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Paper

COMPARISON OF US ENVIRONMENTAL PROTECTION AGENCY'S CAP88 PC VERSIONS 3.0 AND 4.0

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Abstract – The Savannah River National Laboratory (SRNL) with the assistance of Georgia Regents University, completed a comparison of the U.S. Environmental Protection Agency's (EPA) environmental dosimetry code CAP88 PC V3.0 with the recently developed V4.0. CAP88 is a set of computer programs and databases used for estimation of dose and risk from radionuclide emissions to air. At the U.S. Department of Energy's Savannah River Site, CAP88 is used by SRNL for determining compliance with EPA's National Emission Standards for Hazardous Air Pollutants (40 CFR 61, Subpart H) regulations. Using standardized input parameters, individual runs were conducted for each radionuclide within its corresponding database. Some radioactive decay constants, human usage parameters, and dose coefficients changed between the two versions, directly causing a proportional change in the total effective dose. A detailed summary for select radionuclides of concern at the Savannah River Site (^{60}Co, ^{137}Cs, ^{3}H, ^{129}I, ^{239}Pu, and ^{90}Sr) is provided. In general, the total effective doses will decrease for alpha/beta emitters because of reduced inhalation and ingestion rates in V4.0. However, for gamma emitters, such as ^{60}Co and ^{137}Cs, the total effective doses will increase because of changes EPA made in the external ground shine calculations.

Key words: Dosimetry; Environmental; Air Dispersion; Modeling

INTRODUCTION

Radiological airborne emissions from U.S. Department of Energy (DOE) sites are regulated by the U.S. Environmental Protection Agency (EPA) under the Clean Air Act as part of the *National Emissions Standards for Hazardous Air Pollutants* (NESHAP) regulations (EPA 2011). The EPA approved Clean Air Act Assessment Package – 1988 (CAP88) is the dosimetry code used by most DOE sites to demonstrate compliance with the 100 μSv y^{-1} NESHAP annual dose standard. CAP88 is a set of computer programs and databases used for estimation of dose and risk from radionuclide emissions to air. Current and previous versions of CAP88 PC are available from EPA (2015a).

At DOE's Savannah River Site (SRS), which is a large (800 km^2) complex located in South Carolina near Augusta, GA, the Savannah River National Laboratory (SRNL) performs the dose calculations for demonstrating NESHAP compliance. Recently, SRNL, in conjunction with Georgia Regents University (GRU), performed a thorough comparison of all radionuclides in the CAP88 PC V3.0 library with the recently developed V4.0 (dated January 2014) (Sailors and Johnson 2014).

Standardized inputs for each version of the software were used to ensure valid comparisons. These input values are arbitrary and no site specific data were used for the comparison. Due to the slower processing times involved with V3.0, multiple workstations were set up to facilitate a more rapid completion of the job details. V4.0 does not have the slow processing time constraint requirement found in V3.0 because of its improved coding (Wood et al. 2013). While V4.0 is capable of processing any chain length in a matter of seconds, V3.0 could take upwards of 2 hours for radionuclides with long decay chains.

MATERIALS AND METHODS

In Figs. 1 through 6, screenshots are provided of the comparable input tabs for the standardized input parameters used in the CAP88 PC V3.0 and V4.0 calculations. As shown in these figures, an individual run at a midpoint distance of 10 km in the north direction was used as input. The CAP88 default meteorological data for Augusta/Bush Field was selected. This meteorological tower is located on the southside of Augusta, GA about 30 km northwest of SRS. A single stack source at a height of 10 m and diameter of 1 m was used and the plume was fixed at 0 m (no plume rise). The rural food source scenario and the South Carolina food production densities were also selected. An annual release rate of 3.7 x 10^{10} Bq was used for each radionuclide with applicable progeny included.

The radionuclide-independent default input parameters from each version are shown and compared in Table 1. After each individual radionuclide (including applicable progeny) run was completed using CAP88 PC V3.0 and V4.0, the radionuclide-specific dependent default parameters (dose coefficients and transfer factors) and the output parameters (doses and concentrations) were extracted and compiled into comparison tables (Sailors and Johnson 2014).

RESULTS AND DISCUSSION

Radionuclide independent parameters:

As shown in Table 1, the adult inhalation rates and the human food utilization factors went down significantly from CAP88 PC V3.0 to V4.0 because EPA used the human exposure factors from EPA (2009) for all age groups (including adults) in V4.0 (Wood et al. 2013). These exposure factor changes directly and proportionally affected dose for each radionuclide. The inhalation rate decreased about 35% from 8.04×10^{-3} m^3y^{-1} in V3.0 to 5.26×10^{-3} m^3y^{-1} in V4.0. The human food utilization factors decreased from V3.0 to V4.0 by 1) 57% for produce ingestion, 2) 53% for milk ingestion, 3) 1% for meat ingestion, and 4) 57% for leafy vegetable ingestion. All other independent parameters remained consistent between V3.0 and V4.0.

Radionuclide and element dependent parameters:

A small number of radionuclide decay constants changed slightly causing minor changes in the dose outputs. There were no changes noted in the various transfer factors (e.g. soil-to-plant and plant-to-animal). For CAP88 PC V4.0, EPA updated the adult dose coefficients to those documented in DCFPAK V2.2 (Eckerman and Leggett 2008). A primary driver for this change was EPA's desire to include age-specific dose coefficients in V4.0 (Wood et al. 2013). CAP88 PC V4.0 now allows the user to select ingestion and inhalation dose coefficients from 6 different age groups. This update to DCFPAK V2.2 caused many of the inhalation dose coefficients to change (at least slightly) and a smaller number of ingestion dose coefficients changed. Table 2 provides a comparison of the internal dose coefficients for six radionuclides of interest at the Savannah River Site (^{60}Co, ^{137}Cs, ^{3}H, ^{129}I, ^{239}Pu, and ^{90}Sr). One significant difference in dose coefficients was for tritium oxide (HTO). As shown in Table 2, the ingestion and inhalation dose coefficients for HTO went down 50% and 33.3%, respectively.

There were varied changes in most of the external dose coefficients for air immersion and ground shine but most of the changes were relatively small, causing small changes in the doses. However, the external ground shine doses increased by up to a factor of 100 in V4.0. This increase is due to the improvements EPA made in the ground surface buildup/depletion calculations in V4.0 (Wood et al. 2013). This methods change also greatly affected (usually inversely) the air immersion doses for short lived radionuclides, but not to the same magnitude as the ground shine doses.

Concentrations and depositions

EPA made no changes to the Gaussian Plume transport model used in CAP88 PC V3.0 and V4.0. Therefore, only minor changes were noted in the air concentrations, Chi over Q, and wet and dry deposition amounts (Table 3).

Total effective dose comparisons (individual)

Table 4 highlights the effects that the changes in 1) the human usage parameters (inhalation and ingestion rates) and 2) the ground shine calculations have on the total effective doses for ^{60}Co, ^{137}Cs, ^{3}H, ^{129}I, ^{239}Pu, and ^{90}Sr. With the exception of HTO, dramatic increases in ground shine dose can be seen in each of these radionuclides (1,400% to 10,000% increases). The total effective doses for gamma-emitting radionuclides, such as ^{60}Co and ^{137}Cs, were more affected, on a percentage of dose basis, by the changes in ground shine dose.

The decreases in ingestion and inhalation rates proportionally decreased the total effective dose for each radionuclide. The effect of the decreases in the internal doses is more significant for the alpha- and beta-emitting radionuclides and it caused their total effective doses to go down between 20% and 40%. HTO had an even larger decrease (about 65%) in total effective dose because of the decreases in its dose coefficients for ingestion and inhalation.

Total effective dose comparisons (population)

In addition to the thorough individual dose comparisons, a more limited comparison of the collective doses was performed for the population within 80 km from the center of the SRS. The CAP88 PC default population data file from 1980 for the “Savannah River Plant” was used for this comparison. As shown in Table 5, the total collective doses experienced the same changes in the various pathway doses as did the individual doses. The major exception to this was for the ingestion pathway, which did not proportionally decrease with the decrease in ingestion rates because it was limited by the amount of food productivity in the South Carolina region.

CONCLUSIONS

The many architectural and coding changes that EPA made in CAP88 PC V4.0 have greatly improved the appearance and functionality of the model (Wood et al. 2013). The Gaussian Plume model used in V4.0 was not modified from previous versions, so the air concentrations and ground deposition amounts were essentially unchanged. However, the improvements EPA made in the numerical solutions for ground surface buildup and depletion increased dramatically the ground shine doses for most radionuclides.

For CAP88 PC V4.0, EPA updated the adult dose coefficients to those documented in DCFPAK V2.2. These dose coefficient changes caused direct and proportional changes in the total effective dose. EPA also updated the human usage factors to those found in the 2009 version of their Exposure Factors Handbook (EPA 2009). These changes directly and proportionally affected (decreased) the inhalation and ingestion doses.

Therefore, in general, the total effective doses will decrease for alpha/beta emitters because of reduced inhalation and ingestion rates in V4.0. However, for gamma emitters, such as ^{60}Co and ^{137}Cs, the total effective doses will increase because of the changes EPA made in the external ground shine calculations. A full comparison of all radionuclides in the V3.0 library is provided in Sailors and Johnson (2014).

On February 10, 2015, the EPA authorized the use of CAP88 PC V4.0 for demonstrating compliance with NESHAP dose standards (EPA 2015b).

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Figure 1. Standard verification inputs for CAP88 V3.0 (top) and V4.0 (bottom) - Facility

Figure 2. Standard verification inputs for CAP88 V3.0 (top) and V4.0 (bottom) - Run/Population

Figure 3. Standard verification inputs for CAP88 V3.0 (top) and V4.0 (bottom) - Meteorological

Figure 4. Standard verification inputs for CAP88 V3.0 (top) and V4.0 (bottom) - Sources

Figure 5. Standard verification inputs for CAP88 V3.0 (top) and V4.0 (bottom) - Agricultural

Figure 6. Standard verification inputs for CAP88 V3.0 (top) and V4.0 (bottom) - Nuclide Tab

Table 1. Comparison of CAP88 PC V3.0 and V4.0 radionuclide-independent default parameters

	Version 3.0	Version 4.0	% Change
Inhalation Rate (m^3 y^{-1})	8.04 x 10^{-3}	5.26 x 10^{-3}	**-34.58**
Soil Parameters			
x10 effective surface density (kg/sq m, dry weight) (Assumes 15 cm plow layer)	2.15 x 10^{-2}	2.15 x 10^{-2}	**0.00**
Buildup Times			
For activity in soil (yr)	1.00 x 10^{-2}	1.00 x 10^{-2}	**0.00**
For radionuclides deposited on ground/water (yr)	3.65 x 10^{-4}	3.65 x 10^{-4}	**0.00**
Delay Times			
Ingestion Pasture Grass by animals (hr)	0.00 x 10^{-0}	0.00 x 10^{-0}	**0.00**
Ingestion of stored feed by animals (hr)	2.16 x 10^{-3}	2.16 x 10^{-3}	**0.00**
Ingestion of leafy vegetables by man (hr)	3.36 x 10^{-2}	3.36 x 10^{-2}	**0.00**
Ingestion of produce by man (hr)	3.36 x 10^{-2}	3.36 x 10^{-2}	**0.00**
Transport time from animal feed-milk-man (d)	2.00 x 10^{-0}	2.00 x 10^{-0}	**0.00**
Time from slaughter to consumption (d)	2.00 x 10^{-1}	2.00 x 10^{-1}	**0.00**
Weathering			
Removal rate constant for physical loss (per hr)	2.90 x 10^{-3}	2.90 x 10^{-3}	**0.00**
Crop Exposure Duration			
Pasture grass (hr)	7.20 x 10^{-2}	7.20 x 10^{-2}	**0.00**
Crops/leafy vegetables (hr)	1.44 x 10^{-3}	1.44 x 10^{-3}	**0.00**
Agricultural Productivity			
Grass-cow-milk-man pathway (kg m^2)	2.80 x 10^{-1}	2.80 x 10^{-1}	**0.00**
Produce/leafy veg for human consumption (kg m^2)	7.16 x 10^{-1}	7.16 x 10^{-1}	**0.00**
Fallout Interception Fractions			
Vegetables	2.00 x 10^{-1}	2.00 x 10^{-1}	**0.00**
Pasture	5.70 x 10^{-1}	5.70 x 10^{-1}	**0.00**
Grazing Parameters			
Fraction of year animals graze on pasture	4.00 x 10^{-1}	4.00 x 10^{-1}	**0.00**
Fraction of daily feed that is pasture grass when animal grazes on pasture	4.30 x 10^{-1}	4.30 x 10^{-1}	**0.00**
Animal Feed Consumption Factors			
Contaminated feed/forage (kg/day, dry weight)	1.56 x 10^{-1}	1.56 x 10^{-1}	**0.00**
Dairy Productivity			
Milk production of cow (L d^{-1})	1.10 x 10^{-1}	1.10 x 10^{-1}	**0.00**
Meat Animal Slaughter Parameters			
Muscle mass of animal at slaughter (kg)	2.00 x 10^{-2}	2.00 x 10^{-2}	**0.00**
Fraction of herd slaughtered (per day)	3.81 x 10^{-3}	3.81 x 10^{-3}	**0.00**
Decontamination			
Fraction of radioactivity retained after washing			

for leafy vegetables and produce	5.00×10^{-1}	5.00×10^{-1}	**0.00**
Fraction Grown In Garden Of Interest			
Produce ingested	1.00×10^{-0}	1.00×10^{-0}	**0.00**
Leafy vegetables ingested	1.00×10^{-0}	1.00×10^{-0}	**0.00**
Ingestion Ratios: Immediate Surrounding Area/Total Within Area			
Vegetables	7.00×10^{-1}	7.00×10^{-1}	**0.00**
Meat	4.40×10^{-1}	4.40×10^{-1}	**0.00**
Milk	4.00×10^{-1}	4.00×10^{-1}	**0.00**
Minimum Ingestion Fractions: Outside Area (Minimum fractions of food types from outside area listed below are actual fixed values.)			
Vegetables	0.00×10^{-0}	0.00×10^{-0}	**0.00**
Meat	0.00×10^{-0}	0.00×10^{-0}	**0.00**
Milk	0.00×10^{-0}	0.00×10^{-0}	**0.00**
Human Food Utilization Factors			
Produce ingestion (kg y^{-1})	1.76×10^{-2}	7.62×10^{-1}	**-56.70**
Milk ingestion (L y^{-1})	1.12×10^{-2}	5.30×10^{-1}	**-52.68**
Meat ingestion (kg y^{-1})	8.50×10^{-1}	8.40×10^{-1}	**-1.18**
Leafy vegetable ingestion (kg y^{-1})	1.80×10^{-1}	7.79×10^{-0}	**-56.72**
Swimming Parameters			
Fraction of time spent swimming	0.00×10^{-0}	0.00×10^{-0}	**0.00**
Dilution factor for water (cm)	1.00×10^{-0}	1.00×10^{-0}	**0.00**

Table 2. CAP88 PC V3.0 and V4.0 dose coefficients.

		^{60}Co	^{137}Cs	HTO	^{129}I	^{239}Pu	^{90}Sr
Ingestion Dose Coefficient (mSv Bq^{-1})	V3	3.46×10^{-6}	1.36×10^{-5}	3.83×10^{-8}	1.06×10^{-4}	2.51×10^{-4}	2.75×10^{-5}
	V4	3.46×10^{-6}	1.36×10^{-5}	1.92×10^{-8}	1.06×10^{-4}	2.51×10^{-4}	2.75×10^{-5}
	% Change	**0.00**	**0.00**	**-50.00**	**0.00**	**0.00**	**0.00**
Inhalation Dose Coefficient (mSv Bq^{-1})	V3	1.02×10^{-5}	4.67×10^{-6}	2.75×10^{-8}	3.59×10^{-5}	5.02×10^{-2}	3.56×10^{-5}
	V4	9.38×10^{-6}	4.02×10^{-6}	1.83×10^{-8}	3.01×10^{-5}	4.83×10^{-2}	3.40×10^{-5}
	% Change	**-8.08**	**-13.9**	**-33.3**	**-14.3**	**-3.73**	**-4.44**

Table 3. CAP88 PC V3.0 and V4.0 concentration and deposition comparisons.

		^{60}Co	^{137}Cs	HTO	^{129}I	^{239}Pu	^{90}Sr
Air Concentration (Bq m^{-3})	V3	1.30×10^{-4}	1.30×10^{-4}	2.22×10^{-4}	7.67×10^{-6}	1.30×10^{-4}	1.30×10^{-4}
	V4	1.33×10^{-4}	1.33×10^{-4}	2.22×10^{-4}	7.63×10^{-6}	1.33×10^{-4}	1.33×10^{-4}
	% Change	**2.28**	**2.28**	**0.00**	**-0.53**	**2.28**	**2.28**
Chi/Q (Sec m^{-3})	V3	1.11×10^{-7}	1.11×10^{-7}	1.89×10^{-7}	6.54×10^{-9}	1.11×10^{-7}	1.11×10^{-7}
	V4	1.13×10^{-7}	1.13×10^{-7}	1.89×10^{-7}	6.51×10^{-9}	1.13×10^{-7}	1.13×10^{-7}
	% Change	**1.80**	**1.80**	**0.00**	**-0.46**	**1.80**	**1.80**
Dry Deposition (Bq cm^{-2} s^{-1})	V3	2.35×10^{-11}	2.35×10^{-11}	0.00	2.69×10^{-11}	2.35×10^{-11}	2.35×10^{-11}
	V4	2.39×10^{-11}	2.39×10^{-11}	0.00	2.68×10^{-11}	2.39×10^{-11}	2.39×10^{-11}
	% Change	**1.70**	**1.70**	**0.00**	**-0.45**	**1.70**	**1.70**
Wet Depostion (Bq cm^{-2} s^{-1})	V3	1.19×10^{-11}	1.19×10^{-11}	0.00	2.26×10^{-12}	1.19×10^{-11}	1.19×10^{-11}
	V4	1.19×10^{-11}	1.19×10^{-11}	0.00	2.20×10^{-12}	1.19×10^{-11}	1.19×10^{-11}
	% Change	**0.00**	**0.00**	**0.00**	**-2.66**	**0.00**	**0.00**
Ground Deposition (Bq cm^{-2} s^{-1})	V3	3.53×10^{-11}	3.53×10^{-11}	0.00	2.92×10^{-11}	3.53×10^{-11}	3.53×10^{-11}
	V4	3.59×10^{-11}	3.59×10^{-11}	0.00	2.90×10^{-11}	3.59×10^{-11}	3.59×10^{-11}
	% Change	**1.56**	**1.56**	**0.00**	**-0.81**	**1.56**	**1.56**

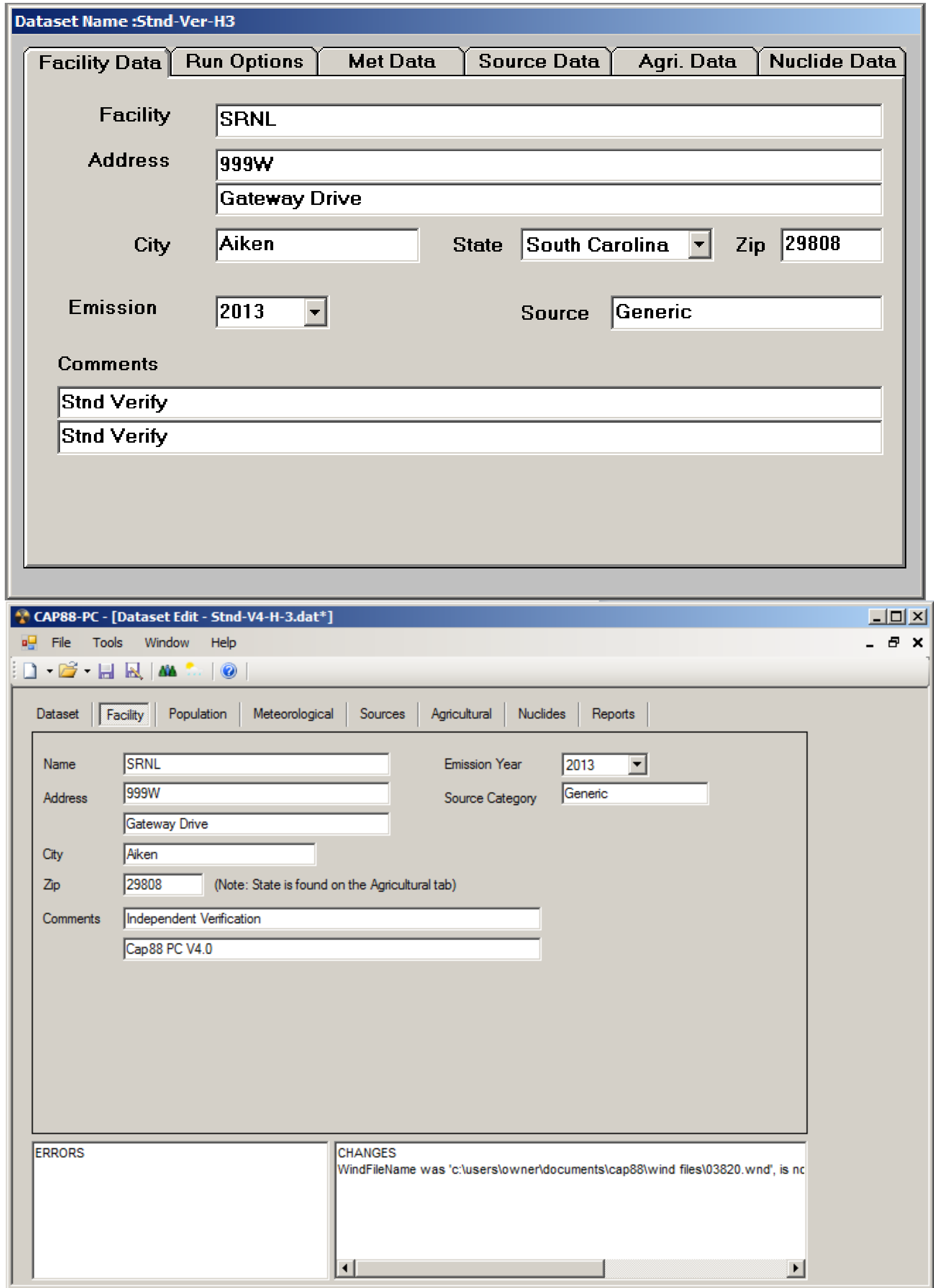
Table 4. CAP88 PC V3.0 and V4.0 individual dose comparisons

		^{60}Co	^{137}Cs	HTO	^{129}I	^{239}Pu	^{90}Sr
Total Effective Dose (mSv)	V3	4.05 x 10^{-4}	2.50 x 10^{-3}	4.68 x 10^{-7}	6.82 x 10^{-3}	5.52 x 10^{-2}	3.99 x 10^{-3}
	V4	2.89 x 10^{-3}	4.12 x 10^{-3}	1.66 x 10^{-7}	5.28 x 10^{-3}	3.51 x 10^{-2}	3.09 x 10^{-3}
	% Change	**613.58**	**64.80**	**-64.53**	**-22.58**	**-36.41**	**-22.56**
Ingestion Dose (mSv y^{-1})	V3	2.17 x 10^{-4}	2.45 x 10^{-3}	4.19 x 10^{-7}	6.82 x 10^{-3}	2.72 x 10^{-3}	3.94 x 10^{-3}
	V4	1.81 x 10^{-4}	1.88 x 10^{-3}	1.45 x 10^{-7}	5.16 x 10^{-3}	1.21 x 10^{-3}	2.62 x 10^{-3}
	% Change	**-16.59**	**-23.27**	**-65.39**	**-24.34**	**-55.51**	**-33.50**
Inhalation Dose (mSv y^{-1})	V3	1.07 x 10^{-5}	4.89 x 10^{-6}	4.89 x 10^{-8}	2.21 x 10^{-6}	5.25 x 10^{-2}	3.87 x 10^{-5}
	V4	6.55 x 10^{-6}	2.81 x 10^{-6}	2.14 x 10^{-8}	1.24 x 10^{-6}	3.39 x 10^{-2}	2.45 x 10^{-5}
	% Change	**-42.54**	**-42.54**	**-56.24**	**-43.89**	**-35.43**	**-36.69**
Air Immersion Dose (mSv y^{-1})	V3	4.88 x 10^{-7}	1.05 x 10^{-7}	0.00	6.84 x 10^{-11}	1.43 x 10^{-11}	3.66 x 10^{-9}
	V4	4.98 x 10^{-7}	1.07 x 10^{-7}	0.00	6.88 x 10^{-11}	1.58 x 10^{-11}	3.72 x 10^{-9}
	% Change	**2.05**	**1.90**	**0.00**	**0.58**	**10.49**	**1.64**
Ground Surface Dose (mSv y^{-1})	V3	1.77 x 10^{-4}	4.36 x 10^{-5}	0.00	1.29 x 10^{-6}	2.27 x 10^{-8}	8.86 x 10^{-6}
	V4	2.70 x 10^{-3}	2.24 x 10^{-3}	0.00	1.24 x 10^{-4}	2.35 x 10^{-6}	4.45 x 10^{-4}
	% Change	**1,425**	**5,037**	**0.00**	**9,512**	**10,252**	**4,922**

Table 5. CAP88 PC V3.0 and V4.0 population dose comparison.

		^{60}Co	^{137}Cs	HTO	^{129}I	^{239}Pu	^{90}Sr
Population Effective Dose (person Sv y^{-1})	V3	1.82×10^{-2}	1.11×10^{-1}	2.11×10^{-5}	3.11×10^{-1}	$1.63 \times 10^{+0}$	1.41×10^{-1}
	V4	1.34×10^{-1}	1.92×10^{-1}	1.15×10^{-5}	2.84×10^{-1}	$1.09 \times 10^{+0}$	1.48×10^{-1}
	% Change	**636**	**73.0**	**-45.5**	**-8.68**	**-33.1**	**4.96**
Ingestion Dose (person Sv y^{-1})	V3	1.05×10^{-2}	1.11×10^{-1}	1.80×10^{-5}	3.10×10^{-1}	3.46×10^{-2}	1.40×10^{-1}
	V4	9.25×10^{-3}	1.02×10^{-1}	1.02×10^{-5}	2.81×10^{-1}	3.51×10^{-2}	1.29×10^{-1}
	% Change	**-1.19**	**-8.11**	**-43.3**	**-9.35**	**1.45**	**-7.86**
Inhalation Dose (person Sv y^{-1})	V3	7.45×10^{-4}	1.49×10^{-4}	3.06×10^{-6}	4.12×10^{-5}	$1.60 \times 10^{+0}$	1.18×10^{-3}
	V4	2.03×10^{-4}	8.72×10^{-5}	1.33×10^{-6}	2.27×10^{-5}	$1.05 \times 10^{+0}$	7.63×10^{-4}
	% Change	**-72.8**	**-41.5**	**-56.5**	**-44.9**	**-34.4**	**-35.3**
Air Immersion Dose (person Sv y^{-1})	V3	1.29×10^{-5}	3.22×10^{-6}	0.00	1.27×10^{-9}	4.37×10^{-10}	1.12×10^{-7}
	V4	1.32×10^{-5}	3.31×10^{-6}	0.00	1.26×10^{-9}	4.90×10^{-10}	1.16×10^{-7}
	% Change	**2.33**	**2.80**	**0.00**	**-0.79**	**12.1**	**3.57**
Ground Surface Dose (person Sv y^{-1})	V3	7.10×10^{-3}	1.75×10^{-3}	0.00	2.63×10^{-5}	9.11×10^{-7}	3.56×10^{-4}
	V4	9.95×10^{-2}	8.99×10^{-2}	0.00	2.47×10^{-3}	9.45×10^{-5}	1.79×10^{-2}
	% Change	**1,302**	**5,037**	**0.00**	**9,292**	**10,273**	**4,928**

Figure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Facility Data
Run Options
Met Data
Source Data
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Facility
SRNL
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999W
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City
Aiken
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South Carolina
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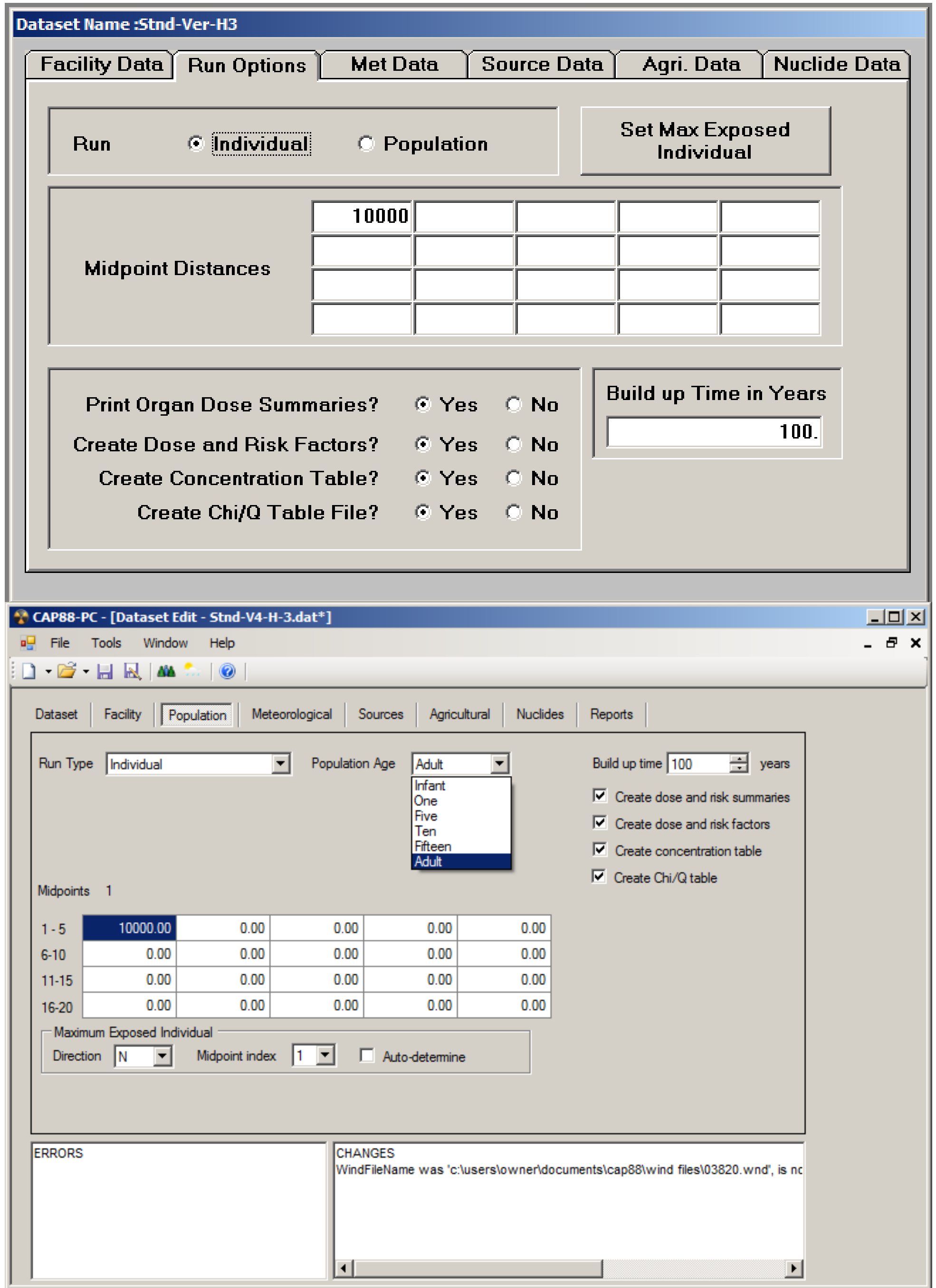
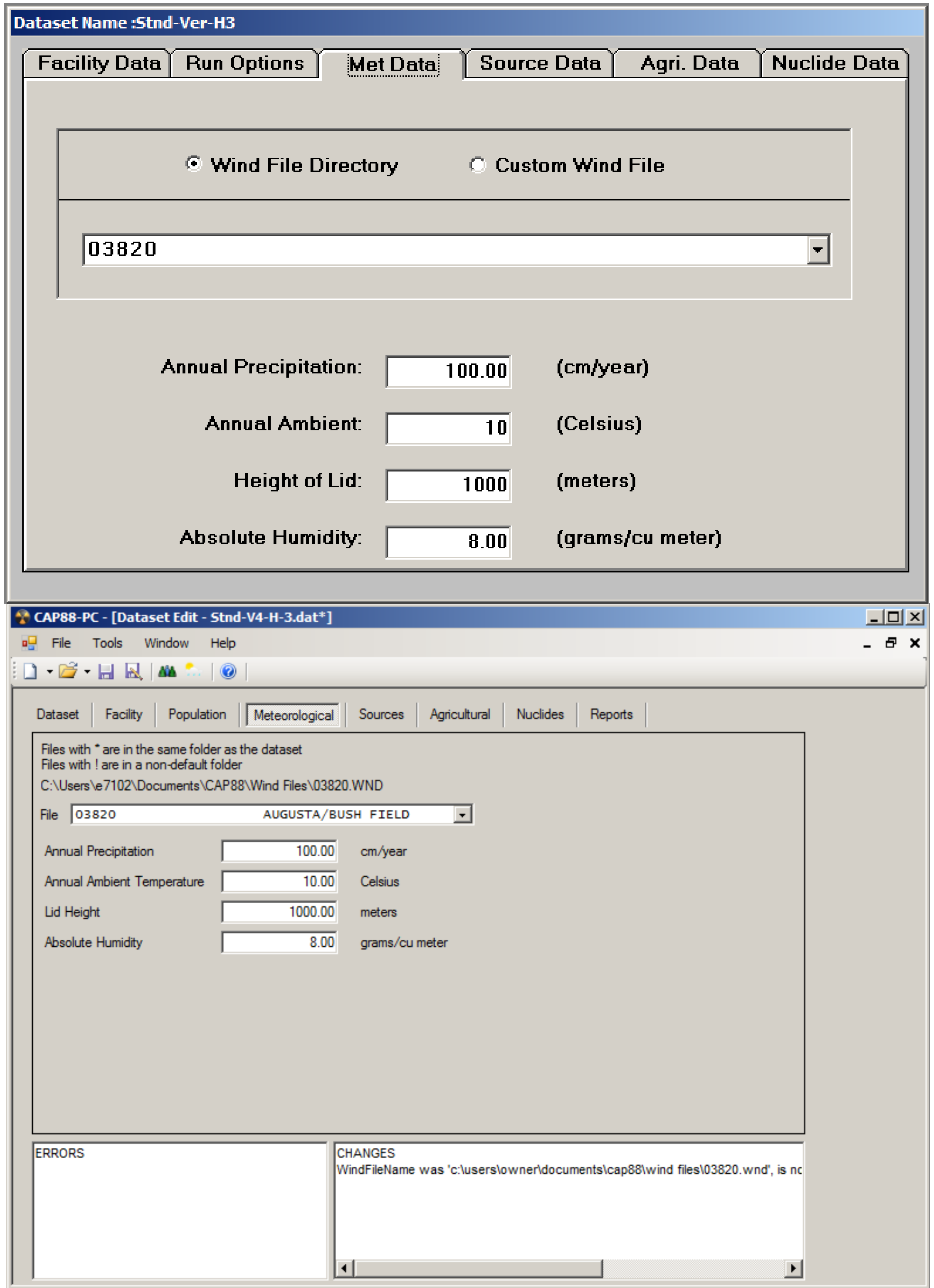
CAP88-PC - [Dataset Edit - Stnd-V4-H-3.dat*]
File
Tools
Window
Help
Dataset
Facility
Population
Meteorological
Sources
Agricultural
Nuclides
Reports
Name
SRNL
Address
999W
Gateway Drive
City
Aiken
Zip
29808
(Note: State is found on the Agricultural tab)
Comments
Independent Verification
Cap88 PC V4.0
Emission Year
2013
Source Category
Generic
ERRORS
CHANGES
WindFileName was 'c:\users\owner\documents\cap88\wind files\03820.wnd', is

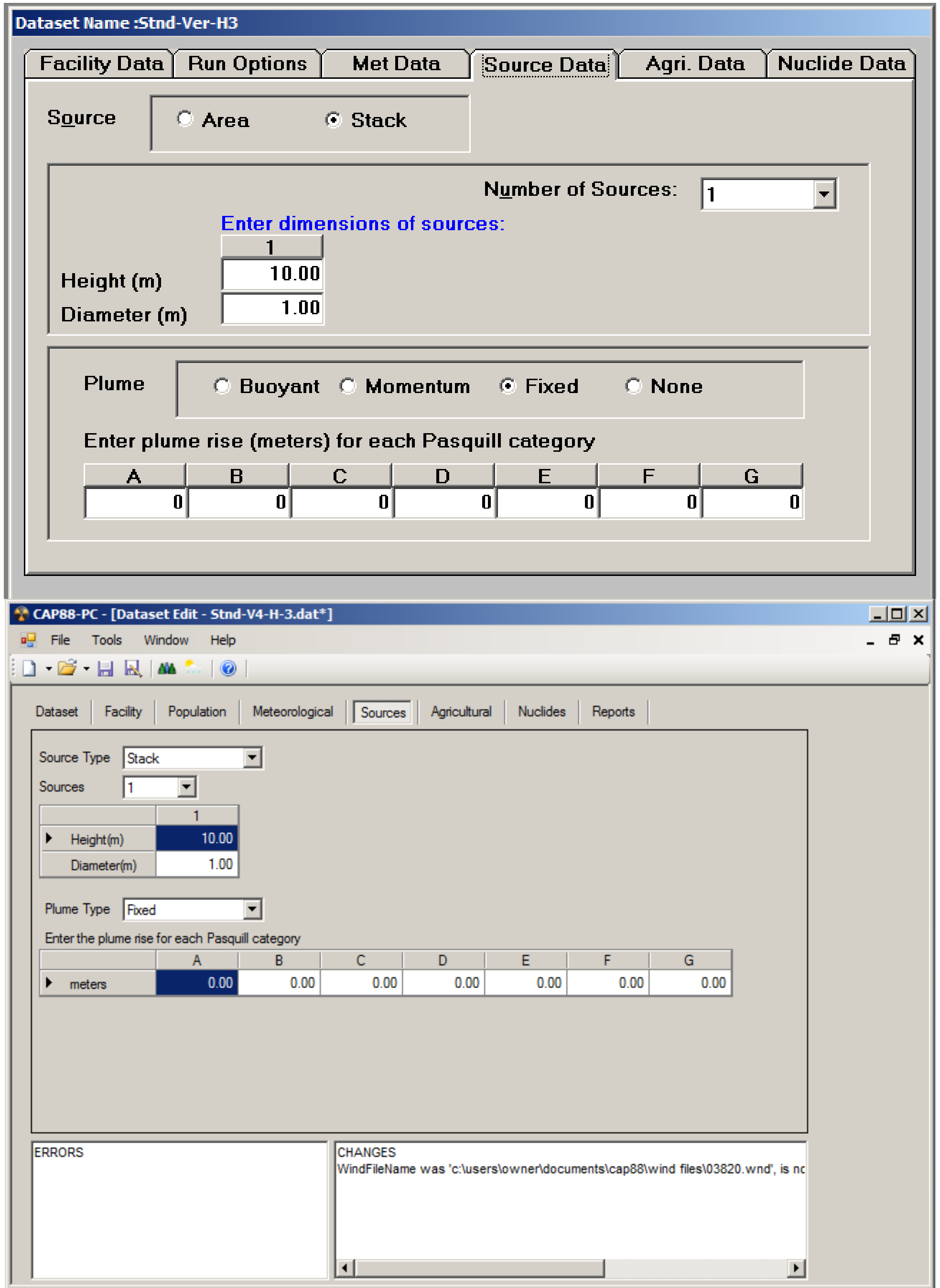
Figure


Dataset Name :Stnd-Ver-H3
Facility Data
Run Options
Met Data
Source Data
Agri. Data
Nuclide Data
Run
Individual
Population
Set Max Exposed Individual
Midpoint Distances
10000
Print Organ Dose Summaries?
Create Dose and Risk Factors?
Create Concentration Table?
Create Chi/Q Table File?
Yes
No
Build up Time in Years
100.
CAP88-PC - [Dataset Edit - Stnd-V4-H-3.dat*]
File
Tools
Window
Help
Dataset
Facility
Population
Meteorological
Sources
Agricultural
Nuclides
Reports
Run Type
Individual
Population Age
Adult
Infant
One
Five
Ten
Fifteen
Adult
Build up time
100
years
Create dose and risk summaries
Create dose and risk factors
Create concentration table
Create Chi/Q table
Midpoints 1
1 - 5
6-10
11-15
16-20
10000.00
0.00
Maximum Exposed Individual
Direction
N
Midpoint index
1
Auto-determine
ERRORS
CHANGES
WindFileName was 'c:\users\owner\documents\cap88\wind files\03820.wnd', is nc

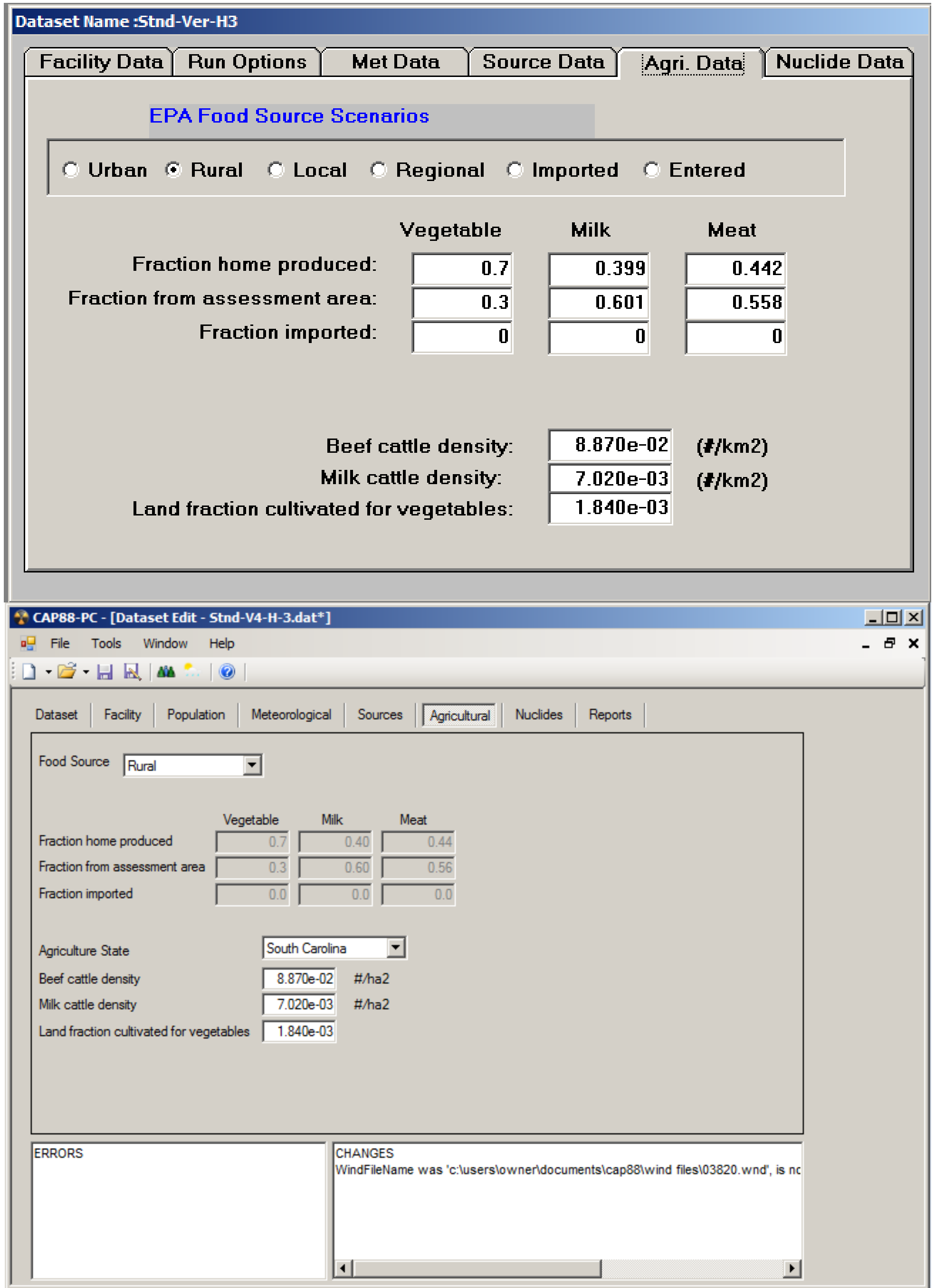
Figure


Dataset Name :Stnd-Ver-H3
Facility Data
Run Options
Met Data
Source Data
Agri. Data
Nuclide Data
Wind File Directory
Custom Wind File
03820
Annual Precipitation:
100.00
(cm/year)
Annual Ambient:
10
(Celsius)
Height of Lid:
1000
(meters)
Absolute Humidity:
8.00
(grams/cu meter)
CAP88-PC - [Dataset Edit - Stnd-V4-H-3.dat*]
File
Tools
Window
Help
Dataset
Facility
Population
Meteorological
Sources
Agricultural
Nuclides
Reports
Files with * are in the same folder as the dataset
Files with ! are in a non-default folder
C:\Users\e7102\Documents\CAP88\Wind Files\03820.WND
File
03820 AUGUSTA/BUSH FIELD
Annual Precipitation
100.00
cm/year
Annual Ambient Temperature
10.00
Celsius
Lid Height
1000.00
meters
Absolute Humidity
8.00
grams/cu meter
ERRORS
CHANGES
WindFileName was 'c:\users\owner\documents\cap88\wind files\03820.wnd', is nc

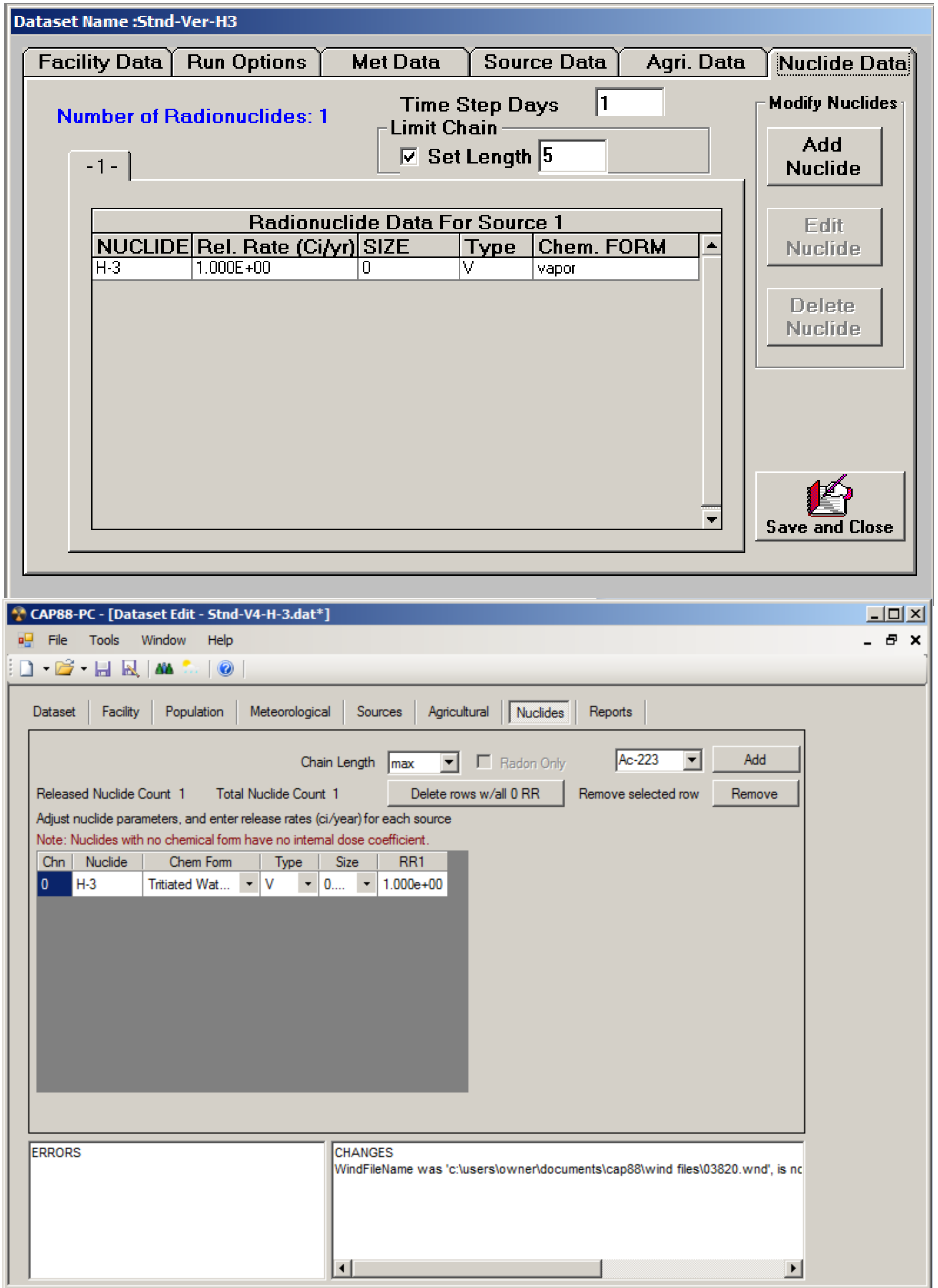
Figure


Dataset Name :Stnd-Ver-H3
Facility Data
Run Options
Met Data
Source Data
Agri. Data
Nuclide Data
Source
Area
Stack
Number of Sources:
1
Enter dimensions of sources:
1
Height (m)
10.00
Diameter (m)
1.00
Plume
Buoyant
Momentum
Fixed
None
Enter plume rise (meters) for each Pasquill category
A B C D E F G
0 0 0 0 0 0 0
CAP88-PC - [Dataset Edit - Stnd-V4-H-3.dat*]
File
Tools
Window
Help
Dataset
Facility
Population
Meteorological
Sources
Agricultural
Nuclides
Reports
Source Type
Stack
Sources
1
1
Height(m)
10.00
Diameter(m)
1.00
Plume Type
Fixed
Enter the plume rise for each Pasquill category
A B C D E F G
meters
0.00 0.00 0.00 0.00 0.00 0.00 0.00
ERRORS
CHANGES
WindFileName was 'c:\users\owner\documents\cap88\wind files\03820.wnd', is nc

Figure


Dataset Name :Stnd-Ver-H3
Facility Data
Run Options
Met Data
Source Data
Agri. Data
Nuclide Data
EPA Food Source Scenarios
Urban
Rural
Local
Regional
Imported
Entered
Vegetable
Milk
Meat
Fraction home produced:
0.7
0.399
0.442
Fraction from assessment area:
0.3
0.601
0.558
Fraction imported:
0
0
0
Beef cattle density:
8.870e-02
(#/km2)
Milk cattle density:
7.020e-03
(#/km2)
Land fraction cultivated for vegetables:
1.840e-03
CAP88-PC - [Dataset Edit - Stnd-V4-H-3.dat*]
File
Tools
Window
Help
Dataset
Facility
Population
Meteorological
Sources
Agricultural
Nuclides
Reports
Food Source
Rural
Vegetable
Milk
Meat
Fraction home produced
0.7
0.40
0.44
Fraction from assessment area
0.3
0.60
0.56
Fraction imported
0.0
0.0
0.0
Agriculture State
South Carolina
Beef cattle density
8.870e-02
#/ha2
Milk cattle density
7.020e-03
#/ha2
Land fraction cultivated for vegetables
1.840e-03
ERRORS
CHANGES
WindFileName was 'c:\users\owner\documents\cap88\wind files\03820.wnd', is nc

Figure


Dataset Name :Stnd-Ver-H3
Facility Data
Run Options
Met Data
Source Data
Agri. Data
Nuclide Data
Number of Radionuclides: 1
Time Step Days
1
Limit Chain
Set Length
5
Modify Nuclides
Add Nuclide
Edit Nuclide
Delete Nuclide
- 1 -
Radionuclide Data For Source 1
NUCLIDE
Rel. Rate (Ci/yr)
SIZE
Type
Chem. FORM
H-3
1.000E+00
0
V
vapor
Save and Close
CAP88-PC - [Dataset Edit - Stnd-V4-H-3.dat*]
File
Tools
Window
Help
Dataset
Facility
Population
Meteorological
Sources
Agricultural
Nuclides
Reports
Chain Length
max
Radon Only
Ac-223
Add
Released Nuclide Count 1
Total Nuclide Count 1
Delete rows w/all 0 RR
Remove selected row
Remove
Adjust nuclide parameters, and enter release rates (ci/year) for each source
Note: Nuclides with no chemical form have no internal dose coefficient.
Chn
Nuclide
Chem Form
Type
Size
RR1
0
H-3
Tritiated Wat...
V
0....
1.000e+00
ERRORS
CHANGES
WindFileName was 'c:\users\owner\documents\cap88\wind files\03820.wnd', is nc

Tim Jannik is a Principal Technical Advisor at the Savannah River National Laboratory (SRNL). He has over 35 years of experience in the nuclear industry, 26 of which have been at the Savannah River Site. Tim is the technical lead of the Environmental Dosimetry Group at SRNL and he specializes in 1) environmental dosimetry and radioecology, 2) effluent and environmental monitoring, and 3) human health risk analyses. He is a Past-President of the Environmental/Radon Section of the Health Physics Society. Tim has a bachelor's degree in Mechanical Engineering from Villanova University and a Master's degree in Health Physics from the Georgia Institute of Technology.

Tim Jannik

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