Simplifying the Tracking of Waste Disposal Inventories: Process Improvement for Rapid Data Interpretation and Reduced Errors – 16143

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ABSTRACT

Tracking the inventory of low-level radioactive waste at an operating disposal facility offers unique challenges. At the Savannah River Site's Saltstone Disposal Facility (SDF) the inventory used in Performance Assessment modeling is determined based on radionuclide concentrations from the aqueous waste in a feed tank and the volume of the waste that is transferred from the feed tank to the Saltstone Production Facility (SPF).   These inputs are reported quarterly. As such, the disposal inventories are also updated quarterly; however, due to decay and in-growth, the inventory values for some radionuclides can be misrepresented if the data is not tracked appropriately. Additionally, it is not feasible to analyze the feed tank samples for every possible radionuclide; therefore, a series of adjustments are necessary to estimate the concentrations of radionuclides that are not explicitly measured but still pose a potential dose risk. Prior to 2015, the SDF disposal inventories were updated using a series of spreadsheets that required users to perform a significant number of steps (including manually transferring data back and forth between a separate decay and ingrowth calculation software). Despite this labor intensive approach, the process only provided single point-in-time results. With multiple steps, minimal automation, and limited result data, this approach to inventory tracking was not ideal and minor mistakes were often identified during the equally cumbersome review process.

As a process improvement, the simplified SDF Waste Inventory Disposed Estimator (SDF-WIDE) Model was developed using GoldSim software. The software allows users to identify specific dates to define the duration of the simulation, from the beginning of operations until the time of future facility closure, and provides graphical interfaces for displaying data over time. Further, GoldSim's Contaminant Transport Module is used to perform the decay and ingrowth calculations, making the model completely self-contained (i.e., there is no need to transfer intermediate data back and forth between different programs). GoldSim also includes model "versioning" features that significantly reduce the time needed to perform the appropriate quality assurance reviews as required for each quarterly inventory update. By transitioning from the complex spreadsheets to the simplified SDF-WIDE model, the time needed to perform updates to the SDF inventory has been reduced from days to hours, the risk of making human errors has been greatly mitigated, and users are able to quickly observe trends in the data over time.

INTRODUCTION

Radioactive operations at the Savannah River Site's Saltstone Production Facility (SPF) began in 1990. This facility processes low-level liquid radioactive waste from the site's tank farms and feeds the treated waste to the Saltstone Disposal Facility (SDF) for final disposal. During processing, the low-level liquid waste is mixed into

saltstone, a cementitious grout with a formula designed to immobilize certain radionuclides. After processing, the saltstone is sent to the Saltstone Disposal Facility (SDF), where it is disposed within Saltstone Disposal Units.

Generating accurate inventories for SDF Performance Assessment modeling requires appropriate characterization of the waste stream fed to the SPF and up-to-date tracking of the transferred waste volume, both of which are reported on a quarterly basis. For the 2009 SDF Performance Assessment [1] and for two recent SDF Special Analyses [2, 3], inventories were updated by inputting the waste characterization and waste volume data into a Microsoft Excel [4] file with multiple sheets, hereafter referred to as the Excel File. As part of calculating the current SDF inventories, the Excel File applied a series of adjustments to estimate inventories for radionuclides which were not explicitly characterized.

The Excel File was not initially designed for continuous (i.e., quarterly) updates, so a significant number of steps had to be manually performed anytime new data was added. This approach was time-consuming and introduced multiple opportunities for user errors. As a process improvement, the SDF Waste Inventory Disposed Estimator (SDF-WIDE) Model [5] was developed. This GoldSim [6] file effectively reduced the time required for generating and reviewing updated inventories from days to hours. The model simplifies the steps required for inputting new data and provides a more dynamic interface, enabling users to quickly generate figures with the new data.

To appreciate the degree of process improvement afforded by the SDF-WIDE Model, both approaches for updating inventory values need to be understood. The following provides a brief discussion of each approach. Note that the focus of this paper is to highlight process improvement, so the specific calculations (and the bases of those calculations) are not provided herein.

UPDATING THE EXCEL FILE

There are multiple sheets within the Excel File, as described in Table I. Following the table is a discussion of the steps that must be manually performed any time the inventory estimate is updated. There are seven steps that must be performed when updating the Excel File:

1. Input new concentration data
2. Update the logic in the sheet: "Tank 50 Final Data"
3. Update figures in the sheet: "Tank 50 Final Data"
4. Input new transfer data
5. Perform decay and ingrowth calculations
6. Determine the total inventory for each Saltstone Disposal Unit (SDU)
7. Review updates

Note that within Table I, and throughout this document, the nomenclature "SDUXX" is used to generically refer to the suite of SDUs with disposed waste inventories (i.e., SDU 1, SDU 4, SDU 2A, SDU 2B, SDU 5A, and SDU 5B). Since the same operations are performed for estimating the inventory for each SDU, the SDUXX nomenclature eliminates the need for redundancy.

TABLE I. Description of the Sheets in the Excel File

Sheet	Description
Summary	This sheet provides a high-level summary of the Excel File. There are no inputs or calculations.
Conversion Factors	This sheet provides unit conversions to be referenced in calculations. Users do not need to update the data in this sheet.
Special Method Values	This sheet provides the appropriate inputs for applying the various adjustments to estimate values for radionuclides not explicitly characterized [7].
Tank 50 All Data	Tank 50 is the current feed tank to the SPF. Samples taken from Tank 50 are analyzed to generate the quarterly waste characterization data. This sheet also uses data from "Special Method Values" to determine the appropriate radionuclide concentration to use when no concentration is reported. This sheet must be updated with values from the quarterly sample report when updating the SDF inventory.
Tank 50 Final Data	This sheet uses data in a series of logic statements to determine which data value to use from the sheet: "Tank 50 All Data" (i.e., detected value, detection limit, special method detection value, special method detection limit, or an assumed value). This sheet must be updated when updating the SDF inventory.
Undecayed SDUXX[a] Inv	This sheet provides to provide a preliminary, SDU-specific inventory estimate. The volume of salt solution transferred from Tank 50 to the specific SDU is multiplied by the respective concentration values (from the sheet: "Tank 50 Final Data"). Data is organized by monthly intervals.
SDUXX[a] Decay	This sheet formats the preliminary, SDU-specific inventory estimate (from the sheet: "Undecayed SDUXX Inv") to be used as in input to an external decay and ingrowth calculation software. Data is organized in quarterly intervals. After the inventory values have been processed through the decay and ingrowth calculation software, it is copied back into this sheet to be reformatted.
SDUXX[a] Decayed Inventory	This sheet takes the formatted decay and ingrowth values for each quarter (from the sheet: "SDUXX Decay") and sums the data to provide an annual inventory estimate.

a. XX = 1, 4, 2A, and 2B (used to identify specific SDUs).

Step 1. Input New Concentration Data

When updating the Excel File, users begin by inserting two columns into the sheet "Tank 50 All Data". These two columns represent a single set of quarterly data

from the Tank 50 sample analyses. Figure 1 provides a screen capture from this sheet.

Note that each radionuclide has multiple rows, each representing a different potential data type (i.e., detected value, detection limit, special method detection value, special method detection limit, or an assumed value). Prior to inputting the new data, users must copy the formulas from a previous set of quarterly samples to ensure that the proper calculations are in place.

	A	D	E	F	G	H
1	Quarter	Q3 2013		Q2 2013		Q1 201
2	Sample Date	2013	7/2/2013	2013	4/3/2013	2013
3-4	Source	SRNL-L3100-2013-00178 Rev 0		SRNL-STI-2013-00390 Rev 0		SRNL-STI-2013-0
5	Rad	Detection Limit?	pCi/mL	Detection Limit?	pCi/mL	Detection Limit?
6	**H-3**	0	6.07E+02	0	5.03E+02	0
7	DL		0.00E+00		0.00E+00	
8	Detection		6.07E+02		5.03E+02	
9	Special DL					
10	Special Detection		0.00E+00		0.00E+00	
11	Assumption					
12	**C-14**	0	4.70E+02	0	4.80E+02	0
13	DL		0.00E+00		0.00E+00	
14	Detection		4.70E+02		4.80E+02	
15	Special DL					
16	Special Detection					
17	Assumption					
18	**Na-22**	0		0		0
19	DL		0.00E+00		0.00E+00	
20	Detection		0.00E+00		0.00E+00	
21	Special DL					
22	Special Detection		6.42E+02		6.42E+02	
23	Assumption					
24	**Al-26**	1	1.66E-01	0	1.69E-01	1
25	DL		1.66E-01		0.00E+00	
26	Detection		0.00E+00		1.69E-01	
27	Special DL					
28	Special Detection					
29	Assumption		3.44E+01		0.00E+00	

Summary / Conversion Factors / Special Method Values / **Tank 50 All Data** / Tank 50 Final Data / Undecayed SDU1 Inv / Undecayed SDU4 Inv / Undeca

Fig. 1. Excel File, Sheet: "Tank 50 All Data".

The first column is used to identify whether or not Tank 50 sample data for each radionuclide represents an actual detected value or a detection limit value (i.e., the actual value was less than the detection limit). The user must input either a "0" (for detected values) or a "1" for non-detected values. The second column is used to input the reported radionuclide concentrations from the quarterly Tank 50 sample analyses.

Users must only enter values into the first row. The other rows have formulas which are used for data selection logic in the sheet: "Tank 50 Final Data". Users could accidentally enter data into the wrong row, which would overwrite the formulas, resulting in inconsistent value assumptions.

Step 2. Update Logic in the Sheet: "Tank 50 Final Data"

Next, users must insert two columns into the sheet: "Tank 50 Final Data". Again, users must copy the formulas from a previous set of quarterly samples to ensure that the proper calculations are in place. Users must verify that the formula logic is referencing the new columns inserted into sheet: "Tank 50 All Data". This sheet has one more row in it for each radionuclide, relative to the organization of the sheet: "Tank 50 All Data". This new row identifies a "Final Value", which provides the recommended radionuclide concentration based upon the values provided. If the new columns are not formatted correctly, the input concentrations could be read from the wrong rows.

Although all of the data resides in only one of the two columns, both columns are maintained. This ensures that data is read from the correct column of the sheet: "Tank 50 All Data". Figure 2 provides a screen capture from this sheet.

	A	B	C	D	E	F	G
1	Sample Date		7/2/2013		4/3/2013		1/17/2013
2	Rad		pCi/mL		pCi/mL		pCi/mL
152	Detection		0.00E+00		0.00E+00		0.00E+00
153	Special DL		0.00E+00		0.00E+00		0.00E+00
154	Special Detection		2.10E+01		1.81E+01		1.90E+01
155	Assumption						
156	*Final Value*		2.10E+01		1.81E+01		1.90E+01
157	Sb-126m						
158	DL		0.00E+00		0.00E+00		0.00E+00
159	Detection		0.00E+00		0.00E+00		0.00E+00
160	Special DL		0.00E+00		0.00E+00		0.00E+00
161	Special Detection		1.50E+02		1.29E+02		1.36E+02
162	Assumption						
163	*Final Value*		1.50E+02		1.29E+02		1.36E+02
164	Te-125m						
165	DL		0.00E+00		0.00E+00		0.00E+00
166	Detection		0.00E+00		0.00E+00		0.00E+00
167	Special DL		0.00E+00		0.00E+00		0.00E+00
168	Special Detection		4.30E+00		1.04E+01		1.84E+01
169	Assumption						
170	*Final Value*		4.30E+00		1.04E+01		1.84E+01
171	I-129						
172	DL		0.00E+00		0.00E+00		0.00E+00
173	Detection		1.43E+01		1.26E+01		1.24E+01
174	Special DL		0.00E+00		0.00E+00		0.00E+00
175	Special Detection		0.00E+00		0.00E+00		0.00E+00
176	Assumption						
177	*Final Value*		1.43E+01		1.26E+01		1.24E+01
178	Cs-134						
179	DL		1.14E+02		3.12E+01		3.31E+01
180	Detection		0.00E+00		0.00E+00		0.00E+00
181	Special DL		0.00E+00		0.00E+00		0.00E+00

Summary / Conversion Factors / Special Method Values / Tank 50 All Data / **Tank 50 Final Data** / Undecayed SDU1 Inv / Undecayed SDU4 Inv / Undeca

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Fig. 2. Excel File, Sheet: "Tank 50 Final Data".

Step 3. Update Figures in the Sheet: "Tank 50 Final Data"

The Excel File tracks quarterly concentrations for seventy radionuclides. One figure for each radionuclide is present to the right of the data set in the sheet: "Tank 50 Final Data". These figures show a graphical representation of the changes in radionuclides concentrations over time. To update each figure, users must (1) ensure that the full data set is selected (including the latest quarter) and (2) ensure

that the time scale is formatted to display the current data. Due to the number of figures (70), this task is repetitive, making it prone to errors.

Step 4. Input New Transfer Data

As with the new concentration data, to input new transfer data, additional columns must be inserted. The specific sheet to update is dependent on which SDUs received waste from the SPF.

For each date in which any waste was transferred from the SPF to an SDU, an additional column must be inserted. The first row of each new column should include the date of the transfers (in standard date format). In the second row, users record the total number of gallons transferred from the SPF to the SDU within the given month. The third row is used for unit conversions (from gallons to liters). Rows 6 to 75 are used to estimate the preliminary inventory values for each radionuclide. Users should update the formulas in these cells according to the same approached used in columns for previous transfers, except that users must take care to ensure that the values being called correspond to appropriate concentration values.

Periodically, additional columns are inserted to generate the monthly or quarterly totals. These columns sum the inventory values from all of the transfers within the desired period.   Figure 3 shows an example of this.

	E	F	G	H	I	J	K	L	M	N
1	Transfer Date	Q4 2013	8/1/13	Q3 2013	6/1/13	4/1/13	Q2 2013	3/28/13	3/26/13	3/20/13
2	Volume (gal)	451,000	451,000	429,600	52,600	377,000	152,900	0	0	41,900
3	Volume (L)		1,707,215		199,112	1,427,096		0	0	158,608
4	Cell		2A		2A	2A		2A	2A	2A
5	Rad	Total Ci	Ci	Total Ci	Ci	Ci	Total Ci	Ci	Ci	Ci
6	H-3	1.04E+00	1.04E+00	8.18E-01	1.00E-01	7.18E-01	3.18E-01	0.00E+00	0.00E+00	8.72E-0
7	C-14	8.02E-01	8.02E-01	7.81E-01	9.56E-02	6.85E-01	1.71E-01	0.00E+00	0.00E+00	4.68E-0
8	Na-22	1.10E+00	1.10E+00	1.04E+00	1.28E-01	9.16E-01	3.71E-01	0.00E+00	0.00E+00	1.02E-0
9	Al-26	2.83E-04	2.83E-04	2.75E-04	3.36E-05	2.41E-04	9.61E-05	0.00E+00	0.00E+00	2.63E-0
10	Cl-36	3.29E-05	3.29E-05	7.38E-05	9.04E-06	6.48E-05	2.54E-05	0.00E+00	0.00E+00	6.95E-0
11	K-40	3.29E-05	3.29E-05	7.38E-05	9.04E-06	6.48E-05	2.54E-05	0.00E+00	0.00E+00	6.95E-0
12	Co-60	4.37E-04	4.37E-04	5.48E-04	6.71E-05	4.81E-04	1.72E-04	0.00E+00	0.00E+00	4.73E-0
13	Ni-59	3.05E-04	3.05E-04	4.29E-04	5.26E-05	3.77E-04	7.14E-05	0.00E+00	0.00E+00	1.96E-0
14	Ni-63	1.52E-02	1.52E-02	2.15E-02	2.63E-03	1.88E-02	3.57E-03	0.00E+00	0.00E+00	9.79E-0
15	Se-79	5.60E-02	5.60E-02	2.88E-02	3.52E-03	2.53E-02	5.79E-03	0.00E+00	0.00E+00	1.59E-0
16	Sr-90	3.29E+00	3.29E+00	7.38E+00	9.04E-01	6.48E+00	2.54E+00	0.00E+00	0.00E+00	6.95E-0
17	Y-90	3.29E+00	3.29E+00	7.38E+00	9.04E-01	6.48E+00	2.54E+00	0.00E+00	0.00E+00	6.95E-0
18	Zr-93	1.18E-01	1.18E-01	6.90E-02	8.44E-03	6.05E-02	2.47E-02	0.00E+00	0.00E+00	6.77E-0
19	Nb-93m	1.18E-01	1.18E-01	6.90E-02	8.44E-03	6.05E-02	2.47E-02	0.00E+00	0.00E+00	6.77E-0
20	Nb-94	6.09E-04	6.09E-04	6.00E-04	7.35E-05	5.27E-04	2.03E-04	0.00E+00	0.00E+00	5.57E-0
21	Tc-99	3.29E+01	3.29E+01	3.46E+01	4.24E+00	3.04E+01	1.20E+01	0.00E+00	0.00E+00	3.28E+0
22	Ru-106	4.39E-03	4.39E-03	3.87E-03	4.74E-04	3.40E-03	1.36E-03	0.00E+00	0.00E+00	3.73E-0
23	Rh-106	4.39E-03	4.39E-03	3.87E-03	4.74E-04	3.40E-03	1.36E-03	0.00E+00	0.00E+00	3.73E-0
24	Pd-107	1.86E-03	1.86E-03	1.77E-03	2.17E-04	1.56E-03	6.31E-04	0.00E+00	0.00E+00	1.73E-0
25	Sn-126	2.56E-01	2.56E-01	2.10E-01	2.57E-02	1.84E-01	7.87E-02	0.00E+00	0.00E+00	2.16E-0

Special Method Values | Tank 50 All Data | Tank 50 Final Data | Undecayed SDU1 Inv | Undecayed SDU4 Inv | **Undecayed SDU2A Inv** | Undecayed SD

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Fig. 3. Excel File, Sheet: "Undecayed SDU2A Inv".

Step 5. Perform Decay and Ingrowth Calculations

An external decay and ingrowth calculation software is used in association with the Excel File. The external software requires special formatting.   The sheet: "SDUXX Decay" is used to apply the special formatting. Values are then copied and pasted into the external software for calculation.

After performing the decay and ingrowth calculations, the results are copied and pasted back into the sheet: "SDUXX Decay" where the results are reformatted.

This step is repeated for each quarter and for each SDU.

Step 6. Determine Total Inventory for Each SDU

Within the sheet: "SDUXX Decayed Inventory", the reformatted results of the decay and ingrowth calculations (from the sheet: "SDUXX Decay") are copied for each quarter and then summed to provide annual, SDU-specific inventory values. Figure 4 displays an example of this.

	A	B	C	D	E	F	G	I	J	K
1										
2			Q12013	Q22013	Q32013	Q42013	Total			
3	Reference Date						9/30/2013			
4	**Rad**									
5	**H-3**		2.5E-01	3.1E-01	8.0E-01	1.0E+00	2.4E+00			
6	**C-14**		2.6E-01	1.7E-01	7.8E-01	8.0E-01	2.0E+00			
7	**Na-22**		4.0E-01	3.1E-01	9.2E-01	1.0E+00	2.7E+00			
8	**Al-26**		1.0E-04	9.6E-05	2.8E-04	2.8E-04	7.5E-04			
9	**Cl-36**		1.2E-05	2.5E-05	7.4E-05	3.3E-05	1.4E-04			
10	**K-40**		1.2E-05	2.5E-05	7.4E-05	3.3E-05	1.4E-04			
11	**Co-60**		1.9E-04	1.6E-04	5.1E-04	4.2E-04	1.3E-03			
12	**Ni-59**		5.3E-05	7.1E-05	4.3E-04	3.0E-04	8.6E-04			
13	**Ni-63**		2.6E-03	3.5E-03	2.1E-02	1.5E-02	4.2E-02			
14	**Se-79**		1.8E-02	5.8E-03	2.9E-02	5.6E-02	1.1E-01			
15	**Sr-90**		1.2E+00	2.5E+00	7.3E+00	3.3E+00	1.4E+01			
16	**Y-90**		1.2E+00	2.5E+00	7.3E+00	3.3E+00	1.4E+01			
17	**Zr-93**		2.7E-02	2.3E-02	6.6E-02	1.1E-01	2.3E-01			
18	**Nb-93m**		2.8E-02	2.5E-02	6.9E-02	1.2E-01	2.4E-01			
19	**Nb-94**		1.2E-04	2.0E-04	6.0E-04	6.1E-04	1.5E-03			
20	**Tc-99**		1.6E+01	1.2E+01	3.5E+01	3.3E+01	9.5E+01			
21	**Ru-106**		5.3E-04	8.4E-04	2.8E-03	3.7E-03	7.9E-03			
22	**Rh-106**		5.3E-04	8.4E-04	2.8E-03	3.7E-03	7.9E-03			
23	**Pd-107**		6.9E-04	6.3E-04	1.8E-03	1.9E-03	5.0E-03			
24	**Sn-126**		7.2E-02	7.9E-02	2.1E-01	2.6E-01	6.2E-01			
25	**Sb-125**		1.0E-01	3.7E-02	6.1E-02	2.8E-02	2.3E-01			

SDU1 Decayed Inventory / SDU4 Decay / SDU4 Decayed Inventory / SDU2A&B Decay / **SDU2A Decayed Inventory** / SDU2B Decayed Inventory

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Fig. 4. Screen Capture from Excel File, Sheet: "SDU2A Decayed Inventory".

Step 7. Review Updates

An independent reviewer must check all new inputs within the Excel File. If the reviewer cannot identify what values or formulas were updated, the correct approach is to review all values and formulas.

The reviewer must verify all of the values in the "Tank 50 All Data" match the referenced quarterly sample report and ensure that all of the formulas within each cell are correct. The reviewer must verify that all of the data links and formula logic within "Tank 50 Final Data" were correctly updated. The reviewer must visually check that each of the 70 figures have been revised to display the full data set. The reviewer must check the values in each of the "Undecayed SDUXX Inv" to ensure that the formulas link to the correct cells and that the volume values and dates are correct.

Next, because the Excel File relies on external calculations for decay and ingrowth, the only way to independently review this work is to recreate it and verify matching results. This must be done for each SDU and for each quarter. Finally, the data and calculations in each "SDUXX Decayed Inventory" must also be checked.

Typically, the review of the updated Excel File takes a reviewer approximately 20 hours to complete.

UPDATING THE SDF-WIDE MODEL

To update the SDF-Wide Model, users must perform five steps:

1. Update the concentration data
2. Update the links to the concentration data
3. Update the transfer data
4. Run the model
5. Review Updates

Step 1. Update the Concentration Data

Within the SDF-WIDE Model, data and calculations are organized in GoldSim containers. To update the radionuclide concentration data, the quarterly data template (Figure 5) is copied.

Yr20XX_QX
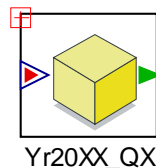
Fig. 5. SDF-WIDE Model, Quarterly Data Template

The template is pasted into the appropriate location within the SDF-WIDE Model, which is organized by quarters, as shown in Figure 6. Next, users should rename the template as appropriate.
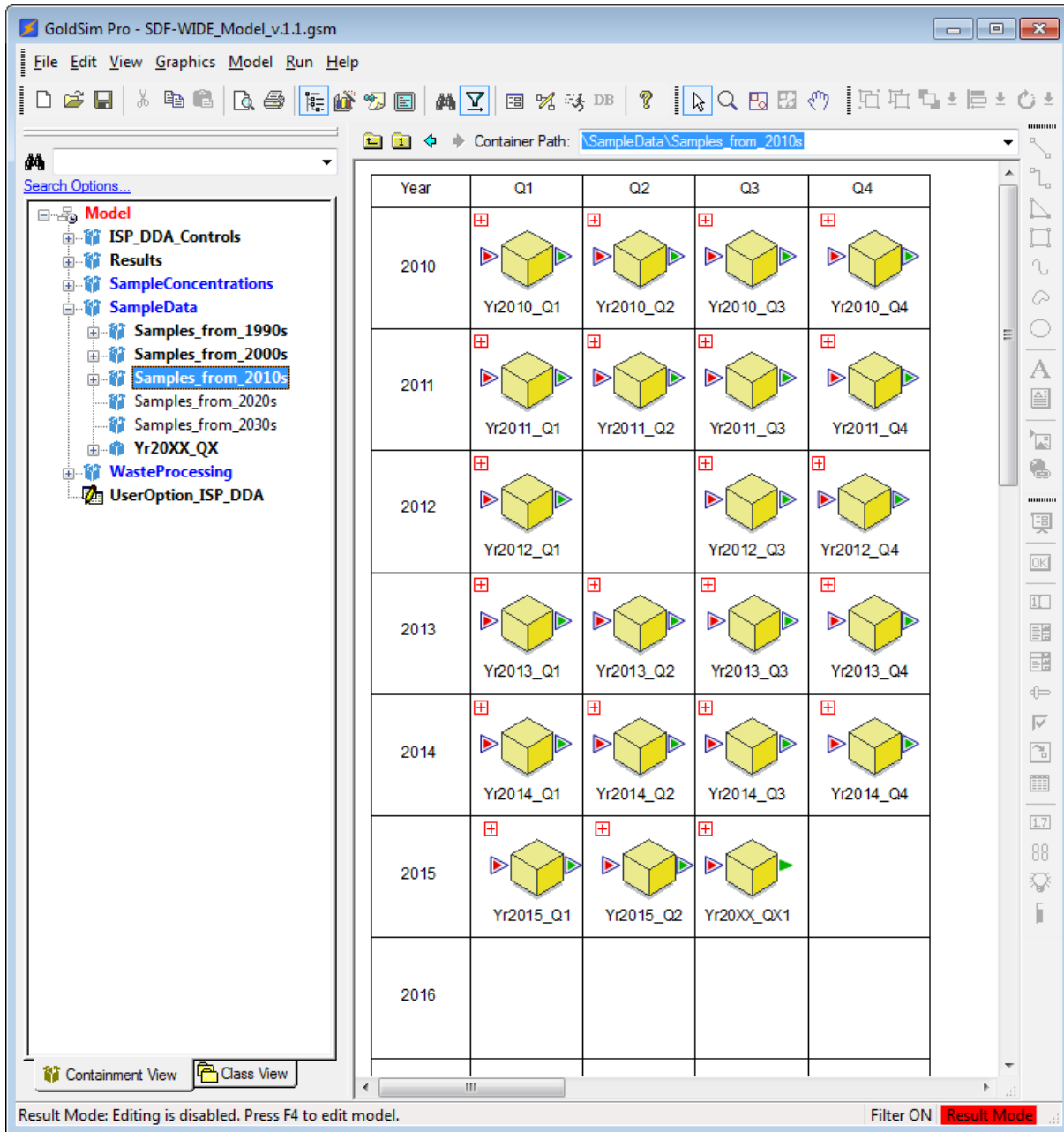
Fig. 6. SDF-WIDE Model, Sample Data Organization

Within the quarterly sample data template, users will see two GoldSim elements. The data element "SampleDate" should be updated with the date of the sample analysis.

Then, within the other element, a conditional container named "Sample", users will find two more data elements: "Concentrations" and "DetectionLimits". Users should edit the values within "Concentrations" to provide either the measured concentration or the detection limit value for each analyzed radionuclide. Figure 7 shows the user interface for updating the "Concentrations" element. As can be seen, this is a simple list for users to complete, unlike the Excel File which included multiple rows for each radionuclide and required users to input values in a specific

row. This list format provides a more user-friendly interface that reduces the risk of input errors.
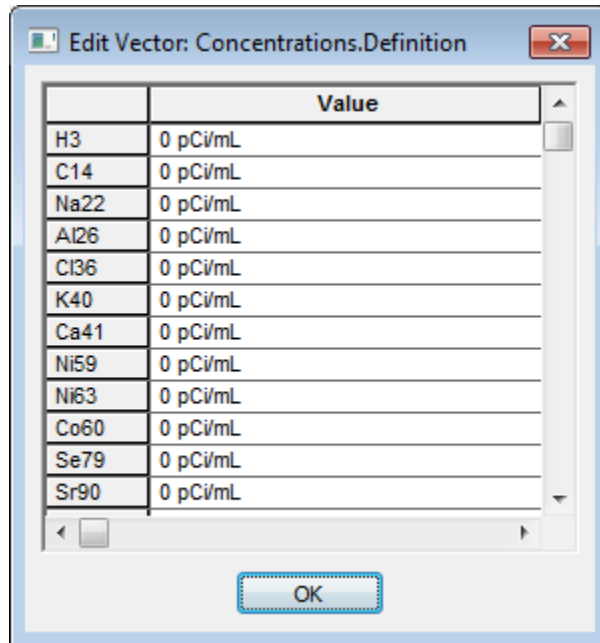
Fig. 7. SDF-WIDE Model, User Interface for Updating Concentrations

Finally, users must update the "DetectionLimits" element by replacing the default zero values with ones for any radionuclide that was measured as being less than the detection limit. Like the "Concentrations" element, the "DetectionLimits" element also provides the input interface in a list format.

Step 2. Update Links to the Concentration Data

There are three selector elements within the SDF-WIDE model that feed sample concentration data into the rest of the calculations. After adding new concentration values, these selector elements must be updated to feed the appropriate data into the rest of the model. Figure 8 shows the three selector elements ("SampleDL_YesNo", "SampleConcentrationInputs", and "SampleOccursYN").
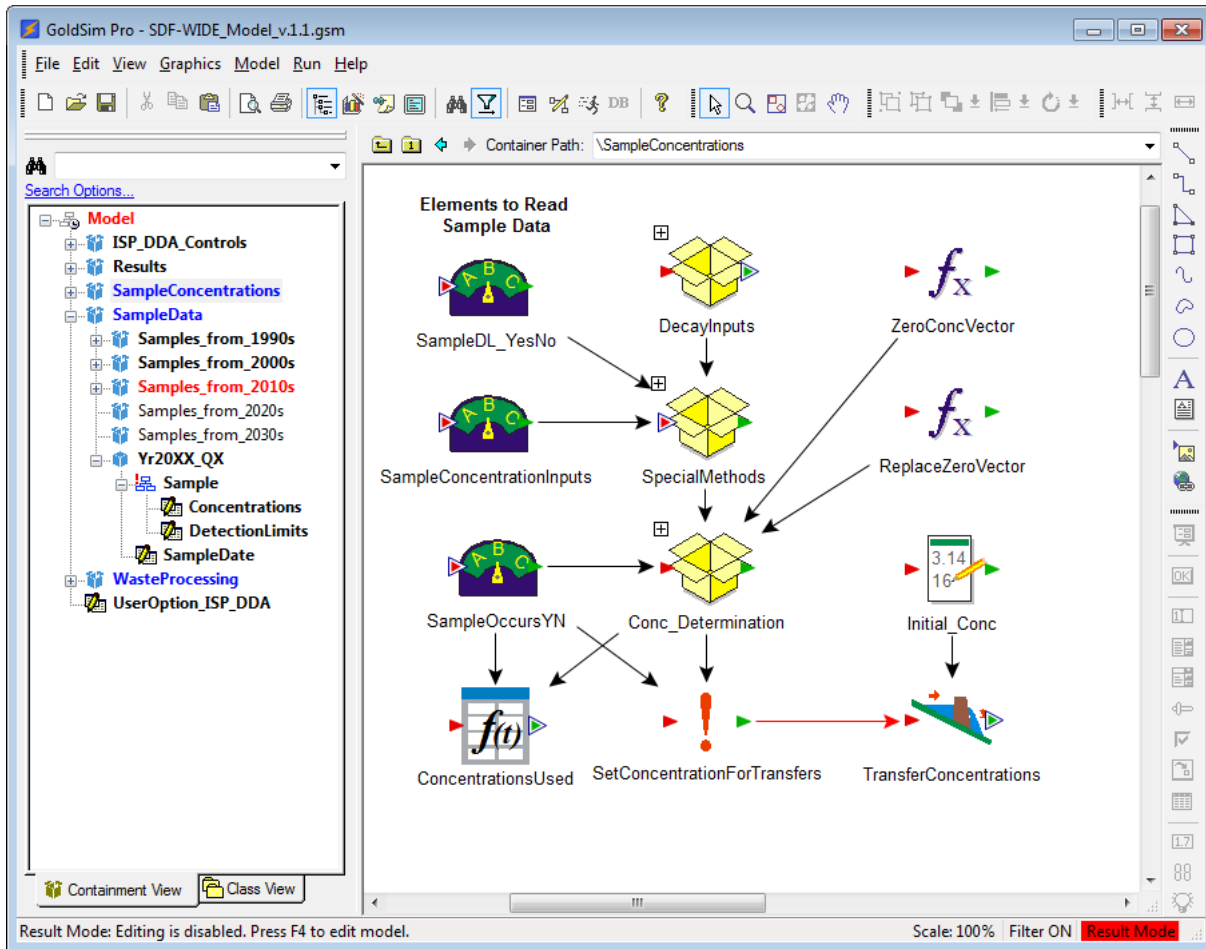
Fig. 8. SDF-WIDE Model, Selector Elements to Read Concentration Data

To update each of these elements, users must add a switch for each new quarter added, then link the selector to the appropriate value within the sample data container for each quarter.

Step 3. Update the Transfer Data

There is a separate container for each SDU within the SDF-WIDE Model. Each container has the exact same structure (for example, see Figure 9). To update the transfer data, users must update the time series element at the beginning of the data flow (top-left element in Figure 9).

The Excel File had required users to input transfer data along a horizontal list in reverse (right-to-left) order. In the SDF-WIDE Model, users simply add rows for each new transfer and input a date and volume value (see the example in Figure 10).

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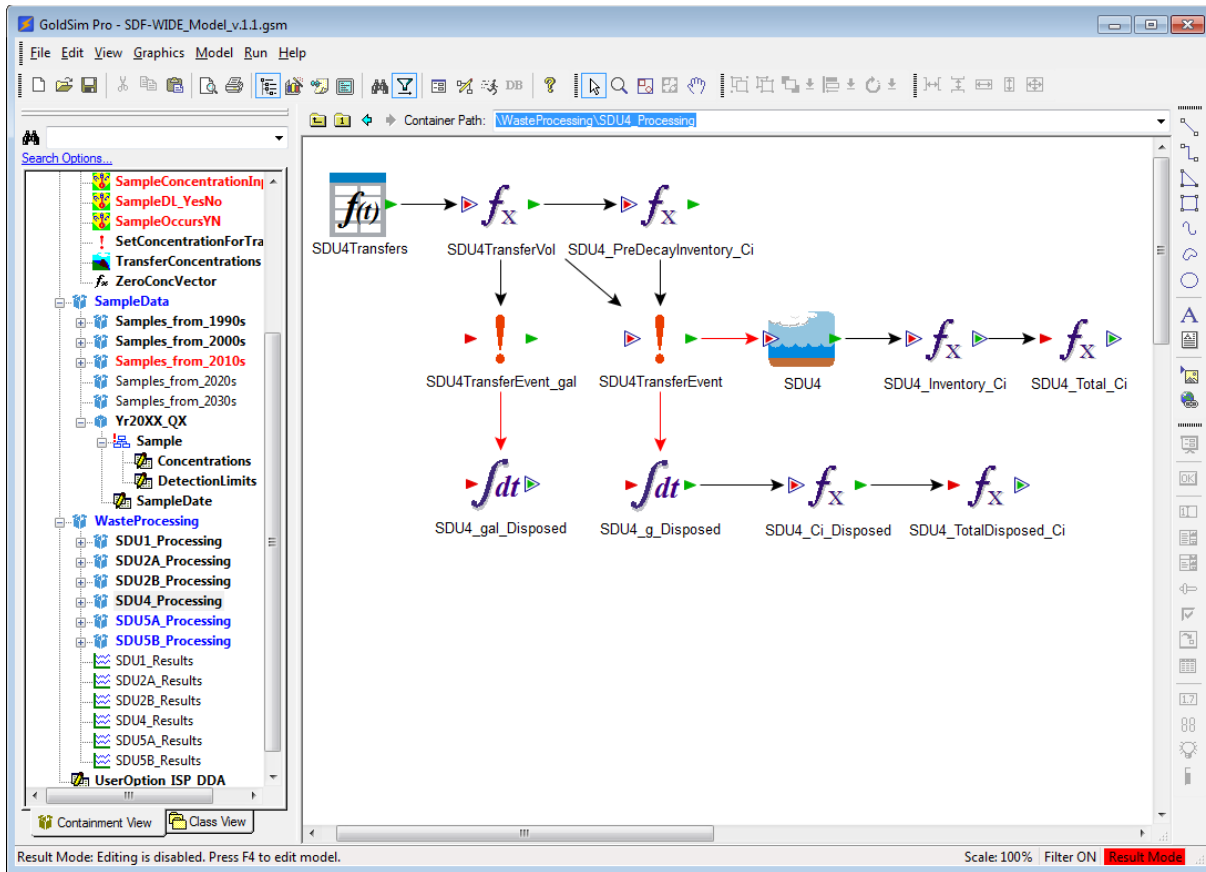
Fig. 9. SDF-WIDE Model, Container Structure for SDU Waste Processing

Fig. 10. SDF-WIDE Model, User Interface for Updating Transfer Volumes

Step 4. Run the Model

To run the SDF-WIDE Model, users press F5.

Step 5. Review Updates

An independent reviewer must check all new inputs within the SDF-WIDE Model. The GoldSim model software provides a versioning feature in which the color of text within the Navigation Pane (left panel of Figures 6, 8, and 9) indicate changes to the model. Containers that hold elements that have changed are shown in blue and elements that have changed are shown in red. Reviewers need only to verify that the elements in red provide correct data or links. Typically, this review takes less than an hour to complete.

OTHER IMPROVEMENTS USING THE SDF-WIDE MODEL

In addition to simplifying the process for updating the data, the SDF-WIDE Model also introduces two other significant process improvements.

First, the SDF-WIDE Model provides a more accurate accounting of the inventory by performing decay and ingrowth calculations on a continuous basis (reported at daily intervals) rather than discretely (reported at monthly or quarterly intervals). For relatively short-lived radionuclides (such as Y-90), performing decay and ingrowth calculations at discrete intervals longer than a few days could introduce errors due to the lack of precision.

Second, the SDF-WIDE Model automatically generates figures which provide users with more data for analysis. As with the Excel File, the SDF-WIDE Model generates concentration history figures for each of the radionuclides. Unlike the Excel File, the figures do not require any manual data selection during updates. In addition, the SDF-WIDE Model also tracks (and generates figures for) the volume of dissolved salt solution disposed to each SDU, the inventory of curies disposed (i.e., undecayed curies) to each SDU for each radionuclide, and the total current inventory of curies (decayed) for each radionuclide within each SDU. Facility totals for each of these are also generated.

These figures allow users to quickly analyze values to determine trends in the changing waste feed and how these trends may impact disposal inventories.

CONCLUSION

The process of tracking the total inventories disposed at the SDF has been significantly improved through deployment of the SDF-WIDE Model. Within the Excel File, the task of updating inputs was both overly-complicated and time-consuming. Minor errors were frequently identified that required revisions to the Excel File and subsequent documentation. By transitioning to the SDF-WIDE Model the process has become less cumbersome and the quality of the results has improved.

Footnotes:

[a] *GoldSim*[TM] *is a trademark of GoldSim Technology Group LLC in the United States and/or other countries.*

[b] *Microsoft Excel*[TM] *is a trademark of the Microsoft Corporation in the United States and/or other countries.*

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