Software Quality Assurance Plan (SQAP) for the H-Area Tank Farm (HTF) Performance Assessment (PA) Probabilistic Model
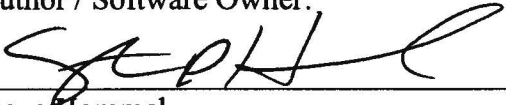
August 2010

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Software Quality Assurance Plan (SQAP) for the H-Area Tank Farm (HTF) Performance Assessment (PA) Probabilistic Model

SRR-CWDA-2010-00080
Revision 0
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APPROVALS

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8 / 13 / 10
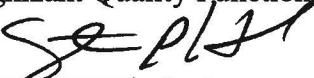Date

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ACRONYMS/ABREVIATIONS

C&WDA	Closure and Waste Disposal Authority
CQF	Cognizant Quality Function
CTF	Cognizant Technical Function
GTG	GoldSim© Technology Group
HTF	H-Area Tank Farm
LWO	Liquid Waste Organization
PA	Performance Assessment
QA	Quality Assurance
QAP	Quality Assurance Procedure
SP	Service Pack
SQAP	Software Quality Assurance Plan
SRNL	Savannah River National Laboratory
SRR	Savannah River Remediation
SRS	Savannah River Site
V	Version

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1.0   SCOPE

This Software Quality Assurance Plan (SQAP) was developed in accordance with the 1Q Quality Assurance Manual, Quality Assurance Procedure (QAP) 20-1, Rev. 11. This document defines the software quality assurance requirements for the software: H-Area Tank Farm (HTF) Performance Assessment (PA) Probabilistic Model (hereafter referred to as the HTF PA Probabilistic Model). The HTF PA Probabilistic Model is classified as "Level C" software, on the basis that this software shall be used to comply with regulatory laws, environmental permits or regulations and/or commitments to compliance (see software classification document: B-SWCD-C-00026).

2.0   SOFTWARE DESCRIPTION

The HTF PA Probabilistic Model shall be developed using commercially available probabilistic modeling software, GoldSim© Version 10 Service Pack 3 (SP3). 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. [GTG-2009] The HTF PA Probabilistic Model will be used to support the HTF PA by modeling the transport of radionuclides and other contaminants from HTF waste disposal facilities at the Savannah River Site (SRS).

The development of this software shall be based upon the functionality of the GoldSim© software and general industry standards for performance assessment modeling.

Qualification of GoldSim© V10 (SP3), for use in the development of the HTF PA Probabilistic Model, is provided via the GoldSim© SQAP developed by Savannah River National Laboratory (SRNL), along with a software acceptance testing report developed by C&WDA. [G-SQA-A-00011; SRR-CWDA-2010-00058]

3.0   ROLES AND RESPONSIBILITIES

The Software Owner's Manager is the manager of the Software Owner's organization. The Software Owner's Manager reviews and approves the SQAP. For this SQAP the Software Owner's organization is C&WDA Assessments.

The Cognizant Technical Function (CTF) is a technical individual or individuals within C&WDA assigned to review and approve the software lifecycle document(s), to ensure that all required reviews and approvals are completed, and to accept the software for operational use.

The Software Owner is the individual or organization assigned to perform the detailed design, development, implementation, and testing activities for the HTF PA Probabilistic Model. The Software Owner reviews and approves change requests and ensures that all required reviews and approvals are completed for the project deliverables.

The Cognizant Quality Function (CQF) is the Quality Assurance (QA) designated individual responsible for quality assurance support to the electronic aids. The CQF reviews and approves the SQAP.

<h3 align="center">4.0 SOFTWARE QA REQUIREMENTS</h3>

The HTF PA Probabilistic Model is a developed application, subject to the QA requirements described in the 1Q Quality Assurance Manual, QAP 20-1, Rev. 11. The requirements described within the following sections must be satisfied for the qualification of the HTF PA Probabilistic Model.

4.1 Lifecycle Documentation

This section describes the documentation requirements related to the lifecycle activities for the HTF PA Probabilistic Model.

Section D.1 of the 1Q Quality Assurance Manual, QAP 20-1, Rev. 11 states that "no strict chronological constraints exist between the requirements identified. The number of phases and relative emphasis placed on each phase … will be dependent on the nature and complexity of the software." The HTF PA Probabilistic Model supports the development of the HTF PA.   In many cases, the HTF PA will include documentation that satisfies these lifecycle documentation requirements. Rather than producing multiple documents that provide identical text, whenever appropriate, the HTF PA (or associated documents) shall be referred to as satisfying the lifecycle documentation requirements.

Therefore, qualification of the HTF PA Probabilistic Model shall be performed in tandem with the development of the HTF PA.   QA documentation for the HTF PA Probabilistic Model shall be prepared under the assumption that the HTF PA will include the prescribed documentation, and the HTF PA shall be prepared under the assumption that the HTF PA Probabilistic Model shall satisfy all software QA requirements upon its completion. A final check shall be performed by the Software Owner to verify this assumption once the HTF PA has been finalized and an update to this SQAP shall be performed, if necessary.

4.1.1 Requirements Phase

The software requirements (with respect to functionality, performance, design inputs, design constraints, installation, etc.) of the HTF PA Probabilistic Model shall be identified in Appendix A of this SQAP. This appendix shall satisfy the Requirements Phase documentation requirements as defined in Section D.2 of 1Q Quality Assurance Manual, QAP 20-1, Rev. 11.

4.1.2 Design Phase

Documentation of the software design phase is provided by the HTF PA. This document provides a description of the major components to be included in the HTF PA Probabilistic Model software design, as well as inputs, the conceptual approach, and process and data flow. Section D.3 of 1Q Quality Assurance Manual, QAP 20-1, Rev. 11, also requires that any theoretical and mathematical approaches used be documented. These aspects of the design, as well as additional inputs, shall also be documented within the HTF PA.

As a final design element, a benchmark test, as described in Section 4.1.4, shall be designed and documented. As appropriate, this benchmark test should be considered during the implementation phase.

4.1.3   Implementation Phase

The HTF PA Probabilistic Model shall be developed to run as a GoldSim© model file (*.gsm). Therefore, implementation of the HTF PA Probabilistic Model is performed by implementing the design features and requirements (see Sections 4.1.1 and 4.1.2, respectively) within GoldSim©, according to the instructions for model development as provided within the GoldSim© *User's Guide*. Accordingly, the GoldSim© *User's Guide* and the HTF PA, satisfies the implementation phase documentation requirements for the HTF PA Probabilistic Model. [GTG-2009]

4.1.4   Test Phase

Due to the complexity of the HTF PA Probabilistic Model, the Test Phase shall be executed in two stages:

1. Input data verification and model implementation checking, and

2. Benchmark model validation testing.

During input data verification and model implementation checking, the CTF (or other independent/competent individual), shall review the data inputs, formulas, calculations, model elements and links, and source documentation to ensure that the input values in the HTF PA Probabilistic Model are correct and that the model design and requirements were implemented properly. The results of the data verification activities shall be documented within a separate software test phase report.

After development of the HTF PA Probabilistic Model, a benchmark test shall be performed to evaluate the validity of the software. To perform this benchmark test, the HTF PA Probabilistic Model shall be executed, and the calculated dose results shall be compared against a set of dose values calculated using an alternative method, such as PORFLOW modeling. The results of this comparison shall be documented within the HTF PA.

4.1.5   Installation and Acceptance Phase

The HTF PA Probabilistic Model shall be developed to run as a GoldSim© model file (*.gsm). Therefore, installation of the HTF PA Probabilistic Model is performed by (1) installing GoldSim© software onto the necessary computer(s), (2) opening the HTF PA Probabilistic Model from such computer(s), and executing model file. Successful execution of the model file shall confirm acceptable performance of this software.

Note: GoldSim© software installation and acceptance shall be performed by following the instructions described in the GoldSim© SQAP and the GoldSim© *User's Guide*. [G-SQA-A-00011; GTG-2009]

The benchmark test, as described in Section 4.1.4 (and documented in the HTF PA), along with the necessary documentation needed to satisfy the GoldSim© SQAP installation and acceptance requirements, shall satisfy the initial Installation and Acceptance Phase documentation requirements for the HTF PA Probabilistic Model. [G-SQA-A-00011; SRR-CWDA-2010-00058]

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Acceptance testing for future versions of the HTF PA Probabilistic Model, or for execution of the HTF PA Probabilistic Model on computer(s) other than those qualified by the initial acceptance testing shall be documented in a separate software acceptance test document.

4.1.6   Operation and Maintenance Phase

Approval from the Software Owner's Manager and Software Owner shall be required for any modifications to the approved baseline. All modifications and approvals shall be documented in a manner consistent with SRR quality assurance practices, such as model change checklists, model corrective action logs, and technical reports.

Any errors identified shall be handled according to Section 4.4.

4.1.7   Retirement Phase

When the retirement is foreseeable, this SQAP shall be revised to address the specifics of the retirement process that will terminate support and prevent routine use of the electronic aid. Retirement of old versions of software shall be managed as part of the standard revision process.

4.2   Software Configuration Control

During the development of this SQAP, documentation and files shall be managed according to C&WDA document management practices, per SRR-CWDA-2009-00053. After development, any changes to this document (or any related documents) shall be subject to approval from the Software Owner's Manager, CTF, CQF, and Software Owner. In the event of any updates or changes, a Revision History section shall be added to this SQAP to describe the changes.

The initial HTF PA Probabilistic Model shall be named: "SRS HTF Transport Module v0.0.gsm." This GoldSim© model file shall be maintained in a controlled directory within the C&WDA organizational server as a "Read-Only" file. Further, the model file and any related files shall be submitted to the Liquid Waste Organization (LWO) document library as supporting documents to the HTF PA. The LWO Document Library is an SRS-internal Lotus Notes application that serves as a file and document repository.

Future versions of the HTF PA Probabilistic Model shall be given a different filename by incrementing the version (v) numbers. For example, a minor change to the model file would result in a model file named: "SRS HTF Transport Module v0.1.gsm"; whereas a major change to the software would result in a model file named: "SRS HTF Transport Module v2.0.gsm." Changes shall be defined as major or minor at the discretion of the Software Owner's Manager and Software Owner.

As a GoldSim© model file, this software is not subject to check-in/check-out procedures, rather copies of the HTF PA Probabilistic Model may be obtained through a request to the Software Owner's Manager. Only copies of the file may be distributed. The base-lined "master version" of the HTF PA Probabilistic Model shall not be modified or removed from the C&WDA server without approval from the Software Owner's Manager. Any unapproved modifications to the GoldSim© model file shall remove it from the baseline.

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4.3   Software Acquisition or Procurement

The HTF PA Probabilistic Model is developed software, a copy of which may be obtained through a request to the Software Owner's Manager.

Note: The HTF PA Probabilistic Model shall run as a GoldSim© model file (*.gsm); therefore, a licensed version of GoldSim© is required to run the HTF PA Probabilistic Model. A licensed version of GoldSim© may be obtained from the GoldSim© Technology Group (GTG) at: http://www.goldsim.com/

4.4   Problem Reporting and Corrective Action

Software users who identify errors, problems, or corrective actions within the HTF PA Probabilistic Model shall notify the Software Owner's Manager or the Software Owner. The Software Owner's Manager or the Software Owner, or delegate, shall document these issues within a Corrective Action Log (see Appendix B). All errors shall be assessed, on a case-by-case basis, to determine impact on modeled results and path forward for resolution.

4.5   Software Security Controls

The CTF along with the responsible technical authorities shall ensure that the security controls comply with applicable site automated data processing system security requirements, as described in Procedure Manual 10Q, Computer Security Manual. The HTF PA Probabilistic Model shall receive reviews for classified or sensitive information in accordance with the requirements of Procedure Manual 7Q, Security Manual.

4.6   Tools, Techniques, Methods, Standards, Practices and Conventions

There are no tools, techniques, methods, standards, practices and conventions to describe, other than those reflected in the other sections. This section shall remain within the SQAP for future use.

4.7   Quality Assurance Records/Documentation

This document shall be submitted to Document Control. In addition, any documents containing results from CTF or CQF reviews shall be submitted to Records Management as QA records. This includes this SQAP and the HTF PA. Further, all documents associated with the qualification of the HTF PA Probabilistic Model shall also be submitted to the LWO document library, per SRR-CWDA-2009-00053.

5.0   TRAINING

Training for the HTF PA Probabilistic Model shall be completed by reading this SQAP and the HTF PA. A working knowledge of GoldSim© is also required. Documentation of such training is not required for qualified use of for the HTF PA Probabilistic Model. No additional training is necessary.

6.0   QA DOCUMENTATION SUMMARY

The following provides a brief summary of the documents that shall support the qualification of the HTF PA Probabilistic Model:

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- Appendix A, Table A-1 of this document shall satisfy documentation requirements for the Requirements Phase of the Software Lifecycle activities.

- The HTF PA shall satisfy documentation requirements for the Design Phase of the Software Lifecycle activities.

- The GoldSim© *User's Guide* and the HTF PA shall satisfy the documentation requirements for the Implementation Phase of the Software Lifecycle activities. [GTG-2009]

- A software test phase report along with the HTF PA shall satisfy the documentation requirements for the Testing Phase of the Software Lifecycle activities.

- A software acceptance test document for GoldSim©, prepared from the requirements described in the GoldSim© SQAP, and documentation of the benchmark testing within the HTF PA shall satisfy the documentation requirements for the initial Installation and Acceptance Phase of the Software Lifecycle activities. [G-SQA-A-00011; SRR-CWDA-2010-00058]

- A separate software acceptance test document shall be prepared to qualify any future versions of the software or to qualify the HTF PA Probabilistic Model for environments not qualified in the initial Installation and Acceptance Phase of the Software Lifecycle activities. The separate software acceptance test document shall be prepared from the requirements described in the GoldSim© SQAP and shall include documentation equivalent to the benchmark testing as documented in the HTF PA. [G-SQA-A-00011; SRR-CWDA-2010-00058]

All other documentation shall be prepared as determined by the Software Owner, according to the needs of the C&WDA and the HTF PA, and pending approval of the Software Owner's Manager.

7.0   REFERENCES

1Q Manual, *Quality Assurance*, Procedure 20-1, Rev. 11, *Software Quality Assurance*. Savannah River Site, November 2007.

7Q Manual, *Security*.

10Q Manual, *Computer Security*.

B-SWCD-C-00026. *Software Classification Document for H-Area Tank Farm (HTF) Performance Assessment (PA) Probabilistic Model*. Savannah River Site, July, 2010.

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

GTG-2009. GoldSim© Technology Group, LLC., *GoldSim© User's Guide*, Version 10, Volumes 1 and 2. Issaquah, WA, 2009.

SRR-CWDA-2009-00053, Dyer, C., et al., *Closure & Waste Disposal Authority (C&WDA) Desktop Guidelines for General Office Practices*. Savannah River Site, Aiken, SC, May 2010.

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

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APPENDIX A. SOFTWARE REQUIREMENTS

Table A-1 identifies all of the requirements that the HTF PA Probabilistic Model must satisfy. These requirements define the functions to be performed by the software and provide the detail and information necessary to design the software. Software requirements shall be verifiable and traceable throughout all stages of the software development cycle.

Objective evidence that the HTF PA Probabilistic Model satisfies all of the defined requirements shall be provided through Test Phase and Installation and Acceptance Phase activities as defined in Sections 3.1.4 and 3.1.5, respectively.

Table A-1: HTF PA Probabilistic Model Requirements

ID	Requirement	Critical (Y/N)	Priority[a]	Acceptance Criteria
R01	GoldSim© model file	Y	High	The HTF PA Probabilistic Model shall be developed as a GoldSim© model file (*.gsm).
R02	System environment	Y	High	The HTF PA Probabilistic Model shall run on a personal computer (PC) with a Windows-based operating system.
R03	Execution	Y	High	The HTF PA Probabilistic Model shall execute as a GoldSim© model file (*.gsm), according to the GoldSim© *User's Guide*. [GTG-2009]
R04	Probabilistic Inputs	Y	High	The HTF PA Probabilistic Model shall accept probabilistic (stochastic element) inputs.
R05	Waste Tank Property Inputs	Y	High	The HTF PA Probabilistic Model shall accept quantified waste tank property data as inputs.
R06	Ancillary Equipment Property Inputs	Y	High	The HTF PA Probabilistic Model shall accept quantified ancillary equipment property data as inputs.
R07	Inventory Data Inputs	Y	High	The HTF PA Probabilistic Model shall accept quantified isotopic and radionuclide inventory data as inputs.
R08	Vadose Zone and Backfill Parameter Inputs	Y	High	The HTF PA Probabilistic Model shall accept quantified vadose zone and backfill property data as inputs.

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Table A-1: HTF PA Probabilistic Model Requirements (continued)

R09	Integrated Conceptual Model	Y	High	The HTF PA Probabilistic Model shall satisfy the design needs of the Integrated Conceptual Model.
R10	Results	Y	High	Based upon the inputs provided, the HTF PA Probabilistic Model shall calculate expected dose values as needed to adequately support the HTF PA.

[a] Priority:

   High: Critical requirement that is mandatory and must be met
   Medium: Non-critical requirement that will be included if possible
   Low: Deferred for later development.

APPENDIX B. CORRECTIVE ACTION LOG EXAMPLE

The following instructions and corrective action (CA) log are provided as an example of the type of information to be tracked, with respect to CAs identified in the HTF PA Probabilistic Model after software design and implementation. A corrective action log only needs to be initiated if errors or issues are identified. This information is provided only as an example.

Table B-1: Instructions for Corrective Action Log Entries

Field	Instruction
ID	Every CA Log entry should have a unique identifier for the Entry ID.
CA Description	Describe the corrective action (for example, describe what should be changed, why it should be changed, and how to make the change).
Location in Model	GoldSim© model files offer transparent, easy-to-document location organizations. The Container Path and element names shall be used to document locations within the model, as applicable.
Identified By	Provide the name of the individual who identified the corrective action.
Date	Provide the date when the corrective action was identified.
Corrected Model Version	Provide the version of the PA Model in which the CA was implemented.
Corrected By	Provide the name of the individual who implemented the corrective action.
Date	Provide the date when the corrective action was implemented.
Impact of correction	Briefly describe the impact of the CA - especially as it pertains to dose calculated in the PA.

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Table B-2: Corrective Action Log Example for the HTF PA Probabilistic Model

ID	CA Description	Location in Model	Identified By	Date	Corrected Model Version	Corrected By	Date	Impact of correction
1	Example entry. Delete this when "real" entries are entered.	\Dashboards	Analyst Name	1/1/2011	0.1	Analyst Name	1/1/2011	Negligible.
2	Example entry. Delete this when "real" entries are entered.	\HTF_Source_Inputs\ HTF_Waste_Tanks\ HTF_Waste_Tank_Inventories	Analyst Name	2/1/2011	2	Analyst Name	2/2/2011	Decrease to dose from nickel dose results by one order of magnitude.