

Waste Characterization System Program Description Document

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SUMMARY OF REVISIONS:

Date	Revision	Description of Changes
2/14/2003	0	Initial Issue
3/11/2003	1	Addition of backup/recovery discussion, addition of Reference 7, clarification of data entry for pre-transfer projections, and editorial changes
6/04/2004	2	Preparation for implementation of a new WCS platform (a web based program) to include clarification for the required changes associated with re-establishing WCS 1.5, deleted reference to the Sample Management Plan, added discussion of salt/sludge volume information sources to include engineering calculations and technical reports, modified PDD format, incorporated the role and responsibility of the DIRT committee for coordination and execution of the PDD implementation items
7/2014	3	Added reference to DIRT Charter, reformatted PDD and added appropriate content to conform to latest S4-Eng. 36 procedure
12/2015	4	Removed some information that can be found more appropriately in the DIRT Charter. Updated implementation actions and included additional information regarding Canyon transfers and Tank 50 Material Balance updates.
6/2017	5	<p>Revised PDD to address implementation of WCS Online web based application that replaced WCS 1.5.</p> <p>Added 4.3 to specify WCS sample results are only updated for corrosion and flammability purposes.</p> <p>Updated Reference Section to update current documents and add new WCS Online implementing and software lifecycle documents</p> <p>Revised Section 4.1.2 to reflect requirements of B-DMP-H-00006 for Data Entry Controls.</p> <p>Updated PDD to align with the requirements of S4-ENG.36.</p>

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1.0 PURPOSE

The purpose of this Program Description Document (PDD) is to provide guidance to Engineering personnel for implementing the associated requirements contained in the Documented Safety Analysis (DSA 5.5.4.2.32) [Ref. 1] and Technical Safety Requirements (TSR 5.8.2.32) [Ref. 2], pertaining to the Liquid Waste (LW), Waste Characterization System (WCS) Administrative Control Program. The WCS Program shall address data acquisition, data entry, and quality assurance.

The WCS was developed for the purpose of establishing and maintaining a data source for waste composition in all high level waste tanks in the Concentration, Storage and Transfer Facilities (CSTF). WCS is a web-based application (WCS Online) which primarily stores supernate, salt, and sludge data. This application accommodates data input (e.g., waste characterization, tank levels, and chemistry) for supernate, sludge and salt.

Additionally, WCS implements requirements of other PDDs, the Waste Acceptance Criteria (WAC) Program, and other programs supporting LW operations. Certain calculations are performed within the database, using the input data, to determine conditions and other parameters associated with various administrative control programs (i.e., Flammability Control Program, Corrosion Control Program, Transfer Control Program, Sludge Carryover Minimization Program, Evaporator Feed Qualification Program, Hydrogen Generation Rate Control Program, Prohibited Operations Program, Gas Release Program, Tank Fill Limits Program, Waste Tank Quiescent Time Program, Inhalation Dose Potential Control Program, Waste Tank Chemical Cleaning Program, ARM Location Program, Waste Acceptance Criteria Program, Tank 48 Unauthorized Operations Program, and Flammable Vapor Sampling Program). Calculations are addressed by WCS Technical Baseline documents and not this PDD, however a description of the process is provided in the PDD to provide an overview of the entire system.

2.0 SCOPE

The scope of this PDD is the WCS database and the guidance for implementing the requirements of TSR 5.8.2.32) [Ref. 2]. Additional WCS information is provided to present the process in total, but the intent of the PDD is to ensure the program meets the TSR requirements for data.

This document is not a Safety Basis Document or a safety basis implementing document.

PDD Owner Qualifications and Responsibilities are established in S-4 Manual, Procedure ENG.36 [Ref. 3] and are not addressed by this document.

3.0 BACKGROUND

3.1 Safety Function

The safety function of this PDD is to ensure that programmatic controls are established to address data acquisition, data entry, and quality assurance as required by the TSR.

3.2 Other Drivers

N/A

4.0 **PROGRAM DESCRIPTION**

4.1 Inputs

4.1.1 Data Acquisition

There are several sources of information and data utilized by WCS. The following requirements are designed to establish a connection between various information sources and the WCS owner.

All reports or approved documents that contain results from waste tank samples shall be forwarded to the organization that owns the WCS. Sample results required by administrative programs shall be incorporated into WCS in accordance with the specific requirements identified within the affected administrative programs.

The results of sludge and salt soundings are to be reported to the organization that owns the WCS. This information is key to performing the providing the data required to support the various program calculations implemented in the WCS. This communication shall be accomplished by the reporting requirements in the procedure for performing a salt or sludge sounding (i.e. SW11.1-WTE-7.2). Typically, the sample coordinator works closely with the facility to coordinate soundings measurements and to collect the results of the soundings.

Sludge and salt soundings may not be the most effective method for determining the amount of salt and sludge in a tank, especially after bulk waste removal has been initiated by the Waste Removal or Salt Removal Programs. These programs typically utilize video inspections and sampling as additional means to establish the tank heel. These results are documented in a Technical Report or Engineering Calculation. Similar evaluations are often performed during intermediate bulk waste removal processing and after salt dissolution and mining activities. These evaluations shall be forwarded to the organization that owns WCS.

The WCS must be updated with sludge canyon receipts (e.g., H-Canyon). The receipts of waste into the Tank Farm are reported on Workgroup 8 ([\WG08](#)) shortly after the transfers are completed. An evaluation is performed at least semi-annually to determine the heat loads associated with these transfers for incorporation into the WCS Online database. By updating the canyon receipts in a timely manner, WCS will reflect a close approximation of what is in each tank at any given time. The typical canyon transfer is less than 2,000 gallons. Assuming there are 10 canyon transfers in a month, the addition to a tank is less than 20,000 gallons. The heat contribution corresponding to 20,000 gallons is inconsequential compared to the heat inventory represented within a typical sludge tank. Several months of typical canyon transfers are required to significantly impact the characterization of a receipt tank.

Additionally, impact reviews are performed prior to special canyon transfers, approved through a special Waste Compliance Plan, into Tank Farm waste tanks; therefore, significant impacts are evaluated and accounted for in advance. Currently, the major repository for Canyon waste is Tank 39. Tank 39 is re-baselined at least semi-annually to verify its separation distance requirements and update heat loads. Re-baseline frequency will be re-evaluated commensurate with changes to the system plan or, at a minimum, during the bi-annual self-assessment. The changes in supernate chemistry resulting from the H-Canyon receipts are captured by periodic samples per the Corrosion Control Program [Ref. 4].

The WCS must be updated with sludge receipts from DWPF into CSTF. These receipts of waste into the Tank Farm are reported on Workgroup 8 ([\WVG08](#)) shortly after the transfers are completed. An evaluation is performed to determine the heat loads associated with these transfers. The results are then utilized to determine the quantity of sludge solids that can be accepted into the designated waste tank. The number of allowable transfers is calculated using a conservative estimate of the quantity of sludge solids per transfer. The number of allowable transfers is reflected in the Emergency Response Data (ERD) such that the maximum quantity of sludge solids is not exceeded. Periodically (when transfers reach approximately 75% of allowable transfers) DWPF will provide an evaluation detailing actual transfer sludge solids data as determined by sample results for incorporation into WCS Online.

Tank 50 receives transfers (non-waste) from ETP, H-Canyon, 512-S, and MCU. As required by the Saltstone WAC [Ref. 5], a material balance of Tank 50 is performed routinely. The Tank 50 Material Balance data in WCS Online has to be updated accordingly. SRNL issues WAC sample data tables. WAC sample data is used to update the Latest Baseline Sample section. Operations input all transfers into and out of Tank 50 into the Isopar Concentration Calculator (ICC). A WCS Online request is generated so that the Tank 50 Material Balance data in WCS Online can be updated with the sample and transfer data. The WAC sample data is input as a Re-baseline periodically. Total transfer volumes are entered, according to transfer waste stream (e.g. ETP, Salt Batch), into the Tank 50 Material Balance worksheet periodically.

All other waste streams coming into the CSTF from outside facilities are similarly required to comply with the CSTF WAC [Ref. 6]. Characterization data from these streams are presented to Data Integrity Review Team (DIRT) where it is determined whether or not WCS needs to be updated or not [Ref. 23].

Prior to entry into WCS, sample data, solids measurements, Tank 50 Material Balance updates, and applicable engineering reports are reviewed by DIRT. As described in the DIRT Charter [Ref. 23], DIRT is a body of personnel, selected by specific technical expertise, designed to represent a quorum of sufficient engineering breadth to provide a holistic perspective to data review. The mission of the DIRT is to review CSTF waste tank characterization data (e.g., chemistry and sounding measurements) to verify its technical validity prior to the incorporation of the data into WCS. Additionally, the DIRT coordinates the execution of the implementation items identified in this WCS

PDD. The major repository for DIRT evaluated data is WCS Online. DIRT meetings are conducted at least monthly (typically weekly) to ensure WCS is updated appropriately.

4.1.2 Data Entry and Quality Assurance

The following guidelines are given to ensure that the data entered into the WCS retains the pedigree commensurate with Level B software. All data entry shall be in compliance with Waste Characterization System Online Data Management Plan (DMP) [Ref. 8] and consistent with the requirements outlined in Manual E7, Procedure 5.80A [Ref. 13]. This DMP outlines the steps necessary to properly document and verify data entered into the WCS Online database.

A Request Form is required for all data entry into WCS Online. Request form process and requirements are found in B-RS-H-00272, *Waste Characterization System Online Software Requirements Specification* (RSS) [Ref. 18]. WCS Online also requires an independent review for all data entry. This process and requirements can also be found within the RSS. The Request Form process within WCS Online is the primary error reporting mechanism for data problems that can be addressed via the application. If data errors, other corrections or additions to WCS Online data are required and cannot be performed through the standard data entry process, a request to the Design Agency to perform necessary changes should be submitted via Data Modification Tracker (DMT).

WCS Online Data Error Reporting and Corrective Action is addressed by the WCS Online DMP [Ref.8]. Per the E7 Conduct of Engineering Manual, Procedure 5.80A, *LW Data Management* [Ref. 13], changes to data or the structure of a database, resulting from errors, quality issues, or new requirements, are reported and controlled by a DMT (OSR 46-523) or other appropriate and approved change control methodology that contains the same essential elements. DMTs will be reviewed and approved in accordance with the E7 Conduct of Engineering Manual for LW Data Management [Ref.13]. Independent reviews are performed for both Request and DMTs associated with WCS Online per E7 Manual requirements.

To address backup and recovery, including disaster recovery, the production version of WCS shall be hosted on a server that provides daily back-up of all files. Back-ups shall be maintained to be available to recover from a failure of the production server. The documents managed as baseline documents include the technical baseline documents (5 modules), RSS) [Ref. 18] and the DDS [Ref. 10], RTM [Ref. 19]. For all other concerns regarding the quality assurance of this WCS, refer to the SQAP [Ref. 17].

4.2 Key Attributes

The key attribute of the WCS Program, addressed by this PDD, is the data entry into the WCS Online application, data integrity, and quality assurance. The integrity of the WCS Program is reliant on the respective pedigrees of the data entered. It is essential that controls are in place to protect the validity of each. This PDD is designed to outline how these controls are implemented.

4.3 Programmatic Assumptions

Samples that are “accepted” by DIRT are entered into WCS within two weeks of acceptance (for those results that are required to be entered into WCS). Not all accepted sample data are utilized in WCS. For example, variable depth sample results are often utilized in engineering evaluations/calculations; however, typically only Corrosion Control (CC) surface samples are entered into WCS as the representative supernate chemistry. Unless otherwise indicated in WCS, sample results are entered “as reported”, without any adjustment for uncertainty.

4.4 Evaluation, Criteria for Evaluation, Bases for Criteria, Inputs and Outputs

4.4.1 WCS Online Baseline

The calculations used to establish a basis for operation, set action limits, and determine operational status (e.g. flammability status of RAPID) or provide any other key safety related parameters are not addressed specifically as part of this PDD. The WCS formulas, evaluations, criteria for evaluations, bases for the criteria and outputs are established as a Level B software program as delineated in Manual E7, 5.01 [Ref. 12], Manual 1Q QAP 20-1 [Ref. 16], and the applicable Software Quality Assurance Plan (SQAP), [Ref. 17].

WCS Online Technical Baseline documents (modules) provide the formulas for the WCS Program to include inputs and outputs for the calculations. The Requirements Software Specification (RSS) establishes the requirements for the application [Ref. 18]. The Design Document for Software (DDS) [Ref. 10] incorporates this baseline into the WCS Online design. A Requirements Traceability Matrix (RTM) [Ref. 19] is maintained to link requirements, design elements, and test cases for the application version in production. The WCS Online Technical Baseline documents (modules) were reviewed and approved in accordance with Manual E7, Procedure 2.31A [Ref. 11]. The WCS Online design was tested and accepted per Manual E7, Procedure 5.01, Manual 1Q, QAP 20-1, and the associated SQAP.

All WCS calculations are clearly presented in the WCS Technical Baseline (5 modules) to include inputs, assumptions and uncertainty considerations appropriately referenced and justified as listed below:

- X-ESR-H-00718, WCS Online Chemical and Radiological Characterization Module (Module 1) Calculations Methodology [Ref. 24]
- X-ESR-H-00723, WCS Online Generic Equations and Conversions Module (Module 2) Calculations Methodology [Ref. 25]
- X-ESR-H-00729, WCS Online Corrosion Module (Module 3) Calculations Methodology [Ref. 26]

- X-ESR-H-00736, WCS Online Flammability (Module 4) Calculations Methodology [Ref. 27]
- X-WSR-H-00740, WCS Online Material Balances and Reports (Module 5) Calculations Methodology [Ref. 28]

4.5 WCS Online Implementation / Modification

Additionally, a Software Quality Assurance Plan (SQAP) [Ref. 17], was revised to provide software lifecycle requirements for the WCS Online application. The SQAP governs the methods that must be used to maintain the WCS Online software as Level B software in accordance with Manual 1Q, QAP 20-1 [Ref. 16]. The SQAP requires that the Computer Program Modification Tracker (CMT), as a minimum, document modifications to baseline computer program files. These modifications shall be identified as Configuration Items (CIs). This includes software changes such as configuration, Operating System (OS) System Settings, Application System Settings, and Database Settings made in accordance with Manual E7, Procedure 5.62A [Ref. 14]. The required design documents, to include technical baseline documents (modules) [Ref. 24-28], Requirements Specification for Software (RSS) [Ref. 18], Design Document for Software (DDS) [Ref. 10], and Requirements Traceability Matrix (RTM) [Ref. 19], will be revised as necessary to implement the changes to WCS Online.

4.6 Implementation Actions

1. Reports or approved documents that contain results from waste tank samples (as described in section 4.3) shall be forwarded to the organization that owns the WCS. After sample results are received, they shall be evaluated through DIRT for inclusion into WCS.
2. Waste Removal or Salt Removal Program tank heel evaluations (e.g., technical report or engineering calculations) shall be forwarded to the organization that owns the WCS. After tank heel evaluation information is received, they shall be evaluated through DIRT for inclusion into WCS.
3. Reports or approved documents that contain results from waste tank sounding measurements shall be forwarded to the organization that owns the WCS. After sludge and/or salt sounding results are received, they shall be evaluated through DIRT for inclusion into WCS.
4. Reports or approved documents (e.g. work packages, procedures) that contain results from waste tank mixing device or transfer device location change or installation shall be forwarded to the organization that owns the WCS.
5. An evaluation shall be performed at least semi-annually to determine the heat loads associated with the Canyon receipt transfers.

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6. DWPF receipts including sludge shall be evaluated through DIRT for inclusion into WCS.
 7. Tank 50 Sample updates shall be evaluated through DIRT for inclusion into WCS. The Tank 50 Material Balance worksheet will be updated in WCS periodically with transfer volumes (into or out of Tank 50) from the Isopar Concentration Calculator (ICC).
 8. The WCS software shall be maintained consistent with requirements for Level B software in accordance with Manual E7, Procedure 5.01 [Ref. 12] and Manual 1Q, QAP 20-1 [Ref. 16].
 9. Sending Facilities (i.e. H-Canyon) that update Workgroup 8 folder ([\\WG08](#)) must communicate with WCS owner/DIRT Chairman.
 10. Characterization data from other WAC controlled streams shall be evaluated through DIRT for inclusion into WCS Online.

5.0 OTHER COMMITMENTS

N/A

6.0 DEVIATION

Proposed Deviations from the Implementation Actions as contained in this PDD shall be evaluated for acceptance by the Program Review Committee per S4-ENG.36 [Ref. 3].

7.0 REFERENCES

1. WSRC-SA-2002-00007, Rev. 19, June 2016, *Concentration, Storage, and Transfer Facilities Documented Safety Analysis [DSA]*
2. S-TSR-G-00001, Rev.54, April 2017, *Concentration, Storage, and Transfer Facilities Technical Safety Requirements [TSR]*
3. S4, ENG-36, *Tank Farms Engineering Program Description Documents*
4. WSRC-TR-2002-00327, *CSTF Corrosion Control Program*
5. X-SD-Z-00001, *Waste Acceptance Criteria For Aqueous Waste Sent To The Z-Area Saltstone Production Facility*
6. X-SD-G-00001, *Waste Acceptance Criteria for Liquid Waste Transfers to the Tank Farms*
7. G-TRT-H-00033, *Data Integrity Review Team Charter*
8. B-DMP-H-00006, *Waste Characterization System Online Data Management Plan*
9. Manual E7, Procedure 5.80A, *LW Data Management*
10. B-DD-H-00076, *Waste Characterization System (WCS) Online Software Design Description*
11. Manual E7, Procedure 2.31A, *LW Engineering Calculations*
12. Manual E7, Procedure 5.01, *Software Engineering and Control*
13. Manual E7, Procedure 5.80A, *LW Data Management*
14. Manual E7, Procedure 5.62A, *LW Computer Program Modification Tracker*
15. Manual E7, Procedure 2.31A, *LW Engineering Calculations*
16. Manual 1Q, QAP 20-1, *Software Quality Assurance*
17. B-SQP-G-00053, *Software Quality Assurance Plan for LWO Engineering – Process Applications Organization [SQAP]*
18. B-RS-H-00272, *Waste Characterization System Online Software Requirements Specification*
19. B-RTM-H-00056, *Waste Characterization System Online Requirements Traceability Matrix [RTM]*
20. WSRC-TR-2003-00087, *CSTF Flammability Control Program*

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21. WSRC-TR-2003-00089, *CSTF Sludge Carryover Minimization Program, Program Description Document*
 22. SW11.1-WTE-7.2, *Transfer Jet/Pump/Waste Downcomer Levels and Adjustments Data Sheet*
 23. G-TRT-H-00033, *Data Integrity Review Team (DIRT) Charter*
 24. X-ESR-H-00718, WCS Online Chemical and Radiological Characterization Module (Module 1) Calculations Methodology
 25. X-ESR-H-00723, WCS Online Generic Equations and Conversions Module (Module 2) Calculations Methodology
 26. X-ESR-H-00729, WCS Online Corrosion Module (Module 3) Calculations Methodology
 27. X-ESR-H-00736, WCS Online Flammability (Module 4) Calculations Methodology
 28. X-WSR-H-00740, WCS Online Material Balances and Reports (Module 5) Calculations Methodology