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**Revision 0**

**Key Words**

GoldSim©

C&WDA

Software

Quality Assurance

**Retention: Permanent**

## **Software Quality Assurance Plan for GoldSim© for the Savannah River Site's Liquid Waste Program**

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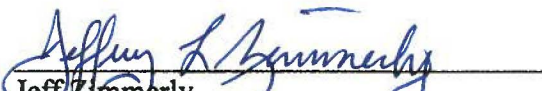
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**ACRONYMS / ABBREVIATIONS**

C&WDA	Closure & Waste Disposal Authority
DB	Database
EDWS	Electronic Document Workflow System
GTG	GoldSim© Technology Group
N/A	Not Applicable
SP	Service Pack
SQAP	Software Quality Assurance Plan

## 1.0 INTRODUCTION

This report documents the Software Quality Assurance Plan (SQAP) for GoldSim®, a vendor-provided modeling software. GoldSim® is classified as Quality Assurance “Level C” software on the basis that it is commercially available software used to comply with regulatory laws, environmental permits or regulations and/or commitments to compliance. [B-SWCD-C-00038]

### 1.1 Scope

This SQAP has been developed in accordance with the following procedure: 1Q, *Quality Assurance Manual*, Procedure 20-1, *Software Quality Assurance*.

This SQAP provides qualification instructions for GoldSim® software and applies to any activities used to support the Savannah River Site's Liquid Waste Program.

This SQAP is applicable to GoldSim® version 9.60 and any subsequent versions. For the purposes of this documentation, qualification of GoldSim® versions shall also apply to any Service Packs (SP) of the specified version(s). For example, if GoldSim® version 9.60 is qualified for use, then versions 9.60 SP1, 9.60 SP2, 9.60 SP3, etc. are all also qualified for use. Service Packs resolve minor software issues but do not significantly change the software (i.e., no major or significant changes to capabilities).

This SQAP is applicable to the qualification of GoldSim® within any operating environment (operating system, network server, laptop computer, or desktop computer), providing that operating environment supports installation and testing of GoldSim® software per instructions from the vendor.

### 1.2 Background

An earlier SQAP (*Software Quality Assurance Plan for GoldSim®*) was developed and used for performance assessment activities. [G-SQA-A-00011] The earlier SQAP was developed by Savannah River National Laboratory for the purpose of qualifying GoldSim® version 9.21 and subsequent versions for use in performance assessment development and was used by the Savannah River Site's Liquid Waste Program to qualify GoldSim® for use in performance assessment modeling.

This SQAP replaces G-SQA-A-00011 for the Savannah River Site's Liquid Waste Program, but does not supersede G-SQA-A-00011 for users at the Savannah River National Laboratory. To create a consistent baseline record, any GoldSim® versions and environments that support the Savannah River Site's Liquid Waste Program shall be requalified according to the provisions of this SQAP.

Table 1.2-1 provides a history of GoldSim® qualification documents supporting the Savannah River Site's Liquid Waste Program prior to the release of this SQAP.

**Table 1.2-1: History of GoldSim® Qualification Documents at the Savannah River Site**

GoldSim® Version	Operating System <sup>a</sup>	Document ID	Title	Date
9.21 or newer	N/A	G-SQA-A-00011	<i>Software Quality Assurance Plan for GoldSim®</i>	8/30/2006
N/A	N/A	Q-SWCD-A-00002	<i>Software Classification Document for GoldSim</i>	10/15/2007
10.11	Windows XP	SRR-CWDA-2010-00058	<i>Software Acceptance Testing for GoldSim® Version 10.11 (SP3)</i>	8/5/2010
9.60	Windows XP	SRR-CWDA-2011-00113	<i>Software Quality Assurance Report for Installation and Acceptance Testing of the H-Area Tank Farm (HTF) Performance Assessment (PA) Probabilistic Model</i>	7/5/2011
	Windows 7			
10.02	Windows XP			
10.11	Windows XP			
	Windows 7			
10.50	Windows XP, Windows 7	SRR-CWDA-2011-00166	<i>Software Acceptance Testing for GoldSim® Version 10.50 SP2</i>	10/25/2011

N/A = Not Applicable

Notes: (a) Although this table only identifies the qualified operating system, users should refer to the cited document(s) to determine specific computers for which qualification was completed.

### 1.3 Roles and Responsibilities

The following describes the pertinent roles and responsibilities, as needed to qualify this software.

The **Software User** is any individual who will use GoldSim® according to provisions of this SQAP. All Software Users are responsible for reading this SQAP and adhering to specified plan to ensure that any version(s) of GoldSim® that they use for qualified work has been appropriately qualified on the environment(s) in which the software is being used.

The **Software User's Manager** is any individual with management authority over the Software User.

The **GoldSim® Qualification Lead** is the individual responsible for the development and approval of this SQAP and associated software quality assurance documentation. This individual shall also maintain a record of which versions and environments have been qualified to support the Savannah River Site's Liquid Waste Program.

### 1.4 Tools, Techniques, Methods, Standards, Practices, and Conventions

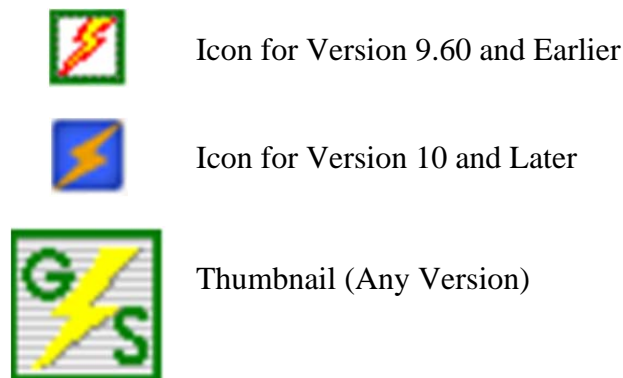
There are no tools, techniques, methods, standards, practices and conventions to describe, other than those discussed in the other sections. This section shall remain within the SQAP in case future revisions require text to be added.

## 2.0 SOFTWARE DESCRIPTION

GoldSim® is a highly graphical, Windows-based program for carrying out dynamic, probabilistic simulations of complex systems to support management and decision-making in engineering, science and business. GoldSim® will be used to model the transport of radionuclide contaminants from waste disposal and closure facilities at the Savannah River Site. The Monte Carlo functionality allows probabilistic simulation of radioactive and contaminant transport, as opposed to deterministic simulation. At the Savannah River Site, this software is currently used for the development of models of flow, radioactive and contaminant transport studies, and uncertainty analyses.

Figure 2.0-1 shows examples of GoldSim® software icons, as they appear on a Windows interface.

**Figure 2.0-1: GoldSim® Software Icons**



Consistent with this software's use and classification, and pursuant to Section 5.10 of 1Q Procedure 20-1, GoldSim® is not Safety Software; therefore, this software is excluded from the Safety Software Inventory List.

### 2.1 Procured Software

GoldSim® is a vendor-supplied software, developed and licensed by GTG. As such, this is purchased software. Accordingly, this software is not classified as "existing" or "developed".

GoldSim® licenses should be purchased directly from GTG's website: [www.goldsim.com](http://www.goldsim.com). Once the license is purchased, users may download the software directly from the website to their computer and follow the vendor's instructions to install. To qualify the newly-installed software, users should follow the instructions for installation testing as defined in Section 4.5, below.

In accordance with Section 5.7.1 of 1Q Procedure 20-1, GoldSim® is Procurement Level 3 software. Consistent with this requirement level, qualifying the use of GoldSim® does not require any additional software information or process information beyond that provided within this SQAP, nor does any additional procurement information need to be provided.



## **2.2 Training**

Due to the intuitive nature of GoldSim© and the software's highly graphical user-interface, training is not required to operate this software. However, as a prerequisite to using GoldSim©, users should have experience operating a computer with a Windows operating system and should read and understand this SQAP. Additionally, it is recommended that new users perform vendor-provided tutorials, as described within the *GoldSim User's Guide, Volumes 1 & 2* and the *GoldSim© Contaminant Transport Module User's Guide*, to become familiar with this software. [GTG-2010c, GTG-2010]

### 3.0 SOFTWARE QUALIFICATION

Table 3.0-1 maps each of the software qualification requirements from 1Q Procedure 20-1 to text within the associated qualifying documentation.

**Table 3.0-1: Software Requirements Matrix**

Software Qualification Activities	Document	Section
Software Classification	Software Classification Document, B-SWCD-C-00038	Entire Document
Software Quality Assurance Procedures/Plans	SQAP: B-SQP-C-00002	Entire Document
Procurement Level	SQAP, B-SQP-C-00002	Section 2.1
Safety Software Inventory Listing	SQAP, B-SQP-C-00002	Section 2.0
Requirements, Life Cycle Phases	SQAP, B-SQP-C-00002	Section 4.1
Design, Life Cycle Phases	SQAP, B-SQP-C-00002	Section 4.2
Implementation, Life Cycle Phases	SQAP, B-SQP-C-00002	Section 4.3
Testing, Life Cycle Phases	SQAP, B-SQP-C-00002	Section 4.4
Installation and Acceptance, Life Cycle Phases	SQAP, B-SQP-C-00002	Section 4.5 and Attachment 1
Operations & Maintenance, Life Cycle Phases	SQAP, B-SQP-C-00002	Section 4.6
Retirement, Life Cycle Phases	SQAP, B-SQP-C-00002	Section 4.7
Configuration Management/Baseline Control	SQAP, B-SQP-C-00002	Section 5.0
Evaluation	SQAP, B-SQP-C-00002	Section 4.5 and Attachment 1
Problem Reporting & Corrective Action	SQAP, B-SQP-C-00002	Section 5.1
Cyber Security Controls	SQAP, B-SQP-C-00002	Section 5.2
Risk and Safety Analysis	SQAP, B-SQP-C-00002	Section 5.2

## 4.0 SOFTWARE LIFE CYCLE REQUIREMENTS

Pursuant to 1Q Procedure 20-1, there are seven phases to the software life cycle that shall be considered and documented, as appropriate. These seven phases are:

- Requirements
- Design
- Implementation
- Testing
- Installation & Acceptance
- Operations & Maintenance
- Retirement

Each software life cycle phase is discussed below. Vendor-provided documentation (*GoldSim User's Guide, Volumes 1 & 2*) provides additional information related to GoldSim© software. [GTG-2010c]

### 4.1 Life Cycle Phase: Requirements

The graded approach for qualification of purchased, Class C software requires justification for exceptions to documenting Requirements Phase requirements (per 1Q Procedure 20-1). GoldSim© is a vendor-provided software. The functional requirements of this software are defined at the discretion of the vendor. The coding that provides functionality to this software is the intellectual property of the vendor, therefore explicit documentation regarding such requirements is not available.

### 4.2 Life Cycle Phase: Design

The graded approach for qualification of purchased, Class C software requires justification for exceptions to documenting Design Phase requirements (per 1Q Procedure 20-1). GoldSim© is a vendor-provided software. The design requirements of this software are defined at the discretion of the vendor. The coding that was used to design this software is the intellectual property of the vendor, therefore explicit documentation regarding such requirements is not available.

### 4.3 Life Cycle Phase: Implementation

The graded approach for qualification of purchased, Class C software requires justification for exceptions to documenting Implementation Phase requirements (per 1Q Procedure 20-1). GoldSim© is a vendor-provided software. The implementation requirements of this software are defined at the discretion of the vendor. The coding that was used to implement this software is the intellectual property of the vendor, therefore explicit documentation regarding such requirements is not available.

### 4.4 Life Cycle Phase: Testing

The graded approach for qualification of purchased, Class C software requires justification for exceptions to documenting Testing Phase requirements (per 1Q Procedure 20-1). GoldSim© is a vendor-provided software. The testing activities that supported the development of this software are defined at the discretion of the vendor. Such information is the intellectual property of the vendor, therefore explicit documentation regarding such requirements is not available.

#### 4.5 Life Cycle Phase: Installation & Acceptance

Four test cases were developed to demonstrate acceptable installation and performance of GoldSim©. As a prerequisite to performing these tests, the Software User must have appropriate administrative permissions prior to downloading and installing software. These test cases use a GoldSim© model file (*TestCaseFile\_R0.gsm*) and a Microsoft Access file (*TestCase\_DB.accdb*), plus a Microsoft Excel file (*TestCaseVerify.xlsx*) for verification purposes. The first test case ensures that GoldSim© is correctly installed. The second test case evaluates the probabilistic functionality of the model and ensures that the software was correctly installed. The third test case evaluates the capability of the software to link to and interface with programs external to GoldSim©. The final test case evaluates the deterministic functionality of the software. Instructions for performing each test case, and evaluating the results, are described below (see Tables 4.5-1, 4.5-2, 4.5-3, and 4.5-4).

The test case model file was developed by modifying an existing performance assessment model file that had been developed using a version of GoldSim qualified under G-SQA-A-00011. The modifications to the existing model file: (1) preserved calculations and formulas to ensure that all relevant functionality of the software is appropriately tested, (2) reduced the file size to facilitate easier file-sharing, and (3) optimized the model file to reduce the amount of time required to run the model. Optimization of the model required removing redundancies of functional components (i.e., formulas and links within the model). These redundancies are sufficiently demonstrated within other areas of the model; therefore, removing these does not compromise the validity of the test cases. Due to these changes, the test case model file does NOT reflect the original performance assessment model file; therefore, users SHOULD NOT attempt to use the test case file for any type of analyses beyond the scope of this report.

Software Users should document the results of these test cases using the GoldSim© Software Quality Assurance Test Form (see Attachment 1) and submit the completed form to the GoldSim© Qualification Lead, consistent with the instructions provided in Section 5.0. If the Software User intends to qualify multiple versions of GoldSim©, they must complete and document a separate GoldSim© Software Quality Assurance Test Form for each version of the software and for each test environment to be qualified. For the purposes of this SQAP a test environment is the combination of the hardware (i.e., desktop computer, laptop computer, or server) and the operating system (e.g., Windows 7).

Although these test cases explicitly test only three functions (probabilistic functionality, external interfacing, and deterministic functionality), the use of the GoldSim© test case file implicitly tests all other needed functions as well (e.g., the plume function and the decay and ingrowth function).

**Table 4.5-1: Installation Test (Test Case 1)**

Step	Task/Action	Expected Result from Task/Action
1	Obtain a GoldSim® license from GTG.	Software User has a GoldSim® license.
2	Following appropriate cyber security policies and procedures, obtain administrative privileges to download and install software on the desired computer.	Software User has administrative privileges.
3	Follow instructions provided by GTG to install GoldSim® to a local directory (e.g., C:\Program Files\GTG).	An executable file named GoldSim.exe can be located within the local directory. The executable file will be represented by the appropriate icon or thumbnail as shown in Figure 2.0-1.
4	Launch GoldSim® by double clicking the icon.	The GoldSim® Launch Window will appear (see Figure 4.5-1). Note: The appearance of this window may vary between software versions.
5	Document the results of Test Case 1 using the GoldSim® Software Quality Assurance Test Form (see Attachment 1).	Test Case 1 is complete.

**Table 4.5-2: Probabilistic Modeling Acceptance Test (Test Case 2)**

Step	Task/Action	Expected Result from Task/Action
1	Contact the GoldSim® Qualification Lead to request the test case files.	User has the following test case files: TestCaseFile_R0.gsm, TestCase_DB.accdb, and TestCaseVerify.xlsx
<i>Open the GoldSim® test case model file.</i>		
2	On the computer desktop, go to Start → Programs → GoldSim.	The GoldSim® Launch Window will appear (see Figure 4.5-1). Note: The appearance of this window may vary between software versions.
3	Click “Open Model”	An Open file dialogue pops up.
4	Navigate to and select the model file: <i>TestCaseFile_R0.gsm</i> .	The model file opens (see Figure 4.5-2).
<i>Ensure that the model file is set to run probabilistically.</i>		
5	In the GoldSim® Tool Bar, go to Run → Simulation Settings...	The “Simulation Settings...” dialogue pops up.
6	At the top of the “Simulation Settings...” dialogue, select the “Monte Carlo” tab.	The “Monte Carlo” tab opens.
7	Verify that the radio button for “Probabilistic Simulation” is selected.	The radio button for “Probabilistic Simulation” is selected.
8	Set the “# Realizations” to 100 and the “# Histories to save” to 100.	The “# Realizations” = 100. The “# Histories to save” = 100.
9	Ensure the check box for “Run the following Realization only” is NOT checked.	The check box for “Run the following realization only” is NOT checked.
10	Ensure the “Use Latin Hypercube Sampling” and the “Repeat Sampling Sequences” check boxes are both checked.	The “Use Latin Hypercube Sampling” and the “Repeat Sampling Sequences” check boxes are both checked.

**Table 4.5-2: Probabilistic Modeling Acceptance Test (Test Case 2), Continued**



Step	Task/Action	Expected Result from Task/Action
11	Click OK at the bottom of the “Simulation Settings...” dialogue.	The “Simulation Settings...” dialogue closes.
<i>Run the model probabilistically.</i>		
12	In the GoldSim® Tool Bar, go to Run → Run Model.	The “GoldSim Run Controller” appears (see Figure 4.5-3).
13	On the “GoldSim Run Controller” click the “Run” button.	The model will begin to run probabilistically. This should take approximately two to three seconds per realization (or three to five minutes to complete all 100-realizations).
14	If a warning message appears, asking to display the “run log file”, select “No”.	The warning message closes.
<i>View the probabilistic results.</i>		
15	In the GoldSim® model window, right click the element named “HighTotalWellDose” and select “Time Histories ...” from the contextual menu.	A Time History window will appear. This will either appear as a table or as a chart.
16	If the Time History window is showing the chart view, select the Table View button: 	The Time History window will show a table of result data. This data will either be statistical result data (starting with the Mean) or the results for individual realizations (1 through 100).
17	If the table shows the results for individual realizations (1 through 100), then select the Probability Histories button: 	The Time History window will show a table of statistical result data (starting with the Mean).
<i>Copy and paste the data result data into the TestCaseVerify.xlsx file.</i>		
18	Copy the statistical result data: Use Ctrl+A (to select all), then Ctrl+C (to copy).	No detectable result.
19	Open the Microsoft Excel file: <i>TestCaseVerify.xlsx</i> . (Note: This Excel file should have been obtained from the GoldSim® GoldSim® Qualification Lead.)	The Excel file opens.
20	Within <i>TestCaseVerify.xlsx</i> , go to the sheet/tab: “TestCase2Data” and select the top left cell (Cell A1).	Cell A1 of the sheet/tab: “TestCase2Data” will be active.
21	Paste the data: Use Ctrl+V to paste the data.	The data will appear in the worksheet.
<i>Verify and document the model results.</i>		
22	Within <i>TestCaseVerify.xlsx</i> , go to the sheet/tab: “TestCase2_Result”.	The results of Test Case 2 shall be shown.
23	Document the results of Test Case 2 using the GoldSim® Software Quality Assurance Test Form (see Attachment 1).	Test Case 2 is complete.
N/A	Keep GoldSim® and Excel open and proceed to Test Case 3 (see Table 4.5-3).	

Figure 4.5-1: GoldSim® Launch Window



Figure 4.5-2: GoldSim® Test Case Model File

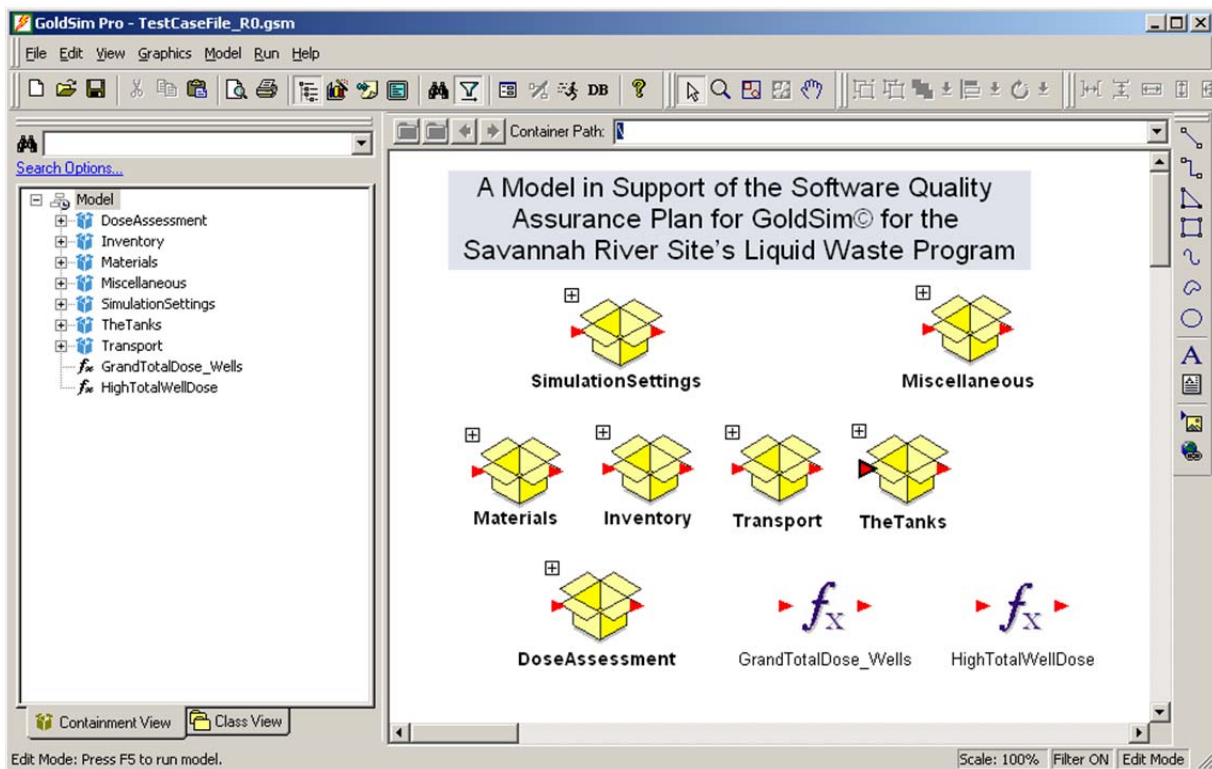


Figure 4.5-3: GoldSim® Run Controller



Table 4.5-3: External Interfacing Acceptance Test (Test Case 3)

Step	Task/Action	Expected Result from Task/Action
<i>Setup Test Case 3. Proceeding from Step 23 of Test Case 2 (see Table 4.5-2).</i>		
1	Within GoldSim®, close the Time History Table by clicking the “x” at the top right of the window.	The Time History window closes.
2	In the GoldSim® Tool Bar, go to Run → Return to Edit Mode.	GoldSim® will display a warning that current results will be destroyed.
3	Click the Yes button to go to Edit Mode.	The model results will be destroyed and the model file will return to Edit Mode.
<i>Establish an external data source. All users follow instructions in black text.  Instructions in blue text only apply to 64-bit Operating Systems (e.g., Windows 7).  Instructions in red text only apply to 32-bit Operating Systems (e.g., Windows XP).</i>		
4	Add 32-bit functionality to the 64-bit system. Go to the directory: C:\Windows\SysWOW64, then double click the file: odbcad32.exe	An “ODBC Data Source Administrator” window opens.
5	On the computer desktop, go to Start → Settings → Control Panel.	The Control Panel appears.
6	Select Performance and Maintenance → Administrative Tools → Data Sources (ODBC).	An “ODBC Data Source Administrator” window opens.
7	Click the Add button and Select the “Microsoft Access Driver (*.mdb, *.accdb)”, then click Finish.	An “ODBC Microsoft Access Setup” window opens.
8	Enter “TestCase_DB” for the Data Source Name.	The Data Source Name is “TestCase_DB”.
9	Click the Select button (within the Database frame) then	A “Select Database” window opens.
10	Use the window controls to navigate to the local copy of the Microsoft Access file: <i>TestCase_DB.accdb</i> and click OK. (Note: This Access file should have been obtained from the GoldSim® GoldSim® Qualification Lead.)	The “Select Database” window closes and navigation returns to the “ODBC Microsoft Access Setup” window.



**Table 4.5-3: External Interfacing Acceptance Test (Test Case 3), Continued**

Step	Task/Action	Expected Result from Task/Action
11	Click OK to finish adding the data source.	The “ODBC Microsoft Access Setup” window closes and navigation returns to the “ODBC Microsoft Access Setup” window. The “TestCase_DB” is now included as a data source.
12	Click OK to close the “ODBC Microsoft Access Setup” window.	The “ODBC Microsoft Access Setup” window closes.
<i>Add a data element linked to the Access database.</i>		
13	Within the main window of the model (the white area with the graphical elements), right click and select Insert Element → Inputs → Data.	A GoldSim Data Element will appear within the main window of the model and “Data Properties” window will pop up (see Figure 4.5-4).
14	Set the Element ID to “DB_Test” and set the units to “m” for meters.	The Element ID is set to “DB_Test” and the units are set to “m” for meters.
15	For Data Source, select “Yucca Mountain Database”.	“Yucca Mountain Database” is selected as the data source and a “Database” tab is added to the “Data Properties” window.
16	Go to the “Database” tab. In the Database drop-down menu, select the “TestCase_DB” database and click the “Download Now” button.	The “Status” frame of the “Data Properties” window indicates that the download was successful.
17	Go to the “Definition” tab. Verify that the Definition of the input is now 10m.	The Definition of the input is now 10m.
18	Click the “OK” button on the “Data Properties” window.	The “Data Properties” window closes.
19	Document the results of Test Case 3 using the GoldSim© Software Quality Assurance Test Form (see Attachment 1).	Test Case 3 is complete.
N/A	Keep GoldSim© and Excel open and proceed to Test Case 4 (see Table 4.5-4).	


Figure 4.5-4: Data Properties Window

The screenshot shows the 'Data Properties : Data1' dialog box. It has a 'Definition' tab selected. The 'Element ID' field contains 'Data1'. The 'Description' field is empty. The 'Display Units' field is empty, and there is a 'Type...' button next to it. The 'Scalar' radio button is selected. The 'Definition' field contains '0.0'. The 'Data Source' dropdown menu is set to 'None'. The 'Save Results' section has two checkboxes: 'Final Values' and 'Time Histories', both of which are unchecked. At the bottom, there are 'OK', 'Cancel', and 'Help' buttons.

Table 4.5-4: Deterministic Modeling Acceptance Test (Test Case 4)

Step	Task/Action	Expected Result from Task/Action
<i>Setup Test Case 4. Proceeding from Step 19 of Test Case 3 (Table 4.5-3)</i>		
1	In the GoldSim® Tool Bar, go to Run → Simulation Settings...	The “Simulation Settings...” dialogue pops up.
2	At the top of the “Simulation Settings...” dialogue, select the “Monte Carlo” tab.	The “Monte Carlo” tab opens.
3	Select the radio button for “Deterministic Simulation”.	The radio button for “Deterministic Simulation” is selected.
4	Ensure that the radio button for “Element Deterministic Values” is selected.	The radio button for “Element Deterministic Values” is selected.
5	Click OK at the bottom of the “Simulation Settings...” dialogue.	The “Simulation Settings...” dialogue closes.
<i>Run the model deterministically.</i>		
6	In the GoldSim® Tool Bar, go to Run → Run Model.	The “GoldSim Run Controller” appears (see Figure 4.5-3).

**Table 4.5-4: Deterministic Modeling Acceptance Test (Test Case 4), Continued**

Step	Task/Action	Expected Result from Task/Action
7	On the “GoldSim Run Controller” click the “Run” button.	The model will begin to run deterministically. This should take approximately two to three seconds.
8	If a warning message appears, asking to display the “run log file”, select “No”.	The warning message closes.
<i>View the deterministic results.</i>		
9	In the GoldSim© model window, right click the element named “HighTotalWellDose” and select “Time Histories ...” from the contextual menu.	A Time History window will appear. This will either appear as a table or as a chart.
10	If the Time History window is showing the chart view, select the Table View button: 	The Time History window will show a table of result data.
<i>Copy and paste the data result data into the TestCaseVerify.xlsx file.</i>		
11	Copy the tabular result data: Use Ctrl+A (to select all), then Ctrl+C (to copy).	No detectable result.
12	Open the Microsoft Excel file: <i>TestCaseVerify.xlsx</i> . (Note: This Excel file should have been obtained from the GoldSim© GoldSim© Qualification Lead.)	The Excel file opens.
13	Within <i>TestCaseVerify.xlsx</i> , go to the sheet/tab: “TestCase4Data” and select the top left cell (Cell A1).	Cell A1 of the sheet/tab: “TestCase4Data” will be active.
14	Paste the data: Use Ctrl+V to paste the data.	The data will appear in the worksheet.
<i>Verify and document the model results.</i>		
15	Within <i>TestCaseVerify.xlsx</i> , go to the sheet/tab: “TestCase4_Result”.	The results of Test Case 4 shall be shown.
16	Document the results of Test Case 4 using the GoldSim© Software Quality Assurance Test Form (see Attachment 1).	Test Case 4 is complete.
N/A	The Software User may close GoldSim© and Excel, if they choose. The modified electronic files do <b>not</b> need to be saved or retained.	

Completion and documentation of these four test cases satisfies the requirements for installation and acceptance testing of GoldSim© software.

#### 4.6 Life Cycle Phase: Operations & Maintenance

The graded approach for qualification of purchased, Class C software requires justification for exceptions to documenting Operations & Maintenance Phase requirements (per 1Q Procedure 20-1). Operation of this software is described within the vendor-provided *GoldSim User's Guide, Volumes 1 & 2*. [GTG-2010c] GoldSim© is a vendor-provided software. Requirements for maintenance (i.e., software updates) are defined at the discretion of the vendor. The coding

that shall be used to maintain this software is the intellectual property of the vendor, therefore explicit documentation regarding such requirements is not available.

#### **4.7 Life Cycle Phase: Retirement**

The graded approach for qualification of purchased, Class C software requires justification for exceptions to documenting Retirement Phase requirements (per 1Q Procedure 20-1). GoldSim© is a vendor-provided software. The vendor, GTG, provides user support for this software. As such, support for this software is at the discretion of the vendor. Routine use of this software shall be terminated at such a time that (1) suitable replacement software has been identified and qualified, (2) it has been determined that the need for this software no longer exists, or (3) conditions have changed that prevent this software from remaining qualified.

## 5.0 CONFIGURATION MANAGEMENT/BASELINE CONTROL

Configuration control is a method established to control, uniquely identify, describe, and document the configuration of each version of a computer program. As GoldSim® is a purchased software, configuration control is largely at the discretion of the vendor. However, configuration control will be initiated locally to ensure that personnel supporting the Savannah River Site's Liquid Waste Program are using a version of the software that has been qualified.

Table 5.0-1 outlines the necessary steps to ensure proper configuration management of GoldSim® software under this SQAP.

**Table 5.0-1: GoldSim® Software Configuration Managements Activities**

Responsible Individual(s)	Step	Task/Activities
Software User and Software User's Manager	1	Identify the need to run a qualified version of GoldSim® software.
Software User	2	Follow the appropriate procurement procedures to purchase a GoldSim® license from GTG. (See Section 2.1)
	3	Verify that your computer and operating system will support running GoldSim®, per instructions and/or documentation from the vendor.
	4	Perform Installation and Acceptance Tests, as described in Section 4.5 of this SQAP.
	5	Document the results of the Installation and Acceptance Tests by completing the GoldSim® Software Qualification Test Form (see Attachment 1).
	6	Submit the completed GoldSim® Software Quality Assurance Test Form to the GoldSim® Qualification Lead.
GoldSim® Qualification Lead	7	Review and approve the completed GoldSim® Software Quality Assurance Test Form.

In addition to these steps, the GoldSim® Qualification Lead shall maintain control of the Installation and Acceptance Test files (described in Section 4.5) and keep a record of all instances of GoldSim® software that have been qualified according to this SQAP.

After qualification, the Software User shall notify the GoldSim® Qualification Lead of any changes to the computing environment that would adversely affect the qualification of GoldSim® (e.g., the operating system is updated or the software is removed).

### 5.1 Problem Reporting and Corrective Action

GoldSim® is a vendor-provided software. Software Users shall report all software problems to the GoldSim® Qualification Lead who shall notify the vendor, GTG. Since GoldSim® is a purchased software, correction of software errors shall be performed and tested by the vendor, at the vendor's discretion. The GoldSim® Qualification Lead, or delegate, shall assess the issue(s) to determine impacts and a path forward, pursuant to 1Q, Procedure 20-1, Section 5.8. Additionally, the GoldSim® Qualification Lead, or delegate, shall notify all qualified GoldSim® Software Users of identified issues, as appropriate.

## **5.2 Software Security Controls (Risks and Safety)**

Computer Security shall be applied per the 10Q, *Cyber Security Manual*. Any Software User who identifies a security-related issue shall immediately report the issue according to Cyber Security Manual 10Q. As this is vendor-provided software, no further controls are required.

## **5.3 Quality Assurance Records/Documentation**

This document shall be submitted to Document Control as a Quality Assurance record. In addition, electronic copies of completed Attachment 1 forms (GoldSim© Software Quality Assurance Test Form) shall be submitted to the Savannah River Site's Electronic Document Workflow System (EDWS).

## 6.0 REFERENCES

1Q Manual, Procedure 20-1, *Quality Assurance Manual, Software Quality Assurance*, Savannah River Site, Aiken, SC, Rev. 13, October 14, 2011.

10Q Manual, *Cyber Security Manual*, Savannah River Site, Aiken, SC, Rev. 3, October 2, 2009.

B-SWCD-C-00038, Hommel, S. P., *Software Classification Document for GoldSim©*, Savannah River Site, Aiken, SC, Rev. 0, April 10, 2012.

G-SQA-A-00011, Swingle, R. F., *Software Quality Assurance Plan for GoldSim©*, Savannah River Site, Aiken, SC, Rev. 0, August 30, 2006.

GTG-2010 (Copyright), *GoldSim Contaminant Transport Module User's Guide*, GoldSim Technology Group LLC, Issaquah, WA, December 2010.

GTG-2010c (Copyright), *GoldSim User's Guide, Volumes 1 & 2*, GoldSim Technology Group LLC, Issaquah, WA, January 2010.

Q-SWCD-A-00002, Butcher, B. T., *Software Classification Document for GoldSim©*, Savannah River Site, Aiken, SC, Rev. 1, October 15, 2007.

SRR-CWDA-2010-00058, Hommel, S., *Software Acceptance Testing for GoldSim© Version 10.11 (SP3)*, Rev. 0, Savannah River Site, Aiken, SC, August 2010.

SRR-CWDA-2011-00113, *Software Quality Assurance Report for Installation and Acceptance Testing of the H-Area Tank Farm (HTF) Performance Assessment (PA) Probabilistic Model*, Rev. 0, Savannah River Site, Aiken, SC, July 5, 2011

SRR-CWDA-2011-00166, Hommel, S., *Software Acceptance Testing for GoldSim© Version 10.50 SP2*, Rev. 0, Savannah River Site, Aiken, SC, October 25, 2011.

## 7.0 GLOSSARY

Deterministic Simulation	A simulation in which the input parameters are represented using single values (i.e., they are "determined" or assumed to be known with certainty). [GTG-2010c]
GoldSim©	A highly graphical, object-oriented computer program for carrying out dynamic, probabilistic simulations. [GTG-2010c]
Model	An abstract representation of system.
Monte Carlo Simulation	A method for propagating (translating) uncertainties in model inputs into uncertainties in model results. [GTG-2010c]
Performance Assessment	An analysis that estimates the impact (e.g., dose) of a system (e.g., liquid waste closure system), usually over time and within the bounds of a regulatory framework.
Probabilistic Simulation	A simulation in which the uncertainty in input parameters is explicitly represented by defining them as probability distributions. [GTG-2010c]
Realization	A single model run within a Monte Carlo simulation. It represents one possible path the system could follow through time. [GTG-2010c]
Simulation	The implementation of a mathematical model of a system within a specific computational tool (or set of tools). [GTG-2010c]
Stochastic	A process that often has some underlying trend or pattern, but inherently has a random component, and as a result, can only be described statistically.



## ATTACHMENT 1. GOLDSIM© SOFTWARE QUALITY ASSURANCE TEST FORM

<b>GoldSim© Version</b> Example: Version 9.60 SP5	
<b>Computer ID</b> Example: V0042##	
<b>Operating System</b> Example: Windows 7	

### Software User Training

Per Section 2.2 of the SQAP, Software User:	Software User Initials:
Has experience operating a computer with a Windows operating system. (Required)	
Has read and understood the SQAP. (Required)	
Has performed vendor-provided GoldSim© software tutorials. (Recommended, but not required)	

### Quality Assurance Test Results

Test Case	Pass	Fail
	(Check One)	
<b>Test Case 1: Installation Test</b> Upon completion of Test Case 1, GoldSim will be installed and launched, indicating successful completion of Test Case 1.		
<b>Test Case 2: Probabilistic Modeling Acceptance Test</b> Upon completion of Test Case 2, the sheet/tab: "TestCase2_Result" within the Excel file: <i>TestCaseVerify.xlsx</i> indicates that Test Case 2 was successfully completed.		
<b>Test Case 3: External Interfacing Acceptance Test</b> Upon completion of Test Case 3, the data definition for the input element "DB_Test" is 10m, indicating successful completion of Test Case 3.		
<b>Test Case 4: Deterministic Modeling Acceptance Test</b> Upon completion of Test Case 4, the sheet/tab: "TestCase4_Result" within the Excel file: <i>TestCaseVerify.xlsx</i> indicates that Test Case 4 was successfully completed.		

### Approvals

<b>Software User</b>	Print	
	Sign	
	Date	
<b>GoldSim© Qualification Lead</b>	Print	
	Sign	
	Date	