

INTEROFFICE MEMORANDUM

SRR-CWDA-2018-00057
Revision 0

September 4, 2018

To: S. P. Hommel, 705-1C

From: K.D. Dixon, 705-1C

Katie Cara Dixon

Reviewer: T. B. Kinard, 705-1C

T. B. Kinard

RECOMMENDED YIELD PERCENTAGE OF LOCALLY GROWN PRODUCE IN THE SAVANNAH RIVER SITE AREA FOR USE IN DOSE CALCULATIONS TO SUPPORT LIQUID WASTE PERFORMANCE ASSESSMENTS

As part of Performance Assessments (PAs), calculations are done to estimate radiological dose to human receptors. The human receptors receive dose via exposure pathways. One exposure pathway is ingestion of produce such as vegetables, fruits, and/or grains which have been contaminated. The produce is contaminated by either direct contact with contaminated irrigation water or root uptake of contaminated irrigation water in the soil. The International Atomic Energy Agency (IAEA) has published element-specific soil-to-plant (produce) transfer factors for a variety of plant groups. These factors allow for the calculation of the quantity of a specific element transferred into produce, which is then ingested by a human receptor. Based on this information, a dose can be calculated to the human receptor.

Since the transfer factors vary by plant groups, the plant groups (i.e., produce) or crops grown in the Savannah River Site (SRS) area should be considered when applying these factors to determine dose to a human receptor in the SRS area. This document recommends assumed percentages for select plant groups based on commercial production in the SRS area. These percentages can be used to calculate weighted, element-specific transfer factors.

Produce Yield Data

To develop the recommended local produce percentages for the SRS area, an estimated percentage breakdown of the major plant groups commercially produced in the SRS area was used based on 2007 agriculture statistics reported by the U.S. Department of Agriculture and found in SRNL-STI-2010-00447, *Land and Water Use Characteristics and Human Health Input Parameters for Use in Environmental Dosimetry and Risk Assessment at the Savannah River Site*, Revision 0. Given that there is considerable uncertainty as to what crops future farmers will grow, current local commercial agricultural practices are assumed to provide a reasonable representation of the types of produce that may be grown locally in the future. Additionally, the Nuclear Regulatory Commission (NRC) report, NUREG/CR-5512, Volume 1, *Residual Radioactive Contamination from Decommissioning*, (ML052220317), provides default values for the produce/crop yield in units of kg wet weight/m², found in Table 6.14 of the report. These values are converted into a percentage by dividing each crop yield value by the sum of all the crop yields. The produce yield percentages are provided in Table 1.

Table 1: Produce Yield Data

	SRNL-STI-2010-00447 Section 3.1.2	NUREG/CR-5512, Volume 1, Table 6.14
Produce	Yield (%)	Yield (%)
Leafy Vegetables	20%	22.2%
Legumes	15%	-
Tubers and Roots	10%	-
Non-Leafy	55%	-
Other vegetables	-	44.4%
Fruit	-	22.2%
Grain	-	11.1%

The dashes (-) in Table 1 indicate a value that was not given because the resource documents have grouped the categories differently. The Savannah River National Laboratory (SRNL) report includes fruit and grain as part of its non-leafy category, while the NRC report groups legumes, tubers, and roots within its other vegetables category.

Recommendation

Combining the data provided from both the SRNL report and the NRC report, provides the recommended produce yield percentages for use in liquid waste PAs as shown in Table 2.

Table 2: Recommended Produce Yield Percentages

Produce	Yield (%)
Leafy Vegetables	22.2%
Legumes	15%
Tubers and Roots	10%
Fruit	22.2%
Grain	11.1%
Other	19.5%

Since both resource documents provide a percentage value for leafy vegetables, it is more conservative to use the higher yield percentage for leafy vegetables in the PAs. For the remaining produce/crop categories, it is recommended that when a value is given for a specified group (or category), that value be used. Using the specific produce group provides more details as to what produce is considered in that category.

The “Other” category is equivalent to the “Non-Leafy” category in the SRNL report or the “Other vegetables” category in the NRC report, as it represents any produce not already represented by the more specific produce categories. As such, the percentage is scaled according to the percentages specified for the other categories to ensure a total percentage of 100%

References

ML052220317, Kennedy, W.E., and Strenge, D.L., *Residual Radioactive Contamination from Decommissioning: Technical Basis for Translating Contamination Levels to Annual Total Effective Dose Equivalents*, NUREG/CR-5512 PNL-7994 Volume 1, Pacific Northwest National Laboratory, Richland, WA, October 1992.

SRNL-STI-2010-00447, Jannik, G.T., Karapatakis, D.J., et.al., *Land and Water Use Characteristics and Human Health Input Parameters for Use in Environmental Dosimetry and Risk Assessment at the Savannah River Site*, Savannah River National Laboratory, Aiken, SC, Rev. 0, August 2010.

CC:

K. H. Rosenberger, 705-1C
