinon, thoron, and radon decay chains, while the rest of the calculators will incorporate all the new A_{eq} and F_{eq} values as appropriate.

1. INTRODUCTION

Radon, the most frequently studied radioactive gas, is a naturally occurring inert gas primarily produced as part of the decay chain of uranium found in rocks and soil. Outdoor exposure to radon is usually of little concern for public health, since it is only present in trace amounts in the Earth's atmosphere. However, when radon escapes natural media such as groundwater, rocks, and soil, it can easily concentrate in indoor air. Thus, radon vapor intrusion screening levels (RVISLs) were developed to assess the contamination level from the actinon, thoron, and radon decay series in indoor residential and commercial environments. These models can be further expanded to include more isotopes of radon as well as other radioactive noble gasses.

Known radiological properties, such as half-life and emission data for the various decay series, were used to determine the activity equilibrium factors (A_{eq}) and inhalation fractional equilibrium factors (F_{eq}) for vapor intrusion risk and dose models. Decay series data along with corresponding alpha energy emissions for the relevant radionuclides are provided in Appendix B (ICRP, 2008). The concentration ratios between radon and its progeny indoors (i.e., the indoor F_{eq}) is very much influenced by ventilation, exhalation, solid-particle concentration, and surface deposition of radon progeny (Chen & Harley, 2018). Exhalation, solid-particle concentration, and surface deposition were neglected in this study, for simplification. Air quality was also neglected, and it was assumed that the original parent and subsequent progeny were uniformly distributed over the air volume.

The methods for determining A_{eq} and F_{eq} in this study are based upon theoretical calculations rather than experimental. Known experimental methods for calculating the individual activity concentrations of thoron and radon progeny in air, such as the Tsivoglou and Cliff methods (NCRP, 1988), are inapplicable for comparison in this study, since they include the surface deposition of individual progeny by using filtered air samples to obtain activity concentrations.

2. CALCULATION OF NOBLE GAS ACTIVITY EQUILIBRIUM FACTORS

The indoor air concentration is dependent upon the air exchange rate within a given volume. The air exchange rate, otherwise known as air changes per hour (ACH), is defined as the ratio of airflow and the total volume of air given by the following equation:

$$ACH\ (hr^{-1}) = \frac{Volume\ of\ Air\ Exchanged\ per\ Hour\ (L/hr)}{Total\ Volume\ of\ Air\ (L)}. \quad [1]$$

The ACH can be a building-specific measurement to provide a more accurate air contamination exposure assessment. The ACH is the exchange rate of indoor air with outdoor air, an important determinant for entry of outdoor air contaminants and for removal of indoor-emitted air contaminants. There is no EPA guidance on recommended methods for determining ACH. Breen et al. (2014) presents an overview and critical analysis of the scientific literature on empirical and physical air exchange rate models for residential and commercial buildings, which are feasible for exposure assessments. Models are included for the three types of airflows that can occur across building envelopes: leakage, natural ventilation, and mechanical ventilation. The paper provides guidance for selecting the preferable air exchange rate model based on available

data, desired temporal resolution, types of airflows, and types of buildings included in the exposure assessment. The US EPA Indoor Air Quality website (EPA, 2019) also provides information on HVAC use in buildings. More detailed papers on particular air exchange measurement approaches (e.g., by placing tubes that emit and collect perfluorocarbon tracers throughout a building (Thornburg, 2005)) are available. As an example, an air exchange rate of 0.18 would mean that eighteen percent of a given volume of air is exchanged per hour.

The A_{eq} is defined as the concentration ratio of progeny and parent activity at a given air exchange rate by the following equation:

$$(A_{eq})_i = \frac{Activity\ Concentration\ of\ Progeny\ (pCi/L)}{Activity\ Concentration\ of\ Parent\ (pCi/L)}, \quad [2]$$

where *i* represents an arbitrary air exchange rate. The numerator of equation [2] includes the activity concentrations of progeny within a specific decay chain. The denominator of equation [2] includes the activity concentration of the parent and is always equal to one picocurie per liter of air. At zero air exchanges, A_{eq} values for progeny in the same generation add up to one; they decrease as the air exchange rate increases.

A_{eq} is utilized in this study for calculations of risk and dose-based screening levels due to inhalation and submersion in gas cloud exposure routes. The inhalation exposure route is based on internal dose resulting from breathing contaminated air. The submersion in gas cloud exposure route is based on exposure to radiation emitted from contaminants in the air. Initial assessments of risk and dose assume that the decay chain members are in equilibrium with each other without any air exchanges present. Therefore, A_{eq} modifies these assessments by accounting for the disequilibrium between the parent gas and its progeny due to air exchange. A_{eq} factors for both inhalation and submersion are equivalent at any given air exchange rate and involve only the decay of each radionuclide in air. A_{eq} does not account for the radiation type (i.e., alpha, beta) since that is already accounted for in the derivation of slope factors (SFs) and dose conversion factors (DCFs), also known as dose coefficients, within the screening level calculations (Bellamy et al., 2014; Leggett & Bellamy, 2017). Appendix A provides A_{eq} values for actinon, thoron, radon, and many other isotopes of radon and other noble gasses for several air exchange rates. Default values of 0.18 and 0.6 air exchanges per hour were selected for the resident and industrial worker land uses, respectively, from Table 19-25 (resident) and Table 19-30 (commercial) of the "Update for Chapter 19 of the Exposure Factors Handbook" (EPA, 2018) using the tenth percentile values. Figure 1 displays the trends in A_{eq} vs. ACH at 0, 0.18, and 0.6 air changes per hour for the radon decay series.

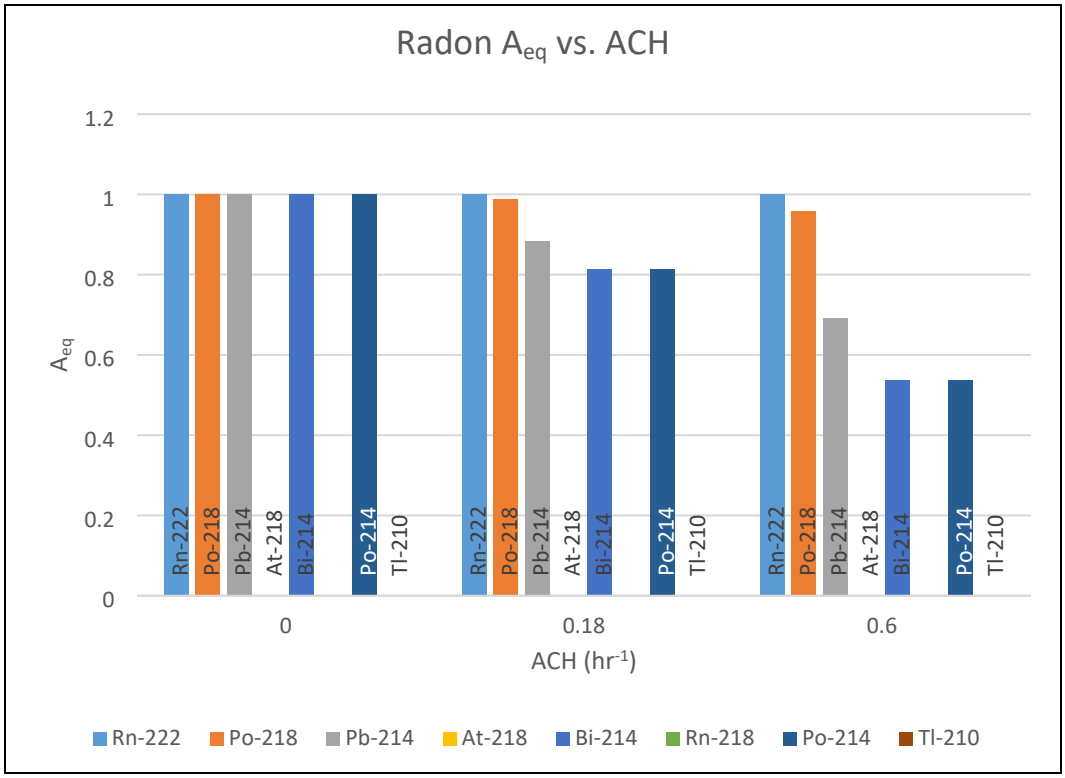

Figure 1. A_{eq} vs. ACH for the radon decay series.
(A_{eq} at 0, 0.18 (default residential land use), and 0.6 (default industrial worker) ACH are shown above with progeny decreasing as the ACH increases.)

A_{eq} values were calculated using MATLAB, as shown in Appendix C, for air exchange rates ranging from zero to nine hundred per hour over a period of two hundred hours at each air exchange rate. An ordinary differential equation (ODE) solver was ultimately utilized to calculate A_{eq} for each radioisotope.

This model does not take deposition into account; as such, the activities calculated will be higher than what they would be in practice. This is especially the case for long lived progeny, such as Pb-210 in the radon decay chain and their subsequent progeny. It has been estimated that the progeny form an aerosol with an average particle size of about 0.2 micrometers (Fogh et al., 1997) and deposit after an average of 100 hours in suspension (Kohanski et al., 2020). To set a cutoff for the long-lived progeny, the deposition time was converted to a half-life to make comparison to radioactive half-lives appropriate. A lifetime of 100 hours corresponds to a deposition half-life of 69.3 hours. This means any radionuclides with half-lives greater than 69.3 hours will deposit faster than they decay and be present at much lower activities than predicted by the model. Including these longer-lived radionuclides would make the model overprotective, especially at lower air exchange rates. In order to curb this, nuclides with half-lives greater than 69.3 hours had their A_{eq} values set to 0 for all air exchange rates and were excluded from F_{eq} calculations.

3. CALCULATION OF NOBLE GAS INHALATION FRACTIONAL EQUILIBRIUM FACTORS

F_{eq} is a unitless measurement of the disequilibrium associated with the decay of the parent and its subsequent progeny. It is useful in calculating the detriment from inhalation of radon progeny. In addition, F_{eq} is useful for calculating the internal dose. Due to a combination of factors, including the decreased residence time of noble gasses in lung tissue compared to that of their progeny, most of the dose received is from the progeny rather than the parent. Therefore, the dose per unit radon gas activity is greatly dependent on the state of equilibrium of the decay products with their parent (CDC, 2018). The equation for F_{eq} is shown below:

$$(F_{eq})_i = \frac{Progeny\ PAEC}{Progeny\ PAEC\ at\ Equilibrium}, \quad [3]$$

where *i* represents an arbitrary air exchange rate (NCRP, 1988). The progeny potential alpha energy concentration (PAEC) in the numerator of equation [3] may be calculated at any air exchange rate. The progeny PAEC in the denominator of equation [3] is at a state of equilibrium, where no air exchanges are taking place. When there is no air exchange, the numerator and denominator of equation [3] are equal, and F_{eq} has a value of one. As the air exchange rate in a given volume increases, F_{eq} decreases and vice-versa. F_{eq} is only defined for decay chains that contain alpha-emitting progeny. Figure 2 on the next page displays the trends in F_{eq} vs. ACH for the actinon, thoron, radon, and Rn-223 decay series.

The potential alpha energy (PAE) of a nuclide is defined as the total amount of energy emitted through alpha particles as the nuclide decays all the way to a stable isotope (or, for this paper, a sufficiently long-lived isotope). If a decay chain has multiple possible paths, the PAE is an average of the energy released by those paths, weighted by the probability of each path. When radioactive particles deposit inside the respiratory system, they will proceed to decay through their full chain; thus, the PAE of a particle represents how much damage it will cause when inhaled. For gasses, it is more helpful to talk about PAEC, the concentration of PAE in a volume. The DOE Standard only defines PAEC and gives the weighting coefficients for the thoron and radon decay chains; this paper extends it to all chains. For a mixture of isotopes (as in the case of a suspended decay chain), the PAEC is simply a sum of the PAECs for each individual isotope. The PAEC for some isotope, k, is given in equation [4] below, where C_k is the activity concentration and $t_{\frac{1}{2}k}$ is the half-life:

$$PAEC_k = \frac{t_{\frac{1}{2}k} PAE_k}{\ln(2)} C_k \cdot \quad [4]$$

By taking the activity concentration of the parent to be 1, the activity concentration of a given progeny at a given ACH is equal to its A_{eq}. Units are irrelevant, as they will be equal in the numerator and denominator of equation [4] and thus cancel.

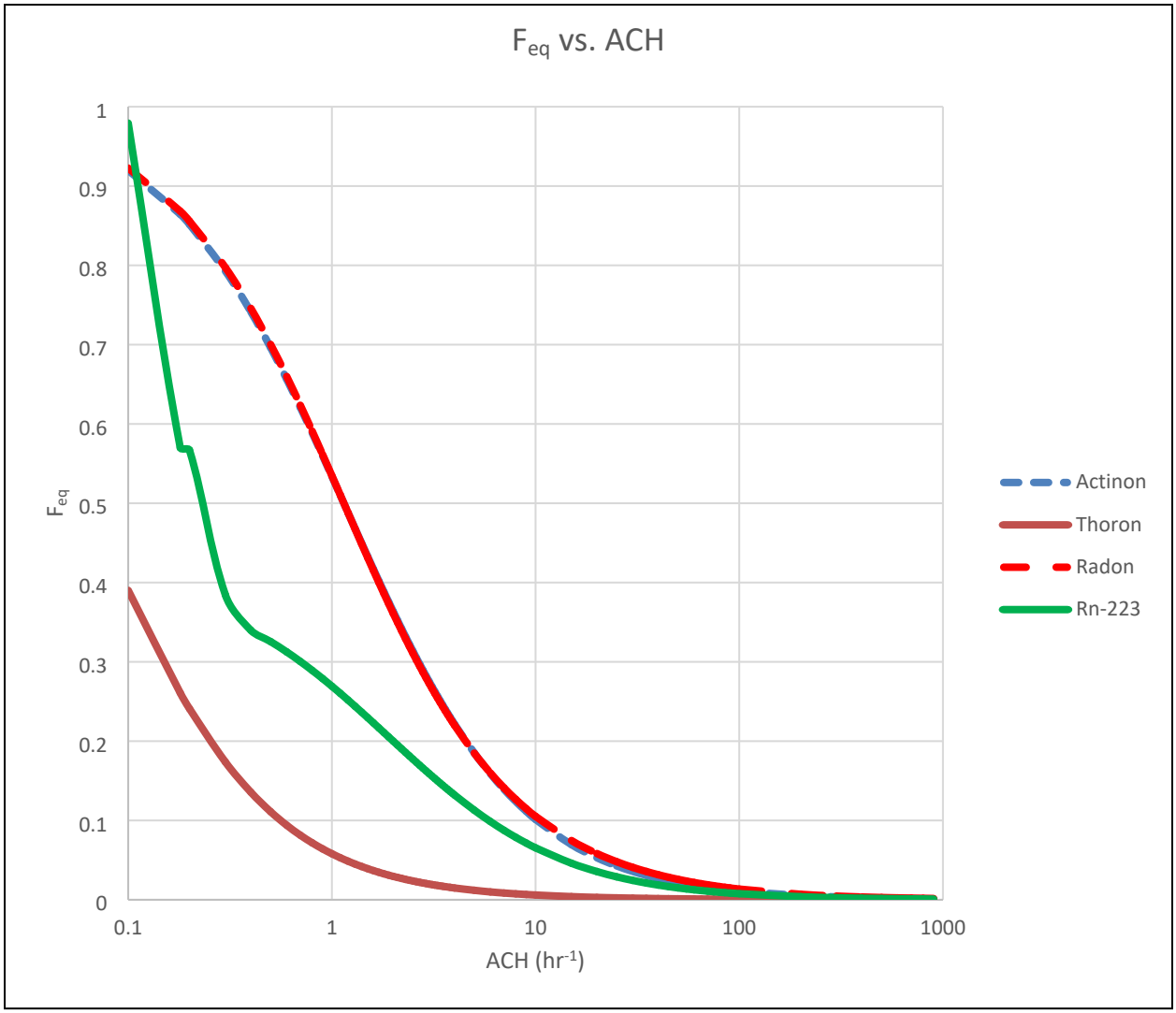

Figure 2. F_{eq} vs. ACH for the actinon, thoron, radon, and Rn-223 decay series. (As the air exchange rate increases, the inhalation fractional equilibrium factor (F_{eq}) decreases. This decrease results in less carcinogenic risk.)

Determining the PAE for each isotope was done as follows: for a nuclide A, which decays into nuclides B (b decay probability, decay alpha energy = 0) and C (c decay probability, decay alpha energy = α), the PAE is given by:

$$PAE_A = b(PAE_B + 0) + c(PAE_C + \alpha)\ . \quad [5]$$

Equation [5] was applied recursively, starting at the bottom of the decay chain (stable and long-lived isotopes) with PAE = 0 and then working upwards.

The alpha energies, obtained from ICRP 107, are shown in Appendix B. All alpha energies were included in the analysis, regardless of fractional contribution. The only exceptions are the progeny eliminated by the 69.3-hour half-life cutoff.

F_{eq} is only used in the conversions of working levels to concentration and is presented in the calculator output (EPA, 2022a) for informational purposes. The conversion equation is shown below:

$$C_{res-ia-inh}\left(\frac{pCi}{L}\right) = \left(\frac{TWL}{\left(F_{eq} \times \frac{1\ WL}{C_{eq}}\right)}\right). \qquad [6]$$

Here, TWL is the target working level and $C_{eq}$is a constant representing what concentration of the parent gas equates to 1 WL at equilibrium, in units of picocuries per liter, per working level. C_{eq} equals 162 $\frac{pCi}{L}$ for actinon, 7.5 $\frac{pCi}{L}$ for thoron, and 100 $\frac{pCi}{L}$for radon.

Historically, F_{eq} was used to describe the disequilibrium of the progeny in air and was significant in evaluating the risk and dose. F_{eq} has been researched for thoron and radon in various dwellings for many years (Chen & Harley, 2018). The analysis in this report presents A_{eq} and F_{eq} (where applicable) for the noble gas decay chains listed in Table 1 below, which are not currently available in literature. Appendix D presents the possible parent radionuclides for each of these gases.

Table 1. Nobel Gas Decay Chains Included in this Study

Noble Gas	Isotopes Covered
Helium	None
Neon	Ne-24
Argon	Ar-42, Ar-43, Ar-44
Krypton	Kr-74, Kr-75, Kr-76, Kr-77, Kr-88, Kr-89
Xenon	Xe-120, Xe-121, Xe-122, Xe-123, Xe-135m, Xe-138
Radon	Rn-207, Rn-209, Rn-210, Rn-211, Rn-215, Rn-216, Rn-217, Rn-218, Rn-219 (Actinon), Rn-220 (Thoron), Rn-222 (Radon), Rn-223

4. USE OF ACTINON, THORON, AND RADON ACTIVITY EQUILIBRIUM FACTORS IN RADON VAPOR INTRUSTION, RISK, AND DOSE MODELS

The A_{eq} values for actinon, thoron, and radon generated from this study are used in WL, ELCR, and annual dose assessment models for intrusion of radioactive gasses into buildings. They can be applied to evaluate WLs, ELCR, and annual dose due to inhalation and external exposure to ionizing radiation in RVISL Calculator equations. Also, for all radioactive noble gases, the A_{eq} values can be used in PRG and DCC Calculator equations to calculate the ELCR and annual dose from tap water during household use. For each radionuclide, the calculators identify all the progeny in the chain. The individual RVISLs, PRGs, and DCCs for each progeny are combined with the parent on a fractional basis, as influenced by the air exchange rate and the resulting A_{eq} (EPA, 2022a; EPA, 2022b; EPA, 2022c). The fractional basis is determined by branching fractions, where a progeny may decay into more than one isotope, and the A_{eq} is determined based on the air exchange rate. The resulting screening levels (SLs) are now based on the air exchange rate

influenced equilibrium of the full chain. It is assumed that the parent is continually being introduced into the structure. The equations found in Sections 4.1 and 4.2 depict the use of A_{eq} in residential air RVISL, PRG, and DCC equations. Age-specific inhalation risk and dose coefficients for Rn-219 have not been published. Therefore, risk and dose due to inhalation are only evaluated for thoron and radon.

4.1 CALCULATION OF SCREENING LEVELS

A_{eq} is used in the inverse sum of reciprocals, as shown below in equations [8], [9], [10] and [11], to account for the air exchange. The RVISLs for inhalation and submersion may be based on either a target risk or an annual dose limit for a receptor. The RVISLs, $C_{res\text{-}ia\text{-}inh}$, and $C_{res\text{-}ia\text{-}sub}$, assume that no air exchange rate is present. The PRG and DCC equations for inhalation and submersion may be used on either target risk or annual dose limit for a receptor. The slope factors and dose coefficients used in the RVISL, PRG, and DCC equations for inhalation and submersion neglect the risk and dose contribution from progeny before intake. After intake of the parent radionuclide, however, the risk and dose from progeny produced in the body is included (Leggett & Bellamy, 2017). The total risk and dose-based RVISL for inhalation and submersion, $C_{res\text{-}ia\text{-}tot}$, is calculated using equation [7] with an inverse sum of reciprocals that utilizes the outputs from equations [8] and [9], where the summation iterates through all the radionuclides present.

Resident Air RVISL Calculator Equations

$$C_{res-ia-tot}\left({}^{pCi}/_{m^3}\right) = \frac{1}{\frac{1}{C_{inh}(pCi/m^3)} + \frac{1}{C_{sub}(pCi/m^3)}} \quad [7]$$

$$C_{inh}\left({}^{pCi}/_{m^3}\right) = \frac{1}{\left(\sum_{i=1}^{n} \frac{1}{\left(\frac{C_{res-ia-inh}(pCi/m^3)}{Aeq}\right)_i}\right)} \quad [8]$$

$$C_{sub}\left({}^{pCi}/_{m^3}\right) = \frac{1}{\left(\sum_{i=1}^{n} \frac{1}{\left(\frac{C_{res-ia-sub}(pCi/m^3)}{Aeq}\right)_i}\right)} \quad [9]$$

Resident Air PRG and DCC Calculator Equations

$$PRG_{wat-inh-tot}\left(\frac{pCi}{L}\right) = \frac{1}{\sum_{i=1}^{n} \frac{1}{\left(\frac{PRG_{wat-inh}\left(\frac{pCi}{L}\right)}{A_{eq}}\right)_i}} \quad [10]$$

$$DCC_{wat-inh-tot}\left(\frac{pCi}{L}\right) = \frac{1}{\sum_{i=1}^{n} \frac{1}{\left(\frac{DCC_{wat-inh}\left(\frac{pCi}{L}\right)}{A_{eq}}\right)_i}} \quad [11]$$

4.2 CALCULATION OF EXCESS LIFETIME CANCER RISK AND ANNUAL DOSE

The inhalation and submersion ELCR and annual dose equations apply A_{eq} to the chronic daily intakes (CDI), as shown below in equations [12] and [13], to account for air exchange and radionuclide decay. The CDIs for inhalation and submersion vary based on duration of exposure. The slope factors and dose coefficients used in the RVISL equations for inhalation and submersion neglect the risk and dose contribution from progeny before intake. After intake of the parent radionuclide, however, the risk and dose from progeny produced in the body is included (Leggett & Bellamy, 2017). The total ELCR and dose, $ELCR_{tot}$ and $Dose_{tot}$, are calculated using the sum of inhalation and submersion ELCR or dose.

Excess Lifetime Cancer Risk

$$ELCR_{tot} = ELCR_{inh} + ELCR_{sub} \ , \qquad [12]$$

where:

$$ELCR_{inh} = \sum_{i=1}^{n} \left(CDI(pCi) \times SF_i\left({}^{risk}/_{pCi}\right) \times A_{eq}\right)_i$$

and:

$$ELCR_{sub} = \sum_{i=1}^{n} \left(CDI\left(pCi - year/m^3\right) \times SF_{sub}\left(\frac{risk/year}{pCi/m^3}\right) \times A_{eq}\right)_i,$$

where i = the number of progeny in the decay series.

Annual Dose

$$Dose_{tot}\left(\frac{mrem}{year}\right) = Dose_{inh}\left(\frac{mrem}{year}\right) + Dose_{sub}\left(\frac{mrem}{year}\right), \quad [13]$$

where:

$$Dose_{inh}\left(\frac{mrem}{year}\right) = \sum_{i=1}^{n}\left(CDI\left(\frac{pCi}{year}\right) \times DCF_i\left(\frac{mrem}{pCi}\right) \times A_{eq}\right)_i$$

and:

$$Dose_{sub}\left(\frac{mrem}{year}\right) = \sum_{i=1}^{n}\left(CDI\left(\frac{pCi}{m^3}\right) \times DCF_{sub}\left(\frac{mrem/year}{pCi/m^3}\right) \times A_{eq}\right)_i,$$

where i = the number of progeny in the decay series.

5. CONCLUSION

RVISLs for the actinon, thoron, and radon decay series were modified using the revised ACH-adjusted A_{eq} and F_{eq} values in this study to provide accurate WL, ELCR, and annual dose calculations. Additionally, by using the revised ACH-adjusted A_{eq} and F_{eq} values presented in this study, PRGs and DCCs for household use of tap water for all radioactive noble gases will now provide accurate ELCR and dose calculations. In an indoor air setting, the screening levels depend on the values of the air exchange rate and the resulting A_{eq}. A computational method in MATLAB was developed to determine the impact of the air exchange rate on A_{eq} and F_{eq} for indoor air residential and commercial settings. As the air exchange rate increases, A_{eq}, inhalation F_{eq}, and risk to receptors decrease. The A_{eq} is applicable in vapor intrusion, risk, and dose models for inhalation and submersion, while the F_{eq} is only applicable for evaluating the dose from inhalation and converting WLs to activity in the air.

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APPENDIX A. TABLES OF ACTIVITY EQUILIBRIUM FACTORS (A_{eq}) AND INHALATION FRACTIONAL EQUILIBRIUM FACTORS (F_{eq}) BASED ON AIR EXCHANGE RATE

The tables in this appendix present the A_{eq} and F_{eq} based on the air exchange rate. F_{eq} is only defined for decay chains that contain short lived progeny that decay via Alpha emission. In the tables below, the FEQ column was omitted for chains that do not meet this criterion. 0.18 and 0.6 are considered the residential and commercial/industrial default air exchange rates, respectively. They have been bolded in the following tables for convenience.

Table A-1: Rn-207 A_{eq} and F_{eq} Based on Air Changes Per Hour

ACH	Rn-207	At-207	Po-207	Po-203	Bi-203	Pb-203	Pb-199	Tl-199	FEQ
0	1.000E+00	7.900E-01	7.221E-01	2.100E-01	2.777E-01	2.527E-01	2.000E-04	2.000E-04	1.000E+00
0.1	1.000E+00	6.271E-01	3.121E-01	1.930E-01	9.150E-02	1.080E-02	2.000E-04	1.000E-04	7.938E-01
0.18	**1.000E+00**	**5.384E-01**	**1.963E-01**	**1.812E-01**	**5.610E-02**	**3.900E-03**	**1.000E-04**	**0.000E+00**	**6.815E-01**
0.2	1.000E+00	5.200E-01	1.778E-01	1.785E-01	5.080E-02	3.200E-03	1.000E-04	0.000E+00	6.582E-01
0.3	1.000E+00	4.441E-01	1.156E-01	1.660E-01	3.350E-02	1.400E-03	1.000E-04	0.000E+00	5.621E-01
0.4	1.000E+00	3.875E-01	8.150E-02	1.552E-01	2.420E-02	8.000E-04	1.000E-04	0.000E+00	4.905E-01
0.5	1.000E+00	3.437E-01	6.060E-02	1.457E-01	1.850E-02	5.000E-04	1.000E-04	0.000E+00	4.351E-01
0.6	**1.000E+00**	**3.088E-01**	**4.690E-02**	**1.373E-01**	**1.460E-02**	**3.000E-04**	**1.000E-04**	**0.000E+00**	**3.909E-01**
0.7	1.000E+00	2.804E-01	3.740E-02	1.298E-01	1.190E-02	2.000E-04	1.000E-04	0.000E+00	3.549E-01
0.8	1.000E+00	2.567E-01	3.050E-02	1.231E-01	1.000E-02	2.000E-04	0.000E+00	0.000E+00	3.249E-01
0.9	1.000E+00	2.367E-01	2.540E-02	1.170E-01	8.400E-03	1.000E-04	0.000E+00	0.000E+00	2.996E-01
1	1.000E+00	2.196E-01	2.140E-02	1.116E-01	7.300E-03	1.000E-04	0.000E+00	0.000E+00	2.780E-01
1.1	1.000E+00	2.048E-01	1.830E-02	1.066E-01	6.300E-03	1.000E-04	0.000E+00	0.000E+00	2.592E-01
1.2	1.000E+00	1.919E-01	1.590E-02	1.020E-01	5.500E-03	1.000E-04	0.000E+00	0.000E+00	2.429E-01
1.3	1.000E+00	1.805E-01	1.390E-02	9.780E-02	4.900E-03	0.000E+00	0.000E+00	0.000E+00	2.285E-01
1.4	1.000E+00	1.704E-01	1.230E-02	9.390E-02	4.400E-03	0.000E+00	0.000E+00	0.000E+00	2.157E-01
1.5	1.000E+00	1.614E-01	1.090E-02	9.040E-02	3.900E-03	0.000E+00	0.000E+00	0.000E+00	2.043E-01
1.6	1.000E+00	1.533E-01	9.700E-03	8.710E-02	3.600E-03	0.000E+00	0.000E+00	0.000E+00	1.941E-01
1.7	1.000E+00	1.459E-01	8.800E-03	8.400E-02	3.200E-03	0.000E+00	0.000E+00	0.000E+00	1.847E-01
1.8	1.000E+00	1.392E-01	7.900E-03	8.110E-02	2.900E-03	0.000E+00	0.000E+00	0.000E+00	1.762E-01
1.9	1.000E+00	1.331E-01	7.200E-03	7.850E-02	2.700E-03	0.000E+00	0.000E+00	0.000E+00	1.685E-01
2	1.000E+00	1.275E-01	6.600E-03	7.600E-02	2.500E-03	0.000E+00	0.000E+00	0.000E+00	1.614E-01
2.1	1.000E+00	1.224E-01	6.000E-03	7.360E-02	2.300E-03	0.000E+00	0.000E+00	0.000E+00	1.549E-01
2.2	1.000E+00	1.177E-01	5.500E-03	7.140E-02	2.100E-03	0.000E+00	0.000E+00	0.000E+00	1.490E-01
2.3	1.000E+00	1.133E-01	5.100E-03	6.930E-02	2.000E-03	0.000E+00	0.000E+00	0.000E+00	1.434E-01
2.4	1.000E+00	1.092E-01	4.700E-03	6.740E-02	1.800E-03	0.000E+00	0.000E+00	0.000E+00	1.382E-01
2.5	1.000E+00	1.054E-01	4.400E-03	6.550E-02	1.700E-03	0.000E+00	0.000E+00	0.000E+00	1.334E-01
2.6	1.000E+00	1.019E-01	4.100E-03	6.370E-02	1.600E-03	0.000E+00	0.000E+00	0.000E+00	1.290E-01
2.7	1.000E+00	9.860E-02	3.800E-03	6.210E-02	1.500E-03	0.000E+00	0.000E+00	0.000E+00	1.248E-01
2.8	1.000E+00	9.550E-02	3.600E-03	6.050E-02	1.400E-03	0.000E+00	0.000E+00	0.000E+00	1.209E-01
2.9	1.000E+00	9.260E-02	3.300E-03	5.900E-02	1.300E-03	0.000E+00	0.000E+00	0.000E+00	1.172E-01
3	1.000E+00	8.990E-02	3.100E-03	5.760E-02	1.300E-03	0.000E+00	0.000E+00	0.000E+00	1.138E-01
3.1	1.000E+00	8.730E-02	3.000E-03	5.620E-02	1.200E-03	0.000E+00	0.000E+00	0.000E+00	1.105E-01

ACH	Rn-207	At-207	Po-207	Po-203	Bi-203	Pb-203	Pb-199	Tl-199	FEQ
3.2	1.000E+00	8.490E-02	2.800E-03	5.490E-02	1.100E-03	0.000E+00	0.000E+00	0.000E+00	1.075E-01
3.3	1.000E+00	8.260E-02	2.600E-03	5.370E-02	1.100E-03	0.000E+00	0.000E+00	0.000E+00	1.046E-01
3.4	1.000E+00	8.040E-02	2.500E-03	5.250E-02	1.000E-03	0.000E+00	0.000E+00	0.000E+00	1.018E-01
3.5	1.000E+00	7.830E-02	2.400E-03	5.140E-02	1.000E-03	0.000E+00	0.000E+00	0.000E+00	9.911E-02
3.6	1.000E+00	7.630E-02	2.200E-03	5.030E-02	9.000E-04	0.000E+00	0.000E+00	0.000E+00	9.658E-02
3.7	1.000E+00	7.450E-02	2.100E-03	4.920E-02	9.000E-04	0.000E+00	0.000E+00	0.000E+00	9.430E-02
3.8	1.000E+00	7.270E-02	2.000E-03	4.820E-02	8.000E-04	0.000E+00	0.000E+00	0.000E+00	9.203E-02
3.9	1.000E+00	7.100E-02	1.900E-03	4.730E-02	8.000E-04	0.000E+00	0.000E+00	0.000E+00	8.987E-02
4	1.000E+00	6.940E-02	1.800E-03	4.640E-02	8.000E-04	0.000E+00	0.000E+00	0.000E+00	8.785E-02
5	1.000E+00	5.650E-02	1.200E-03	3.880E-02	5.000E-04	0.000E+00	0.000E+00	0.000E+00	7.152E-02
6	1.000E+00	4.760E-02	9.000E-04	3.340E-02	4.000E-04	0.000E+00	0.000E+00	0.000E+00	6.025E-02
7	1.000E+00	4.120E-02	6.000E-04	2.930E-02	3.000E-04	0.000E+00	0.000E+00	0.000E+00	5.215E-02
8	1.000E+00	3.630E-02	5.000E-04	2.610E-02	2.000E-04	0.000E+00	0.000E+00	0.000E+00	4.595E-02
9	1.000E+00	3.240E-02	4.000E-04	2.350E-02	2.000E-04	0.000E+00	0.000E+00	0.000E+00	4.101E-02
10	1.000E+00	2.930E-02	3.000E-04	2.140E-02	1.000E-04	0.000E+00	0.000E+00	0.000E+00	3.709E-02
15	1.000E+00	1.980E-02	1.000E-04	1.480E-02	1.000E-04	0.000E+00	0.000E+00	0.000E+00	2.506E-02
20	1.000E+00	1.490E-02	1.000E-04	1.130E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.886E-02
25	1.000E+00	1.200E-02	1.000E-04	9.100E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.519E-02
30	1.000E+00	1.000E-02	0.000E+00	7.600E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.266E-02
35	1.000E+00	8.600E-03	0.000E+00	6.600E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.089E-02
40	1.000E+00	7.500E-03	0.000E+00	5.800E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.494E-03
45	1.000E+00	6.700E-03	0.000E+00	5.200E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.481E-03
50	1.000E+00	6.000E-03	0.000E+00	4.700E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.595E-03
55	1.000E+00	5.500E-03	0.000E+00	4.200E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.962E-03
60	1.000E+00	5.000E-03	0.000E+00	3.900E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.329E-03
65	1.000E+00	4.700E-03	0.000E+00	3.600E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.949E-03
70	1.000E+00	4.300E-03	0.000E+00	3.300E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.443E-03
75	1.000E+00	4.000E-03	0.000E+00	3.100E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.063E-03
80	1.000E+00	3.800E-03	0.000E+00	2.900E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.810E-03
85	1.000E+00	3.600E-03	0.000E+00	2.800E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.557E-03
90	1.000E+00	3.400E-03	0.000E+00	2.600E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.304E-03
95	1.000E+00	3.200E-03	0.000E+00	2.500E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.051E-03
100	1.000E+00	3.000E-03	0.000E+00	2.400E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.798E-03
200	1.000E+00	1.500E-03	0.000E+00	1.200E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.899E-03
300	1.000E+00	1.000E-03	0.000E+00	8.000E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.266E-03
400	1.000E+00	8.000E-04	0.000E+00	6.000E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.013E-03
500	1.000E+00	6.000E-04	0.000E+00	5.000E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.595E-04
600	1.000E+00	5.000E-04	0.000E+00	4.000E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.329E-04
700	1.000E+00	4.000E-04	0.000E+00	3.000E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.063E-04
800	1.000E+00	4.000E-04	0.000E+00	3.000E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.063E-04

ACH	Rn-207	At-207	Po-207	Po-203	Bi-203	Pb-203	Pb-199	Tl-199	FEQ
900	1.000E+00	3.000E-04	0.000E+00	3.000E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.798E-04

Table A-2: Rn-209 A_{eq} and F_{eq} Based on Air Changes Per Hour

ACH	Rn-209	At-209	Po-205	Pb-201	FEQ
0	1.000E+00	8.300E-01	1.700E-01	1.000E-04	1.000E+00
0.1	1.000E+00	4.662E-01	1.372E-01	0.000E+00	5.617E-01
0.18	**1.000E+00**	**3.451E-01**	**1.188E-01**	**0.000E+00**	**4.158E-01**
0.2	1.000E+00	3.241E-01	1.149E-01	0.000E+00	3.905E-01
0.3	1.000E+00	2.484E-01	9.890E-02	0.000E+00	2.993E-01
0.4	1.000E+00	2.014E-01	8.680E-02	0.000E+00	2.427E-01
0.5	1.000E+00	1.693E-01	7.740E-02	0.000E+00	2.040E-01
0.6	**1.000E+00**	**1.460E-01**	**6.980E-02**	**0.000E+00**	**1.759E-01**
0.7	1.000E+00	1.284E-01	6.350E-02	0.000E+00	1.547E-01
0.8	1.000E+00	1.146E-01	5.830E-02	0.000E+00	1.381E-01
0.9	1.000E+00	1.034E-01	5.390E-02	0.000E+00	1.246E-01
1	1.000E+00	9.430E-02	5.010E-02	0.000E+00	1.136E-01
1.1	1.000E+00	8.660E-02	4.680E-02	0.000E+00	1.043E-01
1.2	1.000E+00	8.010E-02	4.390E-02	0.000E+00	9.651E-02
1.3	1.000E+00	7.450E-02	4.130E-02	0.000E+00	8.976E-02
1.4	1.000E+00	6.960E-02	3.910E-02	0.000E+00	8.386E-02
1.5	1.000E+00	6.530E-02	3.700E-02	0.000E+00	7.868E-02
1.6	1.000E+00	6.150E-02	3.520E-02	0.000E+00	7.410E-02
1.7	1.000E+00	5.820E-02	3.350E-02	0.000E+00	7.012E-02
1.8	1.000E+00	5.520E-02	3.200E-02	0.000E+00	6.651E-02
1.9	1.000E+00	5.240E-02	3.060E-02	0.000E+00	6.313E-02
2	1.000E+00	5.000E-02	2.940E-02	0.000E+00	6.024E-02
2.1	1.000E+00	4.770E-02	2.820E-02	0.000E+00	5.747E-02
2.2	1.000E+00	4.570E-02	2.710E-02	0.000E+00	5.506E-02
2.3	1.000E+00	4.380E-02	2.610E-02	0.000E+00	5.277E-02
2.4	1.000E+00	4.210E-02	2.520E-02	0.000E+00	5.072E-02
2.5	1.000E+00	4.050E-02	2.430E-02	0.000E+00	4.880E-02
2.6	1.000E+00	3.900E-02	2.350E-02	0.000E+00	4.699E-02
2.7	1.000E+00	3.760E-02	2.280E-02	0.000E+00	4.530E-02
2.8	1.000E+00	3.630E-02	2.210E-02	0.000E+00	4.374E-02
2.9	1.000E+00	3.510E-02	2.140E-02	0.000E+00	4.229E-02
3	1.000E+00	3.400E-02	2.080E-02	0.000E+00	4.096E-02
3.1	1.000E+00	3.290E-02	2.020E-02	0.000E+00	3.964E-02
3.2	1.000E+00	3.200E-02	1.960E-02	0.000E+00	3.855E-02
3.3	1.000E+00	3.100E-02	1.910E-02	0.000E+00	3.735E-02
3.4	1.000E+00	3.010E-02	1.860E-02	0.000E+00	3.627E-02

ACH	Rn-209	At-209	Po-205	Pb-201	FEQ
3.5	1.000E+00	2.930E-02	1.810E-02	0.000E+00	3.530E-02
3.6	1.000E+00	2.850E-02	1.770E-02	0.000E+00	3.434E-02
3.7	1.000E+00	2.780E-02	1.720E-02	0.000E+00	3.349E-02
3.8	1.000E+00	2.710E-02	1.680E-02	0.000E+00	3.265E-02
3.9	1.000E+00	2.640E-02	1.640E-02	0.000E+00	3.181E-02
4	1.000E+00	2.580E-02	1.610E-02	0.000E+00	3.108E-02
5	1.000E+00	2.070E-02	1.310E-02	0.000E+00	2.494E-02
6	1.000E+00	1.740E-02	1.110E-02	0.000E+00	2.096E-02
7	1.000E+00	1.490E-02	9.600E-03	0.000E+00	1.795E-02
8	1.000E+00	1.310E-02	8.400E-03	0.000E+00	1.578E-02
9	1.000E+00	1.160E-02	7.500E-03	0.000E+00	1.398E-02
10	1.000E+00	1.050E-02	6.800E-03	0.000E+00	1.265E-02
15	1.000E+00	7.000E-03	4.600E-03	0.000E+00	8.434E-03
20	1.000E+00	5.300E-03	3.500E-03	0.000E+00	6.386E-03
25	1.000E+00	4.200E-03	2.800E-03	0.000E+00	5.060E-03
30	1.000E+00	3.500E-03	2.300E-03	0.000E+00	4.217E-03
35	1.000E+00	3.000E-03	2.000E-03	0.000E+00	3.615E-03
40	1.000E+00	2.700E-03	1.800E-03	0.000E+00	3.253E-03
45	1.000E+00	2.400E-03	1.600E-03	0.000E+00	2.892E-03
50	1.000E+00	2.100E-03	1.400E-03	0.000E+00	2.530E-03
55	1.000E+00	1.900E-03	1.300E-03	0.000E+00	2.289E-03
60	1.000E+00	1.800E-03	1.200E-03	0.000E+00	2.169E-03
65	1.000E+00	1.600E-03	1.100E-03	0.000E+00	1.928E-03
70	1.000E+00	1.500E-03	1.000E-03	0.000E+00	1.807E-03
75	1.000E+00	1.400E-03	9.000E-04	0.000E+00	1.687E-03
80	1.000E+00	1.300E-03	9.000E-04	0.000E+00	1.566E-03
85	1.000E+00	1.200E-03	8.000E-04	0.000E+00	1.446E-03
90	1.000E+00	1.200E-03	8.000E-04	0.000E+00	1.446E-03
95	1.000E+00	1.100E-03	7.000E-04	0.000E+00	1.325E-03
100	1.000E+00	1.100E-03	7.000E-04	0.000E+00	1.325E-03
200	1.000E+00	5.000E-04	4.000E-04	0.000E+00	6.024E-04
300	1.000E+00	4.000E-04	2.000E-04	0.000E+00	4.819E-04
400	1.000E+00	3.000E-04	2.000E-04	0.000E+00	3.615E-04
500	1.000E+00	2.000E-04	1.000E-04	0.000E+00	2.410E-04
600	1.000E+00	2.000E-04	1.000E-04	0.000E+00	2.410E-04
700	1.000E+00	2.000E-04	1.000E-04	0.000E+00	2.410E-04
800	1.000E+00	1.000E-04	1.000E-04	0.000E+00	1.205E-04
900	1.000E+00	1.000E-04	1.000E-04	0.000E+00	1.205E-04

Table A-3: Rn-210 A_{eq} and F_{eq} Based on Air Changes Per Hour

ACH	Rn-210	At-210	FEQ
0	1.000E+00	4.000E-02	1.000E+00
0.1	1.000E+00	1.840E-02	4.600E-01
0.18	**1.000E+00**	**1.290E-02**	**3.225E-01**
0.2	1.000E+00	1.200E-02	3.000E-01
0.3	1.000E+00	8.900E-03	2.225E-01
0.4	1.000E+00	7.000E-03	1.750E-01
0.5	1.000E+00	5.800E-03	1.450E-01
0.6	**1.000E+00**	**5.000E-03**	**1.250E-01**
0.7	1.000E+00	4.400E-03	1.100E-01
0.8	1.000E+00	3.900E-03	9.750E-02
0.9	1.000E+00	3.500E-03	8.750E-02
1	1.000E+00	3.200E-03	8.000E-02
1.1	1.000E+00	2.900E-03	7.250E-02
1.2	1.000E+00	2.700E-03	6.750E-02
1.3	1.000E+00	2.500E-03	6.250E-02
1.4	1.000E+00	2.300E-03	5.750E-02
1.5	1.000E+00	2.200E-03	5.500E-02
1.6	1.000E+00	2.000E-03	5.000E-02
1.7	1.000E+00	1.900E-03	4.750E-02
1.8	1.000E+00	1.800E-03	4.500E-02
1.9	1.000E+00	1.700E-03	4.250E-02
2	1.000E+00	1.600E-03	4.000E-02
2.1	1.000E+00	1.600E-03	4.000E-02
2.2	1.000E+00	1.500E-03	3.750E-02
2.3	1.000E+00	1.400E-03	3.500E-02
2.4	1.000E+00	1.400E-03	3.500E-02
2.5	1.000E+00	1.300E-03	3.250E-02
2.6	1.000E+00	1.300E-03	3.250E-02
2.7	1.000E+00	1.200E-03	3.000E-02
2.8	1.000E+00	1.200E-03	3.000E-02
2.9	1.000E+00	1.100E-03	2.750E-02
3	1.000E+00	1.100E-03	2.750E-02
3.1	1.000E+00	1.100E-03	2.750E-02
3.2	1.000E+00	1.000E-03	2.500E-02
3.3	1.000E+00	1.000E-03	2.500E-02
3.4	1.000E+00	1.000E-03	2.500E-02
3.5	1.000E+00	1.000E-03	2.500E-02
3.6	1.000E+00	9.000E-04	2.250E-02
3.7	1.000E+00	9.000E-04	2.250E-02
3.8	1.000E+00	9.000E-04	2.250E-02
3.9	1.000E+00	9.000E-04	2.250E-02
4	1.000E+00	8.000E-04	2.000E-02
5	1.000E+00	7.000E-04	1.750E-02
6	1.000E+00	6.000E-04	1.500E-02
7	1.000E+00	5.000E-04	1.250E-02
8	1.000E+00	4.000E-04	1.000E-02
9	1.000E+00	4.000E-04	1.000E-02
10	1.000E+00	3.000E-04	7.500E-03
15	1.000E+00	2.000E-04	5.000E-03
20	1.000E+00	2.000E-04	5.000E-03
25	1.000E+00	1.000E-04	2.500E-03
30	1.000E+00	1.000E-04	2.500E-03
35	1.000E+00	1.000E-04	2.500E-03
40	1.000E+00	1.000E-04	2.500E-03
45	1.000E+00	1.000E-04	2.500E-03
50	1.000E+00	1.000E-04	2.500E-03
55	1.000E+00	1.000E-04	2.500E-03
60	1.000E+00	1.000E-04	2.500E-03
65	1.000E+00	1.000E-04	2.500E-03
70	1.000E+00	0.000E+00	0.000E+00
75	1.000E+00	0.000E+00	0.000E+00
80	1.000E+00	0.000E+00	0.000E+00
85	1.000E+00	0.000E+00	0.000E+00
90	1.000E+00	0.000E+00	0.000E+00
95	1.000E+00	0.000E+00	0.000E+00
100	1.000E+00	0.000E+00	0.000E+00
200	1.000E+00	0.000E+00	0.000E+00
300	1.000E+00	0.000E+00	0.000E+00
400	1.000E+00	0.000E+00	0.000E+00
500	1.000E+00	0.000E+00	0.000E+00
600	1.000E+00	0.000E+00	0.000E+00
700	1.000E+00	0.000E+00	0.000E+00
800	1.000E+00	0.000E+00	0.000E+00
900	1.000E+00	0.000E+00	0.000E+00

Table A-4: Rn-211 A_{eq} and F_{eq} Based on Air Changes Per Hour

ACH	Rn-211	At-211	Po-211	Po-207	Pb-203	FEQ
0	1.000E+00	7.260E-01	4.225E-01	2.740E-01	1.000E-04	1.000E+00
0.1	1.000E+00	3.557E-01	2.070E-01	1.492E-01	0.000E+00	4.899E-01
0.18	**1.000E+00**	**2.527E-01**	**1.470E-01**	**1.093E-01**	**0.000E+00**	**3.481E-01**
0.2	1.000E+00	2.356E-01	1.371E-01	1.025E-01	0.000E+00	3.245E-01
0.3	1.000E+00	1.761E-01	1.025E-01	7.810E-02	0.000E+00	2.426E-01
0.4	1.000E+00	1.406E-01	8.180E-02	6.300E-02	0.000E+00	1.937E-01
0.5	1.000E+00	1.170E-01	6.810E-02	5.290E-02	0.000E+00	1.612E-01
0.6	**1.000E+00**	**1.002E-01**	**5.830E-02**	**4.550E-02**	**0.000E+00**	**1.380E-01**
0.7	1.000E+00	8.760E-02	5.100E-02	4.000E-02	0.000E+00	1.207E-01
0.8	1.000E+00	7.780E-02	4.530E-02	3.560E-02	0.000E+00	1.072E-01
0.9	1.000E+00	7.000E-02	4.080E-02	3.210E-02	0.000E+00	9.642E-02
1	1.000E+00	6.360E-02	3.700E-02	2.920E-02	0.000E+00	8.760E-02
1.1	1.000E+00	5.830E-02	3.390E-02	2.690E-02	0.000E+00	8.030E-02
1.2	1.000E+00	5.380E-02	3.130E-02	2.480E-02	0.000E+00	7.410E-02
1.3	1.000E+00	5.000E-02	2.910E-02	2.310E-02	0.000E+00	6.887E-02
1.4	1.000E+00	4.660E-02	2.710E-02	2.150E-02	0.000E+00	6.419E-02
1.5	1.000E+00	4.370E-02	2.540E-02	2.020E-02	0.000E+00	6.019E-02
1.6	1.000E+00	4.110E-02	2.390E-02	1.900E-02	0.000E+00	5.661E-02
1.7	1.000E+00	3.880E-02	2.260E-02	1.800E-02	0.000E+00	5.344E-02
1.8	1.000E+00	3.680E-02	2.140E-02	1.710E-02	0.000E+00	5.069E-02
1.9	1.000E+00	3.490E-02	2.030E-02	1.620E-02	0.000E+00	4.807E-02
2	1.000E+00	3.330E-02	1.940E-02	1.540E-02	0.000E+00	4.587E-02
2.1	1.000E+00	3.180E-02	1.850E-02	1.480E-02	0.000E+00	4.380E-02
2.2	1.000E+00	3.040E-02	1.770E-02	1.410E-02	0.000E+00	4.187E-02
2.3	1.000E+00	2.910E-02	1.690E-02	1.350E-02	0.000E+00	4.008E-02
2.4	1.000E+00	2.790E-02	1.630E-02	1.300E-02	0.000E+00	3.843E-02
2.5	1.000E+00	2.690E-02	1.560E-02	1.250E-02	0.000E+00	3.705E-02
2.6	1.000E+00	2.590E-02	1.510E-02	1.200E-02	0.000E+00	3.567E-02
2.7	1.000E+00	2.490E-02	1.450E-02	1.160E-02	0.000E+00	3.430E-02
2.8	1.000E+00	2.410E-02	1.400E-02	1.120E-02	0.000E+00	3.320E-02
2.9	1.000E+00	2.330E-02	1.350E-02	1.080E-02	0.000E+00	3.209E-02
3	1.000E+00	2.250E-02	1.310E-02	1.050E-02	0.000E+00	3.099E-02
3.1	1.000E+00	2.180E-02	1.270E-02	1.020E-02	0.000E+00	3.003E-02
3.2	1.000E+00	2.120E-02	1.230E-02	9.900E-03	0.000E+00	2.920E-02
3.3	1.000E+00	2.050E-02	1.190E-02	9.600E-03	0.000E+00	2.824E-02
3.4	1.000E+00	2.000E-02	1.160E-02	9.300E-03	0.000E+00	2.755E-02
3.5	1.000E+00	1.940E-02	1.130E-02	9.000E-03	0.000E+00	2.672E-02
3.6	1.000E+00	1.890E-02	1.100E-02	8.800E-03	0.000E+00	2.603E-02
3.7	1.000E+00	1.840E-02	1.070E-02	8.600E-03	0.000E+00	2.534E-02

ACH	Rn-211	At-211	Po-211	Po-207	Pb-203	FEQ
3.8	1.000E+00	1.790E-02	1.040E-02	8.400E-03	0.000E+00	2.466E-02
3.9	1.000E+00	1.750E-02	1.020E-02	8.100E-03	0.000E+00	2.410E-02
4	1.000E+00	1.700E-02	9.900E-03	7.900E-03	0.000E+00	2.342E-02
5	1.000E+00	1.370E-02	8.000E-03	6.400E-03	0.000E+00	1.887E-02
6	1.000E+00	1.140E-02	6.700E-03	5.400E-03	0.000E+00	1.570E-02
7	1.000E+00	9.800E-03	5.700E-03	4.600E-03	0.000E+00	1.350E-02
8	1.000E+00	8.600E-03	5.000E-03	4.000E-03	0.000E+00	1.185E-02
9	1.000E+00	7.700E-03	4.500E-03	3.600E-03	0.000E+00	1.061E-02
10	1.000E+00	6.900E-03	4.000E-03	3.200E-03	0.000E+00	9.504E-03
15	1.000E+00	4.600E-03	2.700E-03	2.200E-03	0.000E+00	6.336E-03
20	1.000E+00	3.500E-03	2.000E-03	1.600E-03	0.000E+00	4.821E-03
25	1.000E+00	2.800E-03	1.600E-03	1.300E-03	0.000E+00	3.857E-03
30	1.000E+00	2.300E-03	1.300E-03	1.100E-03	0.000E+00	3.168E-03
35	1.000E+00	2.000E-03	1.100E-03	9.000E-04	0.000E+00	2.755E-03
40	1.000E+00	1.700E-03	1.000E-03	8.000E-04	0.000E+00	2.342E-03
45	1.000E+00	1.500E-03	9.000E-04	7.000E-04	0.000E+00	2.066E-03
50	1.000E+00	1.400E-03	8.000E-04	7.000E-04	0.000E+00	1.928E-03
55	1.000E+00	1.300E-03	7.000E-04	6.000E-04	0.000E+00	1.791E-03
60	1.000E+00	1.200E-03	7.000E-04	5.000E-04	0.000E+00	1.653E-03
65	1.000E+00	1.100E-03	6.000E-04	5.000E-04	0.000E+00	1.515E-03
70	1.000E+00	1.000E-03	6.000E-04	5.000E-04	0.000E+00	1.377E-03
75	1.000E+00	9.000E-04	5.000E-04	4.000E-04	0.000E+00	1.240E-03
80	1.000E+00	9.000E-04	5.000E-04	4.000E-04	0.000E+00	1.240E-03
85	1.000E+00	8.000E-04	5.000E-04	4.000E-04	0.000E+00	1.102E-03
90	1.000E+00	8.000E-04	4.000E-04	4.000E-04	0.000E+00	1.102E-03
95	1.000E+00	7.000E-04	4.000E-04	3.000E-04	0.000E+00	9.642E-04
100	1.000E+00	7.000E-04	4.000E-04	3.000E-04	0.000E+00	9.642E-04
200	1.000E+00	3.000E-04	2.000E-04	2.000E-04	0.000E+00	4.132E-04
300	1.000E+00	2.000E-04	1.000E-04	1.000E-04	0.000E+00	2.755E-04
400	1.000E+00	2.000E-04	1.000E-04	1.000E-04	0.000E+00	2.755E-04
500	1.000E+00	1.000E-04	1.000E-04	1.000E-04	0.000E+00	1.377E-04
600	1.000E+00	1.000E-04	1.000E-04	1.000E-04	0.000E+00	1.377E-04
700	1.000E+00	1.000E-04	1.000E-04	0.000E+00	0.000E+00	1.377E-04
800	1.000E+00	1.000E-04	0.000E+00	0.000E+00	0.000E+00	1.377E-04
900	1.000E+00	1.000E-04	0.000E+00	0.000E+00	0.000E+00	1.377E-04

Table A-5: Rn-215 A_{eq} and F_{eq} Based on Air Changes Per Hour

ACH	Rn-215	Po-211	FEQ
0	1.000E+00	1.000E+00	1.000E+00
0.1	1.000E+00	1.000E+00	1.000E+00
0.18	**1.000E+00**	**1.000E+00**	**1.000E+00**
0.2	1.000E+00	1.000E+00	1.000E+00
0.3	1.000E+00	9.999E-01	9.999E-01
0.4	1.000E+00	9.999E-01	9.999E-01
0.5	1.000E+00	9.999E-01	9.999E-01
0.6	**1.000E+00**	**9.999E-01**	**9.999E-01**
0.7	1.000E+00	9.999E-01	9.999E-01
0.8	1.000E+00	9.998E-01	9.998E-01
0.9	1.000E+00	9.998E-01	9.998E-01
1	1.000E+00	9.998E-01	9.998E-01
1.1	1.000E+00	9.998E-01	9.998E-01
1.2	1.000E+00	9.998E-01	9.998E-01
1.3	1.000E+00	9.997E-01	9.997E-01
1.4	1.000E+00	9.997E-01	9.997E-01
1.5	1.000E+00	9.997E-01	9.997E-01
1.6	1.000E+00	9.997E-01	9.997E-01
1.7	1.000E+00	9.996E-01	9.996E-01
1.8	1.000E+00	9.996E-01	9.996E-01
1.9	1.000E+00	9.996E-01	9.996E-01
2	1.000E+00	9.996E-01	9.996E-01
2.1	1.000E+00	9.996E-01	9.996E-01
2.2	1.000E+00	9.995E-01	9.995E-01
2.3	1.000E+00	9.995E-01	9.995E-01
2.4	1.000E+00	9.995E-01	9.995E-01
2.5	1.000E+00	9.995E-01	9.995E-01
2.6	1.000E+00	9.995E-01	9.995E-01
2.7	1.000E+00	9.994E-01	9.994E-01
2.8	1.000E+00	9.994E-01	9.994E-01
2.9	1.000E+00	9.994E-01	9.994E-01
3	1.000E+00	9.994E-01	9.994E-01
3.1	1.000E+00	9.994E-01	9.994E-01
3.2	1.000E+00	9.993E-01	9.993E-01
3.3	1.000E+00	9.993E-01	9.993E-01
3.4	1.000E+00	9.993E-01	9.993E-01
3.5	1.000E+00	9.993E-01	9.993E-01
3.6	1.000E+00	9.993E-01	9.993E-01
3.7	1.000E+00	9.992E-01	9.992E-01
3.8	1.000E+00	9.992E-01	9.992E-01
3.9	1.000E+00	9.992E-01	9.992E-01
4	1.000E+00	9.992E-01	9.992E-01
5	1.000E+00	9.990E-01	9.990E-01
6	1.000E+00	9.988E-01	9.988E-01
7	1.000E+00	9.986E-01	9.986E-01
8	1.000E+00	9.983E-01	9.983E-01
9	1.000E+00	9.981E-01	9.981E-01
10	1.000E+00	9.979E-01	9.979E-01
15	1.000E+00	9.969E-01	9.969E-01
20	1.000E+00	9.959E-01	9.959E-01
25	1.000E+00	9.949E-01	9.949E-01
30	1.000E+00	9.938E-01	9.938E-01
35	1.000E+00	9.928E-01	9.928E-01
40	1.000E+00	9.918E-01	9.918E-01
45	1.000E+00	9.908E-01	9.908E-01
50	1.000E+00	9.898E-01	9.898E-01
55	1.000E+00	9.888E-01	9.888E-01
60	1.000E+00	9.877E-01	9.877E-01
65	1.000E+00	9.867E-01	9.867E-01
70	1.000E+00	9.857E-01	9.857E-01
75	1.000E+00	9.847E-01	9.847E-01
80	1.000E+00	9.837E-01	9.837E-01
85	1.000E+00	9.827E-01	9.827E-01
90	1.000E+00	9.817E-01	9.817E-01
95	1.000E+00	9.807E-01	9.807E-01
100	1.000E+00	9.797E-01	9.797E-01
200	1.000E+00	9.603E-01	9.603E-01
300	1.000E+00	9.416E-01	9.416E-01
400	1.000E+00	9.236E-01	9.236E-01
500	1.000E+00	9.063E-01	9.063E-01
600	1.000E+00	8.896E-01	8.896E-01
700	1.000E+00	8.736E-01	8.736E-01
800	1.000E+00	8.581E-01	8.581E-01
900	1.000E+00	8.431E-01	8.431E-01

Table A-6: Rn-216 A_{eq} and F_{eq} Based on Air Changes Per Hour

ACH	Rn-216	Po-212	FEQ
0	1.000E+00	1.000E+00	1.000E+00
0.1	1.000E+00	1.000E+00	1.000E+00
0.18	**1.000E+00**	**1.000E+00**	**1.000E+00**
0.2	1.000E+00	1.000E+00	1.000E+00
0.3	1.000E+00	1.000E+00	1.000E+00
0.4	1.000E+00	1.000E+00	1.000E+00
0.5	1.000E+00	9.999E-01	9.999E-01
0.6	**1.000E+00**	**9.999E-01**	**9.999E-01**
0.7	1.000E+00	9.999E-01	9.999E-01
0.8	1.000E+00	9.999E-01	9.999E-01
0.9	1.000E+00	9.999E-01	9.999E-01
1	1.000E+00	9.999E-01	9.999E-01
1.1	1.000E+00	9.999E-01	9.999E-01
1.2	1.000E+00	9.999E-01	9.999E-01
1.3	1.000E+00	9.998E-01	9.998E-01
1.4	1.000E+00	9.998E-01	9.998E-01
1.5	1.000E+00	9.998E-01	9.998E-01
1.6	1.000E+00	9.998E-01	9.998E-01
1.7	1.000E+00	9.998E-01	9.998E-01
1.8	1.000E+00	9.998E-01	9.998E-01
1.9	1.000E+00	9.998E-01	9.998E-01
2	1.000E+00	9.998E-01	9.998E-01
2.1	1.000E+00	9.997E-01	9.997E-01
2.2	1.000E+00	9.997E-01	9.997E-01
2.3	1.000E+00	9.997E-01	9.997E-01
2.4	1.000E+00	9.997E-01	9.997E-01
2.5	1.000E+00	9.997E-01	9.997E-01
2.6	1.000E+00	9.997E-01	9.997E-01
2.7	1.000E+00	9.997E-01	9.997E-01
2.8	1.000E+00	9.997E-01	9.997E-01
2.9	1.000E+00	9.997E-01	9.997E-01
3	1.000E+00	9.996E-01	9.996E-01
3.1	1.000E+00	9.996E-01	9.996E-01
3.2	1.000E+00	9.996E-01	9.996E-01
3.3	1.000E+00	9.996E-01	9.996E-01
3.4	1.000E+00	9.996E-01	9.996E-01
3.5	1.000E+00	9.996E-01	9.996E-01
3.6	1.000E+00	9.996E-01	9.996E-01
3.7	1.000E+00	9.996E-01	9.996E-01

ACH	Rn-216	Po-21	FEQ
3.8	1.000E+00	9.995E-01	9.995E-01
3.9	1.000E+00	9.995E-01	9.995E-01
4	1.000E+00	9.995E-01	9.995E-01
5	1.000E+00	9.994E-01	9.994E-01
6	1.000E+00	9.993E-01	9.993E-01
7	1.000E+00	9.992E-01	9.992E-01
8	1.000E+00	9.990E-01	9.990E-01
9	1.000E+00	9.989E-01	9.989E-01
10	1.000E+00	9.988E-01	9.988E-01
15	1.000E+00	9.982E-01	9.982E-01
20	1.000E+00	9.976E-01	9.976E-01
25	1.000E+00	9.970E-01	9.970E-01
30	1.000E+00	9.964E-01	9.964E-01
35	1.000E+00	9.958E-01	9.958E-01
40	1.000E+00	9.952E-01	9.952E-01
45	1.000E+00	9.946E-01	9.946E-01
50	1.000E+00	9.940E-01	9.940E-01
55	1.000E+00	9.935E-01	9.935E-01
60	1.000E+00	9.929E-01	9.929E-01
65	1.000E+00	9.923E-01	9.923E-01
70	1.000E+00	9.917E-01	9.917E-01
75	1.000E+00	9.911E-01	9.911E-01
80	1.000E+00	9.905E-01	9.905E-01
85	1.000E+00	9.899E-01	9.899E-01
90	1.000E+00	9.893E-01	9.893E-01
95	1.000E+00	9.887E-01	9.887E-01
100	1.000E+00	9.882E-01	9.882E-01
200	1.000E+00	9.766E-01	9.766E-01
300	1.000E+00	9.653E-01	9.653E-01
400	1.000E+00	9.543E-01	9.543E-01
500	1.000E+00	9.435E-01	9.435E-01
600	1.000E+00	9.329E-01	9.329E-01
700	1.000E+00	9.226E-01	9.226E-01
800	1.000E+00	9.125E-01	9.125E-01
900	1.000E+00	9.027E-01	9.027E-01

Table A-7: Rn-217 A_{eq} and F_{eq} Based on Air Changes Per Hour

ACH	Rn-217	Po-213	Pb-209	FEQ
0	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0.1	1.000E+00	1.000E+00	6.806E-01	1.000E+00
0.18	**1.000E+00**	**1.000E+00**	**5.421E-01**	**1.000E+00**
0.2	1.000E+00	1.000E+00	5.158E-01	1.000E+00
0.3	1.000E+00	1.000E+00	4.153E-01	1.000E+00
0.4	1.000E+00	1.000E+00	3.476E-01	1.000E+00
0.5	1.000E+00	1.000E+00	2.988E-01	1.000E+00
0.6	**1.000E+00**	**1.000E+00**	**2.621E-01**	**1.000E+00**
0.7	1.000E+00	1.000E+00	2.334E-01	1.000E+00
0.8	1.000E+00	1.000E+00	2.103E-01	1.000E+00
0.9	1.000E+00	1.000E+00	1.914E-01	1.000E+00
1	1.000E+00	1.000E+00	1.757E-01	1.000E+00
1.1	1.000E+00	1.000E+00	1.623E-01	1.000E+00
1.2	1.000E+00	1.000E+00	1.508E-01	1.000E+00
1.3	1.000E+00	1.000E+00	1.408E-01	1.000E+00
1.4	1.000E+00	1.000E+00	1.321E-01	1.000E+00
1.5	1.000E+00	1.000E+00	1.244E-01	1.000E+00
1.6	1.000E+00	1.000E+00	1.175E-01	1.000E+00
1.7	1.000E+00	1.000E+00	1.114E-01	1.000E+00
1.8	1.000E+00	1.000E+00	1.058E-01	1.000E+00
1.9	1.000E+00	1.000E+00	1.008E-01	1.000E+00
2	1.000E+00	1.000E+00	9.630E-02	1.000E+00
2.1	1.000E+00	1.000E+00	9.210E-02	1.000E+00
2.2	1.000E+00	1.000E+00	8.830E-02	1.000E+00
2.3	1.000E+00	1.000E+00	8.480E-02	1.000E+00
2.4	1.000E+00	1.000E+00	8.150E-02	1.000E+00
2.5	1.000E+00	1.000E+00	7.850E-02	1.000E+00
2.6	1.000E+00	1.000E+00	7.570E-02	1.000E+00
2.7	1.000E+00	1.000E+00	7.310E-02	1.000E+00
2.8	1.000E+00	1.000E+00	7.070E-02	1.000E+00
2.9	1.000E+00	1.000E+00	6.840E-02	1.000E+00
3	1.000E+00	1.000E+00	6.630E-02	1.000E+00
3.1	1.000E+00	1.000E+00	6.430E-02	1.000E+00
3.2	1.000E+00	1.000E+00	6.240E-02	1.000E+00
3.3	1.000E+00	1.000E+00	6.070E-02	1.000E+00
3.4	1.000E+00	1.000E+00	5.900E-02	1.000E+00
3.5	1.000E+00	1.000E+00	5.740E-02	1.000E+00
3.6	1.000E+00	1.000E+00	5.590E-02	1.000E+00
3.7	1.000E+00	1.000E+00	5.450E-02	1.000E+00
3.8	1.000E+00	1.000E+00	5.310E-02	1.000E+00
3.9	1.000E+00	1.000E+00	5.180E-02	1.000E+00
4	1.000E+00	1.000E+00	5.060E-02	1.000E+00
5	1.000E+00	1.000E+00	4.090E-02	1.000E+00
6	1.000E+00	1.000E+00	3.430E-02	1.000E+00
7	1.000E+00	1.000E+00	2.950E-02	1.000E+00
8	1.000E+00	1.000E+00	2.590E-02	1.000E+00
9	1.000E+00	1.000E+00	2.310E-02	1.000E+00
10	1.000E+00	1.000E+00	2.090E-02	1.000E+00
15	1.000E+00	1.000E+00	1.400E-02	1.000E+00
20	1.000E+00	1.000E+00	1.050E-02	1.000E+00
25	1.000E+00	1.000E+00	8.500E-03	1.000E+00
30	1.000E+00	1.000E+00	7.100E-03	1.000E+00
35	1.000E+00	1.000E+00	6.100E-03	1.000E+00
40	1.000E+00	1.000E+00	5.300E-03	1.000E+00
45	1.000E+00	1.000E+00	4.700E-03	1.000E+00
50	1.000E+00	1.000E+00	4.200E-03	1.000E+00
55	1.000E+00	1.000E+00	3.900E-03	1.000E+00
60	1.000E+00	1.000E+00	3.500E-03	1.000E+00
65	1.000E+00	1.000E+00	3.300E-03	1.000E+00
70	1.000E+00	1.000E+00	3.000E-03	1.000E+00
75	1.000E+00	1.000E+00	2.800E-03	1.000E+00
80	1.000E+00	1.000E+00	2.700E-03	1.000E+00
85	1.000E+00	1.000E+00	2.500E-03	1.000E+00
90	1.000E+00	1.000E+00	2.400E-03	1.000E+00
95	1.000E+00	1.000E+00	2.200E-03	1.000E+00
100	1.000E+00	1.000E+00	2.100E-03	1.000E+00
200	1.000E+00	1.000E+00	1.100E-03	1.000E+00
300	1.000E+00	1.000E+00	7.000E-04	1.000E+00
400	1.000E+00	1.000E+00	5.000E-04	1.000E+00
500	1.000E+00	1.000E+00	4.000E-04	1.000E+00
600	1.000E+00	1.000E+00	4.000E-04	1.000E+00
700	1.000E+00	1.000E+00	3.000E-04	1.000E+00
800	1.000E+00	1.000E+00	3.000E-04	1.000E+00
900	1.000E+00	1.000E+00	2.000E-04	1.000E+00

Table A-8: Rn-218 A_{eq} and F_{eq} Based on Air Changes Per Hour

ACH	Rn-218	Po-214	FEQ
0	1.000E+00	1.000E+00	1.000E+00
0.1	1.000E+00	1.000E+00	1.000E+00
0.18	**1.000E+00**	**1.000E+00**	**1.000E+00**
0.2	1.000E+00	1.000E+00	1.000E+00
0.3	1.000E+00	1.000E+00	1.000E+00
0.4	1.000E+00	1.000E+00	1.000E+00
0.5	1.000E+00	1.000E+00	1.000E+00
0.6	**1.000E+00**	**1.000E+00**	**1.000E+00**
0.7	1.000E+00	1.000E+00	1.000E+00
0.8	1.000E+00	1.000E+00	1.000E+00
0.9	1.000E+00	1.000E+00	1.000E+00
1	1.000E+00	1.000E+00	1.000E+00
1.1	1.000E+00	1.000E+00	1.000E+00
1.2	1.000E+00	1.000E+00	1.000E+00
1.3	1.000E+00	1.000E+00	1.000E+00
1.4	1.000E+00	1.000E+00	1.000E+00
1.5	1.000E+00	1.000E+00	1.000E+00
1.6	1.000E+00	1.000E+00	1.000E+00
1.7	1.000E+00	1.000E+00	1.000E+00
1.8	1.000E+00	1.000E+00	1.000E+00
1.9	1.000E+00	1.000E+00	1.000E+00
2	1.000E+00	1.000E+00	1.000E+00
2.1	1.000E+00	1.000E+00	1.000E+00
2.2	1.000E+00	1.000E+00	1.000E+00
2.3	1.000E+00	1.000E+00	1.000E+00
2.4	1.000E+00	1.000E+00	1.000E+00
2.5	1.000E+00	1.000E+00	1.000E+00
2.6	1.000E+00	1.000E+00	1.000E+00
2.7	1.000E+00	1.000E+00	1.000E+00
2.8	1.000E+00	1.000E+00	1.000E+00
2.9	1.000E+00	1.000E+00	1.000E+00
3	1.000E+00	1.000E+00	1.000E+00
3.1	1.000E+00	1.000E+00	1.000E+00
3.2	1.000E+00	1.000E+00	1.000E+00
3.3	1.000E+00	1.000E+00	1.000E+00
3.4	1.000E+00	1.000E+00	1.000E+00
3.5	1.000E+00	1.000E+00	1.000E+00
3.6	1.000E+00	1.000E+00	1.000E+00
3.7	1.000E+00	1.000E+00	1.000E+00

ACH	Rn-218	Po-214	FEQ
3.8	1.000E+00	1.000E+00	1.000E+00
3.9	1.000E+00	1.000E+00	1.000E+00
4	1.000E+00	1.000E+00	1.000E+00
5	1.000E+00	1.000E+00	1.000E+00
6	1.000E+00	1.000E+00	1.000E+00
7	1.000E+00	1.000E+00	1.000E+00
8	1.000E+00	1.000E+00	1.000E+00
9	1.000E+00	1.000E+00	1.000E+00
10	1.000E+00	1.000E+00	1.000E+00
15	1.000E+00	1.000E+00	1.000E+00
20	1.000E+00	1.000E+00	1.000E+00
25	1.000E+00	1.000E+00	1.000E+00
30	1.000E+00	1.000E+00	1.000E+00
35	1.000E+00	1.000E+00	1.000E+00
40	1.000E+00	1.000E+00	1.000E+00
45	1.000E+00	1.000E+00	1.000E+00
50	1.000E+00	1.000E+00	1.000E+00
55	1.000E+00	1.000E+00	1.000E+00
60	1.000E+00	1.000E+00	1.000E+00
65	1.000E+00	1.000E+00	1.000E+00
70	1.000E+00	1.000E+00	1.000E+00
75	1.000E+00	1.000E+00	1.000E+00
80	1.000E+00	1.000E+00	1.000E+00
85	1.000E+00	1.000E+00	1.000E+00
90	1.000E+00	1.000E+00	1.000E+00
95	1.000E+00	1.000E+00	1.000E+00
100	1.000E+00	1.000E+00	1.000E+00
200	1.000E+00	1.000E+00	1.000E+00
300	1.000E+00	1.000E+00	1.000E+00
400	1.000E+00	1.000E+00	1.000E+00
500	1.000E+00	1.000E+00	1.000E+00
600	1.000E+00	1.000E+00	1.000E+00
700	1.000E+00	1.000E+00	1.000E+00
800	1.000E+00	9.999E-01	9.999E-01
900	1.000E+00	9.999E-01	9.999E-01

Table A-9: Actinon (Rn-219) A_{eq} and F_{eq} Based on Air Changes Per Hour

ACH	Rn-219	Po-215	Pb-211	Bi-211	Tl-207	Po-211	FEQ
0	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.972E-01	2.800E-03	1.000E+00
0.1	1.000E+00	1.000E+00	9.201E-01	9.154E-01	9.025E-01	2.500E-03	9.198E-01
0.18	**1.000E+00**	**1.000E+00**	**8.649E-01**	**8.569E-01**	**8.373E-01**	**2.400E-03**	**8.645E-01**
0.2	1.000E+00	1.000E+00	8.521E-01	8.434E-01	8.222E-01	2.300E-03	8.516E-01
0.3	1.000E+00	1.000E+00	7.934E-01	7.813E-01	7.533E-01	2.200E-03	7.927E-01
0.4	1.000E+00	1.000E+00	7.423E-01	7.273E-01	6.935E-01	2.000E-03	7.415E-01
0.5	1.000E+00	1.000E+00	6.973E-01	6.799E-01	6.412E-01	1.900E-03	6.963E-01
0.6	**1.000E+00**	**1.000E+00**	**6.575E-01**	**6.379E-01**	**5.951E-01**	**1.800E-03**	**6.564E-01**
0.7	1.000E+00	1.000E+00	6.220E-01	6.004E-01	5.543E-01	1.700E-03	6.208E-01
0.8	1.000E+00	1.000E+00	5.902E-01	5.668E-01	5.178E-01	1.600E-03	5.889E-01
0.9	1.000E+00	1.000E+00	5.614E-01	5.366E-01	4.850E-01	1.500E-03	5.600E-01
1	1.000E+00	1.000E+00	5.353E-01	5.091E-01	4.555E-01	1.400E-03	5.338E-01
1.1	1.000E+00	1.000E+00	5.116E-01	4.842E-01	4.287E-01	1.300E-03	5.101E-01
1.2	1.000E+00	1.000E+00	4.898E-01	4.613E-01	4.044E-01	1.300E-03	4.882E-01
1.3	1.000E+00	1.000E+00	4.698E-01	4.404E-01	3.822E-01	1.200E-03	4.682E-01
1.4	1.000E+00	1.000E+00	4.514E-01	4.211E-01	3.618E-01	1.200E-03	4.497E-01
1.5	1.000E+00	1.000E+00	4.344E-01	4.033E-01	3.431E-01	1.100E-03	4.327E-01
1.6	1.000E+00	1.000E+00	4.186E-01	3.868E-01	3.259E-01	1.100E-03	4.168E-01
1.7	1.000E+00	1.000E+00	4.039E-01	3.714E-01	3.100E-01	1.000E-03	4.021E-01
1.8	1.000E+00	1.000E+00	3.903E-01	3.572E-01	2.952E-01	1.000E-03	3.884E-01
1.9	1.000E+00	1.000E+00	3.775E-01	3.438E-01	2.815E-01	9.000E-04	3.756E-01
2	1.000E+00	1.000E+00	3.655E-01	3.314E-01	2.688E-01	9.000E-04	3.636E-01
2.1	1.000E+00	1.000E+00	3.543E-01	3.197E-01	2.569E-01	9.000E-04	3.524E-01
2.2	1.000E+00	1.000E+00	3.437E-01	3.087E-01	2.458E-01	9.000E-04	3.417E-01
2.3	1.000E+00	1.000E+00	3.337E-01	2.984E-01	2.355E-01	8.000E-04	3.317E-01
2.4	1.000E+00	1.000E+00	3.243E-01	2.887E-01	2.257E-01	8.000E-04	3.223E-01
2.5	1.000E+00	1.000E+00	3.155E-01	2.795E-01	2.166E-01	8.000E-04	3.135E-01
2.6	1.000E+00	1.000E+00	3.070E-01	2.708E-01	2.080E-01	7.000E-04	3.050E-01
2.7	1.000E+00	1.000E+00	2.991E-01	2.626E-01	1.999E-01	7.000E-04	2.971E-01
2.8	1.000E+00	1.000E+00	2.915E-01	2.548E-01	1.923E-01	7.000E-04	2.894E-01
2.9	1.000E+00	1.000E+00	2.843E-01	2.474E-01	1.851E-01	7.000E-04	2.822E-01
3	1.000E+00	1.000E+00	2.775E-01	2.404E-01	1.783E-01	7.000E-04	2.754E-01
3.1	1.000E+00	1.000E+00	2.709E-01	2.337E-01	1.719E-01	6.000E-04	2.688E-01
3.2	1.000E+00	1.000E+00	2.647E-01	2.273E-01	1.658E-01	6.000E-04	2.626E-01
3.3	1.000E+00	1.000E+00	2.588E-01	2.212E-01	1.600E-01	6.000E-04	2.567E-01
3.4	1.000E+00	1.000E+00	2.531E-01	2.154E-01	1.545E-01	6.000E-04	2.510E-01
3.5	1.000E+00	1.000E+00	2.476E-01	2.098E-01	1.493E-01	6.000E-04	2.455E-01
3.6	1.000E+00	1.000E+00	2.424E-01	2.045E-01	1.444E-01	6.000E-04	2.403E-01
3.7	1.000E+00	1.000E+00	2.374E-01	1.995E-01	1.396E-01	6.000E-04	2.353E-01

ACH	Rn-219	Po-215	Pb-211	Bi-211	Tl-207	Po-211	FEQ
3.8	1.000E+00	1.000E+00	2.326E-01	1.946E-01	1.352E-01	5.000E-04	2.305E-01
3.9	1.000E+00	1.000E+00	2.280E-01	1.899E-01	1.309E-01	5.000E-04	2.259E-01
4	1.000E+00	1.000E+00	2.236E-01	1.854E-01	1.268E-01	5.000E-04	2.215E-01
5	1.000E+00	1.000E+00	1.873E-01	1.489E-01	9.440E-02	4.000E-04	1.852E-01
6	1.000E+00	1.000E+00	1.611E-01	1.231E-01	7.270E-02	3.000E-04	1.590E-01
7	1.000E+00	1.000E+00	1.413E-01	1.039E-01	5.750E-02	3.000E-04	1.392E-01
8	1.000E+00	1.000E+00	1.259E-01	8.920E-02	4.640E-02	2.000E-04	1.238E-01
9	1.000E+00	1.000E+00	1.135E-01	7.760E-02	3.810E-02	2.000E-04	1.115E-01
10	1.000E+00	1.000E+00	1.033E-01	6.820E-02	3.170E-02	2.000E-04	1.013E-01
15	1.000E+00	1.000E+00	7.130E-02	4.030E-02	1.480E-02	1.000E-04	6.957E-02
20	1.000E+00	1.000E+00	5.450E-02	2.680E-02	8.100E-03	1.000E-04	5.295E-02
25	1.000E+00	1.000E+00	4.410E-02	1.930E-02	5.000E-03	1.000E-04	4.271E-02
30	1.000E+00	1.000E+00	3.700E-02	1.450E-02	3.300E-03	0.000E+00	3.574E-02
35	1.000E+00	1.000E+00	3.190E-02	1.140E-02	2.300E-03	0.000E+00	3.075E-02
40	1.000E+00	1.000E+00	2.800E-02	9.200E-03	1.600E-03	0.000E+00	2.695E-02
45	1.000E+00	1.000E+00	2.500E-02	7.500E-03	1.200E-03	0.000E+00	2.402E-02
50	1.000E+00	1.000E+00	2.250E-02	6.300E-03	9.000E-04	0.000E+00	2.160E-02
55	1.000E+00	1.000E+00	2.050E-02	5.400E-03	7.000E-04	0.000E+00	1.966E-02
60	1.000E+00	1.000E+00	1.880E-02	4.600E-03	6.000E-04	0.000E+00	1.801E-02
65	1.000E+00	1.000E+00	1.740E-02	4.000E-03	5.000E-04	0.000E+00	1.665E-02
70	1.000E+00	1.000E+00	1.620E-02	3.500E-03	4.000E-04	0.000E+00	1.549E-02
75	1.000E+00	9.999E-01	1.510E-02	3.100E-03	3.000E-04	0.000E+00	1.443E-02
80	1.000E+00	9.999E-01	1.420E-02	2.800E-03	3.000E-04	0.000E+00	1.356E-02
85	1.000E+00	9.999E-01	1.340E-02	2.500E-03	2.000E-04	0.000E+00	1.279E-02
90	1.000E+00	9.999E-01	1.260E-02	2.200E-03	2.000E-04	0.000E+00	1.202E-02
95	1.000E+00	9.999E-01	1.200E-02	2.000E-03	2.000E-04	0.000E+00	1.144E-02
100	1.000E+00	9.999E-01	1.140E-02	1.900E-03	1.000E-04	0.000E+00	1.087E-02
200	1.000E+00	9.999E-01	5.700E-03	5.000E-04	0.000E+00	0.000E+00	5.411E-03
300	1.000E+00	9.998E-01	3.800E-03	2.000E-04	0.000E+00	0.000E+00	3.600E-03
400	1.000E+00	9.997E-01	2.900E-03	1.000E-04	0.000E+00	0.000E+00	2.745E-03
500	1.000E+00	9.996E-01	2.300E-03	1.000E-04	0.000E+00	0.000E+00	2.179E-03
600	1.000E+00	9.996E-01	1.900E-03	1.000E-04	0.000E+00	0.000E+00	1.801E-03
700	1.000E+00	9.995E-01	1.600E-03	0.000E+00	0.000E+00	0.000E+00	1.512E-03
800	1.000E+00	9.994E-01	1.400E-03	0.000E+00	0.000E+00	0.000E+00	1.323E-03
900	1.000E+00	9.994E-01	1.300E-03	0.000E+00	0.000E+00	0.000E+00	1.229E-03

Table A-10: Thoron (Rn-220) A_{eq} and F_{eq} Based on Air Changes Per Hour

ACH	Rn-220	Po-216	Pb-212	Bi-212	Po-212	Tl-208	FEQ
0	1.000E+00	1.000E+00	1.000E+00	1.000E+00	6.410E-01	3.590E-01	1.000E+00
0.1	1.000E+00	1.000E+00	3.945E-01	3.443E-01	2.207E-01	1.227E-01	3.902E-01
0.18	**1.000E+00**	**1.000E+00**	**2.657E-01**	**2.106E-01**	**1.350E-01**	**7.460E-02**	**2.609E-01**
0.2	1.000E+00	1.000E+00	2.457E-01	1.903E-01	1.220E-01	6.730E-02	2.409E-01
0.3	1.000E+00	1.000E+00	1.784E-01	1.242E-01	7.960E-02	4.360E-02	1.737E-01
0.4	1.000E+00	1.000E+00	1.401E-01	8.850E-02	5.670E-02	3.090E-02	1.356E-01
0.5	1.000E+00	1.000E+00	1.153E-01	6.670E-02	4.280E-02	2.310E-02	1.111E-01
0.6	**1.000E+00**	**1.000E+00**	**9.790E-02**	**5.230E-02**	**3.350E-02**	**1.800E-02**	**9.396E-02**
0.7	1.000E+00	1.000E+00	8.510E-02	4.220E-02	2.700E-02	1.440E-02	8.139E-02
0.8	1.000E+00	1.000E+00	7.530E-02	3.480E-02	2.230E-02	1.180E-02	7.180E-02
0.9	1.000E+00	9.999E-01	6.750E-02	2.920E-02	1.870E-02	9.800E-03	6.419E-02
1	1.000E+00	9.999E-01	6.120E-02	2.490E-02	1.600E-02	8.300E-03	5.806E-02
1.1	1.000E+00	9.999E-01	5.590E-02	2.150E-02	1.380E-02	7.100E-03	5.293E-02
1.2	1.000E+00	9.999E-01	5.150E-02	1.870E-02	1.200E-02	6.200E-03	4.867E-02
1.3	1.000E+00	9.999E-01	4.770E-02	1.650E-02	1.060E-02	5.400E-03	4.500E-02
1.4	1.000E+00	9.999E-01	4.450E-02	1.460E-02	9.400E-03	4.800E-03	4.192E-02
1.5	1.000E+00	9.999E-01	4.160E-02	1.310E-02	8.400E-03	4.200E-03	3.914E-02
1.6	1.000E+00	9.999E-01	3.910E-02	1.170E-02	7.500E-03	3.800E-03	3.673E-02
1.7	1.000E+00	9.999E-01	3.690E-02	1.060E-02	6.800E-03	3.400E-03	3.463E-02
1.8	1.000E+00	9.999E-01	3.490E-02	9.600E-03	6.200E-03	3.100E-03	3.272E-02
1.9	1.000E+00	9.999E-01	3.310E-02	8.800E-03	5.600E-03	2.800E-03	3.100E-02
2	1.000E+00	9.999E-01	3.150E-02	8.100E-03	5.200E-03	2.500E-03	2.948E-02
2.1	1.000E+00	9.999E-01	3.010E-02	7.400E-03	4.800E-03	2.300E-03	2.814E-02
2.2	1.000E+00	9.999E-01	2.880E-02	6.800E-03	4.400E-03	2.100E-03	2.690E-02
2.3	1.000E+00	9.999E-01	2.750E-02	6.300E-03	4.100E-03	1.900E-03	2.567E-02
2.4	1.000E+00	9.999E-01	2.640E-02	5.900E-03	3.800E-03	1.800E-03	2.463E-02
2.5	1.000E+00	9.999E-01	2.540E-02	5.500E-03	3.500E-03	1.700E-03	2.368E-02
2.6	1.000E+00	9.998E-01	2.440E-02	5.100E-03	3.300E-03	1.500E-03	2.273E-02
2.7	1.000E+00	9.998E-01	2.360E-02	4.800E-03	3.100E-03	1.400E-03	2.198E-02
2.8	1.000E+00	9.998E-01	2.270E-02	4.500E-03	2.900E-03	1.300E-03	2.113E-02
2.9	1.000E+00	9.998E-01	2.200E-02	4.200E-03	2.700E-03	1.200E-03	2.046E-02
3	1.000E+00	9.998E-01	2.120E-02	4.000E-03	2.500E-03	1.200E-03	1.972E-02
3.1	1.000E+00	9.998E-01	2.060E-02	3.700E-03	2.400E-03	1.100E-03	1.914E-02
3.2	1.000E+00	9.998E-01	1.990E-02	3.500E-03	2.300E-03	1.000E-03	1.849E-02
3.3	1.000E+00	9.998E-01	1.940E-02	3.300E-03	2.100E-03	1.000E-03	1.801E-02
3.4	1.000E+00	9.998E-01	1.880E-02	3.200E-03	2.000E-03	9.000E-04	1.746E-02
3.5	1.000E+00	9.998E-01	1.830E-02	3.000E-03	1.900E-03	9.000E-04	1.698E-02
3.6	1.000E+00	9.998E-01	1.780E-02	2.800E-03	1.800E-03	8.000E-04	1.651E-02
3.7	1.000E+00	9.998E-01	1.730E-02	2.700E-03	1.700E-03	8.000E-04	1.604E-02

ACH	Rn-220	Po-216	Pb-212	Bi-212	Po-212	Tl-208	FEQ
3.8	1.000E+00	9.998E-01	1.690E-02	2.600E-03	1.700E-03	7.000E-04	1.567E-02
3.9	1.000E+00	9.998E-01	1.640E-02	2.500E-03	1.600E-03	7.000E-04	1.520E-02
4	1.000E+00	9.998E-01	1.600E-02	2.300E-03	1.500E-03	7.000E-04	1.482E-02
5	1.000E+00	9.997E-01	1.290E-02	1.600E-03	1.000E-03	4.000E-04	1.193E-02
6	1.000E+00	9.997E-01	1.070E-02	1.100E-03	7.000E-04	3.000E-04	9.875E-03
7	1.000E+00	9.996E-01	9.200E-03	8.000E-04	5.000E-04	2.000E-04	8.479E-03
8	1.000E+00	9.995E-01	8.100E-03	6.000E-04	4.000E-04	1.000E-04	7.457E-03
9	1.000E+00	9.995E-01	7.200E-03	5.000E-04	3.000E-04	1.000E-04	6.627E-03
10	1.000E+00	9.994E-01	6.500E-03	4.000E-04	3.000E-04	1.000E-04	5.979E-03
15	1.000E+00	9.991E-01	4.300E-03	2.000E-04	1.000E-04	0.000E+00	3.952E-03
20	1.000E+00	9.988E-01	3.200E-03	1.000E-04	1.000E-04	0.000E+00	2.939E-03
25	1.000E+00	9.985E-01	2.600E-03	1.000E-04	0.000E+00	0.000E+00	2.391E-03
30	1.000E+00	9.983E-01	2.200E-03	0.000E+00	0.000E+00	0.000E+00	2.016E-03
35	1.000E+00	9.980E-01	1.900E-03	0.000E+00	0.000E+00	0.000E+00	1.742E-03
40	1.000E+00	9.977E-01	1.600E-03	0.000E+00	0.000E+00	0.000E+00	1.468E-03
45	1.000E+00	9.974E-01	1.400E-03	0.000E+00	0.000E+00	0.000E+00	1.286E-03
50	1.000E+00	9.971E-01	1.300E-03	0.000E+00	0.000E+00	0.000E+00	1.194E-03
55	1.000E+00	9.968E-01	1.200E-03	0.000E+00	0.000E+00	0.000E+00	1.103E-03
60	1.000E+00	9.965E-01	1.100E-03	0.000E+00	0.000E+00	0.000E+00	1.012E-03
65	1.000E+00	9.962E-01	1.000E-03	0.000E+00	0.000E+00	0.000E+00	9.204E-04
70	1.000E+00	9.959E-01	9.000E-04	0.000E+00	0.000E+00	0.000E+00	8.291E-04
75	1.000E+00	9.957E-01	9.000E-04	0.000E+00	0.000E+00	0.000E+00	8.291E-04
80	1.000E+00	9.954E-01	8.000E-04	0.000E+00	0.000E+00	0.000E+00	7.378E-04
85	1.000E+00	9.951E-01	8.000E-04	0.000E+00	0.000E+00	0.000E+00	7.378E-04
90	1.000E+00	9.948E-01	7.000E-04	0.000E+00	0.000E+00	0.000E+00	6.464E-04
95	1.000E+00	9.945E-01	7.000E-04	0.000E+00	0.000E+00	0.000E+00	6.464E-04
100	1.000E+00	9.942E-01	6.000E-04	0.000E+00	0.000E+00	0.000E+00	5.551E-04
200	1.000E+00	9.885E-01	3.000E-04	0.000E+00	0.000E+00	0.000E+00	2.810E-04
300	1.000E+00	9.829E-01	2.000E-04	0.000E+00	0.000E+00	0.000E+00	1.897E-04
400	1.000E+00	9.773E-01	2.000E-04	0.000E+00	0.000E+00	0.000E+00	1.896E-04
500	1.000E+00	9.718E-01	1.000E-04	0.000E+00	0.000E+00	0.000E+00	9.825E-05
600	1.000E+00	9.663E-01	1.000E-04	0.000E+00	0.000E+00	0.000E+00	9.821E-05
700	1.000E+00	9.609E-01	1.000E-04	0.000E+00	0.000E+00	0.000E+00	9.817E-05
800	1.000E+00	9.556E-01	1.000E-04	0.000E+00	0.000E+00	0.000E+00	9.813E-05
900	1.000E+00	9.503E-01	1.000E-04	0.000E+00	0.000E+00	0.000E+00	9.809E-05

Table A-11: Radon (Rn-222) A_{eq} and F_{eq} Based on Air Changes Per Hour

ACH	Rn-222	Po-218	Pb-214	At-218	Bi-214	Rn-218	Po-214	Tl-210	FEQ
0	1.000E+00	1.000E+00	9.998E-01	2.000E-04	1.000E+00	0.000E+00	9.998E-01	2.000E-04	1.000E+00
0.1	1.000E+00	9.926E-01	9.323E-01	2.000E-04	8.899E-01	0.000E+00	8.898E-01	2.000E-04	9.226E-01
0.18	**1.000E+00**	**9.868E-01**	**8.840E-01**	**2.000E-04**	**8.141E-01**	**0.000E+00**	**8.139E-01**	**2.000E-04**	**8.683E-01**
0.2	1.000E+00	9.853E-01	8.726E-01	2.000E-04	7.966E-01	0.000E+00	7.964E-01	2.000E-04	8.556E-01
0.3	1.000E+00	9.781E-01	8.195E-01	2.000E-04	7.168E-01	0.000E+00	7.167E-01	1.000E-04	7.972E-01
0.4	1.000E+00	9.710E-01	7.719E-01	2.000E-04	6.480E-01	0.000E+00	6.479E-01	1.000E-04	7.458E-01
0.5	1.000E+00	9.641E-01	7.290E-01	2.000E-04	5.884E-01	0.000E+00	5.883E-01	1.000E-04	7.003E-01
0.6	**1.000E+00**	**9.572E-01**	**6.902E-01**	**2.000E-04**	**5.364E-01**	**0.000E+00**	**5.362E-01**	**1.000E-04**	**6.599E-01**
0.7	1.000E+00	9.504E-01	6.548E-01	2.000E-04	4.907E-01	0.000E+00	4.906E-01	1.000E-04	6.236E-01
0.8	1.000E+00	9.437E-01	6.226E-01	2.000E-04	4.504E-01	0.000E+00	4.503E-01	1.000E-04	5.910E-01
0.9	1.000E+00	9.371E-01	5.930E-01	2.000E-04	4.146E-01	0.000E+00	4.146E-01	1.000E-04	5.614E-01
1	1.000E+00	9.306E-01	5.658E-01	2.000E-04	3.828E-01	0.000E+00	3.827E-01	1.000E-04	5.347E-01
1.1	1.000E+00	9.242E-01	5.407E-01	2.000E-04	3.544E-01	0.000E+00	3.543E-01	1.000E-04	5.103E-01
1.2	1.000E+00	9.179E-01	5.175E-01	2.000E-04	3.289E-01	0.000E+00	3.288E-01	1.000E-04	4.880E-01
1.3	1.000E+00	9.117E-01	4.960E-01	2.000E-04	3.059E-01	0.000E+00	3.058E-01	1.000E-04	4.675E-01
1.4	1.000E+00	9.055E-01	4.759E-01	2.000E-04	2.851E-01	0.000E+00	2.851E-01	1.000E-04	4.486E-01
1.5	1.000E+00	8.994E-01	4.573E-01	2.000E-04	2.663E-01	0.000E+00	2.662E-01	1.000E-04	4.313E-01
1.6	1.000E+00	8.934E-01	4.398E-01	2.000E-04	2.492E-01	0.000E+00	2.491E-01	0.000E+00	4.152E-01
1.7	1.000E+00	8.875E-01	4.235E-01	2.000E-04	2.336E-01	0.000E+00	2.336E-01	0.000E+00	4.002E-01
1.8	1.000E+00	8.817E-01	4.081E-01	2.000E-04	2.194E-01	0.000E+00	2.193E-01	0.000E+00	3.863E-01
1.9	1.000E+00	8.759E-01	3.937E-01	2.000E-04	2.063E-01	0.000E+00	2.063E-01	0.000E+00	3.733E-01
2	1.000E+00	8.703E-01	3.801E-01	2.000E-04	1.943E-01	0.000E+00	1.943E-01	0.000E+00	3.611E-01
2.1	1.000E+00	8.647E-01	3.674E-01	2.000E-04	1.833E-01	0.000E+00	1.833E-01	0.000E+00	3.498E-01
2.2	1.000E+00	8.591E-01	3.553E-01	2.000E-04	1.732E-01	0.000E+00	1.731E-01	0.000E+00	3.392E-01
2.3	1.000E+00	8.537E-01	3.438E-01	2.000E-04	1.638E-01	0.000E+00	1.637E-01	0.000E+00	3.291E-01
2.4	1.000E+00	8.483E-01	3.330E-01	2.000E-04	1.551E-01	0.000E+00	1.551E-01	0.000E+00	3.197E-01
2.5	1.000E+00	8.429E-01	3.228E-01	2.000E-04	1.470E-01	0.000E+00	1.470E-01	0.000E+00	3.108E-01
2.6	1.000E+00	8.377E-01	3.130E-01	2.000E-04	1.396E-01	0.000E+00	1.395E-01	0.000E+00	3.024E-01
2.7	1.000E+00	8.325E-01	3.038E-01	2.000E-04	1.326E-01	0.000E+00	1.326E-01	0.000E+00	2.945E-01
2.8	1.000E+00	8.273E-01	2.950E-01	2.000E-04	1.261E-01	0.000E+00	1.261E-01	0.000E+00	2.869E-01
2.9	1.000E+00	8.223E-01	2.866E-01	2.000E-04	1.201E-01	0.000E+00	1.201E-01	0.000E+00	2.798E-01
3	1.000E+00	8.172E-01	2.786E-01	2.000E-04	1.144E-01	0.000E+00	1.144E-01	0.000E+00	2.730E-01
3.1	1.000E+00	8.123E-01	2.709E-01	2.000E-04	1.092E-01	0.000E+00	1.091E-01	0.000E+00	2.665E-01
3.2	1.000E+00	8.074E-01	2.636E-01	2.000E-04	1.042E-01	0.000E+00	1.042E-01	0.000E+00	2.604E-01
3.3	1.000E+00	8.026E-01	2.566E-01	2.000E-04	9.960E-02	0.000E+00	9.960E-02	0.000E+00	2.545E-01
3.4	1.000E+00	7.978E-01	2.500E-01	2.000E-04	9.520E-02	0.000E+00	9.520E-02	0.000E+00	2.489E-01
3.5	1.000E+00	7.931E-01	2.436E-01	2.000E-04	9.110E-02	0.000E+00	9.110E-02	0.000E+00	2.436E-01
3.6	1.000E+00	7.884E-01	2.374E-01	2.000E-04	8.730E-02	0.000E+00	8.730E-02	0.000E+00	2.385E-01
3.7	1.000E+00	7.838E-01	2.316E-01	2.000E-04	8.360E-02	0.000E+00	8.360E-02	0.000E+00	2.336E-01

ACH	Rn-222	Po-218	Pb-214	At-218	Bi-214	Rn-218	Po-214	Tl-210	FEQ
3.8	1.000E+00	7.793E-01	2.259E-01	2.000E-04	8.020E-02	0.000E+00	8.020E-02	0.000E+00	2.289E-01
3.9	1.000E+00	7.748E-01	2.205E-01	2.000E-04	7.700E-02	0.000E+00	7.700E-02	0.000E+00	2.244E-01
4	1.000E+00	7.703E-01	2.153E-01	2.000E-04	7.390E-02	0.000E+00	7.390E-02	0.000E+00	2.201E-01
5	1.000E+00	7.285E-01	1.725E-01	1.000E-04	5.090E-02	0.000E+00	5.090E-02	0.000E+00	1.850E-01
6	1.000E+00	6.910E-01	1.420E-01	1.000E-04	3.670E-02	0.000E+00	3.670E-02	0.000E+00	1.599E-01
7	1.000E+00	6.571E-01	1.192E-01	1.000E-04	2.740E-02	0.000E+00	2.740E-02	0.000E+00	1.411E-01
8	1.000E+00	6.264E-01	1.018E-01	1.000E-04	2.110E-02	0.000E+00	2.110E-02	0.000E+00	1.265E-01
9	1.000E+00	5.985E-01	8.800E-02	1.000E-04	1.660E-02	0.000E+00	1.660E-02	0.000E+00	1.148E-01
10	1.000E+00	5.729E-01	7.700E-02	1.000E-04	1.330E-02	0.000E+00	1.330E-02	0.000E+00	1.052E-01
15	1.000E+00	4.721E-01	4.430E-02	1.000E-04	5.400E-03	0.000E+00	5.400E-03	0.000E+00	7.470E-02
20	1.000E+00	4.015E-01	2.890E-02	1.000E-04	2.700E-03	0.000E+00	2.700E-03	0.000E+00	5.831E-02
25	1.000E+00	3.492E-01	2.040E-02	1.000E-04	1.600E-03	0.000E+00	1.600E-03	0.000E+00	4.800E-02
30	1.000E+00	3.090E-01	1.520E-02	1.000E-04	1.000E-03	0.000E+00	1.000E-03	0.000E+00	4.085E-02
35	1.000E+00	2.771E-01	1.180E-02	1.000E-04	7.000E-04	0.000E+00	7.000E-04	0.000E+00	3.562E-02
40	1.000E+00	2.512E-01	9.400E-03	0.000E+00	5.000E-04	0.000E+00	5.000E-04	0.000E+00	3.157E-02
45	1.000E+00	2.297E-01	7.700E-03	0.000E+00	3.000E-04	0.000E+00	3.000E-04	0.000E+00	2.835E-02
50	1.000E+00	2.116E-01	6.400E-03	0.000E+00	3.000E-04	0.000E+00	3.000E-04	0.000E+00	2.577E-02
55	1.000E+00	1.961E-01	5.400E-03	0.000E+00	2.000E-04	0.000E+00	2.000E-04	0.000E+00	2.358E-02
60	1.000E+00	1.827E-01	4.600E-03	0.000E+00	2.000E-04	0.000E+00	2.000E-04	0.000E+00	2.175E-02
65	1.000E+00	1.711E-01	4.000E-03	0.000E+00	1.000E-04	0.000E+00	1.000E-04	0.000E+00	2.018E-02
70	1.000E+00	1.608E-01	3.500E-03	0.000E+00	1.000E-04	0.000E+00	1.000E-04	0.000E+00	1.883E-02
75	1.000E+00	1.517E-01	3.100E-03	0.000E+00	1.000E-04	0.000E+00	1.000E-04	0.000E+00	1.767E-02
80	1.000E+00	1.436E-01	2.700E-03	0.000E+00	1.000E-04	0.000E+00	1.000E-04	0.000E+00	1.660E-02
85	1.000E+00	1.363E-01	2.400E-03	0.000E+00	1.000E-04	0.000E+00	1.000E-04	0.000E+00	1.568E-02
90	1.000E+00	1.297E-01	2.200E-03	0.000E+00	1.000E-04	0.000E+00	1.000E-04	0.000E+00	1.488E-02
95	1.000E+00	1.237E-01	2.000E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.410E-02
100	1.000E+00	1.183E-01	1.800E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.343E-02
200	1.000E+00	6.290E-02	5.000E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.906E-03
300	1.000E+00	4.280E-02	2.000E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.627E-03
400	1.000E+00	3.250E-02	1.000E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.487E-03
500	1.000E+00	2.610E-02	1.000E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.811E-03
600	1.000E+00	2.190E-02	1.000E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.367E-03
700	1.000E+00	1.880E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.987E-03
800	1.000E+00	1.650E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.744E-03
900	1.000E+00	1.470E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.554E-03

Table A-12: Rn-223 A_{eq} and F_{eq} Based on Air Changes Per Hour

ACH	Rn-223	Fr-223	Rn-219	At-219	Bi-215	Po-215	Pb-211	Bi-211	Tl-207	Po-211	FEQ
0	1.000E+00	1.000E+00	0.000E+00	1.000E-04	1.000E-04	1.000E-04	1.000E-04	1.000E-04	1.000E-04	0.000E+00	1.000E+00
0.1	1.000E+00	9.498E-01	0.000E+00	1.000E-04	1.000E-04	1.000E-04	1.000E-04	1.000E-04	1.000E-04	0.000E+00	9.793E-01
0.18	**1.000E+00**	**9.131E-01**	**0.000E+00**	**1.000E-04**	**1.000E-04**	**1.000E-04**	**0.000E+00**	**0.000E+00**	**0.000E+00**	**0.000E+00**	**5.704E-01**
0.2	1.000E+00	9.043E-01	0.000E+00	1.000E-04	1.000E-04	1.000E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.668E-01
0.3	1.000E+00	8.630E-01	0.000E+00	1.000E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.844E-01
0.4	1.000E+00	8.254E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.398E-01
0.5	1.000E+00	7.908E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.256E-01
0.6	**1.000E+00**	**7.591E-01**	**0.000E+00**	**0.000E+00**	**0.000E+00**	**0.000E+00**	**0.000E+00**	**0.000E+00**	**0.000E+00**	**0.000E+00**	**3.125E-01**
0.7	1.000E+00	7.298E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.005E-01
0.8	1.000E+00	7.026E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.893E-01
0.9	1.000E+00	6.775E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.789E-01
1	1.000E+00	6.540E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.692E-01
1.1	1.000E+00	6.322E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.603E-01
1.2	1.000E+00	6.117E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.518E-01
1.3	1.000E+00	5.925E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.439E-01
1.4	1.000E+00	5.745E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.365E-01
1.5	1.000E+00	5.576E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.296E-01
1.6	1.000E+00	5.416E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.230E-01
1.7	1.000E+00	5.265E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.168E-01
1.8	1.000E+00	5.122E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.109E-01
1.9	1.000E+00	4.987E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.053E-01
2	1.000E+00	4.859E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.000E-01
2.1	1.000E+00	4.737E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.950E-01
2.2	1.000E+00	4.622E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.903E-01
2.3	1.000E+00	4.511E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.857E-01
2.4	1.000E+00	4.406E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.814E-01
2.5	1.000E+00	4.306E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.773E-01
2.6	1.000E+00	4.210E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.733E-01
2.7	1.000E+00	4.118E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.695E-01
2.8	1.000E+00	4.030E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.659E-01
2.9	1.000E+00	3.946E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.625E-01
3	1.000E+00	3.866E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.592E-01
3.1	1.000E+00	3.788E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.559E-01
3.2	1.000E+00	3.714E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.529E-01
3.3	1.000E+00	3.642E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.499E-01
3.4	1.000E+00	3.573E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.471E-01
3.5	1.000E+00	3.507E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.444E-01
3.6	1.000E+00	3.443E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.417E-01
3.7	1.000E+00	3.382E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.392E-01

ACH	Rn-223	Fr-223	Rn-219	At-219	Bi-215	Po-215	Pb-211	Bi-211	Tl-207	Po-211	FEQ
3.8	1.000E+00	3.322E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.368E-01
3.9	1.000E+00	3.265E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.344E-01
4	1.000E+00	3.209E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.321E-01
5	1.000E+00	2.744E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.130E-01
6	1.000E+00	2.396E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.864E-02
7	1.000E+00	2.126E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.753E-02
8	1.000E+00	1.911E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.867E-02
9	1.000E+00	1.736E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.147E-02
10	1.000E+00	1.590E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.546E-02
15	1.000E+00	1.119E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.607E-02
20	1.000E+00	8.640E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.557E-02
25	1.000E+00	7.030E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.894E-02
30	1.000E+00	5.930E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.441E-02
35	1.000E+00	5.120E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.108E-02
40	1.000E+00	4.510E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.857E-02
45	1.000E+00	4.030E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.659E-02
50	1.000E+00	3.640E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.499E-02
55	1.000E+00	3.320E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.367E-02
60	1.000E+00	3.050E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.256E-02
65	1.000E+00	2.830E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.165E-02
70	1.000E+00	2.630E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.083E-02
75	1.000E+00	2.460E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.013E-02
80	1.000E+00	2.310E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.510E-03
85	1.000E+00	2.180E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.975E-03
90	1.000E+00	2.060E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.481E-03
95	1.000E+00	1.950E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.028E-03
100	1.000E+00	1.860E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.658E-03
200	1.000E+00	9.400E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.870E-03
300	1.000E+00	6.300E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.594E-03
400	1.000E+00	4.700E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.935E-03
500	1.000E+00	3.800E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.564E-03
600	1.000E+00	3.100E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.276E-03
700	1.000E+00	2.700E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.112E-03
800	1.000E+00	2.400E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.881E-04
900	1.000E+00	2.100E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.646E-04

Table A-13: Ne-24 A_{eq} Based on Air Changes Per Hour

ACH	Ne-24	Na-24
0	1.000E+00	9.999E-01
0.1	1.000E+00	3.166E-01
0.18	**1.000E+00**	**2.047E-01**
0.2	1.000E+00	1.881E-01
0.3	1.000E+00	1.338E-01
0.4	1.000E+00	1.038E-01
0.5	1.000E+00	8.480E-02
0.6	**1.000E+00**	**7.170E-02**
0.7	1.000E+00	6.210E-02
0.8	1.000E+00	5.470E-02
0.9	1.000E+00	4.900E-02
1	1.000E+00	4.430E-02
1.1	1.000E+00	4.040E-02
1.2	1.000E+00	3.720E-02
1.3	1.000E+00	3.440E-02
1.4	1.000E+00	3.200E-02
1.5	1.000E+00	3.000E-02
1.6	1.000E+00	2.810E-02
1.7	1.000E+00	2.650E-02
1.8	1.000E+00	2.510E-02
1.9	1.000E+00	2.380E-02
2	1.000E+00	2.260E-02
2.1	1.000E+00	2.160E-02
2.2	1.000E+00	2.060E-02
2.3	1.000E+00	1.970E-02
2.4	1.000E+00	1.890E-02
2.5	1.000E+00	1.820E-02
2.6	1.000E+00	1.750E-02
2.7	1.000E+00	1.690E-02
2.8	1.000E+00	1.630E-02
2.9	1.000E+00	1.570E-02
3	1.000E+00	1.520E-02
3.1	1.000E+00	1.470E-02
3.2	1.000E+00	1.430E-02
3.3	1.000E+00	1.380E-02
3.4	1.000E+00	1.340E-02
3.5	1.000E+00	1.310E-02
3.6	1.000E+00	1.270E-02
3.7	1.000E+00	1.240E-02
3.8	1.000E+00	1.200E-02
3.9	1.000E+00	1.170E-02
4	1.000E+00	1.150E-02
5	1.000E+00	9.200E-03
6	1.000E+00	7.700E-03
7	1.000E+00	6.600E-03
8	1.000E+00	5.800E-03
9	1.000E+00	5.100E-03
10	1.000E+00	4.600E-03
15	1.000E+00	3.100E-03
20	1.000E+00	2.300E-03
25	1.000E+00	1.900E-03
30	1.000E+00	1.500E-03
35	1.000E+00	1.300E-03
40	1.000E+00	1.200E-03
45	1.000E+00	1.000E-03
50	1.000E+00	9.000E-04
55	1.000E+00	8.000E-04
60	1.000E+00	8.000E-04
65	1.000E+00	7.000E-04
70	1.000E+00	7.000E-04
75	1.000E+00	6.000E-04
80	1.000E+00	6.000E-04
85	1.000E+00	5.000E-04
90	1.000E+00	5.000E-04
95	1.000E+00	5.000E-04
100	1.000E+00	5.000E-04
200	1.000E+00	2.000E-04
300	1.000E+00	2.000E-04
400	1.000E+00	1.000E-04
500	1.000E+00	1.000E-04
600	1.000E+00	1.000E-04
700	1.000E+00	1.000E-04
800	1.000E+00	1.000E-04
900	1.000E+00	1.000E-04

Table A-14: Ar-42 A_{eq} Based on Air Changes Per Hour

ACH	Ar-42	K-42
0	1.000E+00	1.000E+00
0.1	1.000E+00	3.593E-01
0.18	**1.000E+00**	**2.375E-01**
0.2	1.000E+00	2.190E-01
0.3	1.000E+00	1.575E-01
0.4	1.000E+00	1.230E-01
0.5	1.000E+00	1.008E-01
0.6	**1.000E+00**	**8.550E-02**
0.7	1.000E+00	7.420E-02
0.8	1.000E+00	6.550E-02
0.9	1.000E+00	5.870E-02
1	1.000E+00	5.310E-02
1.1	1.000E+00	4.850E-02
1.2	1.000E+00	4.460E-02
1.3	1.000E+00	4.140E-02
1.4	1.000E+00	3.850E-02
1.5	1.000E+00	3.600E-02
1.6	1.000E+00	3.390E-02
1.7	1.000E+00	3.190E-02
1.8	1.000E+00	3.020E-02
1.9	1.000E+00	2.870E-02
2	1.000E+00	2.730E-02
2.1	1.000E+00	2.600E-02
2.2	1.000E+00	2.490E-02
2.3	1.000E+00	2.380E-02
2.4	1.000E+00	2.280E-02
2.5	1.000E+00	2.190E-02
2.6	1.000E+00	2.110E-02
2.7	1.000E+00	2.030E-02
2.8	1.000E+00	1.960E-02
2.9	1.000E+00	1.900E-02
3	1.000E+00	1.840E-02
3.1	1.000E+00	1.780E-02
3.2	1.000E+00	1.720E-02
3.3	1.000E+00	1.670E-02
3.4	1.000E+00	1.620E-02
3.5	1.000E+00	1.580E-02
3.6	1.000E+00	1.530E-02
3.7	1.000E+00	1.490E-02
3.8	1.000E+00	1.450E-02
3.9	1.000E+00	1.420E-02
4	1.000E+00	1.380E-02
5	1.000E+00	1.110E-02
6	1.000E+00	9.300E-03
7	1.000E+00	7.900E-03
8	1.000E+00	7.000E-03
9	1.000E+00	6.200E-03
10	1.000E+00	5.600E-03
15	1.000E+00	3.700E-03
20	1.000E+00	2.800E-03
25	1.000E+00	2.200E-03
30	1.000E+00	1.900E-03
35	1.000E+00	1.600E-03
40	1.000E+00	1.400E-03
45	1.000E+00	1.200E-03
50	1.000E+00	1.100E-03
55	1.000E+00	1.000E-03
60	1.000E+00	9.000E-04
65	1.000E+00	9.000E-04
70	1.000E+00	8.000E-04
75	1.000E+00	7.000E-04
80	1.000E+00	7.000E-04
85	1.000E+00	7.000E-04
90	1.000E+00	6.000E-04
95	1.000E+00	6.000E-04
100	1.000E+00	6.000E-04
200	1.000E+00	3.000E-04
300	1.000E+00	2.000E-04
400	1.000E+00	1.000E-04
500	1.000E+00	1.000E-04
600	1.000E+00	1.000E-04
700	1.000E+00	1.000E-04
800	1.000E+00	1.000E-04
900	1.000E+00	1.000E-04

Table A-15: Ar-43 A_{eq} Based on Air Changes Per Hour

ACH	Ar-43	K-43
0	1.000E+00	9.981E-01
0.1	1.000E+00	2.371E-01
0.18	**1.000E+00**	**1.473E-01**
0.2	1.000E+00	1.345E-01
0.3	1.000E+00	9.390E-02
0.4	1.000E+00	7.210E-02
0.5	1.000E+00	5.850E-02
0.6	**1.000E+00**	**4.930E-02**
0.7	1.000E+00	4.250E-02
0.8	1.000E+00	3.740E-02
0.9	1.000E+00	3.340E-02
1	1.000E+00	3.010E-02
1.1	1.000E+00	2.750E-02
1.2	1.000E+00	2.520E-02
1.3	1.000E+00	2.340E-02
1.4	1.000E+00	2.170E-02
1.5	1.000E+00	2.030E-02
1.6	1.000E+00	1.910E-02
1.7	1.000E+00	1.800E-02
1.8	1.000E+00	1.700E-02
1.9	1.000E+00	1.610E-02
2	1.000E+00	1.530E-02
2.1	1.000E+00	1.460E-02
2.2	1.000E+00	1.390E-02
2.3	1.000E+00	1.330E-02
2.4	1.000E+00	1.280E-02
2.5	1.000E+00	1.230E-02
2.6	1.000E+00	1.180E-02
2.7	1.000E+00	1.140E-02
2.8	1.000E+00	1.100E-02
2.9	1.000E+00	1.060E-02
3	1.000E+00	1.030E-02
3.1	1.000E+00	9.900E-03
3.2	1.000E+00	9.600E-03
3.3	1.000E+00	9.300E-03
3.4	1.000E+00	9.100E-03
3.5	1.000E+00	8.800E-03
3.6	1.000E+00	8.600E-03
3.7	1.000E+00	8.300E-03

ACH	Ar-42	K-43
3.8	1.000E+00	8.100E-03
3.9	1.000E+00	7.900E-03
4	1.000E+00	7.700E-03
5	1.000E+00	6.200E-03
6	1.000E+00	5.200E-03
7	1.000E+00	4.400E-03
8	1.000E+00	3.900E-03
9	1.000E+00	3.400E-03
10	1.000E+00	3.100E-03
15	1.000E+00	2.100E-03
20	1.000E+00	1.600E-03
25	1.000E+00	1.200E-03
30	1.000E+00	1.000E-03
35	1.000E+00	9.000E-04
40	1.000E+00	8.000E-04
45	1.000E+00	7.000E-04
50	1.000E+00	6.000E-04
55	1.000E+00	6.000E-04
60	1.000E+00	5.000E-04
65	1.000E+00	5.000E-04
70	1.000E+00	4.000E-04
75	1.000E+00	4.000E-04
80	1.000E+00	4.000E-04
85	1.000E+00	4.000E-04
90	1.000E+00	3.000E-04
95	1.000E+00	3.000E-04
100	1.000E+00	3.000E-04
200	1.000E+00	2.000E-04
300	1.000E+00	1.000E-04
400	1.000E+00	1.000E-04
500	1.000E+00	1.000E-04
600	1.000E+00	1.000E-04
700	1.000E+00	0.000E+00
800	1.000E+00	0.000E+00
900	1.000E+00	0.000E+00

Table A-16: Ar-44 A_{eq} Based on Air Changes Per Hour

ACH	Ar-44	K-44
0	1.000E+00	1.000E+00
0.1	1.000E+00	9.495E-01
0.18	**1.000E+00**	**9.126E-01**
0.2	1.000E+00	9.038E-01
0.3	1.000E+00	8.623E-01
0.4	1.000E+00	8.245E-01
0.5	1.000E+00	7.899E-01
0.6	**1.000E+00**	**7.580E-01**
0.7	1.000E+00	7.286E-01
0.8	1.000E+00	7.014E-01
0.9	1.000E+00	6.762E-01
1	1.000E+00	6.527E-01
1.1	1.000E+00	6.308E-01
1.2	1.000E+00	6.103E-01
1.3	1.000E+00	5.911E-01
1.4	1.000E+00	5.731E-01
1.5	1.000E+00	5.561E-01
1.6	1.000E+00	5.401E-01
1.7	1.000E+00	5.250E-01
1.8	1.000E+00	5.108E-01
1.9	1.000E+00	4.973E-01
2	1.000E+00	4.844E-01
2.1	1.000E+00	4.723E-01
2.2	1.000E+00	4.607E-01
2.3	1.000E+00	4.497E-01
2.4	1.000E+00	4.392E-01
2.5	1.000E+00	4.291E-01
2.6	1.000E+00	4.196E-01
2.7	1.000E+00	4.104E-01
2.8	1.000E+00	4.016E-01
2.9	1.000E+00	3.932E-01
3	1.000E+00	3.852E-01
3.1	1.000E+00	3.774E-01
3.2	1.000E+00	3.700E-01
3.3	1.000E+00	3.628E-01
3.4	1.000E+00	3.560E-01
3.5	1.000E+00	3.494E-01
3.6	1.000E+00	3.430E-01
3.7	1.000E+00	3.368E-01
3.8	1.000E+00	3.309E-01
3.9	1.000E+00	3.252E-01
4	1.000E+00	3.196E-01
5	1.000E+00	2.732E-01
6	1.000E+00	2.385E-01
7	1.000E+00	2.116E-01
8	1.000E+00	1.902E-01
9	1.000E+00	1.727E-01
10	1.000E+00	1.582E-01
15	1.000E+00	1.113E-01
20	1.000E+00	8.590E-02
25	1.000E+00	6.990E-02
30	1.000E+00	5.900E-02
35	1.000E+00	5.100E-02
40	1.000E+00	4.490E-02
45	1.000E+00	4.010E-02
50	1.000E+00	3.620E-02
55	1.000E+00	3.300E-02
60	1.000E+00	3.040E-02
65	1.000E+00	2.810E-02
70	1.000E+00	2.610E-02
75	1.000E+00	2.440E-02
80	1.000E+00	2.300E-02
85	1.000E+00	2.160E-02
90	1.000E+00	2.050E-02
95	1.000E+00	1.940E-02
100	1.000E+00	1.840E-02
200	1.000E+00	9.300E-03
300	1.000E+00	6.200E-03
400	1.000E+00	4.700E-03
500	1.000E+00	3.700E-03
600	1.000E+00	3.100E-03
700	1.000E+00	2.700E-03
800	1.000E+00	2.300E-03
900	1.000E+00	2.100E-03

Table A-17: Kr-74 A_{eq} Based on Air Changes Per Hour

ACH	Kr-74	Br-74
0	1.000E+00	1.000E+00
0.1	1.000E+00	9.424E-01
0.18	**1.000E+00**	**9.010E-01**
0.2	1.000E+00	8.911E-01
0.3	1.000E+00	8.451E-01
0.4	1.000E+00	8.037E-01
0.5	1.000E+00	7.661E-01
0.6	**1.000E+00**	**7.318E-01**
0.7	1.000E+00	7.005E-01
0.8	1.000E+00	6.718E-01
0.9	1.000E+00	6.453E-01
1	1.000E+00	6.208E-01
1.1	1.000E+00	5.982E-01
1.2	1.000E+00	5.771E-01
1.3	1.000E+00	5.574E-01
1.4	1.000E+00	5.391E-01
1.5	1.000E+00	5.219E-01
1.6	1.000E+00	5.058E-01
1.7	1.000E+00	4.906E-01
1.8	1.000E+00	4.763E-01
1.9	1.000E+00	4.629E-01
2	1.000E+00	4.501E-01
2.1	1.000E+00	4.381E-01
2.2	1.000E+00	4.267E-01
2.3	1.000E+00	4.159E-01
2.4	1.000E+00	4.056E-01
2.5	1.000E+00	3.957E-01
2.6	1.000E+00	3.864E-01
2.7	1.000E+00	3.775E-01
2.8	1.000E+00	3.690E-01
2.9	1.000E+00	3.609E-01
3	1.000E+00	3.531E-01
3.1	1.000E+00	3.456E-01
3.2	1.000E+00	3.385E-01
3.3	1.000E+00	3.316E-01
3.4	1.000E+00	3.250E-01
3.5	1.000E+00	3.187E-01
3.6	1.000E+00	3.126E-01
3.7	1.000E+00	3.068E-01
3.8	1.000E+00	3.011E-01
3.9	1.000E+00	2.957E-01
4	1.000E+00	2.904E-01
5	1.000E+00	2.467E-01
6	1.000E+00	2.144E-01
7	1.000E+00	1.896E-01
8	1.000E+00	1.699E-01
9	1.000E+00	1.539E-01
10	1.000E+00	1.407E-01
15	1.000E+00	9.840E-02
20	1.000E+00	7.570E-02
25	1.000E+00	6.150E-02
30	1.000E+00	5.180E-02
35	1.000E+00	4.470E-02
40	1.000E+00	3.930E-02
45	1.000E+00	3.510E-02
50	1.000E+00	3.170E-02
55	1.000E+00	2.890E-02
60	1.000E+00	2.660E-02
65	1.000E+00	2.460E-02
70	1.000E+00	2.290E-02
75	1.000E+00	2.140E-02
80	1.000E+00	2.010E-02
85	1.000E+00	1.890E-02
90	1.000E+00	1.790E-02
95	1.000E+00	1.690E-02
100	1.000E+00	1.610E-02
200	1.000E+00	8.100E-03
300	1.000E+00	5.400E-03
400	1.000E+00	4.100E-03
500	1.000E+00	3.300E-03
600	1.000E+00	2.700E-03
700	1.000E+00	2.300E-03
800	1.000E+00	2.000E-03
900	1.000E+00	1.800E-03

Table A-18: Kr-75 A_{eq} Based on Air Changes Per Hour

ACH	Kr-75	Br-75	Se-75
0	1.000E+00	1.000E+00	4.650E-02
0.1	1.000E+00	8.113E-01	2.000E-03
0.18	**1.000E+00**	**7.050E-01**	**9.000E-04**
0.2	1.000E+00	6.826E-01	8.000E-04
0.3	1.000E+00	5.891E-01	5.000E-04
0.4	1.000E+00	5.181E-01	3.000E-04
0.5	1.000E+00	4.624E-01	2.000E-04
0.6	**1.000E+00**	**4.175E-01**	**2.000E-04**
0.7	1.000E+00	3.806E-01	1.000E-04
0.8	1.000E+00	3.496E-01	1.000E-04
0.9	1.000E+00	3.233E-01	1.000E-04
1	1.000E+00	3.007E-01	1.000E-04
1.1	1.000E+00	2.811E-01	1.000E-04
1.2	1.000E+00	2.638E-01	1.000E-04
1.3	1.000E+00	2.486E-01	0.000E+00
1.4	1.000E+00	2.350E-01	0.000E+00
1.5	1.000E+00	2.228E-01	0.000E+00
1.6	1.000E+00	2.119E-01	0.000E+00
1.7	1.000E+00	2.019E-01	0.000E+00
1.8	1.000E+00	1.929E-01	0.000E+00
1.9	1.000E+00	1.846E-01	0.000E+00
2	1.000E+00	1.770E-01	0.000E+00
2.1	1.000E+00	1.700E-01	0.000E+00
2.2	1.000E+00	1.635E-01	0.000E+00
2.3	1.000E+00	1.575E-01	0.000E+00
2.4	1.000E+00	1.520E-01	0.000E+00
2.5	1.000E+00	1.468E-01	0.000E+00
2.6	1.000E+00	1.419E-01	0.000E+00
2.7	1.000E+00	1.374E-01	0.000E+00
2.8	1.000E+00	1.331E-01	0.000E+00
2.9	1.000E+00	1.292E-01	0.000E+00
3	1.000E+00	1.254E-01	0.000E+00
3.1	1.000E+00	1.218E-01	0.000E+00
3.2	1.000E+00	1.185E-01	0.000E+00
3.3	1.000E+00	1.153E-01	0.000E+00
3.4	1.000E+00	1.123E-01	0.000E+00
3.5	1.000E+00	1.094E-01	0.000E+00
3.6	1.000E+00	1.067E-01	0.000E+00
3.7	1.000E+00	1.041E-01	0.000E+00
3.8	1.000E+00	1.017E-01	0.000E+00
3.9	1.000E+00	9.930E-02	0.000E+00
4	1.000E+00	9.710E-02	0.000E+00
5	1.000E+00	7.920E-02	0.000E+00
6	1.000E+00	6.690E-02	0.000E+00
7	1.000E+00	5.790E-02	0.000E+00
8	1.000E+00	5.100E-02	0.000E+00
9	1.000E+00	4.560E-02	0.000E+00
10	1.000E+00	4.120E-02	0.000E+00
15	1.000E+00	2.790E-02	0.000E+00
20	1.000E+00	2.110E-02	0.000E+00
25	1.000E+00	1.690E-02	0.000E+00
30	1.000E+00	1.410E-02	0.000E+00
35	1.000E+00	1.210E-02	0.000E+00
40	1.000E+00	1.060E-02	0.000E+00
45	1.000E+00	9.500E-03	0.000E+00
50	1.000E+00	8.500E-03	0.000E+00
55	1.000E+00	7.800E-03	0.000E+00
60	1.000E+00	7.100E-03	0.000E+00
65	1.000E+00	6.600E-03	0.000E+00
70	1.000E+00	6.100E-03	0.000E+00
75	1.000E+00	5.700E-03	0.000E+00
80	1.000E+00	5.300E-03	0.000E+00
85	1.000E+00	5.000E-03	0.000E+00
90	1.000E+00	4.800E-03	0.000E+00
95	1.000E+00	4.500E-03	0.000E+00
100	1.000E+00	4.300E-03	0.000E+00
200	1.000E+00	2.100E-03	0.000E+00
300	1.000E+00	1.400E-03	0.000E+00
400	1.000E+00	1.100E-03	0.000E+00
500	1.000E+00	9.000E-04	0.000E+00
600	1.000E+00	7.000E-04	0.000E+00
700	1.000E+00	6.000E-04	0.000E+00
800	1.000E+00	5.000E-04	0.000E+00
900	1.000E+00	5.000E-04	0.000E+00

Table A-19: Kr-76 A_{eq} Based on Air Changes Per Hour

ACH	Kr-76	Br-76m	Br-76
0	1.000E+00	8.100E-03	9.998E-01
0.1	1.000E+00	8.100E-03	2.996E-01
0.18	**1.000E+00**	**8.100E-03**	**1.920E-01**
0.2	1.000E+00	8.100E-03	1.762E-01
0.3	1.000E+00	8.100E-03	1.248E-01
0.4	1.000E+00	8.100E-03	9.660E-02
0.5	1.000E+00	8.100E-03	7.880E-02
0.6	**1.000E+00**	**8.100E-03**	**6.660E-02**
0.7	1.000E+00	8.100E-03	5.760E-02
0.8	1.000E+00	8.100E-03	5.080E-02
0.9	1.000E+00	8.100E-03	4.540E-02
1	1.000E+00	8.100E-03	4.100E-02
1.1	1.000E+00	8.100E-03	3.740E-02
1.2	1.000E+00	8.100E-03	3.440E-02
1.3	1.000E+00	8.100E-03	3.190E-02
1.4	1.000E+00	8.100E-03	2.970E-02
1.5	1.000E+00	8.100E-03	2.770E-02
1.6	1.000E+00	8.100E-03	2.600E-02
1.7	1.000E+00	8.100E-03	2.460E-02
1.8	1.000E+00	8.100E-03	2.320E-02
1.9	1.000E+00	8.100E-03	2.200E-02
2	1.000E+00	8.100E-03	2.090E-02
2.1	1.000E+00	8.100E-03	2.000E-02
2.2	1.000E+00	8.100E-03	1.910E-02
2.3	1.000E+00	8.100E-03	1.830E-02
2.4	1.000E+00	8.100E-03	1.750E-02
2.5	1.000E+00	8.100E-03	1.680E-02
2.6	1.000E+00	8.100E-03	1.620E-02
2.7	1.000E+00	8.100E-03	1.560E-02
2.8	1.000E+00	8.100E-03	1.510E-02
2.9	1.000E+00	8.100E-03	1.450E-02
3	1.000E+00	8.100E-03	1.410E-02
3.1	1.000E+00	8.100E-03	1.360E-02
3.2	1.000E+00	8.100E-03	1.320E-02
3.3	1.000E+00	8.100E-03	1.280E-02
3.4	1.000E+00	8.100E-03	1.240E-02
3.5	1.000E+00	8.100E-03	1.210E-02
3.6	1.000E+00	8.100E-03	1.170E-02
3.7	1.000E+00	8.100E-03	1.140E-02

ACH	Kr-76	Br-76m	Br-76
3.8	1.000E+00	8.100E-03	1.110E-02
3.9	1.000E+00	8.100E-03	1.090E-02
4	1.000E+00	8.100E-03	1.060E-02
5	1.000E+00	8.100E-03	8.500E-03
6	1.000E+00	8.100E-03	7.100E-03
7	1.000E+00	8.100E-03	6.100E-03
8	1.000E+00	8.100E-03	5.300E-03
9	1.000E+00	8.100E-03	4.700E-03
10	1.000E+00	8.100E-03	4.300E-03
15	1.000E+00	8.100E-03	2.800E-03
20	1.000E+00	8.000E-03	2.100E-03
25	1.000E+00	8.000E-03	1.700E-03
30	1.000E+00	8.000E-03	1.400E-03
35	1.000E+00	8.000E-03	1.200E-03
40	1.000E+00	7.900E-03	1.100E-03
45	1.000E+00	7.900E-03	9.000E-04
50	1.000E+00	7.900E-03	9.000E-04
55	1.000E+00	7.900E-03	8.000E-04
60	1.000E+00	7.900E-03	7.000E-04
65	1.000E+00	7.800E-03	7.000E-04
70	1.000E+00	7.800E-03	6.000E-04
75	1.000E+00	7.800E-03	6.000E-04
80	1.000E+00	7.800E-03	5.000E-04
85	1.000E+00	7.800E-03	5.000E-04
90	1.000E+00	7.700E-03	5.000E-04
95	1.000E+00	7.700E-03	5.000E-04
100	1.000E+00	7.700E-03	4.000E-04
200	1.000E+00	7.300E-03	2.000E-04
300	1.000E+00	7.000E-03	1.000E-04
400	1.000E+00	6.700E-03	1.000E-04
500	1.000E+00	6.400E-03	1.000E-04
600	1.000E+00	6.200E-03	1.000E-04
700	1.000E+00	5.900E-03	1.000E-04
800	1.000E+00	5.700E-03	1.000E-04
900	1.000E+00	5.500E-03	0.000E+00

Table A-20: Kr-77 A_{eq} Based on Air Changes Per Hour

ACH	Kr-77	Br-77m	Br-77
0	1.000E+00	9.610E-02	9.124E-01
0.1	1.000E+00	9.520E-02	1.083E-01
0.18	**1.000E+00**	**9.440E-02**	**6.310E-02**
0.2	1.000E+00	9.420E-02	5.720E-02
0.3	1.000E+00	9.330E-02	3.880E-02
0.4	1.000E+00	9.230E-02	2.940E-02
0.5	1.000E+00	9.140E-02	2.360E-02
0.6	**1.000E+00**	**9.050E-02**	**1.970E-02**
0.7	1.000E+00	8.970E-02	1.700E-02
0.8	1.000E+00	8.880E-02	1.490E-02
0.9	1.000E+00	8.800E-02	1.320E-02
1	1.000E+00	8.720E-02	1.190E-02
1.1	1.000E+00	8.640E-02	1.080E-02
1.2	1.000E+00	8.560E-02	9.900E-03
1.3	1.000E+00	8.480E-02	9.200E-03
1.4	1.000E+00	8.400E-02	8.500E-03
1.5	1.000E+00	8.330E-02	7.900E-03
1.6	1.000E+00	8.250E-02	7.400E-03
1.7	1.000E+00	8.180E-02	7.000E-03
1.8	1.000E+00	8.110E-02	6.600E-03
1.9	1.000E+00	8.040E-02	6.300E-03
2	1.000E+00	7.970E-02	5.900E-03
2.1	1.000E+00	7.910E-02	5.700E-03
2.2	1.000E+00	7.840E-02	5.400E-03
2.3	1.000E+00	7.770E-02	5.200E-03
2.4	1.000E+00	7.710E-02	4.900E-03
2.5	1.000E+00	7.650E-02	4.700E-03
2.6	1.000E+00	7.580E-02	4.600E-03
2.7	1.000E+00	7.520E-02	4.400E-03
2.8	1.000E+00	7.460E-02	4.200E-03
2.9	1.000E+00	7.400E-02	4.100E-03
3	1.000E+00	7.350E-02	3.900E-03
3.1	1.000E+00	7.290E-02	3.800E-03
3.2	1.000E+00	7.230E-02	3.700E-03
3.3	1.000E+00	7.180E-02	3.600E-03
3.4	1.000E+00	7.120E-02	3.500E-03
3.5	1.000E+00	7.070E-02	3.400E-03
3.6	1.000E+00	7.010E-02	3.300E-03
3.7	1.000E+00	6.960E-02	3.200E-03
3.8	1.000E+00	6.910E-02	3.100E-03
3.9	1.000E+00	6.860E-02	3.000E-03
4	1.000E+00	6.810E-02	2.900E-03
5	1.000E+00	6.350E-02	2.300E-03
6	1.000E+00	5.940E-02	1.900E-03
7	1.000E+00	5.590E-02	1.700E-03
8	1.000E+00	5.270E-02	1.500E-03
9	1.000E+00	4.990E-02	1.300E-03
10	1.000E+00	4.740E-02	1.200E-03
15	1.000E+00	3.780E-02	8.000E-04
20	1.000E+00	3.140E-02	6.000E-04
25	1.000E+00	2.690E-02	5.000E-04
30	1.000E+00	2.350E-02	4.000E-04
35	1.000E+00	2.090E-02	3.000E-04
40	1.000E+00	1.880E-02	3.000E-04
45	1.000E+00	1.710E-02	2.000E-04
50	1.000E+00	1.560E-02	2.000E-04
55	1.000E+00	1.440E-02	2.000E-04
60	1.000E+00	1.340E-02	2.000E-04
65	1.000E+00	1.250E-02	2.000E-04
70	1.000E+00	1.170E-02	2.000E-04
75	1.000E+00	1.100E-02	1.000E-04
80	1.000E+00	1.040E-02	1.000E-04
85	1.000E+00	9.900E-03	1.000E-04
90	1.000E+00	9.400E-03	1.000E-04
95	1.000E+00	8.900E-03	1.000E-04
100	1.000E+00	8.500E-03	1.000E-04
200	1.000E+00	4.500E-03	1.000E-04
300	1.000E+00	3.000E-03	0.000E+00
400	1.000E+00	2.300E-03	0.000E+00
500	1.000E+00	1.800E-03	0.000E+00
600	1.000E+00	1.500E-03	0.000E+00
700	1.000E+00	1.300E-03	0.000E+00
800	1.000E+00	1.200E-03	0.000E+00
900	1.000E+00	1.000E-03	3.100E-03

Table A-21: Kr-88 A_{eq} Based on Air Changes Per Hour

ACH	Kr-88	Rb-88
0	1.000E+00	1.000E+00
0.1	1.000E+00	9.590E-01
0.18	**1.000E+00**	**9.285E-01**
0.2	1.000E+00	9.212E-01
0.3	1.000E+00	8.863E-01
0.4	1.000E+00	8.540E-01
0.5	1.000E+00	8.239E-01
0.6	**1.000E+00**	**7.959E-01**
0.7	1.000E+00	7.697E-01
0.8	1.000E+00	7.451E-01
0.9	1.000E+00	7.221E-01
1	1.000E+00	7.005E-01
1.1	1.000E+00	6.801E-01
1.2	1.000E+00	6.609E-01
1.3	1.000E+00	6.428E-01
1.4	1.000E+00	6.256E-01
1.5	1.000E+00	6.093E-01
1.6	1.000E+00	5.938E-01
1.7	1.000E+00	5.791E-01
1.8	1.000E+00	5.651E-01
1.9	1.000E+00	5.518E-01
2	1.000E+00	5.391E-01
2.1	1.000E+00	5.269E-01
2.2	1.000E+00	5.153E-01
2.3	1.000E+00	5.042E-01
2.4	1.000E+00	4.936E-01
2.5	1.000E+00	4.834E-01
2.6	1.000E+00	4.736E-01
2.7	1.000E+00	4.642E-01
2.8	1.000E+00	4.552E-01
2.9	1.000E+00	4.465E-01
3	1.000E+00	4.381E-01
3.1	1.000E+00	4.301E-01
3.2	1.000E+00	4.223E-01
3.3	1.000E+00	4.148E-01
3.4	1.000E+00	4.076E-01
3.5	1.000E+00	4.006E-01
3.6	1.000E+00	3.938E-01
3.7	1.000E+00	3.873E-01
3.8	1.000E+00	3.810E-01
3.9	1.000E+00	3.749E-01
4	1.000E+00	3.690E-01
5	1.000E+00	3.187E-01
6	1.000E+00	2.805E-01
7	1.000E+00	2.505E-01
8	1.000E+00	2.262E-01
9	1.000E+00	2.063E-01
10	1.000E+00	1.896E-01
15	1.000E+00	1.349E-01
20	1.000E+00	1.047E-01
25	1.000E+00	8.560E-02
30	1.000E+00	7.230E-02
35	1.000E+00	6.260E-02
40	1.000E+00	5.520E-02
45	1.000E+00	4.940E-02
50	1.000E+00	4.470E-02
55	1.000E+00	4.080E-02
60	1.000E+00	3.750E-02
65	1.000E+00	3.470E-02
70	1.000E+00	3.230E-02
75	1.000E+00	3.020E-02
80	1.000E+00	2.840E-02
85	1.000E+00	2.680E-02
90	1.000E+00	2.530E-02
95	1.000E+00	2.400E-02
100	1.000E+00	2.290E-02
200	1.000E+00	1.160E-02
300	1.000E+00	7.700E-03
400	1.000E+00	5.800E-03
500	1.000E+00	4.700E-03
600	1.000E+00	3.900E-03
700	1.000E+00	3.300E-03
800	1.000E+00	2.900E-03
900	1.000E+00	2.600E-03

Table A-22: Kr-89 A_{eq} Based on Air Changes Per Hour

ACH	Kr-89	Rb-89
0	1.000E+00	1.000E+00
0.1	1.000E+00	9.649E-01
0.18	**1.000E+00**	**9.385E-01**
0.2	1.000E+00	9.321E-01
0.3	1.000E+00	9.015E-01
0.4	1.000E+00	8.728E-01
0.5	1.000E+00	8.459E-01
0.6	**1.000E+00**	**8.206E-01**
0.7	1.000E+00	7.968E-01
0.8	1.000E+00	7.743E-01
0.9	1.000E+00	7.531E-01
1	1.000E+00	7.330E-01
1.1	1.000E+00	7.139E-01
1.2	1.000E+00	6.958E-01
1.3	1.000E+00	6.786E-01
1.4	1.000E+00	6.623E-01
1.5	1.000E+00	6.467E-01
1.6	1.000E+00	6.318E-01
1.7	1.000E+00	6.176E-01
1.8	1.000E+00	6.040E-01
1.9	1.000E+00	5.910E-01
2	1.000E+00	5.785E-01
2.1	1.000E+00	5.666E-01
2.2	1.000E+00	5.551E-01
2.3	1.000E+00	5.441E-01
2.4	1.000E+00	5.335E-01
2.5	1.000E+00	5.234E-01
2.6	1.000E+00	5.136E-01
2.7	1.000E+00	5.041E-01
2.8	1.000E+00	4.951E-01
2.9	1.000E+00	4.863E-01
3	1.000E+00	4.778E-01
3.1	1.000E+00	4.696E-01
3.2	1.000E+00	4.617E-01
3.3	1.000E+00	4.541E-01
3.4	1.000E+00	4.467E-01
3.5	1.000E+00	4.396E-01
3.6	1.000E+00	4.326E-01
3.7	1.000E+00	4.259E-01

ACH	Kr-76	Br-76m
3.8	1.000E+00	4.194E-01
3.9	1.000E+00	4.131E-01
4	1.000E+00	4.070E-01
5	1.000E+00	3.544E-01
6	1.000E+00	3.139E-01
7	1.000E+00	2.817E-01
8	1.000E+00	2.555E-01
9	1.000E+00	2.337E-01
10	1.000E+00	2.154E-01
15	1.000E+00	1.547E-01
20	1.000E+00	1.207E-01
25	1.000E+00	9.890E-02
30	1.000E+00	8.380E-02
35	1.000E+00	7.270E-02
40	1.000E+00	6.420E-02
45	1.000E+00	5.750E-02
50	1.000E+00	5.200E-02
55	1.000E+00	4.750E-02
60	1.000E+00	4.380E-02
65	1.000E+00	4.050E-02
70	1.000E+00	3.770E-02
75	1.000E+00	3.530E-02
80	1.000E+00	3.320E-02
85	1.000E+00	3.130E-02
90	1.000E+00	2.960E-02
95	1.000E+00	2.810E-02
100	1.000E+00	2.670E-02
200	1.000E+00	1.350E-02
300	1.000E+00	9.100E-03
400	1.000E+00	6.800E-03
500	1.000E+00	5.500E-03
600	1.000E+00	4.600E-03
700	1.000E+00	3.900E-03
800	1.000E+00	3.400E-03
900	1.000E+00	3.000E-03

Table A-23: Xe-120 A_{eq} Based on Air Changes Per Hour

ACH	Xe-120	I-120
0	1.000E+00	1.000E+00
0.1	1.000E+00	8.360E-01
0.18	**1.000E+00**	**7.390E-01**
0.2	1.000E+00	7.182E-01
0.3	1.000E+00	6.295E-01
0.4	1.000E+00	5.603E-01
0.5	1.000E+00	5.048E-01
0.6	**1.000E+00**	**4.593E-01**
0.7	1.000E+00	4.213E-01
0.8	1.000E+00	3.892E-01
0.9	1.000E+00	3.616E-01
1	1.000E+00	3.376E-01
1.1	1.000E+00	3.166E-01
1.2	1.000E+00	2.981E-01
1.3	1.000E+00	2.816E-01
1.4	1.000E+00	2.669E-01
1.5	1.000E+00	2.536E-01
1.6	1.000E+00	2.416E-01
1.7	1.000E+00	2.307E-01
1.8	1.000E+00	2.207E-01
1.9	1.000E+00	2.115E-01
2	1.000E+00	2.031E-01
2.1	1.000E+00	1.953E-01
2.2	1.000E+00	1.881E-01
2.3	1.000E+00	1.814E-01
2.4	1.000E+00	1.752E-01
2.5	1.000E+00	1.693E-01
2.6	1.000E+00	1.639E-01
2.7	1.000E+00	1.588E-01
2.8	1.000E+00	1.540E-01
2.9	1.000E+00	1.495E-01
3	1.000E+00	1.452E-01
3.1	1.000E+00	1.412E-01
3.2	1.000E+00	1.374E-01
3.3	1.000E+00	1.338E-01
3.4	1.000E+00	1.304E-01
3.5	1.000E+00	1.271E-01
3.6	1.000E+00	1.240E-01
3.7	1.000E+00	1.211E-01
3.8	1.000E+00	1.183E-01
3.9	1.000E+00	1.156E-01
4	1.000E+00	1.130E-01
5	1.000E+00	9.250E-02
6	1.000E+00	7.830E-02
7	1.000E+00	6.790E-02
8	1.000E+00	5.990E-02
9	1.000E+00	5.360E-02
10	1.000E+00	4.850E-02
15	1.000E+00	3.290E-02
20	1.000E+00	2.490E-02
25	1.000E+00	2.000E-02
30	1.000E+00	1.670E-02
35	1.000E+00	1.440E-02
40	1.000E+00	1.260E-02
45	1.000E+00	1.120E-02
50	1.000E+00	1.010E-02
55	1.000E+00	9.200E-03
60	1.000E+00	8.400E-03
65	1.000E+00	7.800E-03
70	1.000E+00	7.200E-03
75	1.000E+00	6.700E-03
80	1.000E+00	6.300E-03
85	1.000E+00	6.000E-03
90	1.000E+00	5.600E-03
95	1.000E+00	5.300E-03
100	1.000E+00	5.100E-03
200	1.000E+00	2.500E-03
300	1.000E+00	1.700E-03
400	1.000E+00	1.300E-03
500	1.000E+00	1.000E-03
600	1.000E+00	8.000E-04
700	1.000E+00	7.000E-04
800	1.000E+00	6.000E-04
900	1.000E+00	6.000E-04

Table A-24: Xe-121 A_{eq} Based on Air Changes Per Hour

ACH	Xe-121	I-121
0	1.000E+00	1.000E+00
0.1	1.000E+00	7.658E-01
0.18	**1.000E+00**	**6.449E-01**
0.2	1.000E+00	6.205E-01
0.3	1.000E+00	5.215E-01
0.4	1.000E+00	4.498E-01
0.5	1.000E+00	3.954E-01
0.6	**1.000E+00**	**3.527E-01**
0.7	1.000E+00	3.184E-01
0.8	1.000E+00	2.901E-01
0.9	1.000E+00	2.665E-01
1	1.000E+00	2.464E-01
1.1	1.000E+00	2.291E-01
1.2	1.000E+00	2.141E-01
1.3	1.000E+00	2.010E-01
1.4	1.000E+00	1.893E-01
1.5	1.000E+00	1.790E-01
1.6	1.000E+00	1.697E-01
1.7	1.000E+00	1.613E-01
1.8	1.000E+00	1.537E-01
1.9	1.000E+00	1.468E-01
2	1.000E+00	1.405E-01
2.1	1.000E+00	1.347E-01
2.2	1.000E+00	1.294E-01
2.3	1.000E+00	1.245E-01
2.4	1.000E+00	1.199E-01
2.5	1.000E+00	1.157E-01
2.6	1.000E+00	1.117E-01
2.7	1.000E+00	1.080E-01
2.8	1.000E+00	1.046E-01
2.9	1.000E+00	1.013E-01
3	1.000E+00	9.830E-02
3.1	1.000E+00	9.540E-02
3.2	1.000E+00	9.270E-02
3.3	1.000E+00	9.010E-02
3.4	1.000E+00	8.770E-02
3.5	1.000E+00	8.540E-02
3.6	1.000E+00	8.330E-02
3.7	1.000E+00	8.120E-02
3.8	1.000E+00	7.920E-02
3.9	1.000E+00	7.740E-02
4	1.000E+00	7.560E-02
5	1.000E+00	6.140E-02
6	1.000E+00	5.170E-02
7	1.000E+00	4.460E-02
8	1.000E+00	3.930E-02
9	1.000E+00	3.510E-02
10	1.000E+00	3.170E-02
15	1.000E+00	2.130E-02
20	1.000E+00	1.610E-02
25	1.000E+00	1.290E-02
30	1.000E+00	1.080E-02
35	1.000E+00	9.300E-03
40	1.000E+00	8.100E-03
45	1.000E+00	7.200E-03
50	1.000E+00	6.500E-03
55	1.000E+00	5.900E-03
60	1.000E+00	5.400E-03
65	1.000E+00	5.000E-03
70	1.000E+00	4.600E-03
75	1.000E+00	4.300E-03
80	1.000E+00	4.100E-03
85	1.000E+00	3.800E-03
90	1.000E+00	3.600E-03
95	1.000E+00	3.400E-03
100	1.000E+00	3.300E-03
200	1.000E+00	1.600E-03
300	1.000E+00	1.100E-03
400	1.000E+00	8.000E-04
500	1.000E+00	7.000E-04
600	1.000E+00	5.000E-04
700	1.000E+00	5.000E-04
800	1.000E+00	4.000E-04
900	1.000E+00	4.000E-04

Table A-25: Xe-122 A_{eq} Based on Air Changes Per Hour

ACH	Xe-122	I-122
0	1.000E+00	1.000E+00
0.1	1.000E+00	9.913E-01
0.18	**1.000E+00**	**9.845E-01**
0.2	1.000E+00	9.828E-01
0.3	1.000E+00	9.745E-01
0.4	1.000E+00	9.663E-01
0.5	1.000E+00	9.582E-01
0.6	**1.000E+00**	**9.502E-01**
0.7	1.000E+00	9.424E-01
0.8	1.000E+00	9.347E-01
0.9	1.000E+00	9.272E-01
1	1.000E+00	9.197E-01
1.1	1.000E+00	9.124E-01
1.2	1.000E+00	9.052E-01
1.3	1.000E+00	8.981E-01
1.4	1.000E+00	8.911E-01
1.5	1.000E+00	8.842E-01
1.6	1.000E+00	8.775E-01
1.7	1.000E+00	8.708E-01
1.8	1.000E+00	8.642E-01
1.9	1.000E+00	8.578E-01
2	1.000E+00	8.514E-01
2.1	1.000E+00	8.451E-01
2.2	1.000E+00	8.389E-01
2.3	1.000E+00	8.328E-01
2.4	1.000E+00	8.268E-01
2.5	1.000E+00	8.209E-01
2.6	1.000E+00	8.150E-01
2.7	1.000E+00	8.093E-01
2.8	1.000E+00	8.036E-01
2.9	1.000E+00	7.980E-01
3	1.000E+00	7.925E-01
3.1	1.000E+00	7.870E-01
3.2	1.000E+00	7.817E-01
3.3	1.000E+00	7.764E-01
3.4	1.000E+00	7.712E-01
3.5	1.000E+00	7.660E-01
3.6	1.000E+00	7.609E-01
3.7	1.000E+00	7.559E-01
3.8	1.000E+00	7.509E-01
3.9	1.000E+00	7.460E-01
4	1.000E+00	7.412E-01
5	1.000E+00	6.962E-01
6	1.000E+00	6.563E-01
7	1.000E+00	6.207E-01
8	1.000E+00	5.888E-01
9	1.000E+00	5.601E-01
10	1.000E+00	5.340E-01
15	1.000E+00	4.330E-01
20	1.000E+00	3.642E-01
25	1.000E+00	3.143E-01
30	1.000E+00	2.764E-01
35	1.000E+00	2.466E-01
40	1.000E+00	2.227E-01
45	1.000E+00	2.029E-01
50	1.000E+00	1.864E-01
55	1.000E+00	1.724E-01
60	1.000E+00	1.603E-01
65	1.000E+00	1.498E-01
70	1.000E+00	1.407E-01
75	1.000E+00	1.325E-01
80	1.000E+00	1.253E-01
85	1.000E+00	1.188E-01
90	1.000E+00	1.129E-01
95	1.000E+00	1.076E-01
100	1.000E+00	1.028E-01
200	1.000E+00	5.420E-02
300	1.000E+00	3.680E-02
400	1.000E+00	2.780E-02
500	1.000E+00	2.240E-02
600	1.000E+00	1.870E-02
700	1.000E+00	1.610E-02
800	1.000E+00	1.410E-02
900	1.000E+00	1.260E-02

Table A-26: Xe-123 A_{eq} Based on Air Changes Per Hour

ACH	Xe-122	I-122
0	1.000E+00	1.000E+00
0.1	1.000E+00	3.431E-01
0.18	**1.000E+00**	**2.249E-01**
0.2	1.000E+00	2.071E-01
0.3	1.000E+00	1.483E-01
0.4	1.000E+00	1.155E-01
0.5	1.000E+00	9.460E-02
0.6	**1.000E+00**	**8.010E-02**
0.7	1.000E+00	6.940E-02
0.8	1.000E+00	6.130E-02
0.9	1.000E+00	5.490E-02
1	1.000E+00	4.960E-02
1.1	1.000E+00	4.530E-02
1.2	1.000E+00	4.170E-02
1.3	1.000E+00	3.860E-02
1.4	1.000E+00	3.600E-02
1.5	1.000E+00	3.370E-02
1.6	1.000E+00	3.160E-02
1.7	1.000E+00	2.980E-02
1.8	1.000E+00	2.820E-02
1.9	1.000E+00	2.680E-02
2	1.000E+00	2.550E-02
2.1	1.000E+00	2.430E-02
2.2	1.000E+00	2.320E-02
2.3	1.000E+00	2.220E-02
2.4	1.000E+00	2.130E-02
2.5	1.000E+00	2.050E-02
2.6	1.000E+00	1.970E-02
2.7	1.000E+00	1.900E-02
2.8	1.000E+00	1.830E-02
2.9	1.000E+00	1.770E-02
3	1.000E+00	1.710E-02
3.1	1.000E+00	1.660E-02
3.2	1.000E+00	1.610E-02
3.3	1.000E+00	1.560E-02
3.4	1.000E+00	1.510E-02
3.5	1.000E+00	1.470E-02
3.6	1.000E+00	1.430E-02
3.7	1.000E+00	1.390E-02

ACH	Xe-122	I-122
3.8	1.000E+00	1.360E-02
3.9	1.000E+00	1.320E-02
4	1.000E+00	1.290E-02
5	1.000E+00	1.030E-02
6	1.000E+00	8.600E-03
7	1.000E+00	7.400E-03
8	1.000E+00	6.500E-03
9	1.000E+00	5.800E-03
10	1.000E+00	5.200E-03
15	1.000E+00	3.500E-03
20	1.000E+00	2.600E-03
25	1.000E+00	2.100E-03
30	1.000E+00	1.700E-03
35	1.000E+00	1.500E-03
40	1.000E+00	1.300E-03
45	1.000E+00	1.200E-03
50	1.000E+00	1.000E-03
55	1.000E+00	9.000E-04
60	1.000E+00	9.000E-04
65	1.000E+00	8.000E-04
70	1.000E+00	7.000E-04
75	1.000E+00	7.000E-04
80	1.000E+00	7.000E-04
85	1.000E+00	6.000E-04
90	1.000E+00	6.000E-04
95	1.000E+00	5.000E-04
100	1.000E+00	5.000E-04
200	1.000E+00	3.000E-04
300	1.000E+00	2.000E-04
400	1.000E+00	1.000E-04
500	1.000E+00	1.000E-04
600	1.000E+00	1.000E-04
700	1.000E+00	1.000E-04
800	1.000E+00	1.000E-04
900	1.000E+00	1.000E-04

Table A-27: Xe-135m A_{eq} Based on Air Changes Per Hour

ACH	Xe-135m	Xe-135
0	1.000E+00	9.940E-01
0.1	1.000E+00	4.287E-01
0.18	**1.000E+00**	**2.946E-01**
0.2	1.000E+00	2.733E-01
0.3	1.000E+00	2.006E-01
0.4	1.000E+00	1.584E-01
0.5	1.000E+00	1.309E-01
0.6	**1.000E+00**	**1.115E-01**
0.7	1.000E+00	9.720E-02
0.8	1.000E+00	8.610E-02
0.9	1.000E+00	7.720E-02
1	1.000E+00	7.010E-02
1.1	1.000E+00	6.410E-02
1.2	1.000E+00	5.910E-02
1.3	1.000E+00	5.480E-02
1.4	1.000E+00	5.110E-02
1.5	1.000E+00	4.780E-02
1.6	1.000E+00	4.500E-02
1.7	1.000E+00	4.240E-02
1.8	1.000E+00	4.020E-02
1.9	1.000E+00	3.820E-02
2	1.000E+00	3.630E-02
2.1	1.000E+00	3.460E-02
2.2	1.000E+00	3.310E-02
2.3	1.000E+00	3.170E-02
2.4	1.000E+00	3.040E-02
2.5	1.000E+00	2.930E-02
2.6	1.000E+00	2.820E-02
2.7	1.000E+00	2.720E-02
2.8	1.000E+00	2.620E-02
2.9	1.000E+00	2.530E-02
3	1.000E+00	2.450E-02
3.1	1.000E+00	2.370E-02
3.2	1.000E+00	2.300E-02
3.3	1.000E+00	2.230E-02
3.4	1.000E+00	2.170E-02
3.5	1.000E+00	2.110E-02
3.6	1.000E+00	2.050E-02
3.7	1.000E+00	2.000E-02
3.8	1.000E+00	1.940E-02
3.9	1.000E+00	1.900E-02
4	1.000E+00	1.850E-02
5	1.000E+00	1.490E-02
6	1.000E+00	1.240E-02
7	1.000E+00	1.070E-02
8	1.000E+00	9.300E-03
9	1.000E+00	8.300E-03
10	1.000E+00	7.500E-03
15	1.000E+00	5.000E-03
20	1.000E+00	3.800E-03
25	1.000E+00	3.000E-03
30	1.000E+00	2.500E-03
35	1.000E+00	2.100E-03
40	1.000E+00	1.900E-03
45	1.000E+00	1.700E-03
50	1.000E+00	1.500E-03
55	1.000E+00	1.400E-03
60	1.000E+00	1.300E-03
65	1.000E+00	1.200E-03
70	1.000E+00	1.100E-03
75	1.000E+00	1.000E-03
80	1.000E+00	9.000E-04
85	1.000E+00	9.000E-04
90	1.000E+00	8.000E-04
95	1.000E+00	8.000E-04
100	1.000E+00	8.000E-04
200	1.000E+00	4.000E-04
300	1.000E+00	3.000E-04
400	1.000E+00	2.000E-04
500	1.000E+00	2.000E-04
600	1.000E+00	1.000E-04
700	1.000E+00	1.000E-04
800	1.000E+00	1.000E-04
900	1.000E+00	1.000E-04

Table A-28: Xe-138 A_{eq} Based on Air Changes Per Hour

ACH	Xe-138	Cs-138
0	1.000E+00	1.000E+00
0.1	1.000E+00	9.256E-01
0.18	**1.000E+00**	**8.737E-01**
0.2	1.000E+00	8.616E-01
0.3	1.000E+00	8.058E-01
0.4	1.000E+00	7.568E-01
0.5	1.000E+00	7.134E-01
0.6	**1.000E+00**	**6.748E-01**
0.7	1.000E+00	6.401E-01
0.8	1.000E+00	6.088E-01
0.9	1.000E+00	5.804E-01
1	1.000E+00	5.545E-01
1.1	1.000E+00	5.309E-01
1.2	1.000E+00	5.092E-01
1.3	1.000E+00	4.892E-01
1.4	1.000E+00	4.707E-01
1.5	1.000E+00	4.535E-01
1.6	1.000E+00	4.376E-01
1.7	1.000E+00	4.227E-01
1.8	1.000E+00	4.088E-01
1.9	1.000E+00	3.958E-01
2	1.000E+00	3.836E-01
2.1	1.000E+00	3.722E-01
2.2	1.000E+00	3.614E-01
2.3	1.000E+00	3.512E-01
2.4	1.000E+00	3.415E-01
2.5	1.000E+00	3.324E-01
2.6	1.000E+00	3.238E-01
2.7	1.000E+00	3.156E-01
2.8	1.000E+00	3.078E-01
2.9	1.000E+00	3.003E-01
3	1.000E+00	2.933E-01
3.1	1.000E+00	2.865E-01
3.2	1.000E+00	2.801E-01
3.3	1.000E+00	2.739E-01
3.4	1.000E+00	2.680E-01
3.5	1.000E+00	2.624E-01
3.6	1.000E+00	2.569E-01
3.7	1.000E+00	2.517E-01
3.8	1.000E+00	2.467E-01
3.9	1.000E+00	2.420E-01
4	1.000E+00	2.373E-01
5	1.000E+00	1.993E-01
6	1.000E+00	1.718E-01
7	1.000E+00	1.510E-01
8	1.000E+00	1.346E-01
9	1.000E+00	1.215E-01
10	1.000E+00	1.107E-01
15	1.000E+00	7.660E-02
20	1.000E+00	5.860E-02
25	1.000E+00	4.740E-02
30	1.000E+00	3.980E-02
35	1.000E+00	3.430E-02
40	1.000E+00	3.020E-02
45	1.000E+00	2.690E-02
50	1.000E+00	2.430E-02
55	1.000E+00	2.210E-02
60	1.000E+00	2.030E-02
65	1.000E+00	1.880E-02
70	1.000E+00	1.750E-02
75	1.000E+00	1.630E-02
80	1.000E+00	1.530E-02
85	1.000E+00	1.440E-02
90	1.000E+00	1.360E-02
95	1.000E+00	1.290E-02
100	1.000E+00	1.230E-02
200	1.000E+00	6.200E-03
300	1.000E+00	4.100E-03
400	1.000E+00	3.100E-03
500	1.000E+00	2.500E-03
600	1.000E+00	2.100E-03
700	1.000E+00	1.800E-03
800	1.000E+00	1.600E-03
900	1.000E+00	1.400E-03

APPENDIX B. DECAY SERIES DATA

The tables below present, for each decay series that was used in this paper, all information relevant to the A_{eq} and F_{eq} calculations from ICRP 107. Regarding the Effective Potential Alpha Energy (Effective PAE), it is the Potential Alpha Energy obtained by treating relatively long-lived radionuclides as stable (assuming they have an Effective PAE of 0). For some nuclides, it will be equal to the true PAE, and for others, it will be lower. Effective PAE was used in all calculations.

Table B-1: Rn-207 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Rn-207	9.25m	EC, B+, A	206.990734	7.90E-01	At-207	2.10E-01	Po-203	1.3126	0.3100
At-207	1.8h	EC, B+, A	206.985783	9.14E-01	Po-207	8.60E-02	Bi-203	0.5049	0.0434
Po-207	5.8h	EC, B+, A	206.981593	1.00E+00	Bi-207	2.10E-04	Pb-203	0.001	2.10E-07
Bi-207*	32.9y	EC, B+	206.97847	1.00E+00	Stable Pb-207			0	0
Po-203	36.7m	EC, B+, A	202.98142	9.99E-01	Bi-203	1.10E-03	Pb-199	0.006	6.60E-06
Bi-203	11.76h	EC, B+	202.976876	1.00E+00	Pb-203			0	0
Pb-203	51.873h	EC	202.97339	1.00E+00	Stable Tl-203			0	0
Pb-199	90m	EC, B+	198.972916	1.00E+00	Tl-199			0	0
Tl-199	7.42h	EC, B+	198.969877	1.00E+00	Stable Hg-199			0	0

*This nuclide was treated as stable due to its relatively long half-life.

Table B-2: Rn-209 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Rn-209	28.5m	EC, B+, A	208.990414	8.30E-01	At-209	1.70E-01	Po-205	1.0465	0.1859
At-209	5.41h	EC, B+, A	208.986173	9.59E-01	Po-209	4.10E-02	Bi-205	0.236	0.0097
Po-209*	102y	A, EC	208.98243	9.95E-01	Pb-205	4.80E-03	Bi-209	0	0
Bi-209*	2.01E+19y	A	208.980398	1.00E+00	Stable Tl-205			3.14	0
Po-205	1.66h	EC, B+, A	204.981203	1.00E+00	Bi-205	4.00E-04	Pb-201	0.0021	8.40E-07
Bi-205*	15.31d	EC, B+	204.977389	1.00E+00	Pb-205			0	0
Pb-205*	1.53E+7y	EC	204.974481	1.00E+00	Stable Tl-205			0	0
Pb-201	9.33h	EC, B+	200.972884	1.00E+00	Tl-201			0	0
Tl-201*	72.912h	EC	200.970818	1.00E+00	Stable Hg-201			0	0

*These nuclides were treated as stable due to Po-209 and Bi-205 long half-lives.

Table B-3: Rn-210 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Rn-210	2.4h	A, EC	209.9897	9.60E-01	Po-206	4.00E-02	At-210	5.9121	5.6756
At-210	8.1h	EC, B+, A	209.9871	9.98E-01	Po-210	1.75E-03	Bi-206	0.0097	1.70E-05
Po-210*	138.376d	A	209.9829	1.00E+00	Stable Pb-206			5.4074	0
Po-206*	8.8d	EC, A	205.9805	9.46E-01	Bi-206	5.45E-02	Pb-202	0.2902	0
Bi-206*	6.243d	EC, B+	205.9785	1.00E+00	Stable Pb-206			0	0
Pb-202*	5.25E+4 y	EC, A	201.9722	9.90E-01	Tl-202	1.00E-02	Stable Hg-198	0.0259	0
Tl-202*	12.23d	EC	201.9721	1.00E+00	Stable Hg-202			0	0

*These nuclides treated as stable due to Po-210, Po-206, and Bi-206 long half-lives.

Table B-4: Rn-211 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Rn-211	14.6h	EC, B+, A	210.9906	7.26E-01	At-211	2.74E-01	Po-207	1.6204	4.4079
At-211	7.214h	EC, A	210.987496	5.82E-01	Po-211	4.18E-01	Bi-207	2.4998	5.4600
Po-211	0.516s	A	210.986653	1.00E+00	Stable Pb-207			7.586	7.586
Po-207	5.8h	EC, B+, A	206.981593	1.00E+00	Bi-207	2.10E-04	Pb-203	0.001	2.10E-07
Bi-207*	32.9y	EC, B+	206.97847	1.00E+00	Stable Pb-207			0	0
Pb-203	51.873h	EC	202.97339	1.00E+00	Stable Tl-203			0	0

*This nuclide was treated as stable due to its long half-life.

Table B-5: Rn-215 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Rn-215	2.3us	A	214.998745	1.00E+00	Po-211			8.839	16.425
Po-211	0.516s	A	210.986653	1.00E+00	Stable Pb-207			7.586	7.586

Table B-6: Rn-216 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Rn-216	45us	A	216.000274	1.00E+00	Po-212			8.1999	15.1062
Po-212	0.299us	A	211.988867	1.00E+00	Stable Pb-208			6.9063	6.9063

Table B-7: Rn-217 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Rn-217	0.54ms	A	217.003927	1.00E+00	Po-213			7.8855	16.4224
Po-213	4.2us	A	212.992857	1.00E+00	Pb-209			8.5369	8.5369
Pb-209	3.253h	B-	208.98109	1.00E+00	Stable Bi-209			0	0
Bi-209*	2.01E+19y	A	208.980398	1.00E+00	Stable Tl-205			3.14	0

*This nuclide was treated as stable due to its long half-life.

Table B-8: Rn-218 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Rn-218	0.035s	A	218.005601	1.00E+00	Po-214			7.2618	15.0951
Po-214	0.1643ms	A	213.995201	1.00E+00	Pb-210			7.8333	7.8333
Pb-210*	22.2y	B-, A	209.984188	1.00E+00	Bi-210	1.90E-08	Hg-206	0	0
Bi-210*	5.013d	B-, A	209.98412	1.00E+00	Po-210	1.32E-06	Tl-206	0	0
Po-210*	138.376d	A	209.982873	1.00E+00	Stable Pb-206			5.4074	0
Hg-206*	8.15m	B-	205.977514	1.00E+00	Tl-206			0	0
Tl-206*	4.2m	B-	205.97611	1.00E+00	Stable Pb-206			0	0

*These nuclides were treated as stable due to Pb-210 long half-life.

Table B-9: Actinon (Rn-219) Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Rn-219	3.96s	A	219.00948	1.00E+00	Po-215			6.8801	21.0843
Po-215	1.781E-3s	A	214.999419	1.00E+00	Pb-211			7.5261	14.2042
Pb-211	36.1m	B-	210.988736	1.00E+00	Bi-211			0	6.6781
Bi-211	2.14m	A, B-	210.987269	9.97E-01	Tl-207	2.76E-03	Po-211	6.6756	6.6781
Tl-207	4.77m	B-	206.977419	1.00E+00	Stable Pb-207			0	0
Po-211	0.516s	A	210.986653	1.00E+00	Stable Pb-207			7.586	7.586

Table B-10: Thoron (Rn-220) Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Rn-220	55.6s	A	220.011393	1.00E+00	Po-216			6.404	19.8455
Po-216	0.145s	A	216.001915	1.00E+00	Pb-212			6.9063	13.4415
Pb-212	10.64h	B-	211.991897	1.00E+00	Bi-212			0	6.5352
Bi-212	60.55m	B-, A	211.991285	6.41E-01	Po-212	3.59E-01	Tl-208	2.2163	6.5352
Po-212	2.99E-7s	A	211.988867	1.00E+00	Stable Pb-208			8.9541	8.9541
Tl-208	3.053m	B-	207.982018	1.00E+00	Stable Pb-208			0	0

Table B-11: Radon (Rn-222) Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Rn-222	3.8235d	A	222.017577	1.00E+00	Po-218			5.5898	19.535
Po-218	3.10m	B-, A	218.008973	1.00E+00	Pb-214	2.00E-04	At-218	6.1134	13.945
Pb-214	26.8m	B-	213.999805	1.00E+00	Bi-214			0	7.8317
At-218	1.5s	A, B-	218.008694	9.99E-01	Bi-214	1.00E-03	Rn-218	6.8041	14.636
Bi-214	19.9m	B-, A	213.998711	1.00E+00	Po-214	2.10E-04	Tl-210	0.0011	7.8317
Rn-218	3.5E-2s	A	218.005601	1.00E+00	Po-214			7.2618	15.095
Po-214	1.643E-4s	A	213.995201	1.00E+00	Pb-210			7.8333	7.8333
Tl-210	1.30m	B-	209.990073	1.00E+00	Pb-210			0	0
Pb-210*	22.20y	B-, A	209.984188	1.00E+00	Bi-210	1.90E-08	Hg-206	0	0
Bi-210*	5.013d	B-, A	209.98412	1.00E+00	Po-210	1.32E-06	Tl-206	0	0
Hg-206*	8.15m	B-	205.977514	1.00E+00	Tl-206			0	0
Po-210*	138.376d	A	209.982873	1.00E+00	Stable Pb-206			5.4074	0
Tl-206*	4.200m	B-	205.97611	1.00E+00	Stable Pb-206			0	0

*These nuclides were treated as stable due to Pb-210 long half-life.

Table B-12: Rn-223 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Rn-223	24.3m	B-	223.02179	1.00E+00	Fr-223			0	1.22E-03
Fr-223	22m	B-, A	223.019735	1.00E+00	Ra-223	6.00E-05	At-219	0.0003	1.22E-03
Ra-223*	11.43d	A	223.018502	1.00E+00	Rn-219			5.7701	0
At-219	56s	A	219.011161	9.70E-01	Bi-215	3.00E-2	Rn-219	6.1342	20.3608
Rn-219	3.96s	A	219.00948	1.00E+00	Po-215			6.8801	21.0843
Bi-215	7.6m	B-	215.001769	1.00E+00	Po-215			0	14.2042
Po-215	1.781ms	A	214.999419	1.00E+00	Pb-211			7.5261	14.2042
Pb-211	36.1m	B-	210.988736	1.00E+00	Bi-211			0	6.6781
Bi-211	2.4m	A, B-	210.987269	9.97E-01	Tl-207	2.76E-03	Po-211	6.6756	6.6781
Tl-207	4.77m	B-	206.977419	1.00E+00	Stable Pb-207			0	0
Po-211	0.516s	A	210.986653	1.00E+00	Stable Pb-207			7.586	7.586

*These nuclides were treated as stable due to Ra-223 long half-life.

Table B-13: Ne-24 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Ne-24	3.38m	B-	23.99361	1.00E+00	Na-24			0	0
Na-24	14.959h	B-	23.990962	1.00E+00	Stable Mg-24			0	0

Table B-14: Ar-42 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Ar-42	32.9y	B-	41.963045	1.00E+00	K-42			0	0
K-42	12.36h	B-	41.962402	1.00E+00	Stable Ca-42			0	0

Table B-15: Ar-43 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Ar-43	5.37m	B-	42.965636	1.00E+00	K-43			0	0
K-43	22.3h	B-	42.960715	1.00E+00	Stable Ca-43			0	0

Table B-16: Ar-44 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Ar-44	11.87m	B-	43.964924	1.00E+00	K-44			0	0
K-44	22.13m	B-	43.961556	1.00E+00	Stable Ca-44			0	0

Table B-17: Kr-74 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Kr-74	11.5m	EC, B+	73.933084	1.00E+00	Br-74			0	0
Br-74	25.4m	EC, B+	73.929891	1.00E+00	Stable Se-74			0	0

Table B-16: Kr-75 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Kr-75	4.29m	EC, B+	74.930945	1.00E+00	Br-75			0	0
Br-75	96.7m	EC, B+	74.925776	1.00E+00	Se-75			0	0
Se-75	119.779d	EC	74.922523	1.00E+00	Stable As-75			0	0

Table B-19: Kr-76 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Kr-76	14.8h	EC	75.92591	9.92E-01	Br-76	8.11E-03	Br-76m	0	0
Br-76m	1.31s	IT, EC, B+	75.924541	9.97E-01	Br-76	3.00E-03	Stable Se-76	0	0
Br-76	16.2h	EC, B+	75.924541	1.00E+00	Stable Se-76			0	0

Table B-20: Kr-77 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Kr-77	74.4m	EC, B+	76.92467	0.90386	Br-77	0.096135	Br-77m	0	0
Br-77m	4.28m	EC, B+	76.92138	1	Br-77			0	0
Br-77	57.036h	IT	76.92138	1	Stable Se-77			0	0

Table B-21: Kr-88 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Kr-88	2.84h	B-	87.914446	1.00E+00	Rb-88			0	0
Rb-88	17.78m	B-	87.911315	1.00E+00	Stable Sr-88			0	0

Table B-22: Kr-89 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Kr-89	3.15m	B-	88.91763	1.00E+00	Rb-89			0	0
Rb-89	15.15m	B-	88.912278	1.00E+00	Sr-89			0	0
Sr-89*	50.53d	B-	88.90745	1.00E+00	Stable Y-89			0	0

*This nuclide was treated as stable due to its long half-life.

Table B-23: Xe-120 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Xe-120	40m	EC, B+	119.911784	1.00E+00	I-120			0	0
I-120	81.6m	EC, B+	119.910048	1.00E+00	Stable Te-120			0	0

Table B-24: Xe-121 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Xe-121	40.1m	EC, B+	120.911461	1.00E+00	I-121			0	0
I-121	2.12h	EC, B+	120.907366	9.97E-01	Te-121	2.86E-03	Te-121m	0	0
Te-121m*	154d	IT, EC	120.904936	8.86E-01	Te-121	1.14E-01	Stable Sb-121	0	0
Te-121*	19.16d	EC	120.904936	1.00E+00	Stable Sb-121			0	0

*These nuclides were treated as stable due to their long half-lives.

Table B-25: Xe-122 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Xe-122	20.1h	EC	121.908367	1.00E+00	I-122			0	0
I-122	3.63m	EC, B+	121.907589	1.00E+00	Stable Te-122			0	0

Table B-26: Xe-123 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Xe-123	2.08h	EC, B+	122.908481	1.00E+00	I-123			0	0
I-123	13.27h	EC	122.905588	1.00E+00	Te-123	4.44E-05	Te-123m	0	0
Te-123m*	119.25d	IT	122.90427	1.00E+00	Te-123			0	0
Te-123*	6E14 y	EC	122.90427	1.00E+00	Stable Sb-123			0	0

*These nuclides were treated as stable due to their long half-live.

Table B-27: Xe-135m Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Xe-135m	15.29m	IT, B-	134.907227	9.94E-01	Xe-135	6.00E-03	Cs-135	0	0
Xe-135	9.14h	B-	134.907227	1.00E+00	Cs-135			0	0
Cs-135*	2.3E6 y	B-	134.905977	1.00E+00	Stable Ba-135			0	0

*This nuclide was treated as stable due to its long half-life.

Table B-28: Xe-138 Decay Series

Nuclide	Half-life	Mode	Mass	Branching Fraction	Daughter	Branching Fraction	Daughter	Alpha Energy (MeV)	Effective PAE (MeV)
Xe-138	14.08m	B-	137.913954	1.00E+00	Cs-138			0	0
Cs-138	33.41m	B-	137.911016	1.00E+00	Stable Ba-138			0	0

APPENDIX C. SUPPORTING MATLAB CODE

Rn-207 Activity Equilibrium Factor Code

```
%%AEQ calculator
for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  9.25/60;        %1. Rn-207
            1.8;            %2. At-207
            5.8;            %3. Po-207
            36.7/60;        %4. Po-203
            32.9*24*365.24; %5. Bi-207
            11.76;          %6. Bi-203
            51.873;         %7. Pb-203
            90/60;          %8. Pb-199
            7.42;];          %9. Tl-199

    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    disp(Lambda)

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 0.79;
    F(4,1) = 0.21;
    F(3,2) = 0.914;
    F(6,2) = 0.086;
    F(7,3) = 0.00021;
    F(6,4) = 0.989;
    F(8,4) = 0.0011;
    F(5,5) = 0;
```

```
    F(7,6) = 1;
    F(9,8) = 1;

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Rn-209 Activity Equilibrium Factor Code

```
%%AEQ calculator
for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  28.5/60;        %1. Rn-209
            5.41;           %2. At-209
            102*24*365;     %3. Po-209
            2.01*24*365*(10^19); %4. Bi-209
            1.66;           %5. Po-205
```

```
        15.31*24;       %6. Bi-205
        1.53*24*365*(10^7);  %7. Pb-205
        9.33;           %8. Pb-201
        72.912;];       %9. Tl-201

i = length(hl);

L = zeros([1 i]);

for k = 1:i
    L(k) = log(2)/hl(k);
end

Lambda = diag(L);

%disp(Lambda)

%BEGIN STEP 2)

%% Initialize transfer matrix
F = ones(i);
F = -1*diag(diag(F,0),0);

%% Add decay probabilities
% F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
% fraction). If excluding a long lived progeny with index p, do not include
% decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
F(2,1) = 0.83;
F(5,1) = 0.17;
F(3,3) = 0;
F(4,4) = 0;
F(6,6) = 0;
F(7,7) = 0;
F(8,5) = 0.0004;
F(9,9) = 0;

%disp(F);

F = F * Lambda; % Obtain partial decay constant matrix

%BEGIN STEPS 3-5)

%% setup air Removal
Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
F = F + Rem; % Air removal rate modifies the partial decay constants
tspan = [0 200]; % Time span of 200 hours for decay
y0 = zeros([1 i]);
y0(1) = 1/L(1); % Initial Conditions
[t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
Activities = y*Lambda; %Get AEQs
Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
%clearvars
```

```
end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Rn-210 Activity Equilibrium Factor Code

```
%%AEQ calculator
for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  2.4;        %1. Rn-210
            8.1;];      %2. At-210


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(Lambda)

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 0.04;
```

```
    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Rn-211 Activity Equilibrium Factor Code

```
%% AEQ calculator
for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    s = 1/3600;
    m = 1/60;
    d = 24;
    year = 24*365;

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  14.6;       %1. Rn-211
            7.214;      %2. At-211
```

```
            0.516*s;    %3. Po-211
            5.8;        %4. Po-207
            32.9*year;  %5. Bi-207
            522.873;];  %6. Pb-203



    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 0.726;
    F(4,1) = 0.274;
    F(3,2) = 0.582;
    F(6,4) = 0.00021;
    F(5,5) = 0;

    %disp(F);

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end
```

```
%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Rn-215 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  2.3*us;    %1. Rn-21
            0.516*s;]; %2. Po-211


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)
```

```
    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 1;

    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Rn-216 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]
```

```
%BEGIN STEP 1)

%Time unit conversions into hours for convenience
h = 1;
d = 24*h;
year = 365*d;
m = h / 60;
s = m /60;
ms = s/1000;
us = ms/1000;

% halflife in hours, such that if A is at index a and decays into B,
% which is at index b, a < b. In other words, decay paths always go
% downwards. If excluding a long lived progeny, it need not be added.
hl = [  45*us;    %1. Rn-216
        0.299*us;]; %2. Po-212


i = length(hl);

L = zeros([1 i]);

for k = 1:i
    L(k) = log(2)/hl(k);
end

Lambda = diag(L);

%disp(L);

%BEGIN STEP 2)

%% Initialize transfer matrix
F = ones(i);
F = -1*diag(diag(F,0),0);

%% Add decay probabilities
% F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
% fraction). If excluding a long lived progeny with index p, do not include
% decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
F(2,1) = 1;

%disp(F)

F = F * Lambda; % Obtain partial decay constant matrix

%BEGIN STEPS 3-5)

%% setup air Removal
Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
F = F + Rem; % Air removal rate modifies the partial decay constants
tspan = [0 200]; % Time span of 200 hours for decay
y0 = zeros([1 i]);
y0(1) = 1/L(1); % Initial Conditions
[t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
```

```
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Rn-217 Activity Equilibrium Factor Code

```
%% AEQ calculator
warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  0.54*ms;    %1. Rn-217
            4.2*us;     %2. Po-213
            3.253;];    %3. Pb-209


    i = length(hl);

    L = zeros([1 i]);
```

```
    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 1;
    F(3,2) = 1;

    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Rn-218 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  0.035*s;      %1. Rn-218
            0.1643*ms;    %2. Po-214
            22*year;];    %3. Pb-210


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 1;
    F(3,3) = 0;
```

```
    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Actinon (Rn-219) Activity Equilibrium Factor Code

```
%% Actinon AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    h = 1;
    d = 24*h;
    year = 365*d;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours
```

```
    hl = [  3.96*s;      %1. Rn-219
            1.781*ms;    %2. Po-215
            36.1*m;      %3. Pb-211
            2.14*m;      %4. Bi-211
            4.77*m;      %5. Tl-207
            0.516*s;];   %6. Po-211


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    F(2,1) = 1;
    F(3,2) = 1;
    F(4,3) = 1;
    F(5,4) = 0.99724;
    F(6,4) = 0.00276;

    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end
```

```
%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Thoron (Rn-220) Activity Equilibrium Factor Code

```
%% Thoron AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    h = 1;
    d = 24*h;
    year = 365*d;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours
    hl = [  55.6*s;     %1. Rn-220
            0.145*s;    %2. Po-216
            10.64*h;    %3. Pb-212
            60.55*m;    %4. Bi-212
            0.299*us;   %5. Po-212
            3.053*m;];  %6. Tl-208


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);
```

```
    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    F(2,1) = 1;
    F(3,2) = 1;
    F(4,3) = 1;
    F(5,4) = 0.641;
    F(6,4) = 0.359;

    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Radon (Rn-220) Activity Equilibrium Factor Code:

```
%% Radon AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
```

```
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    h = 1;
    d = 24*h;
    year = 365*d;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours
    hl = [  3.8235*d;   %1. Rn-222
            3.1*m;      %2. Po-218
            26.8*m;     %3. Pb-214
            1.5*s;      %4. At-218
            19.9*m;     %5. Bi-214
            0.035*s;    %6. Rn-218
            164.3*us;   %7. Po-214
            1.3*m;];    %8. Tl-210


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    F(2,1) = 1;
    F(3,2) = .9998;
    F(4,2) = 0.0002;
    F(5,3) = 1;
    F(5,4) = 0.999;
    F(6,4) = 0.001;
    F(7,5) = 0.99979;
    F(8,5) = 0.00021;
    F(7,6) = 1;

    %disp(F)
```

```
    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Rn-223 Activity Equilibrium Factor Code

```
%% AEQ calculator
for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  24.3/60;        %1. Rn-223
            22/60;          %2. Fr-223
            11.43*24;       %3. Ra-223
            56/3600;        %4. At-219
            3.96/3600;      %5. Rn-219
            7.6/60;         %6. Bi-215
            1.781/3600000;  %7. Po-215
            36.1/60;        %8. Pb-211
            2.4/60;         %9. Bi-211
            4.77/60;        %10. Tl-207
```

```
        0.516/3600;];   %11. Po-211


i = length(hl);

L = zeros([1 i]);

for k = 1:i
    L(k) = log(2)/hl(k);
end

Lambda = diag(L);

%BEGIN STEP 2)

%% Initialize transfer matrix
F = ones(i);
F = -1*diag(diag(F,0),0);

%% Add decay probabilities
% F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
% fraction). If excluding a long lived progeny with index p, do not include
% decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
F(2,1) = 1;
F(4,2) = 0.00006;
F(3,3) = 0;
F(6,4) = 0.97;
F(5,4) = 0.03;
F(7,5) = 1;
F(7,6) = 1;
F(8,7) = 1;
F(9,8) = 1;
F(10,9) = 0.99724;
F(11, 9) = 0.00276;

%disp(F);

F = F * Lambda; % Obtain partial decay constant matrix

%BEGIN STEPS 3-5)

%% setup air Removal
Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
F = F + Rem; % Air removal rate modifies the partial decay constants
tspan = [0 200]; % Time span of 200 hours for decay
y0 = zeros([1 i]);
y0(1) = 1/L(1); % Initial Conditions
[t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
Activities = y*Lambda; %Get AEQs
Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
%clearvars
```

```
end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Ne-24 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  3.38*m;      %1. Ne-24
            14.959;];    %2. Ar-24


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);
```

```
    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 1;

    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Ar-42 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
```

```
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  32.9*year;  %1. Ar-42
            12.36;];    %2. K-42


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 1;

    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
```

```
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Ar-43 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  5.37*m;  %1. Ar-43
            22.3;];  %2. K-43


    i = length(hl);
```

```
    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 1;

    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Ar-44 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  11.87*m;    %1. Ar-44
            22.13*m;];  %2. K-44


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 1;

    %disp(F)
```

```
    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Kr-74 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;
```

```
    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  11.5*m;    %1. Kr-74
            25.4*m;];  %2. Br-74


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 1;

    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
```

```
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Kr-75 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    My = year * 1000000;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  4.29*m;         %1. Kr-75
            96.7*m;         %2. Br-75
            119.779*d;];    %3. Sr-75


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)
```

```
    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 1;
    F(3,2) = 1;

    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Kr-76 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]
```

```
%BEGIN STEP 1)

%Time unit conversions into hours for convenience
h = 1;
d = 24*h;
year = 365*d;
My = year * 1000000;
m = h / 60;
s = m /60;
ms = s/1000;
us = ms/1000;

% halflife in hours, such that if A is at index a and decays into B,
% which is at index b, a < b. In other words, decay paths always go
% downwards. If excluding a long lived progeny, it need not be added.
hl = [  14.8;      %1. Kr-76
        1.31*s;    %2. Br-76m
        16.2;];    %3. Br-76


i = length(hl);

L = zeros([1 i]);

for k = 1:i
    L(k) = log(2)/hl(k);
end

Lambda = diag(L);

%disp(L);

%BEGIN STEP 2)

%% Initialize transfer matrix
F = ones(i);
F = -1*diag(diag(F,0),0);

%% Add decay probabilities
% F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
% fraction). If excluding a long lived progeny with index p, do not include
% decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
F(2,1) = 0.0081144;
F(3,1) = 0.99189;
F(3,2) = 0.997;

%disp(F)

F = F * Lambda; % Obtain partial decay constant matrix

%BEGIN STEPS 3-5)

%% setup air Removal
Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
```

```
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Kr-77 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    My = year * 1000000;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  74.4*m;      %1. Kr-77
            4.28*m;    %2. Br-77m
            57.036;];    %3. Br-77
```

```
    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 0.096135;
    F(3,1) = 0.903865;
    F(3,2) = 1;

    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;
```

```
end
```

Kr-88 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  2.84;       %1. Kr-88
            17.78*m;];  %2. Rb-88


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
```

```
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 1;

    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Kr-89 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
```

```
year = 365*d;
My = year * 1000000;
m = h / 60;
s = m /60;
ms = s/1000;
us = ms/1000;

% halflife in hours, such that if A is at index a and decays into B,
% which is at index b, a < b. In other words, decay paths always go
% downwards. If excluding a long lived progeny, it need not be added.
hl = [  3.15*m;      %1. Kr-89
        15.15*m;     %2. Rb-89
        50.53*d;];   %3. Sr-89


i = length(hl);

L = zeros([1 i]);

for k = 1:i
    L(k) = log(2)/hl(k);
end

Lambda = diag(L);

%disp(L);

%BEGIN STEP 2)

%% Initialize transfer matrix
F = ones(i);
F = -1*diag(diag(F,0),0);

%% Add decay probabilities
% F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
% fraction). If excluding a long lived progeny with index p, do not include
% decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
F(2,1) = 1;
F(3,3) = 0;

%disp(F)

F = F * Lambda; % Obtain partial decay constant matrix

%BEGIN STEPS 3-5)

%% setup air Removal
Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
F = F + Rem; % Air removal rate modifies the partial decay constants
tspan = [0 200]; % Time span of 200 hours for decay
y0 = zeros([1 i]);
y0(1) = 1/L(1); % Initial Conditions
[t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
Activities = y*Lambda; %Get AEQs
Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
```

```
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Xe-120 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  40*m;       %1. Xe-120
            81.6*m;];   %2. I-120


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end
```

```
    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 1;

    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Xe-121 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');
```

```
for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    My = year * 1000000;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  40.1*m;     %1. Xe-121
            2.12;       %2. I-121m
            154*d;      %3. Te-121m
            19.16*d;];  %4. Te-121


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 1;
    F(3,3) = 0;
    F(4,4) = 0;

    %disp(F)
```

```
    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Xe-122 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;
```

```
    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  20.1;       %1. Xe-122
            3.63*m;];   %2. I-122


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 1;

    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
```

```
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Xe-123 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  2.08;               %1. Xe-123
            13.27;              %2. I-123
            119.25*d;           %3. Te-123m
            6*year*(10^14);];   %4. Te-123


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)
```

```
    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 1;
    F(3,3) = 0;
    F(4,4) = 0;

    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Xe-135m Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
```

```
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    My = year * 1000000;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  15.29*m;    %1. Xe-135m
            9.14;       %2. Xe-135
            2.3*My;];   %3. Cs-135


    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,d) or F(d,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = .994;
    F(3,3) = 0;

    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
```

```
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

Xe-138 Activity Equilibrium Factor Code

```
%% AEQ calculator
%warning('off','all');

for AirRemovalRate = [0  0.1  0.18  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1  1.1
1.2  1.3  1.4  1.5  1.6  1.7  1.8  1.9  2  2.1  2.2  2.3  2.4  2.5  2.6  2.7  2.8
2.9  3  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4  5  6  7  8  9  10  15  20  25
30  35  40  45  50  55  60  65  70  75  80  85  90  95  100  200  300  400  500  600
700  800  900]

    %BEGIN STEP 1)

    %Time unit conversions into hours for convenience
    h = 1;
    d = 24*h;
    year = 365*d;
    m = h / 60;
    s = m /60;
    ms = s/1000;
    us = ms/1000;

    % halflife in hours, such that if A is at index a and decays into B,
    % which is at index b, a < b. In other words, decay paths always go
    % downwards. If excluding a long lived progeny, it need not be added.
    hl = [  14.08*m;        %1. Xe-138
            33.41*m;];      %2. Cs-138
```

```
    i = length(hl);

    L = zeros([1 i]);

    for k = 1:i
        L(k) = log(2)/hl(k);
    end

    Lambda = diag(L);

    %disp(L);

    %BEGIN STEP 2)

    %% Initialize transfer matrix
    F = ones(i);
    F = -1*diag(diag(F,0),0);

    %% Add decay probabilities
    % F(a,b) = c; means nuclide b decays into nuclide a with c probablity (branching
    % fraction). If excluding a long lived progeny with index p, do not include
    % decays F(i,p) or F(p,i) for all i, and zero out p with F(p,p) = 0;
    F(2,1) = 1;

    %disp(F)

    F = F * Lambda; % Obtain partial decay constant matrix

    %BEGIN STEPS 3-5)

    %% setup air Removal
    Rem = eye(i) * -1* AirRemovalRate; % Air removal rate matrix setup
    F = F + Rem; % Air removal rate modifies the partial decay constants
    tspan = [0 200]; % Time span of 200 hours for decay
    y0 = zeros([1 i]);
    y0(1) = 1/L(1); % Initial Conditions
    [t,y] = ode23s(@(t,y) odefcn(t,y,F), tspan, y0);  % Stiff ODE solver equation
    Activities = y*Lambda; %Get AEQs
    Activities(Activities>1)=1;  % Set AEQ to 1 for values greater than 1
    disp([AirRemovalRate Activities(end,1:i)]) % Display AEQ vs. ACH
    %clearvars



end

%% First-order ODE function to solve for number of atoms undergoing alpha/beta
function dydt = odefcn(~,y,F)
dydt = F*y;
dydt(1) = 0;

end
```

APPENDIX D. POTENTIAL PARENTS OF EACH RADIOACTIVE NOBLE GAS

Table D-1: Possible Parents of the Radioactive Noble Gasses Presented in ICRP 107

Noble Gas	Possible parents
Ar-42	none
Ar-43	none
Ar-44	none
Kr-74	none
Kr-75	none
Kr-76	none
Kr-77	Rb-77
Kr-79	Rb-79, Sr-79
Kr-81	Sr-81, Y-81, Kr-81m, Rb-81, Rb-81m
Kr-81m	Sr-81, Y-81, Rb-81, Rb-81m
Kr-83m	Rb-83, Sr-83, Y-83, Y-83m, Se-83, Se-83m, Br-83
Kr-85	Br-85, Kr-85m
Kr-85m	Br-85
Kr-87	none
Kr-88	none
Kr-89	none
Ne-19	none
Ne-24	none
Rn-207	none
Rn-209	none
Rn-210	none
Rn-211	none
Rn-212	Fr-212
Rn-215	Ra-219, Th-223, U-227
Rn-216	Fr-220, Ra-220, Ac-224, Th-224, Pa-228, U-228, Pu-232
Rn-217	Ra-221
Rn-218	Fr-222, Ra-222, Ra-226, Ra-230, Ac-226, Ac-230, Th-230, Th-234, Pa-230, Pa-234, Pa-234m, U-234, U-238, U-242, Np-234, Np-238, Np-242, Np-242m, Pu-234, Pu-238, Pu-242, Pu-246, Am-238, Am-242, Am-242m, Am-246, Am-246m, Cm-238, Cm-242, Cm-246, Cm-250, Bk-246, Bk-250, Cf-246, Cf-250, Cf-254, Es-250, Es-250m, Es-254, Es-254m, Fm-254
Rn-219	Rn-223, Fr-223, Fr-227, Ra-223, Ra-227, Ac-227, Ac-231, Th-227, Th-231, Th-235, Pa-227, Pa-231, Pa-235, U-231, U-235, U-235m, U-239, Np-235, Np-239, Pu-235, Pu-239, Pu-243, Am-239, Am-243, Am-247, Cm-239, Cm-243, Cm-247, Cm-251, Bk-247, Bk-251, Cf-247, Cf-251, Cf-255, Es-251, Es-255, Fm-251, Fm-255

Noble Gas	Possible parents
Rn-220	At-220, Fr-224, Ra-224, Ra-228, Ac-224, Ac-228, Ac-232, Th-228, Th-232, Th-236, Pa-228, Pa-232, Pa-236, U-232, U-236, U-240, Np-232, Np-236, Np-236m, Np-240, Np-240m, Pu-232, Pu-236, Pu-240, Pu-244, Am-240, Am-244, Am-244m, Cm-240, Cm-244, Cm-248, Bk-248m, Cf-244, Cf-248, Cf-252, Es-256, Fm-252, Fm-256
Rn-222	Ra-226, Ra-230, Ac-226, Ac-230, Th-230, Th-234, Pa-230, Pa-234, Pa-234m, U-234, U-238, U-242, Np-234, Np-238, Np-242, Np-242m, Pu-234, Pu-238, Pu-242, Pu-246, Am-238, Am-242, Am-242m, Am-246, Am-246m, Cm-238, Cm-242, Cm-246, Cm-250, Bk-246, Bk-250, Cf-246, Cf-250, Cf-254, Es-250, Es-250m, Es-254, Es-254m, Fm-254
Rn-223	none
Xe-120	none
Xe-121	Cs-121, Cs-121m
Xe-122	none
Xe-123	Cs-123
Xe-125	Cs-125
Xe-127	none
Xe-127m	none
Xe-129m	none
Xe-131m	Sb-131, Te-131, Te-131m, I-131
Xe-133	Sb-133, Te-133, Te-133m
Xe-133m	I-133, Sb-133, Te-133, Te-133m
Xe-135	I-135, Xe-135m
Xe-135m	I-135
Xe-137	none
Xe-138	none