**Appendix 1: Dose Calculations for the large Japanese field mouse**

**Soil Radiocesium Concentration Estimating Methods**

Sampling soil to determine the actual radiocesium concentration in every location where mice were trapped was not possible due to financial and time considerations. The concentration of radiocesium in soil was estimated by taking a measurement with an ion chamber at the location of each trap. The soil concentrations were then estimated using Federal Guidance Report 15 (FGR15), assuming a 5 cm maximum depth of radiocesium, equally distributed throughout the 5 cm layer.

A confirmation of the validity of the methods used to estimate soil concentration was confirmed at a location in Takase Gorge. A measurement was taken, and soil sample collected. Next, the dose rate produced using FGR15 estimating methods was compared to the actual ion chamber measurement at that location.

The calculation was performed in two parts, one part for the contribution of Cs-134, and another for the contribution of Cs-137 (and Ba-137m), and the dose total summed. Cs-137 was assumed to be in secular equilibrium with Ba-137m, as FGR15 treats each nuclide separately. A soil sample was collected at Takase Gorge (surface to 5 cm depth) and found to contain 1.85 × 104 Bq kg-1 Cs-134 and 1.29 × 105 Bq kg-1 Cs-137, producing an estimated dose of 10.5 μSv h-1, where the ion chamber read 9.8 μSv h-1. Calculation methods are below.

Estimate of Cs-134 contribution to dose rate at 1 m:

Dose conversion coefficient for 5 cm soil



Changing units



Assuming a soil density of 1.3 × 103 kg m-3 per FGR15



Calculating dose rate based on Cs-134 concentration



Estimate of Cs-137 (and Ba-137m) contribution to dose rate at 1 m:



Summing the Cs-137 and Ba-137m,



Converting units



Assuming a soil density of 1.3 × 103 kg m-3 per FGR15



Calculating dose rate based on Cs-137 concentration



Thus, the total dose rate estimated from FGR15 based on soil concentration was 2.9 μSv h-1 + 7.6 μSv h-1 = 10.5 μSv h-1 This compares well with the actual measured dose rate of 9.8 μSv h-1.

**External Mouse Dose Calculation**

External dose to the mice was determined using estimates of the soil concentration, and assuming mice spent 50% of their time above ground, and 50% below ground. The external dose was calculated for Cs-137, and it was assumed all external dose was from Cs-137. The contribution of Cs-134 to the mouse dose was considered negligible. The age of the mouse in day was multiplied by the daily dose rate to determine the total lifetime dose. The dose was calculated using the DCF’s in Perri and Johnson. Although the DCF’s were computed to a depth of 10 cm, and the contamination at the collection locations was approximately 5 cm, Perri and Johnson determined that the dose rate changes for subterranean and surface doses did not very significantly with changes in depth contamination.

Mouse Dose Example Calculation for Takase Gorge Mouse 181111T1, Age: 91.26 d

The contamination level was first estimated using FGR15.

Using the inverse of conversion factor calculated above for Cs-137,

 inverted is 1.7 × 104

The measured dose rate at the collection site was approximately 20 μSv h-1, so the concentration in the soil at that location is determined to be

·1.7 × 104= 3.4 × 105 

Next, calculate the external dose to the mouse, assuming 50% of the time it is on the surface, using the DCF from Perri & Johnson from table 2, external volumetric 0.0021 μGy∙kg Bq-1∙d-1

0.5·3.4 × 105 ·0.0021 = 3.2 × 104 μGy

Finally, the balance of the external dose from subterranean exposure for 50% of the time is calculated using the DCF from Perri & Johnson table 2,

0.5·3.4 × 105 ·0.0056 = 8.6 × 104 μGy

The sum of the external and subterranean doses is the total external dose,

3.2 × 104 μGy + 8.6 × 104 μGy = 1.2 × 105 μGy total external dose

**Internal Mouse Dose Calculations**

Each mouse was sacrificed after blood collection and counted in an HPGe detector. The activity concentration was determined for each mouse, along with the mass of each mouse. Dose was then used with the DCF from Perri and Johnson.

Mouse Dose Example Calculation for Takase Gorge Mouse 181111T1, Age: 91.26 d

Cs-134

Internal dose calculated using Table 2 DCF Cs-134 value (Perri & Johnson) for mice 0.0031 μGy∙kg Bq-1 d-1

Concentration of Cs-134 in mouse 3.40 × 103 Bq kg-1

= 9.6 × 102 μGy

Cs-137

Internal dose calculated using Table 2 DCF Cs-137 value (Perri & Johnson) for mice 0.0030 μGy∙kg Bq-1 d-1

Concentration of Cs-137 in mouse 3.58 × 104 Bq kg-1

= 9.8 × 103 μGy

The sum of the internal doses from Cs-134 and Cs-137,

9.6 × 102 μGy + 9.8 × 103 μGy = 1.1 × 104 μGy internal dose

Total mouse dose, both external and internal is

1.2 × 105 μGy + 1.1 × 104 μGy = 1.3 × 105 μGy

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Mouse ID | Collection Site | Age in days | Sample Group | Dose Rate Range, uSv h-1 | Soil conc. Bq kg-1 | Above Ground Dose uGy | Subterranean dose uGy | External Dose uGy |
| 181111S3 | Soma Site 3 | 213 | Control | 0.1-0.2 | 2528  | 565.3 | 1507.5 | 2072.8 |
| 181111T1 | Takase Site K3 | 92 | Low | 15-25 | 337109 | 32302.8 | 86140.8 | 118443.6 |
| 181025T4 | Takase Site J7 | 107 | Low | 15-25 | 337109 | 37686.5 | 100497.6 | 138184.1 |
| 181106T1 | Takase Site 1 | 472 | Low | 0.1-0.2 | 2528 | 1251.7 | 3338 | 4589.7 |
| 181025T1 | Takase Site B7 | 91 | Low | 15-25 | 337109 | 32302.8 | 86140.8 | 118443.6 |
| 181108S1 | Soma Site 1 | 213 | Control | 0.1-0.2 | 2528 | 565.3 | 1507.5 | 2072.8 |
| 181110S3 | Soma Site 3 | 472 | Control | 0.1-0.2 | 2528 | 1251.7 | 3338 | 4589.7 |
| 181025T2 | Takase Site G7 | 213 | High | 15-25 | 337109 | 75373.2 | 200995.1 | 276368.3 |
| 181110T2 | Takase Site K7 | 92 | Low | 15-25 | 337109 | 32302.8 | 86140.8 | 118443.6 |
| 181110S5 | Soma Site 3 | 411 | Control | 0.1-0.2 | 2528 | 1090.2 | 2907.3 | 3997.5 |
| 181110S4 | Soma Site 3 | 213 | Control | 0.1-0.2 | 2528 | 565.3 | 1507.5 | 2072.8 |
| 181110S1 | Soma Site 2 | 411 | Control | 0.1-0.2 | 2528 | 1090.2 | 2907.3 | 3997.5 |
| 181025T3 | Takase Site H2 | 472 | High | 15-25 | 337109 | 166897.8 | 445060.7 | 611958.4 |
| 181107TI | Takase Site K2 | 107 | Low | 15-25 | 337109 | 37686.6 | 100497.6 | 138184.2 |
| 181104T1 | Takase Site 1 | 91 | Low |  |  |  |  |  |
| 181110S2 | Soma Site 2 | 304 | Control | 0.1-0.2 | 2528 | 807.6 | 2153.5 | 2961 |
| 181027T2 | Takase Site I7 | 91 | Low |  |  |  |  |  |
| 181103S1 | Soma Site 1 | 107 | Control | 0.1-0.2 | 2528 | 282.6 | 753.7 | 1036.4 |