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7. Abstract This document provides the software quality assurance plan, verification and validation plan, and the software configuration management plan for the software that was developed to operate the void fraction instrument.		
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SOFTWARE QUALITY ASSURANCE PLAN FOR VOID FRACTION INSTRUMENT

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SOFTWARE QUALITY ASSURANCE PLAN FOR VOID FRACTION INSTRUMENT

1.0 INTRODUCTION

Waste Tank SY-101 has been the focus of extensive characterization work over the past few years. The waste continually generates gases, most notably hydrogen, which are periodically released from the waste. Gas can be trapped in tank waste in three forms: as void gas (bubbles), dissolved gas, or absorbed gas. Void fraction is the volume percentage of a given sample that is comprised of void gas. The void fraction instrument (VFI) acquires the data necessary to calculate void fraction.

This document covers the product, "Void Fraction Data Acquisition Software." The void fraction software being developed will have the ability to control the void fraction instrument hardware and acquire data necessary to calculate the void fraction in samples.

2.0 SCOPE

This document provides the software quality assurance plan (SQAP), verification and validation plan (V&V), and configuration management plan for developing the software for the instrumentation that will be used to obtain void fraction data from Tank SY-101.

3.0 SOFTWARE QUALITY ASSURANCE PLAN (SOFTWARE LIFE CYCLE)

The software quality assurance plan describes the actions needed to assure the quality of the void fraction instrument and associated software. Implementation of this plan results in compliance with WHC-CM-3-10, "Software Practices," Section 3.4, "Small Job Development," and WHC-CM-4-2, "Quality Assurance Manual." TWRS Safety Special Projects will perform this effort.

The void fraction software life cycle phases that are covered by this activity are described in the following subsections. The verification and validation plan, configuration management plan, and discrepancy reporting and corrective action are described in Sections 6.0, 7.0, and 8.0 of this document.

3.1 REQUIREMENTS PHASE

The requirements phase involved defining the specific functional, performance, and interface requirements for the void fraction software. The specific, detailed requirements of the void fraction software was documented by the design group in WHC-SD-WM-SRS-020, "Software Requirements Specification for Tank 101-SY Void Fraction Instrument," and provides the basis for the verification and validation activities.

3.2 DESIGN PHASE

The software design phase shall evolve from the results of the requirements definition phase. The design effort will focus on providing a design that meets the following design goals:

- Maintainable
- Reliable
- Responsive
- Usable

A software design description (SDD) will be prepared by the software design group.

3.3 IMPLEMENTATION PHASE

This phase will involve implementation of requirements and design phase by translating the design into actual code using a graphical programming language.

3.4 TESTING PHASE

The void fraction software will be tested to verify and validate the software. The programmer shall do informal testing during development. Informal testing avoids costly iterative formal testing.

In addition to informal testing, formal testing will be conducted. The formal test is discussed in WHC-SD-WM-ATP-081, Rev. 0, "Software Acceptance Test Procedure for Tank 101-SY Void Fraction Instrument," and the results are documented in WHC-SD-WM-ATR-081, Rev. 0, "Software Acceptance Test Report for Tank 101-SY Void Fraction Instrument."

The test procedure will be executed to validate the performance of the void fraction software to the established requirements. The test results obtained during test execution shall be documented in a verification and

validation report (or acceptance test report). Refer to the "Verification and Validation Plan" section of this document.

3.5 INSTALLATION AND CHECKOUT PHASE

This instrument will not be permanently installed in any tank. It will be used to make measurements and removed. Therefore, the installation and checkout phase that normally involves integrating the software into its operational environment is not necessary.

3.6 OPERATION AND MAINTENANCE PHASE

The operation and maintenance phase of this instrument is covered by the document WHC-SD-WM-OMM-011, Rev. 0, "Void Fraction Instrument Operation and Maintenance Manual."

4.0 SOFTWARE DEVELOPMENT METHOD

Software will be developed and maintained using a graphical programming language for instrumentation. This development method results in program code that consists of interconnected icons, not in text computer code. The benefit is that for smaller jobs such as this one, less time is required to develop the software and changes are more easily made in the future. The drawback is that software documentation (SDD) is unconventional.

5.0 DOCUMENTATION

The engineering organization must prepare documentation to describe each phase of the void fraction software life cycle. The documents to be prepared are listed in each phase of the software life cycle in the "Software Quality Assurance Plan" section of this document. In addition to this documentation, an operation and maintenance manual has been prepared.

6.0 VERIFICATION AND VALIDATION PLAN

Because the size and complexity of this activity is small, verification and validation planning for the activity is included in this SQAP, and a separate V&V plan will not be developed.

All phases of the software life cycle require checks to assure quality. All documentation shall consist of either supporting documents or electronic records. The approval and release of supporting documents must follow WHC-CM-6-1, "Standard Engineering Practices," EP-1.7, "Engineering Document Approval and Release Requirements." Completion of the following activities must occur before release of the associated supporting documents.

A verification and validation report (acceptance test report) will be prepared to include documentation of all V&V activities described below.

6.1 DESIGN REVIEWS

Independent design reviews shall be conducted in accordance with WHC-CM-6-1, EP-4.1, "Design Verification Requirements." All supporting documents referred to in Section 5.0 of this document shall be reviewed. These reviews shall serve as the primary method of design verification.

Reviewers shall evaluate the traceability of the design to the requirements; quality criteria consisting of: maintainability, reliability, responsiveness, and ease of use; the applicability, adequacy, and method of any calculations; and overall design documentation for correctness, consistency, completeness, and readability.

6.2 TESTING

The testing activities described in Section 3.4, "Testing Phase," will be performed to validate the software. These activities shall be performed in accordance with WHC-CM-6-1, EP-4.2, "Testing Practices."

7.0 CONFIGURATION MANAGEMENT PLAN

Each phase of the life cycle shall have configuration control. Approval, release, and control of supporting documents shall follow WHC-CM-6-1, EP-1.7 and EP-2.2, "Engineering Document Change Control." Initial release of documents sets the baseline for the associated life cycle phase. Later, Engineering Change Notices (ECNs) will update the baseline.

The software custodian responsible for maintaining configuration control of the software covered by this SQAP shall be the organization TWRS Safety Special Projects or the successor organization. In the sections that follow, each time TWRS Safety Special Projects is used, it is referred to as TWRS Safety Special Projects or successor organization. TWRS Safety Special Projects shall control software code listings and configuration records. TWRS

Safety Special Projects may use an automated approach with electronic record maintenance.

The void fraction instrument computer software that will be placed under configuration control will include the commercial computer software used by the software.

7.1 CONFIGURATION IDENTIFICATION

A unique descriptive name and revision number shall be assigned to each software file. The supporting document number, title, and revision number assigned to the software design description (SDD) shall be used for labeling each floppy diskette. The SDD will include the void fraction software listings and be updated with each software change (including error corrections). The content of each software file will contain the name and revision number. Each revision shall have a revision date. The initial revision, Rev. 0, shall be the baseline. The descriptive label shall appear as shown below:

- WHC-SD-XXX-XXX-XXX (supporting document #)
- Void fraction software disk (title)
- Revision number/revision date
- Diskette number

7.2 CONFIGURATION CHANGE CONTROL

Each software file shall contain a functional description of the contents of the file. The contents of the file shall have a revision history. The revision history shall include a description of the initial release and all subsequent changes to the file. The description shall include the following:

- Revision number/revision date
- Nature of the change
- Identity of requester
- Rationale for the change
- Identity of author making the change

7.3 CONFIGURATION STATUS ACCOUNTING

TWRS Safety Special Projects shall prepare a status accounting file before software release. The file will be included in the released SDD document. The status accounting shall include a list of all software files that make or produce a released product. The status accounting file shall contain the following:

- Name and revision of the release product
- Name and revision of all software files

Instructions on how to build the software product from the files shall include identification of support software. Support software includes compilers, assemblers, editors, operating system, and other utility software.

7.4 MEDIA CONTROL

The form of media used to store the software shall be on floppy disks. The software media shall be stored in two locations. One set of the software media shall be stored in a locked file cabinet labeled "software records" in the file named "void fraction software." This file cabinet will be located at a location specified by the manager of TWRS Safety Special Projects or successor organization. The other set of software media shall be stored in a file that is kept by the software developer.

8.0 DISCREPANCY REPORTING AND CORRECTIVE ACTION

Any person who identifies any problem or discrepancy at any time shall report it to the cognizant engineer. The cognizant engineer shall include a written description (on DSI) of the problem or discrepancy in the design file under "problems." The cognizant engineer shall provide a copy of this written description to the manager of TWRS Safety Special Projects or the successor organization. The corrective action is recorded in an action-tracking database by the manager of TWRS Safety Special Projects. The manager of TWRS Safety Special Projects and cognizant engineer are responsible for assuring correction of the problem or discrepancy.

9.0 QUALIFICATION OF EXISTING SOFTWARE

Commercial software used to support the void fraction software will not be separately qualified but will be qualified during the testing phase of the void fraction to the extent that it is used in the system.

10.0 REQUIREMENTS

The work and designs delineated in this document shall be done in accordance with WHC-CM-6-1, EP-2.0, "Engineering System Design Control," and other applicable WHC policies and procedures.

11.0 QUALITY ASSURANCE AND SAFETY

The documentation for this activity will incorporate Quality Assurance review and approval.

12.0 GLOSSARY OF TERMS

- **Correctness** The degree to which a function satisfies its intended purpose.
- **Data Flow** A software design element that represents the transfer of data from one process to another or to/from a data storage function.
- **Life Cycle** The collection of product phases from initial concept to retirement used to manage the product development and use.
- **Media** The recording material and form used to maintain retrievable records. Usually magnetic or optical disks or tapes.
- **Traceability** The ability to trace a hardware/software function from the final product back to the starting requirement.
- **Validation** Making sure the end product meets its intended use.
- **Verification** Making sure the end product meets the specifications.

13.0 APPLICABLE DOCUMENTS

- WHC-CM-6-1, "Standard Engineering Practices."
- IEEE Software Engineering Standards Collection, Spring 1991 edition.
- WHC-CM-1-3, "Management Requirements and Procedures."
- WHC-CM-3-10, "Software Practices."