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Project Title/Work Order SURVEILLANCE ANALYSIS COMPUTER SYSTEM (SACS) Software Requirements Specification (SRS) WHC-SD-WM-CSRS-007 Rev. 2		EDT No. ECN No. 608597

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Page 1 of 2

1. ECN 608597

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2. ECN Category (mark one) Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Standby ☐ Supersedure ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. J. A. Glasscock, 62610, R1-01, 373-4302		3a. USQ Required? ☐ Yes ☒ No	4. Date 02/24/95
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13a. Justification (mark one) Criteria Change ☒ Design Improvement ☐ Environmental ☐ Facility Deactivation ☐ As-Found ☐ Facilitate Const ☐ Const. Error/Omission ☐ Design Error/Omission ☐				
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SURVEILLANCE ANALYSIS COMPUTER SYSTEM
(SACS)

SOFTWARE REQUIREMENTS SPECIFICATION
(SRS)

February 1995

BY:

J.A. Glasscock

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1. INTRODUCTION

1.1 PURPOSE

This document is the primary document establishing requirements for the Surveillance Analysis Computer System (SACS) Database, an Impact Level 3Q system. The purpose is to provide the customer and the performing organizations with the requirements for the SACS Project.

1.2 SCOPE

This SRS describes the system requirements for the SACS Project, and follows the *Standard Engineering Practices (WHC-CM-6-1)*, *Software Practices (WHC-CM-3-10)* and *Quality Assurance (WHC-CM-4-2, QR 19.0)* policies. This SRS includes sections on general description, specific requirements, references, appendices, and index.

The SACS system defined in this document stores information on tank temperatures, surface levels, and interstitial liquid levels. This information is retrieved by the customer through a PC-based interface and is then available to a number of other software tools.

1.3 ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

Table 1. Acronyms and Abbreviations

BCSR	Boeing Computer Services Richland
CASS	Computer Automated Surveillance System
CPPM	Computer Protection Program Manager
DFD	Data Flow Diagram
DOE	United States Department of Energy
DOE-HQ	United States Department of Energy, Headquarters, Washington D.C.
DOE-RL	United States Department of Energy, Richland Operations Office
EPA	Environmental Protection Agency
ERD	Entity-relationship Diagram
FIC	Food Instrument Corporation
FTP	File Transfer Protocol
GUI	Graphical User Interface
H DAT	Hand-Held Data Acquisition for Tank Farms
HLAN	Hanford Local Area Network
ILL	Interstitial Liquid Level
ISS	Information and Scientific Systems
LAN	Local Area Network
LOW	Liquid Observation Well
MGRIDS	Machine-generated Record Inventory Disposition Schedule
OSD	Operating Specification Document
OSR	Operational Safety Requirements
PC	Personal Computer
RIDS	Record Inventory Disposition Schedule
SACS	Surveillance Analysis Computer System
SAR	Safety Analysis Report
SQL	Structured Query Language
TC	Thermocouple
TCP/IP	Transmission Control Protocol / Internet Protocol
TFO	Tank Farm Operations

TFTS	Tank Farms Technical Support
TMACS	Tank Monitor and Control System
WHC	Westinghouse Hanford Company

Table 2. Definitions

Acceptance Criteria	Acceptance criteria are formally specified limits placed on characteristics of an item, process, or service defined in codes, standards, or other requirement documents.
Boeing Computer Services Richland	Boeing Computer Services Richland, Inc. (BCSR) is a subcontractor to the Westinghouse Hanford Company. BCSR performs the Information Resource Management tasks.
Computer Automated Surveillance System	The Computer Automated Surveillance System (CASS) is a computer system that collects tank farm surveillance data from the tank farms. CASS often refers to the entire surveillance system, which includes the central facility, substation microcomputers, drywell vans, and field sensors.
Computer Protection Program Manager	A Computer Protection Program Manager (CPPM) is the individual responsible for assuring that computer usage is not violating DOE orders, DOE 1360 and DOE 5637.
Configuration Data	Configuration data are data that define the characteristics and state of an entity. Configuration data are not measured values. Examples of configuration data are tank characteristics, baseline values, and criteria limits.
Context Diagram	A context diagram is a drawing that shows the boundaries of a system and the interfaces associated with the system.
Criteria/ criterion	Criteria are the monitoring characteristics against which readings are compared. See Surveillance Criteria.
Data Collection	Data collection is the act of gathering data.
Data Collection System	A data collection system is the hardware, software, and procedures related to gathering, processing, storing, reporting, and archiving a specific type of data.
Data Flow Diagram	A data flow diagram (DFD) is a figure, following a certain style, that displays data movement and processing of a system.
Data Integrity	Data integrity is the assurance that the data reported by the system are the same as those received from the field.
Data Set	A data set is a group of data. This group can be obtained directly from the database or it can be derived from data in the database.
Data Sheet	A data sheet is a form used to collect waste tank storage data.
Data Traceability	Data traceability is the ability to know where and how a datum element was obtained, processed, and stored.
Date_Time	A date and a time treated as a single data element.
Department of Energy	The Department of Energy (DOE) is the United States agency responsible for the oversight of operations at the Hanford Site.

Double-Shell Tank	A double-shell tank is an underground storage tank constructed of reinforced concrete with a primary steel liner, an air space, and a secondary steel liner. These tanks have one million gallon capacity and are used to store high level radioactive wastes.
Drywell	A drywell is a vertical bore hole located outside a waste storage tank or crib. A drywell has a steel casing generally six inches in diameter and is drilled to various depths. It is called a drywell because it does not reach the water table. A drywell is drilled to allow monitoring for detection of leaks and movement of existing radionuclides in the soil.
Engineering Maintenance Services	Engineering Maintenance Services (EMS) is an organization in WHC responsible for maintaining and repairing tank farm equipment. EMS also monitors temperature data when requested by work order.
Entity	An entity is a person, place, thing, or concept that has characteristics of interest to the enterprise.
Entity-Relationship Diagram	An entity-relationship diagram (ERD) is a figure, following a certain style, that displays business entities and their relationships with each other. ERDs are used to explain the business model of a (proposed) computer system.
Environmental Protection Agency	The Environmental Protection Agency is the United States agency responsible for ensuring that the federal regulations on the environment are adhered to.
File	A file is a collection of records in a single place.
File Transfer Protocol	File Transfer Protocol (FTP) is a TCP/IP protocol for transferring files from one computer to another.
Graph	A graph is a plot or graphic display suitable for analyst interpretation. A graph may appear on-screen, on paper, or in a computer file.
Graphical User Interface	A Graphical User Interface (GUI) is a form of communication between users and computers that uses graphics-oriented software, such as windows, menus, and icons, to facilitate the interaction.
Hand-Held Data Acquisition for Tank Farms	Hand-Held Data Acquisition for Tank Farms (HDAT) is a system that improves manual data collection by utilizing hand-held computers and bar code technology.
Hanford Local Area Network	The Hanford Local Area Network (HLAN) is a local area network on the Hanford Site.
Information and Scientific Systems	Information and Scientific Systems (ISS) is an organization of BCSR that provides support and personnel for development and maintenance of information and scientific computer systems.
Liquid Level	The liquid level is the height in inches from the reference bottom of a waste storage tank to the top of the supernatant liquid. Liquid levels are monitored in tanks to calculate waste volumes and to identify intrusions and leakage.

Liquid Observation Well	A thin tube, closed on the bottom, that is inserted into a waste storage tank through a riser. Radiation sampling equipment is inserted in this tube to sample conditions inside the tank.
Local Area Network	A local area network (LAN) connects information processing equipment, such as PCs and printers, in a limited geographical area to allow high-speed communications for information resource sharing.
Operating Specification Document	An Operating Specification Document (OSD) is a document issued by WHC to define criteria related to various activities performed by Tank Farm Operations.
Operational Safety Requirement	Operational Safety Requirements (OSRs) are mandatory criteria related to safety concerns. OSRs define operational, surveillance and design controls to ensure safe operation. They are established in Safety Analysis Reports (SARs).
Probe	A probe is a mobile carrier of one or more sensors. It may refer to the sensor itself, if mobile. Examples of probes are gamma probes and temperature probes used in LOWs.
Quality Affecting Record	A Quality Affecting Record or Quality Assurance Record is "information contained on any media, including, but not limited to, hard copy, sample material, photo copy, and electronic systems that is complete in terms of appropriate content and furnishes evidence of the quality of items and/or activities affecting quality." (Document Control and Records Management Manual, Quality Assurance Records (WHC-CM-3-5, Section 9))
Quality Assurance	Quality Assurance (QA) is the systematic actions necessary to provide adequate confidence that a material, component, system, process, or facility performs satisfactorily, or as planned in service.
Quality Assurance Record	See Quality Affecting Record.
Quality Record File	A Quality Record File is a collection of Quality Affecting Records, which can be in the form of a hard copy or log book.
Receive Data	To receive data is to accept data from an external source without prompting.
Remote Access	Remote access is access via HLAN to a computer system.
Report	A report is a formatted output suitable for analyst interpretation. A report may appear on-screen, on paper, or in a computer file.
Retrieve Data	To retrieve data is the process of prompting other systems for data and accepting data.

Riser	A riser is a pipe emerging through the top of an underground waste tank or from a transfer line. Risers are identified by number on engineering drawings and in <i>Double-shell Underground Waste Storage Tanks - Riser Survey</i> , WHC-SD-RE-TI-093, and in <i>Riser Configuration Document for Single Shell Tanks</i> , WHC-SD-RE-TI-053. Risers may be used for various monitoring and operation purposes, such as temperature measurements or LOW insertion.
Safety Analysis Report	Safety Analysis Reports (SAR) are documents issued by WHC to describe a safety concern and related requirements.
Sensor	A sensor is a instrument that converts physical states or conditions into a signal representative of the state or condition.
Single-Shell Tank	A single-shell tank is an underground waste storage tank of reinforced concrete with a steel liner on the sides and bottom.
String	A series of characters treated as a group.
Structured Query Language	Structured Query Language (SQL) is a standardized language for requesting data from a database.
Surface-Level	Surface-level is the measurement of the top of the waste measured from the bottom of the tank in inches. These measurements are taken to allow calculation of waste volumes and identify intrusions or leaks.
Surveillance	Surveillance is the act of monitoring or observing to verify whether an item or activity conforms to specified requirements.
Surveillance Analysis Computer System	Surveillance Analysis Computer System (SACS) is a computer system providing electronic storage and report generation of tank farm surveillance data. The SACS includes the software, the database, and the documentation.
Surveillance and Data Acquisition	Surveillance and Data Acquisition (SDA) is a WHC organization, which conducts an overview of waste tank integrity surveillance for all single and double-shell tanks. SDA reports early detection anomalies to management and various customers. Previously, SDA was called Tank Farm Surveillance Analysis (TFSA).
Surveillance Criteria	Surveillance criteria are monitoring criteria against which readings are compared.
Suspect Data	Suspect data are data that a SDA technical analyst has reviewed for correctness, but has chosen to suspend final judgment.
Systems Engineering	Systems Engineering is the WHC organization for the operation of the Hanford waste processing plants and tank farms.
Sybase	Sybase is a commercial relational database management software package. It includes software for data entry, database queries, and reports from the database.
Tank Farm	A tank farm is a set of waste storage tanks. A tank farm is identified by a 1 or 2 character name, e.g., A, AX, or AP.

Tank Farm Operations	Tank Farm Operations (TFO) is an organization in WHC that operates and maintains the waste storage tanks and ancillary equipment.
Tank Farm Surveillance Data	Tank farm surveillance data are data gathered to verify integrity and safe operation of waste storage tanks.
Tank Integrity	Tank integrity is a condition associated with a waste storage tank. Tank integrity may be sound or assumed leaker.
Tank Monitor and Control System	Tank Monitor and Control System (TMACS) monitors tank farm instrumentation in 200 area waste tanks, displays current values and trends of these instruments, and provides alarm annunciation for the Tank Farm Operators. The TMACS computers and operator terminals are located in the Computer Automated Surveillance System (CASS) Central Facility.
Tank Temperature	Tank temperature refers to the temperature sensor reading obtained at a specific location associated with a waste storage tank or related equipment.
Tank Temperature Data	Tank temperature data are tank temperature measurements. These readings are obtained manually and electronically from thermocouples and other temperature measurement devices associated with the waste storage tanks.
Temperature Probe	A temperature probe is a structure containing an assembly of temperature sensors. The assembly is composed of one or more temperature sensors and the wiring that carries the signals generated by the sensors. Also called a Thermocouple Tree.
Test Case	A Test Case is a specific test specifying inputs, predicted results, and a set of execution conditions for a test item.
Test Plan	A Test Plan specifies the Test Cases to be used to test a portion of the system. A Test Plan may include other Test Plans.
TFTS Analyst/Engineer	A Tank Farm Technical Support (TFTS) analyst/engineer is an employee assigned to the TFTS organization.
Thermocouple	A thermocouple is an electrical device used to measure temperatures.
Traceability	Traceability is the ability to trace the history, application, or location of an item and like items or activities by means of recorded identification. Also see Data traceability.
Transmission Control Protocol / Internet Protocol	Transmission Control Protocol / Internet Protocol (TCP/IP) is the communication protocol used to connect the Sun workstations to the network.
Trigger	Specific to relational databases: a type of stored procedure that is executed automatically when a user attempts a specified modification statement on a specified table.
Valid Data	Valid data are values within the range possible for a sensor.

Washington State
Department of
Ecology

The Washington State Department of Ecology is the state agency responsible for assuring that Washington State regulations are adhered to by the Hanford Site.

Waste Storage Tank

See Double-Shell Tank and Single-Shell Tank.

Westinghouse
Hanford Company

Westinghouse Hanford Company (WHC) is the current site operations and engineering contractor for the Hanford Site.

1.4 OVERVIEW

Section 2, General Description, contains a general description of the product, its environment, its functions, and its users.

Section 3, Specific Requirements, contains the detailed functional requirements for the system.

Section 4, References, contains a list of documents referenced in this document.

1.5 DATA FLOW DIAGRAM TUTORIAL

The following section is a tutorial on data flow diagrams (DFD). Readers familiar with these diagrams may want to skip this section. These diagrams show the flow of data in a system. The diagrams indicate where data are processed and stored, entities who receive or provide data, and the information flows. Data flow diagrams are composed of 4 major elements:

PROCESS

Processes identify functions or activities performed by the system. The process name and number are shown in the bubble. Process names are composed of an active verb and a noun describing the operations performed by the process. A process may contain human and computer activities.

DATA STORE

Data stores show where information is stored. The data store name is shown between the horizontal lines. The data stores may vary from computer files to file cabinets.

ENTITY

Boxes represent the providers and users of data and reports. The name of the person, organization, or machine is shown in the box. The figures in Section 2.1 contain boxes of this type.

DATA FLOW

The arrow on a data flow shows the direction that information moves through the system. The data flow label shows the type of information moving between processes. On the diagrams in this document the names have been abbreviated to reduce the

complexity of the diagrams. Each data flow may represent more than one kind of data.

A context diagram is a high-level data flow diagram. Everything within the central circle is part of the system that this project may modify. The boxes on the outside represent the providers and users of data and reports. The boxes are elements outside the system that the project may not modify. The arrows show the direction of the information which passes between the circle and the boxes. The labels associated with the arrows are items and data elements familiar to users.

2. GENERAL DESCRIPTION

2.1 PRODUCT PERSPECTIVE

The SACS was initiated to centralize and automate storage of waste storage tank farm surveillance data in the response of a 1988 Department of Energy (DOE) directive. The first release of SACS, in 1989, was a waste tank surface-level database, the SACS Surface-Level System. Later, tank temperatures were included in an Experimental Temperature System in response to ferrocyanide concerns. This experimental system provided a basis for refinement in the temperature system requirements.

2.1.1 CURRENT SAMPLE COLLECTION AND USE

2.1.1.1 TEMPERATURE

The Westinghouse Hanford Company (WHC) Tank Waste Remediation System organizational charters state that Systems Engineering is responsible for tracking temperatures in the single-shell and double-shell waste storage tanks.

Surveillance Engineering, now reporting to Plant Engineering, is responsible for waste storage tank surveillance. Currently the temperature analysis by Tank Farms Technical Support (TFST) is based on the maximum temperature in the high-heat-generating, ferrocyanide-containing, hydrogen-generating, and organic-salt-containing tanks. The high-heat-generating tanks are reviewed to assure that they do not exceed the maximum temperature established in *Single-Shell Tank Isolation Safety Analysis Report, WHC-SD-WM-SAR-006*. The *Operating Specification for Single-Shell Waste Storage Tanks, OSD-T-151-00013*, specifies a more conservative surveillance alert temperature for the high-heat-generating tanks.

Ferrocyanide-containing, hydrogen-generating, and organic-salt-containing tanks are being reviewed for temperature increases from established baselines. These increases are defined in *Waste Storage Tank Status and Leak Detection Criteria, WHC-SD-WM-TI-357*.

2.1.1.2 SURFACE LEVEL AND ILL

Tank Farms Technical Support is also responsible for leak detection in the waste storage tanks. The surface levels of the tanks are reviewed for changes from established baselines. The increase and decrease limits are set by OSD T-151-00013.

2.1.2 FUTURE SAMPLE COLLECTION AND USE

The SACS will become the repository for existing tank farm surveillance data. In the future these data will continue to flow into the SACS database. In addition, new types and sources of tank farm surveillance data will be added to the SACS. There will be new sensors for existing data types and new types of sensors. SACS must be flexible enough to deal with the additions.

2.1.2.1 TEMPERATURE

Work is planned in the tank farms to repair and replace existing temperature sensors and wiring. New temperature sensor probes are scheduled to be installed in some tanks. When field sensors and wiring are repaired, replaced, or added, automatically collected temperature data will be received from the CASS/TMACS.

2.1.2.2 SURFACE LEVEL

A more accurate surface-level sensor, the ENRAF, is being installed in some tanks and connected to TMACS. These data will be reported to SACS.

2.1.2.3 INTERSTITIAL LIQUID LEVEL

The circa 1980 sampling vans are being replaced by newer vans with better depth resolution and sampling rates. SACS will receive the calculated ILL value from CASS in the near future. At some future time SACS will calculate the ILL from the raw scan data.

2.1.3 SCOPE OF SACS SYSTEM

The scope of the SACS is shown in the context diagram of Figure 1; a block diagram depicting the physical interfaces to external systems in Figure 2. Figure 3 is a diagram of the major functional areas within SACS.

Figure 1. SACS Context Diagram

Figure 2. SACS Physical Connection Diagram

2.2 PRODUCT FUNCTIONS

The SACS will perform the following functions:

- Store data received from manual and automatic sources
- Allow the customer to verify and validate the data entered
- Allow the customer to retrieve stored data in different formats
- Store system and tank farm configuration
- Archive data.

Detailed information on functional requirements is provided in Section 3.1.

2.2.1 DATA FLOW DIAGRAM

Data Flow Diagrams (DFD) give an overview of data movement and processing related to a system. A tutorial on DFDs is provided in Section 1.3.

The system diagram in Figure 3 uses the DFD notation but is not a true DFD; this diagram does not show all data transformations, data flows, or temporary data storage. The diagram shows the major system activities and their relationship from the users' perspective. It identifies the type of information moving from one activity to another. A brief description of processes, data flows, data stores, and users shown in the diagram are described in the following subsections.

Figure 3. SACS Level 1 Diagram

2.2.1.1 PROCESS DESCRIPTIONS

The following processes appear in Figure 3. The processes are arranged in order by the process numbers.

2.2.1.1.1 Readings Data Entry

This process accepts reading data from either electronic or manual systems and stores it in the database. Included in this process are the human and machine interfaces that receive data.

2.2.1.1.2 Perform Verification & Validation

This process performs verification and validation on data received by SACS. This process includes the user interface that allows the user to set suspect data status codes on readings; and the automatic processing performed by SACS to assign certain quality indicators..

2.2.1.1.3 Maintain Configuration

This process keeps the internal representation of the tank farms current. This process includes the user interfaces for entering and modifying different limits such as surface level baselines and sample frequencies.

2.2.1.1.4 Retrieve Readings Data

This process gathers parameters from the user and uses those parameters to retrieve data from the database. Retrieved data may be dumped to the customer or may be sent as a formatted report.

2.2.1.1.5 Database Maintenance

This process maintains the database and the user access to the database.

2.2.1.1.6 Archive Data

This process retrieves information from the database and stores it in another, permanent location, in accordance with RIDS or MGRIDS requirements.

2.2.1.2 PROVIDER/USER DESCRIPTIONS

The following users appear in the DFD in Figure 3. They provide and use data coming to and from the SACS.

Computer User is any other computer system that sends information to or receives information from SACS. Examples are: TMACS, CASS, HDAT, and TWINS.

Human User refers to the people who use temperature reports, graphs, and data sets generated by the system. A list of these user organizations is included in the *Statement of User Needs, WHC-SD-WM-CSWD-027*.

2.2.1.3 DATA FLOW DESCRIPTIONS

D.1 Electronic Readings Data

These are data collected and transmitted to SACS by other computer systems.

Examples are:

Surface-level readings	CASS
Calculated ILL values	CASS
Temperature readings	TMACS
Surface-level readings	TMACS

D.2 Electronic Data Retrieval

These are data retrieved directly from SACS by other computer systems. It does not include the PC-SACS interface. Examples are:

Surface-level readings	TMACS
Temperature readings	TWINS

D.3 Manual Readings Data

The reading values are generally written on paper forms and typed into the SACS. Some data gathered electronically is typed into SACS.

D.4 V&V Data

Readings are retrieved for review by the user. The Quality Indicator is updated and the records are returned to the database.

D.5 Physical Configuration Data

The names and connections of the tanks, sensors, farms, etc., are stored in the database.

D.6 Manual Data Retrieval

The customer can retrieve groups of data into their PC. The data include readings, limits, and locations.

D.7 Readings Data

The readings from data flows D.1 and D.3, formatted for storage, are passed to the database.

D.8 V&V Updates

Readings with corrected QIs are stored in the database.

D.9 Configuration Data

Physical configuration and administrative limits to be stored in the database.

D.10 Readings Data

The readings that the customer has requested are brought from the database. Additional information useful in interpreting the readings, such as limits and frequencies, may also be provided.

D.11 Archive Records

Readings and related configuration information sent for the database for storage for a length of time determined by law.

D.12 Database Records

These are the data records stored in the database - readings, configuration, audit trail, etc.

D.13 Archived Data

These are records from the database formatted for storage outside the database.

2.2.1.4 DATA STORE DESCRIPTIONS

The following data stores appear in the DFD in Figure 3.

Archived Data

Archived Records is a file or set of files containing records that have been removed from the system for permanent storage.

SACS Data

SACS Data is the SACS database. It stores all the active readings data and configuration information.

2.2.2 DATA SOURCE AND FREQUENCY DESCRIPTION

Manual data sheets for temperature sensors are completed according to schedules provided in operating procedures. These field data sheets are considered the primary means of reporting temperature data and are the Quality Affecting Records that are retained for permanent record storage. The SACS is considered a secondary means of reporting temperature data.

Data are entered manually every day.

The SACS must be able to support electronic data transfers from TMACS, HDAT, and CASS at a minimum of once per hour, e.g., it will take less than an hour for SACS to process and store the data gathered by these other systems during that hour.

2.3 USER CHARACTERISTICS

The primary user of SACS is the TSTS. TSTS has a high level of knowledge about the data and the system. They are physically located near the SACS development team and are able to receive special SACS training and support. TSTS will have relatively frequent contact with the SACS. TSTS will be responsible for manual data input and most reports generated by SACS.

The secondary user of SACS is the general engineering population of Hanford. These people are used to working with computers and should require little training to use SACS. These people will have limited access to the SACS functions and will use the system mainly to retrieve data.

2.4 GENERAL CONSTRAINTS

2.4.1 REGULATORY POLICIES

The SACS will be developed and operated following WHC procedures for an Impact Level 3Q, Safety Class 3, system.

2.4.2 RESOURCE LIMITATIONS

The SACS system database runs on a Sun Sparc 2 computer. The speed of this computer limits the database performance. According to the current funding plan there are no funds to upgrade or replace this computer.

The SACS will be developed by the Information and Scientific Systems' (ISS) Chemical and Waste Management Software Support group. This organization is part of Boeing Computer Services Richland (BCSR).

2.4.3 COST AND SCHEDULE

The SACS funding varies from year to year with no firm, long-term commitments from WHC management.

2.5 ASSUMPTIONS AND DEPENDENCIES

2.5.1 HARDWARE AND SOFTWARE AVAILABILITY

The existing SACS hardware and software will be available for development use. There will be continued vendor support for the software and hardware used in the SACS. As funds become available, existing equipment will need to be updated to newer versions to assure continued vendor maintenance support.

The general Hanford user uses a PC. The PCs that the SACS users have must support the site-standard MS-WINDOWS software and have sufficient disk space to hold temporary files used for report creation and data transfer. The PCs must connect to HLAN through the TCP/IP protocol.

2.5.2 DEVELOPER TRAINING

Developers will receive on-the-job, on-site, and off-site training.

3. SPECIFIC REQUIREMENTS

3.1 FUNCTIONAL REQUIREMENTS

3.1.1 ENTER READINGS DATA

All readings data entered into SACS have several data elements and requirements in common.

Each reading has the following status attributes used to identify data reliability:

- Readings_Suspect_Data_Status. Section 3.1.2 describes how this value is set.
- Readings_Data_Quality_Status.

Readings_Suspect_Data_Status can have 1 of the following values:

- G - Good. This means that the reading appears to be correct.
- S - Suspect. This means that the reading appears to be incorrect, e.g. it has a value that does not reflect the conditions where it was taken.
- T - Transcribed. Used for records that have not been reviewed by Surveillance. These readings have an unknown quality.

Readings_Data_Quality_Status can have 1 of the following values:

- V - Valid. This reading is within the range of the instrument that took it. This is the default value for the Readings_Data_Quality_Status.
- I - Invalid. This marks readings that are outside the range of the instrument that took the reading.

Each reading will carry an identifier to tell which data collection system gathered the data, i.e. CASS, TMACS, Manual, or HDAT.

All changes to the Reading tables will be recorded for posterity EXCEPT the REVIEWED_EMP_ID column. Any change in the following fields will result in a record being written to the audit trail:

- Reading Collection System
- Sensor Number
- Tank ID
- Date_Time of reading
- Quantity
- Unit of Measure
- Data Quality Status Code
- Suspect Data Status Code

The audit trail for the surface-level and temperature reading tables will perform the following functions:

- Any record added to the table will have the employee identification set to the current employee if an employee ID is not provided in the record.
- Any record added to the table will have the date and time of entry stored in the record.
- Any record modified in the table, except for changes in the REVIEWED_EMP_ID column, will have the employee identification and date-time of modification stored in the record.
- Any record added to the reading tables will not create an entry in the audit trail.
- Any record modified in the reading tables, except for modifications to the REVIEWED_EMP_ID column, will create an entry in the audit trail. The entry will consist of the record as it existed before the modification was made.
- Any record deleted from the reading tables will create 2 entries in the audit trail.
 1. The first entry will consist of the record as it existed before the deletion.
 2. The second entry will consist of the record modified to show the employee identification and date-time of deletion.
- A record that has a change in a key field will be treated as a deletion of the old record and the addition of a new.

The audit trail will have the following information from the old record:

- Reading Collection System
- Sensor Number
- Tank ID
- Date_time of reading
- Unit of Measure
- Data Quality Status Code
- Suspect Data Status Code
- Data Entry Date_time
- Reviewed Employee ID
- Audit Code

3.1.1.1 Manual Data Entry

Several requirements apply to all readings that are entered by hand.

- Any person who enters a data element will be able to read that data element.
- The system will not allow a situation where a person who has entered data cannot see the data.
- All date and time entries will have their formats checked when the date or time entry is complete. The user will be notified if the format is incorrect.
- No future dates will be allowed for data entry. If a future date is detected the customer will be notified and the date/time entry reset.
- When a tank name is required the user will be able to type in a tank name or select a tank from a list. If an invalid tank name is detected the user will be notified and the tank name will be reset to A101.
- When a tank farm name is required the user will be able to type in a tank farm name or select a tank farm from a list. If an invalid farm name is detected the user will be notified and the farm name will be reset to A.
- For all manually-entered data the SACS will be able to identify when and by whom the data were entered into the system.

3.1.1.1.1 Temperature Data

Temperature data are entered manually from a variety of paper sources; some sources are written by hand in the field, others are printed by other computer systems. These papers are the source of temperature data entered into SACS. From each source the following data elements are entered:

- Tank and farm identification of tank where reading was taken.
- Date and time of temperature reading.
- Type of instrument used to collect the reading
- Identifier of the instrument used to collect the reading
- Temperature sensor identification (Sensor number)
- Temperature reading
- Unit of measure for the reading - limited to degrees Fahrenheit or Celsius

To assist in data entry the technician shall have the following features:

- Entry of tank identification, date and time once per farm.
- The default date for the reading shall be the current date.
- The user may override the time and type in a new value.
- The default time of the reading shall be 0:00 (midnight).
- The user may override the default time and type in a new value.
- The instrument used to take the reading will be entered once per TC tree; it will not need to be entered for each reading on the tree.
- Different instruments may be used with different trees.
- Identification of the riser where the tree is located.
- The initial value assigned to each field will be a null. Passing over a field leaves the null value.
- Data on the screen may be modified by the user before committing data to the database.

- Data are not sent to SACS until a separate button is pressed.
- The user may exit the process without saving any data to the database.
- Values for all fields can be typed in from the keyboard.
- The ability to enter comments. See Section 3.1.1.1.4 for the Comment entry requirements.
- The ability to enter new instrument identifiers used to collect the reading within the instrument types already defined.

Features that would be nice to have are:

- A form similar to the Tank Temperature Profile Data Sheet will be displayed and used.
- The ability to select certain values from a list, e.g. Tank Name or Instrument Number.

The customer needs the ability to modify manually-entered temperature readings. The customer will not be allowed to modify records from automatic sources, e.g. TMACS, other than to modify the Readings_Suspect_Data_Status field.

The system will have the following functions to support temperature reading modification:

- Enter a tank and day to create a list of readings to modify.
- Choose the readings to modify from the list generated in the prior step.
- Modify the date and time of the reading.
- Modify the tank where the reading was taken.
- Modify the instrument type and the instrument number.
- Modify the value and units for the reading.
- Add and modify Comments related to the reading.
- Changes will not be stored in SACS until a separate button is pressed.
- The user may exit from the process without storing any changes.

3.1.1.1.2 Surface Level Data

Surface level data are entered manually from a variety of paper sources; some sources are written by hand in the field, others are printed by other computer systems. These papers are the source of Surface level data entered into SACS. From each source the following data elements are entered:

- Tank and farm identification of tank where reading was taken.
- Date and time of Surface level reading.
- Type of surface level device used, i.e. Manual ENRAF, Manual Tape, Manual FIC.
- Surface level reading.
- Unit of measure for the reading - limited to inches or feet.

To assist in data entry the technician shall have the following features:

- The default value for a tank will be 'A101.' The user will be able to override this default.
- The default date for the reading date will be the prior day.
- The user may override the default date and type in a new date.
- The date of a reading may be static or automatically increment by 1 day for each record; the user will have a switch to determine which mode to enter.

- The reading time will default to the current time if the customer has started the form before noon and has set the date to the current day. Otherwise the default time will be 12:00 noon.
- The user may override the default time and type in a new time.
- The new time will remain static until the user changes it.
- The date and time may be different for each record entered during a session.
- The instrument type will be chosen from a list. The list will contain only instrument types valid for the tank being entered.
- The default value for the instrument type will vary by tank; it will be the instrument name first in order alphabetically.
- The user will be able to enter comments.
- The default value for the comments is blank. No comment will be entered unless there is something typed in the comment field.
- The comment field will accept strings at least 200 characters long.
- Readings data will be typed on a single line.
- When a reading is entered it will be displayed on a scrolling grid on the top of the screen. The most recently-entered readings will always be visible.
- After the reading data are transferred to the scrolling grid the input fields will remain unchanged. The cursor will be positioned in the Reading Date input field.
- Changes can be made to data in the scrolling grid before the data are sent to the database.
- The user can save all of the data entered this session by clicking the ACCEPT button. The user will be notified if data already exist in the database for a given tank and date/time; the notification will occur after the attempt to insert the readings in the database.
- The user will be able to cancel out of a session without saving any data to the database.

The user will have the ability to change existing surface level readings which were entered manually. The user will not be able to modify/delete records entered automatically. The following features will be available:

- The user will be able to retrieve readings from the database for modification. The readings that meet a tank + date-range + collection instrument combination will be displayed on a modification form.
- The user may change values in all the fields visible on the input form.
- Changes are not saved to the database until the ACCEPT Command Button is clicked. Only readings that were changed will be updated in the database.
- The user may delete a reading already in the database.
- The user may delete a comment already in the database.
- The user may add a comment to a reading that was entered automatically.
- The user may modify comments for readings that were entered automatically.

3.1.1.1.3 Interstitial Liquid Level Data

No requirements for manual data entry into SACS have been identified at this time.

3.1.1.1.4 Comments

Comments provide information about the tank farms. They are often used to provide additional information about a reading or the reason why a reading was not taken.

- A comment consists of a text field and a reference to one of these objects:
 - a tank
 - an instrument tree
 - a farm
 - a sensor
 - a reading.
- Comments may be entered on each form where readings are entered.
- Comments may be viewed on each form where readings are entered.
- Comments may be modified after they have been entered in the database.
- Comments may be deleted.

3.1.1.2 Automatic Data Entry

The SACS does not need to record when electronically-entered data were added to the system.

3.1.1.2.1 Temperature

3.1.1.2.1.1 TMACS

SACS will be able to accept individual readings from TMACS and store these readings in the SACS database. The TMACS system will send the data elements in the formats specified in Table 3.

Table 3. TMACS Temperature Data Elements and Formats

Data Element	Format	Sample Values
Date File Transmitted	MM-DD-YYYY	12-15-1994
Time File Transmitted	H:M:SS in 24-hour clock	0:0:21
Tag Name of Sensor Point	Variable	BY108-TI-R008-01 C108-TI-U1-RJA
Quantity	Variable. 999.9 or 99.9 or 999.99 or 99.99 or -99.9	109.04 86.0
Unit of Measure	A	F
Status Code	Variable character string	GOOD UNKNOWN
Alarm State	Variable character string	NORMAL LOW
Date and Time of Last modification to reading value	DD Mon YY HH:MM:SS a.m. or DD Mon YY HH:MM:SS p.m.	14 Dec 94 11:50:00 p.m.

The delimiter between data fields is the vertical bar character.

Data from points that have not been configured in SACS will not be stored; failure to store a reading will result in an error being reported to the system administrator.

TMACS may mix data from different instrument types in the same file, e.g. temperature and surface level data may be reported in the same file.

3.1.1.2.1.2 HDAT

The input format for HDAT data will match TMACS.

3.1.1.2.2 Surface Level Data

3.1.1.2.2.1 Data from CASS

- SACS will store surface level information sent by CASS. The information will be sent as files in ASCII characters.
- All surface level readings that CASS collects automatically will be sent to SACS daily. The data in the CASS file may contain readings for more than one day. Therefore it may be possible to enter data for more than one day from a single CASS file.
- All surface level readings that are entered manually into CASS will be sent to SACS when they are entered.
- SACS will process the CASS files as they are received. When SACS receives automatically-collected surface level readings from CASS, SACS will run the Frequency Violation Report
- CASS will append the CASS internal status flags to the readings; the status flags are a series of bits that indicate possible problems with the readings. The status flags important to SACS are bits 1, 2, 5, 6, 7, and 8 - if any of these flags are set (= 1) then the reading has a "bad quality indicator." Otherwise the reading has a "good quality indicator."
- SACS will store one surface level reading per day per tank from CASS readings according to the following procedure:

If a surface level reading already exists for that tank for that day

then no reading will be stored

else if readings for a tank with a good quality indicator and a non-zero value for that day exist

then the reading in the file with a good quality indicator and a non-zero value for that tank taken on that day closest to 0700 will be stored

else if readings with a bad quality indicator and a non-zero value for that day exist

then the reading with a bad quality indicator and a non-zero value for that tank taken on that day closest to 0700 will be stored

else if readings with a zero value exist

then the reading with a zero value taken on that day closest to 0700 will be stored

else no reading will be stored.

- For automatically collected readings CASS will send the data elements in the formats specified in Table 4. The data are in columns separated by a variable number of spaces. CASS may write several header lines in the file; SACS will ignore these header lines.

Table 4. CASS Automatic Surface Level Data Elements and Formats

Data Element	Format	Sample Values
Tank Name	999-A	106-A
	999-AA	101-AN
	A-999-A	S-302-A
	AA-999-A	TX-302-C
Type of Collecting Instrument	Character String	AUTOMATIC INTRUSION
Date of Reading	MM-DD-YY	12-14-94
Time of Reading	9999 or 999 in 24-hour clock	2203
		2304
		003
		104
Surface Level	999.99	140.00
		50.30
		0.00
CASS Internal Status Codes	If present, 9999999999999999	0001000000000001
	May not be present	0000000000000001

- For manually-entered readings CASS will send the data elements in the formats specified in Table 5. The data are in columns separated by a variable number of spaces. CASS may write several header lines in the file; SACS will ignore these header lines.

Table 5. CASS Manual Surface Level Data Elements and Formats

Data Element	Format	Sample Values
Tank Name	999-A	102-T
	999-AA	101-SY
	A-999-A	S-302-A
	AA-999-A	TX-302-C
Type of Collecting Instrument	Character String	MAN ENRAF MAN FIC MAN TAPE
Date of Reading	MM-DD-YY	12-14-94
Time of Reading	9999 or 999 in 24-hour clock	2203
		2304
		326
Surface Level	999.99	399.15
		50.71

3.1.1.2.2.2 Data from TMACS

SACS will be able to accept individual readings from TMACS and store these readings in the SACS database. The TMACS system will send the data elements in the formats specified in Table 6.

Table 6. TMACS Surface Level Data Elements and Formats

Data Element	Format	Sample Values
Date Reading written to file	MM-DD-YYYY	12-15-1994
Time Reading written to file	H:M:SS in 24-hour clock	0:0:26
Tag Name of Sensor Point	Variable	BX-106-LI-R008-01 C103-LI-R008-01
Quantity	Variable. 999.9 or 99.9 or 999.99 or 99.99 or -99.9	12.24 0.0
Unit of Measure	Variable character string	INCHES
Status Code	Variable character string	GOOD UNKNOWN
Alarm State	Variable character string	NORMAL LOW
Date and Time of Last modification to reading value	DD Mon YY HH:MM:SS a.m. or DD Mon YY HH:MM:SS p.m.	14 Dec 94 11:50:00 p.m.

The delimiter between data fields is the vertical bar character.

Data from points that have not been configured in SACS will not be stored; failure to store a reading will result in an error being reported to the system administrator.

TMACS may mix data from different instrument types in the same file, e.g. temperature and surface level data may be reported in the same file.

3.1.1.2.3 Interstitial Liquid Level

ILL values are calculated on the Computer Automated Surveillance System (CASS) and transmitted to the SACS system. The SACS system will store ILL data and make it available to the surveillance engineers.

The SACS system will:

- Store interpreted ILL values as received from CASS.
- Overwrite any existing records with updated records from CASS.
- Make the ILL values available on the retrieval form.

The SACS system will not:

- Calculate any ILL values.
- Keep any sort of an audit trail of changes to the ILL values.
- Allow the user to delete ILL values from SACS using the PC-SACS MDI form

3.1.2 PERFORM VALIDATION AND VERIFICATION

Readings Suspect Data Status Code may have the values GOOD, SUSPECT, or TRANSCRIBED.

- A GOOD reading has a value that represents the conditions at the time and location where the reading was taken.
- A SUSPECT reading has a value that does not, in the opinion of the analyst, represent the conditions at the time and location where the reading was taken.
- A TRANSCRIBED reading has been entered into SACS without having been through the V&V process.

The default Readings Suspect Data Status Code for all readings entered into SACS is TRANSCRIBED with the exception noted below. SACS will automatically mark certain readings as SUSPECT when they are entered into the database:

- Surface level readings with a value < 1
- Temperature readings with a value < 1

The Data Quality Status Code may have the values VALID or INVALID. A VALID reading is one with a value that could have been taken with that instrument, e.g. it is physically possible to obtain such a reading. An INVALID reading is one with a value outside these limits. For example, a thermocouple reading of 400° F is VALID - the TC could have taken such a reading; a value of -5575° F is INVALID - such a temperature can't be measured with a TC.

The default value for Data Quality Status Code is VALID; this is set automatically by SACS. There are no requirements to allow changes to this value through the PC-SACS user interface.

3.1.2.1 Automatic V&V

Other than the exception listed above, no requirements have been identified.

3.1.2.2 Manual V&V

The customer will be able to set a reading's Suspect Data Status Code to GOOD or SUSPECT regardless of the value of the reading. The customer will not be able to set the Suspect Data Status Code to TRANSCRIBED.

Manual V&V will be performed through the PC-SACS user interface. The user will be able to change only the Suspect Data Status Code; the user identifier, the Suspect Data Status Code, and date and time of the change will be stored in the readings modified by the user.

The PC-SACS V&V options will have the following functions:

- The user will be able to choose a tank and a date range to analyze.
- The user will select from all available data types for the given tank and date range.
- Only one data type can be selected at a time.
- The user may select 1 or more sensor points for that data type to retrieve. The V&V form will retrieve all readings for the selected sensor points available for the given tank, date range, and data type.
- The readings will be displayed in a graph with the Y-axis labeled to show reading values. The X-axis will be labeled to show dates. Not every date for a reading needs to be shown.
- The graph will display the tank name and the date range used to select readings.
- The user will be able to see the following information for each reading on the chart by using a detailed display (separate from the chart). The columns shown will differ for the different data types displayed as shown in the Table 7.

Table 7. Manual V&V Data Elements Displayed by Sensor Type

Type of Reading		
Surface Level	Temperature	ILL
Collection Type	Riser	LOW Well Number
Date	TC Number	Sequence Number
Value	Date	Value
QI	Value	QI
Reviewed By	QI	Reviewed By
	Reviewed By	

- Data will be sent to the detailed display according to the filters set by the customer. Those filters may be selected individually or in combination. They are:
 - TRANSCRIBED
 - SUSPECT
 - GOOD
- The user will have the option of adding maximum and minimum limit lines to the graph. When the limits have been set the user may set the following filters:
 - Within Limits
 - Above Limits
 - Below Limits
 - Outside Limits.
 When there are no limits set then the user will have only the filter
 - No limits.
- The user will be able to retrieve the baseline value + relative upper limit and the baseline value - the relative lower limit into the graph.
- The user will not be able to retrieve the baseline value for temperature sensors.
- The default value for the filters will be: TRANSCRIBED, NO LIMITS.
- Multiple points may be sent to the detailed display by dragging the pointer on the graph from the desired starting point to the desired ending point. When the mouse button is released, the selected data will be displayed in a grid.
- Only data points that pass the selected filters will be displayed in the grid, e.g. only transcribed data that is outside of the limits.
- The user will have an option to send all readings on the graph to the detailed display that pass the selected filters.
- The user will have the ability to manually set the upper and lower limits for the Y-axis of the graph.
- The user will have the ability to manually set the beginning and ending date ranges for the X-axis of the graph.
- The QI can be changed for one reading or all readings in the grid.
- The modified readings may be written to the database immediately or stored for modification by a batch job at the user's discretion.
- The user may leave the form without storing any changes.
- No changes will take place in the database without confirmation.

3.1.2.3 Batch Update Process

Readings that were marked for modification by the process in section 3.1.2.2 will be physically modified by a batch job each evening. This will result in less burden on the database processor during the day.

The batch process will select all readings that meet the parameters stored by the manual V&V process:

Reading Collection = stored Reading Collection
 Sensor Number = stored Sensor Number
 Date_Time of Reading >= Start Date_Time
 Date_Time of Reading <= End Date_Time
 Suspect Data Status Code = Transcribed
 Data entry date < Reviewed Date_Time

For any records that meet the criteria above the batch update process will:

- Set the Suspect Data Status Code to "Good"
- Set the Reviewed Employee Id = Employee ID of the person using the V&V form
- Set the Date_Time of modification to the time that the records were marked on the V&V form.

If there are any errors during processing they will be reported to the system administrator.

3.1.3 MAINTAIN CONFIGURATION

Configuration refers to maintaining the descriptions and relationships of things that are important to the user and customer. These things may be physical objects, like tanks, risers, and sensors, or administrative values, like tank sample frequencies or alarm limits.

3.1.3.1 Physical Configuration

The SACS shall be capable of storing the information that allows the customer to specify where sensors are located within or around tanks. The locations and sensor information will be provided by the user and entered by the developer during this phase of the system. There is no requirement at this time that the users be able to maintain these data through the PC-SACS interface.

Table 8 lists the different tank farm objects and the minimum attributes that must be stored for each. Additional objects and attributes are described in the entity-relationships in *WHC-SD-WM-CSWD-037*.

Table 9 lists the relationships between the tank farm objects that must be maintained by SACS. Additional relationships are described in *WHC-SD-WM-CSWD-037*.

Table 8. Tank Farm Objects and Data Elements

Tank Farm Physical Object	Information to Store	Description of Information
Farm	Farm name	Name of the farm, i.e. A, AX, U.

Reading Collection System	Abbreviated Name of the system Name of System	An abbreviated name, e.g. TMACS. The name of the system, e.g. Tank Monitor and Control System.
Reading device	Reading device type	For thermocouple readers, which sorts of thermocouples can it read?
Riser	Riser common name	The common name of the riser, e.g. Riser 1, Riser 4A.
Sample Space	Sample space name	The name or description of the space being sampled. Usually takes the name of the tank that contains the sensor or the riser used to insert the sensor.
Sensor	Type of sensor	The type of sensor, i.e. Manual ENRAF, Automatic FIC, J - Temperature.
Tank	Tank name	The common name of the tank, i.e. A101, BY106, U101.
Tree	Number of sensors on tree	The number of sample points on the thermocouple tree.

Table 9. Relationships between Tank Farm Objects

Object 1	Relationship	Object 2
Riser	located in	Tank
Sensor	read by	Reading Collection System
Sensor	located on	Tree
Tank	is in	Farm
Tank	contains	Sample Space
Tree	located in	Riser
Tree	located in	Sample Space

3.1.3.2 Baselines

SACS will support baselines for each sensor point and for each type of sensor. The customer will be able to set and change these baselines through the PC-SACS MDI form. The SACS will support:

- Each sensor may have its own baseline value.
- A baseline consists of a start date, a slope, a baseline value, 1 relative upper limit and 1 relative lower limit. No absolute limits are required.
- Once established a baseline will continue in force until replaced by another baseline.
- There is only one baseline in effect for a sensor at one time and it has the end date open.
- Baselines are only changed sequentially in time and when a new baseline is installed, the end date of the previous baseline is filled out automatically with the date and time of the replacement.

- The baseline changes shall immediately take effect.

3.1.3.3 Sample Frequency

SACS will support sample frequency checking. This is the process of checking a sample point to see if the time elapsed since the last sample was taken is greater than some limit. The customer will be able to define and maintain the sample frequencies and to assign them to types of sensors in riser in a tank.

A frequency consists of:

- Frequency Name
- Limit and unit of measure for limit
- Warning Limit and unit of measure for Warning Limit
- Extended Limit and unit of measure for Extended Limit

The warning limit is usually a time before the real limit. The extended limit is usually a time after the limit.

The units of measure available for the limits will be:

- Day
- Hour
- Minute
- Second.

A riser - tank - sample-type can have only 1 sample frequency at a time.

The sample frequency changes shall immediately take effect.

3.1.3.4 Tank Group

A number of different reports are made for tanks that are members of a group. Example groups are:

- Ferrocyanide (FeCN)
- High Heat
- Watch List

The reports that use these groups are specified in sections 3.1.4.3.5 to 3.1.4.3.6.

- A tank may be a member of no, one, or several tank groups; a group may contain 0 or more tanks.
- Users shall have the ability to create and delete tank groups through the PC-SACS interface. At first this option will be restricted to members of the "total" group.
- A tank group must have a description before it can be created. The description field provided by SACS must allow long textual descriptions, e.g. more than 280 characters.
- A tank group may not be deleted if it still has tanks associated with it. The user will be warned that all tanks must be removed from a group before the group can be deleted.

- Users shall be able to add and remove tanks from any existing tank group using the PC-SACS interface. When a tank is added to or removed from a group the information in Table 10 will be stored.

Table 10. Tank in Tank Group - Data Elements Stored

Data Element	When Set	Default
Tank Name	When added to group	None
Date Tank added to group	When added to group	Today's date
Date Tank removed from group	When removed from group	Today's date

- The default date may be overridden and set by the user; this date will be used for all further activity during that session on PC-SACS until re-set by user.
- The tank group changes shall immediately take effect.

3.1.4 RETRIEVE READINGS DATA

Readings and related data can be retrieved from SACS in several ways as described in the following sections.

Quality Assurance, WHC-CM-4-2, Section QR 19.0, Paragraph 4.2.5, states:

"Software application outputs shall be traceable to the software and hardware configuration status used to produce those outputs. Output documents, including designs, reports, spreadsheets, charts, etc., shall be traceable to the software and its revision identification, the hardware configuration, date, user identification, and input data source, as a minimum."

To satisfy this requirement identification, date, and time of creation shall be included with reports and data retrieved from SACS. The software configuration and hardware configuration is controlled by the *SACS Software Configuration Management Plan, WHC-SD-WM-CSCM-012*.

3.1.4.1 Readings Retrieval Form

The Readings Retrieval Form is used to extract readings information from SACS. The information retrieval function has the following limitations and requirements:

- Readings are retrieved from a single tank at a time.
- Only readings on and between the start date and end date will be retrieved.
- The date range may span at least 8 years.
- The customer may select 1 or more different data types to retrieve data for. All data types selected will be retrieved at the same time.
- Only readings with Suspect_Data_Status_Codes that match selected codes will be retrieved. 1 to all of the Suspect_Data_Status_Codes may be selected at the same time.
- The default is to select readings with any Suspect_Data_Status_Code.
- Output may be sent to an Excel spreadsheet or an ASCII file.
- The user shall have an option to retrieve the average of readings by data type for the time period.

- #### 3.1.4.1.1 Text File Format

Tank: C106	Tank Chosen
Starting Date: 10/1/1994	Starting Date
Ending Date: 11/18/1994	Ending Date
Retrieval Date: 11/18/1994	Date data were retrieved
Quality Indicators:	Quality indicator filters
GOOD	Good data were selected
SUSPECT	Suspect data were selected
TRANSCRIBED	Transcribed data were selected

SACS will be able to produce a file of surface-level readings by date. The data for each type of sensor will be identified by a character string and a string of " | " characters. The abbreviations are:

Each reading will contain the date and time of the reading, the value, and the QI. All data retrieved will be displayed in inches. Examples are shown in Example 1.

[illegible]

DATE	SURFACE LEVEL (in)	QI
10/02/1994 00:00	-999.	S
10/08/1994 00:00	76.53	G

DATE	SURFACE LEVEL (in)	QI
10/01/1994 06:06	77.1	G
10/02/1994 06:04	77.2	G

DATE	SURFACE LEVEL (in)	QI
10/01/1994 12:00	77.35	G
10/02/1994 12:00	77.25	G

DATE	SURFACE LEVEL (in)	QI
10/29/1994 12:00	75.9	G

3.1.4.1.1.2 Temperature Readings

SACS will be able to produce a listing of temperature data by date and tank or by date and thermocouple. The data for each type of sensor will be identified by a character string and a string of " | " characters. The abbreviations are:

ETPTR	E-type Thermocouples
JTPTR	J-type Thermocouples

All data retrieved will be displayed in degrees Fahrenheit.

When individual thermocouples are selected for display each reading will contain the date and time of the reading, the value, the QI, and the thermocouple position number on the tree. Examples are shown in Example 2.

Example 2. Temperature Data Retrieved by Individual Thermocouple

DATE	TEMPERATURE Deg F	QI	TC #
10/01/1994 00:00	164.66	G	1
10/02/1994 00:00	164.66	G	1
10/03/1994 00:00	164.3	G	1

DATE	TEMPERATURE Deg F	QI	TC #
10/01/1994 00:00	146.3	G	2
10/02/1994 00:00	146.48	G	2
10/03/1994 00:00	145.22	G	2

Retrieval Date	E2
Starting Date	E3
Ending Date	E4
Good	E5
Suspect	E6
Transcribed	E7

When more than one type of data is chosen the temperature readings will be placed in the left-hand columns of the Excel spreadsheet.

The exact placement of the data for the first data type is:

Data Element	Starting Cell
Date Label	B9
Value Label	C9
Quality Indicator Label	D9
Dates Column	B11
Values Column	C11
Quality Indicators Column	D11

The exact placement of the data for the second data type is:

Data Element	Starting Cell
Date Label	E9
Value Label	F9
Quality Indicator Label	G9
Dates Column	E11
Values Column	F11
Quality Indicators Column	G11

The pattern is repeated for additional data types.

Baseline data are placed in the following locations:

Data Element	Starting Cell
Baseline Value	H2
Baseline Date	H3
Baseline Slope	H4
Increase Tolerance	H5
Decrease Tolerance	H6

3.1.4.2 Report Selection Forms

This section describes the forms used to ask for reports. Some of the processing for these reports is done as a batch job - this scheduling is described here. The actual algorithms used to select or calculate columns in the reports are described in section 3.1.4.3.

3.1.4.2.1 Frequency Violation Report Request Form

The Frequency Violation calculations will run automatically after receipt of CASS automatic surface level readings. (This is scheduled to happen once each day, in the morning.) The results of the calculations will be saved in the database and will overwrite any previous results. The process, whether triggered by the user or automatically, will update records for all data types.

The user may retrieve the frequency violation records stored in the database or may choose to run a new report. The time of the last run of the batch report will be shown on this form. The user will be able to run the report on demand after a warning that the report will take 5+ minutes to run.

During the time that the report is being generated the user will not be able to start another Frequency Violation report. The user will be warned that the report is in progress. The user screen will not be locked during the process. In other words, the user will be able to continue to work on PC-SACS while this report is being automatically generated.

The user can select 1 or more data types to report on.

The user can select the type of violation to report:

- Warning Limit violations
- Limit violations
- Extended Limit violations.

The output of the report will appear on a display screen within PC-SACS. The report may be printed from this display screen. The format is described in section 3.1.4.3.1.

3.1.4.2.2 Surveillance Alert Report Request Form

The Surveillance Alert calculations will run automatically starting at 0800 each day. The results of the calculations will be saved in the database and will overwrite any previous results. The process, whether triggered by the user or automatically, will update records for all data types.

The user may select surveillance alert records stored in the database or may choose to generate a new report. The time of the last run of the batch report will be shown on this form. The customer will be able to run the report on demand after a warning that the report will take 5+ minutes to run.

The customer will have the following filters to use when selecting tanks and sensor types to report on:

- All tanks or a single tank.
- A date range.
- 1 or several types of data.
- The type of limit to report on. Any or all may be checked:
 - Good Values
 - Increase
 - Decrease
 - Increase Exceeded

- Decrease Exceeded

The output of the report will be displayed on the screen. The report may be printed from the display screen.

3.1.4.2.3 Temperature Profile Report Request Form

This form is used to create a temperature or comment report on temperature readings.

The customer will have the following filters to use when selecting a report:

- A single tank name
- Date range
- Type of report (either or both may be selected)
 - Temperature report
 - Comment report

The Temperature report may include none, 1, or both options:

- Mark Suspect readings
- Display liquid level

The report will be printed from the PC. There are no requirements to display the report on the PC.

3.1.4.2.4 Surface Level Report Request Form

This form will be used to request a surface-level report for a single tank for a date range. The information that the user must enter is:

- Tank Name
- Start Date for Readings
- End Date for Readings
- The QI for the data to be reported - Good, Suspect, Transcribed, any or all.
- The output location - Screen, Printer, or File.

The user must be able to exit the form without creating a report.

3.1.4.2.5 Maximum Temperature Reports Request Form

This form will be used to request a report for a Tank Group for a date range. The information that the user must enter is:

- The Tank Group
- Start Date for Readings
- End Date for Readings
- Report Summation Period - one of the following
 - Weekly
 - Monthly
 - Quarterly
 - Annually
- Reporting Units - one or both of the following

- Fahrenheit
- Celsius
- Location of Temperature Sensors - one of the following
 - Waste
 - Vapor Space
- The output location - one of the following:
 - Screen
 - Printer
 - Disk File

The user must be able to exit the form without creating a report.

The tank group chosen must be a tank group defined within the database. See Section 3.1.3.4 for details.

3.1.4.3 Printed Formats

3.1.4.3.1 Frequency Violation Report

The Frequency Violation report will be used to determine which sample data have not been entered into SACS according to a schedule established by the user.

- A sampling frequency may be assigned to a fixed sample space - type of sensor combination (e.g. Tank SY101, Riser 17C, thermocouples shall be sampled weekly).
- Not every fixed sample space - type of sensor must have a sample frequency.
- The user will define and apply these frequencies as defined in Section 3.1.3.3.
- For the purposes of frequency checking any reading with a zero value will not be counted as a reading for satisfying the sampling criteria. Readings that are otherwise suspect will count as a valid reading.
- The warning limit Date_Time is calculated by adding the warning limit value to the date of the last valid reading.
- The extended limit Date_Time is calculated by adding the extended limit value to the date of the last valid reading.
- The limit Date_Time is calculated by adding the limit value to the date of the last valid reading.
- Comparisons between the expected sample time and the limits are made and records are selected for the report as shown in Table 11.

Table 11. Sample Frequency Report Columns

Column Header	Definition	Typical Values
Tank	The Tank where the reading should be taken.	A101 BX104
Riser	The number of the riser where the reading should be taken.	SY101 Riser 4A
Type of Sensor	The type of sensor.	Temperature Surface Level

Sampling Frequency	The frequency name as defined by the customer.	Weekly Semi-Annual
Date Last Read	The reading date and time from the temperature, surface level, or ILL tables. This is for the last valid (non-zero) reading.	Dec 4 1977 1:00 AM
Quality of Last Reading	The Suspect_Data_Status_Code for the reading,	G S T
Date for Next Reading	The date that the next reading is due. This is calculated by adding the LIMIT value from FREQUENCY_DEFN to the last valid reading from the reading table.	Dec 11 1977 1:00 AM
Warning Limit Violated	This is a flag set on when the date that the report was run is greater than the warning date.	X (blank)
Limit Violated	This is a flag set on when the date that the report was run is greater than the limit date.	X (blank)
Extended Limit Violated	This is a flag set on when the date that the report was run is greater than the extended date.	X (blank)

3.1.4.3.2 Surveillance Limit Report

The Surveillance Alert Report will contain the following information:

- Date and time report was run
- Date and time reading was taken
- Tank and farm identification
- Tank sample space name
- Sensor identification (probe number, sensor number)
- Value of reading or calculation
- Value of Baseline as of the date the reading was taken
- QI of the reading
- Value of the upper and lower limits for the baseline
- The discrepancy category for the reading. The categories are:
 - Good
 - Increase
 - Decrease
 - Increase exceeded
 - Decrease exceeded
- The actual per cent of the distance between the baseline and the nearest limit.

The following additional requirements apply to the report:

- All surface level values will be reported in inches.
- All ILL values will be reported in inches.
- All temperature values will be reported in degrees Fahrenheit.
- The report output will be grouped by type of reading device (i.e. ILL, surface level, temperature), Tank, Instrument name, and date.
- When comparing readings with baselines, baselines will be adjusted to the current baselines.

3.1.4.3.3 Temperature Profile Report

This report is created from the Temperature Report Request form. Every temperature report will have the following:

- Tank and farm identification.
- Date range for the report.
- Notification that all temperatures are in degrees Fahrenheit.
- The distance from the bottom of the tank for each sample point.
- The number for each sample point (1,2,3,...).
- Date of reading.
- Tank sample space name (riser number).
- Type of thermocouple (E, J, etc.).
- Reading collection system that took the reading (TMACS, MANUAL).
- Readings for that sample space for that day arranged on the same line. Readings for different days for the same sample point will form a column on the page.
- Points that were not sampled will have blanks on the line.
- A line between readings from different days.

When there is only one sample space in the tank:

- The distance from the bottom of the tank will be printed.

When there is more than one sample space in the tank:

- The date will be shown for only the first sample space in the day.

When requested:

- Surface level for the tank on the day the report was requested will be printed on each page.
- Readings that are SUSPECT will be marked.

3.1.4.3.4 Temperature Comment Report

This report is created from the Temperature Report Request form. The comment report will have the following fields:

- Tank and farm identification.
- Date range for the report.
- Date of comment
- Tank and sample space for the comment
- Comment text

3.1.4.3.5 Surface Level Reports

This report is created from the Surface Level Report Request Form. The report will have the fields specified in Table 12 and Table 13.

Table 12. Surface Level Report Header/Footer Fields

Header Fields		
Field Header	Definition	Typical Values

Surface Level Report	Literal Field	
Tank Name:	Tank Name	A101
Retrieval Date:	Date that report was generated.	01/01/1995
Starting Date:	First date to look for data.	01/01/1994
Ending Date:	Last date to look for data.	12/31/1994
Type of Data:	The types of data retrieved. There may be more than one value printed.	Good Suspect Transcribed

Footer Fields		
Field Header	Definition	Typical Values
Surveillance Analysis Computer System - Reporting Page	Literal Field Page number	 1, 3

Table 13. Surface Level Report Fields

Column Header	Definition	Typical Values
DATE	Date that reading was taken.	01/01/94
READING	Value of the reading in inches.	344.0
QI	Quality Indicator	S, T, G
INSTRUMENT TYPE	Type of instrument used to obtain the surface-level reading.	Manual Tape

3.1.4.3.6 Maximum Temperature Reports

The Maximum Temperature Report will contain the following fields:

- Tank Id
- Sample Space Name
- Thermocouple Location Number
- Reading Value in degrees Fahrenheit
- Reading Value in degrees Celsius
- Date of reading
- Source of reading
- Surface Level Found indicator.

The heading will contain the following fields:

- In-Out of Waste label
- Tank Group being reported
- Date range of temperature data selected
- Date report was created.

The readings shown will be chosen using the following algorithm:

For the chosen tank group

For each tank

For each temperature reading device in the tank

For each reading taken within the date range given

Decide whether the reading was taken in the waste or not

For the type of readings chosen (in-out of waste)

For the summary period selected

Print the reading with the highest value.

- If the maximum value occurs on multiple days report the latest day with that value.
- A reading is in the waste if there is a valid surface level taken before the temperature reading and that surface level is less than the height of the temperature sensor from the bottom of the tank.
- A reading is out of the waste if there is a valid surface level taken before the temperature reading and that surface level is greater than the height of the temperature sensor from the bottom of the tank.
- If a valid surface level cannot be found for a reading then the reading is considered to be both in and out of the waste and will be shown on both reports. The row will be marked with *.

3.1.4.4 Reports to Other Computer Systems

3.1.4.4.1 TWINS

TWINS will be able to log in to the SACS database and get temperature and surface-level values directly from the database.

3.1.4.4.2 TMACS

TMACS will be able to log in to the SACS database and get the latest surface-level value for a tank directly from the database.

3.1.4.4.3 HDAT

No requirements to report to HDAT have been identified at this time.

3.1.5 MAINTAIN DATABASE

3.1.5.1 Database Access

The database administrator will have the ability to:

- Add users to the SACS
- Delete users from the SACS
- Modify user access permissions within SACS
- Check the history of persons who logged on, logged off, and who unsuccessfully tried to log on to the database
- Check the database for data integrity
- Provide a list of authorized users.

The UNIX system administrator will have the ability to:

- Check the system for unauthorized programs and viruses
- Check the history of persons who logged on, logged off, and who unsuccessfully tried to log on to the system
- Monitor the network activity
- Make network configuration changes.

Access to the system will be limited to authorized users. To prevent unauthorized access to this system and its data the system will:

- Require each user to enter a user name and a password. Failure to enter a valid user name and password will prevent the person from gaining access to the system.
- Allow a different, unique password for each different user name.
- Passwords will be case-sensitive.
- Passwords will support all keyboard characters (other than control keys).
- Not display or echo the password characters when the user is logging in. The display will be suppressed or replaced with meaningless characters.

Users will be able to change their database access passwords as often as they like through their standard interface. The interface will enforce the following rules:

- Passwords must be greater than six characters in length.
- Passwords must contain both upper and lower case letters.
- Passwords must contain both letters and numeric characters.
- The user will be prompted to re-enter the new password before the old password is changed.

A user will be a member of a group within SACS. Each group will have its own permissions to use and see certain data and to perform limited functions. Each member of a group will have the same permissions as other members of the group.

3.1.6 ARCHIVE DATA

Must support the MGRIDS for the SACS system.

Data archives sent to the Records Holding Area will meet their requirements for media and format.

3.2 PERFORMANCE REQUIREMENTS

3.2.1 AVAILABILITY

The SACS will be on-line and available from 7:00 AM to 5:00 PM on weekdays (minimum). TFS analysts must be able to review data as soon as possible after receipt and entry. Readings that exceed surveillance criteria can generate occurrence reporting per *Occurrence*

Reporting and Processing of Operations Information (WHC-CM-1-3, MP 5.14), and Tank Farms Occurrence Reporting and Processing of Operations Information (WHC-CM-5-7, Section 1.22). The current maximum time that SACS can be down varies and may be as long as 72 hours.

3.3 DESIGN CONSTRAINTS

3.3.1 NUMBER OF USERS SUPPORTED

The SACS will allow at least:

- 64 PC-SACS connections
- 20 SACS users to connect and work concurrently
- 100 different login identifiers, e.g. 100 users each with their own unique identifier
- 20 different user groups with different data access privileges

3.3.2 DATA STORAGE CAPACITY

Data stored in SACS are divided into two categories depending on sample frequency.

- Surveillance Data come from points that are sampled with a frequency of once a day or less, i.e., weekly, monthly, or quarterly.
- High Frequency Data come from points that are sampled more than once a day.

Requirements for storage and retrieval of high-frequency data have not been identified.

Storage requirements for surveillance data are:

- Provide on-line storage for at least 5 years of surveillance temperature data. The temperature data for calendar year 1994 shall be the volume of data used for one year's data.
- Provide on-line storage for at least 3 years of surveillance surface-level data. The surface level data for calendar year 1994 shall be the volume of data used for one year's data.
- All surface-level data stored electronically for the last 10 years must be available for use in reports within 24 hours.

3.3.3 STANDARDS COMPLIANCE

3.3.3.1 DATABASE ELEMENT NAMING STANDARDS

The SACS will follow the Hanford Site Protocol Standard for Data Naming Convention.

3.3.3.2 DATABASE MANAGEMENT

The SACS will use a Database Management System (DBMS) that has a structured query language (SQL) or a SQL interface.

The DBMS must provide full null value support where a null value is not equal to either a blank or a zero. This allows the user to differentiate between blanks and undefined data.

3.3.3.3 USER INTERFACE

The SACS will use a recognized GUI for the user interface. For example, if the user interface is written using Microsoft Windows the Windows Style Guide will be used as the standard for the user interface.

3.3.4 HARDWARE LIMITATIONS

The user interface shall use the site-standard personal computers.

3.3.5 SOFTWARE LIMITATIONS

As implemented, SACS software development will be carried out on 2 different operating systems. For the UNIX system the following SACS software is available for use during development:

- Sybase database
- SQL Debug
- SQL Monitor
- UNIX operating system
- C programming language.

For the PC the following software is available for use during development:

- MS-Windows
- DBLIBS for Windows
- Appropriate NETLIBS for the network
- SQL Server
- SQL Server Programmer's Toolkit
- Sybase Open Client Software
- ODBC Administrator Utilities
- Visual Basic Pro
- VB Spy
- Crystal Reports Pro
- Chart Builder
- Microsoft Excel

In addition to the availability of use, SACS is limited by the software license agreements.

3.4 ATTRIBUTES

3.4.1 MAINTAINABILITY

The SACS will be installed on commercially-available hardware installed in office environments. No special maintenance requirements have been identified.

3.5 OTHER REQUIREMENTS

3.5.1 DATA

Detailed information on the SACS attributes is provided in the *SACS ERD Document, WHC-SD-WM-CSWD-037*.

3.5.2 OPERATIONS

System boot, backup and recovery will normally be done by the SACS system administrator.

3.5.3 SITE ADAPTATION

No special site adaptation requirements have been identified for the SACS.

3.5.4 SCHEDULING

Most processes in SACS are event-driven - in other words, SACS responds to messages sent by other systems or users. SACS does have some processes that run periodically and this timing is described in this section. The actual operation of the processes is described in Section 3.1.

3.5.4.1 DAILY

Certain processes will be run automatically by SACS. Table 14 lists the process, the result, and the conditions for starting the process.

Table 14. Automatically Scheduled Processes

Process	End result	Conditions for Running
Surveillance Limit	Output stored in database	Time is 0820.
Frequency Violation	Output stored in database	Automatic Surface Level data received from CASS.
V&V Batch Update	Modifications stored in database	Time is 19:15.

3.5.5 RELIABILITY AND RECOVERY

TFTS analysts must be able to review data as soon as possible after receipt and entry. Readings that exceed surveillance criteria can generate occurrence reporting per *Occurrence Reporting and Processing of Operations Information (WHC-CM-1-3, MP 5.14)*, and *Tank Farms Occurrence Reporting and Processing of Operations Information (WHC-CM-5-7, Section 1.22)*. The SACS unavailability will not exceed 24 hours at a time.

If both the primary and secondary systems are unavailable, the contingency plan is to return to manual data evaluation.

3.5.6 AUDIT

The information in an audit trail will be retrievable. It will be archived and restored like the other files in the database.

3.5.7 PRIORITIES

No special preceding, succeeding or interface production applications were identified.

3.5.8 TRANSFERABILITY

No transferability requirements have been identified.

3.5.9 CONVERSION

No conversion requirements have been identified.

3.5.10 TESTING AND ACCEPTANCE CRITERIA

Test procedures will be written and maintained as internal documents to SACS according to the *SACS Temperature Database Test Plan, WHC-SD-WM-TP-122*. These Test Reports will summarize the results of the designated testing activities and should provide evaluation based on the results.

3.5.11 DOCUMENTATION

The documentation required for the design, development and implementation of the SACS will be prepared in accordance with the guidelines provided in *Software Practices (WHC-CM-3-10)*, *Quality Assurance (WHC-CM-4-2)*, and *Standard Engineering Practices (WHC-CM-6-1)*. The *SACS Temperature Database SPMP, WHC-SD-WM-SDP-003*, contains documents to be produced.

3.5.12 TRAINING

The customer will prepare a *SACS System Training Plan* which will provide a guide for training on the SACS and provide and maintain the User Guide.

3.5.13 SECURITY AND PRIVACY

The manager of the system users will have the authority to add, change, or delete user access to the system. Once the manager has approved the change, the system administrator will be empowered to make the necessary changes.

The system administrator will work with the Computer Protection Program Manager (CPPM) to assure the integrity of the system.

There is no classified or proprietary information in the system.

The user has the responsibility of keeping unauthorized persons from using a workstation while the user is logged in.

4. REFERENCES

A requirements document, *SACS Temperature Data SRS, WHC-SD-WM-CSWD-031*, was drafted, reviewed, and released as a reference only document. That document became the basis for the first revision of the Database SRS document. An associated document, *SACS Entity Relationship Diagram (ERD) Document, WHC-SD-WM-CSWD-037*, contains the temperature database business model for the SACS Project.

The following documents are referenced within this document:

WHC-CM-1-3, Management Requirements and Procedures, by Westinghouse Hanford Company, February 1988.

WHC-CM-3-10, Software Practices, by Westinghouse Hanford Company.

WHC-CM-4-2, Quality Assurance, by Westinghouse Hanford Company.

WHC-CM-5-7, Tank Farm Surveillance and Operations Administration, by Westinghouse Hanford Company.

WHC-CM-6-1, Standard Engineering Standards, by Westinghouse Hanford Company.

WHC-SD-RE-TI-093, Double-shell Underground Waste Storage Tanks - Riser Survey, by Westinghouse Hanford Company.

WHC-SD-WM-CSWD-027, Statement of User Needs, by Westinghouse Hanford Company.

WHC-SD-WM-CSCM-012, Surveillance Analysis Computer System Software Configuration Management Plan, by K.Y. Jones.

WHC-SD-WM-CSWD-031, Surveillance Analysis Computer System (SACS) Temperature Data Software Requirements Specification (SRS) by WHC Tank Surveillance Technology and Information Resource Management, January 1992.

WHC-SD-WM-CSWD-037, Surveillance Analysis Computer System (SACS) Entity Relation Diagram (ERD) Document by M.S. Nutter, K.Y. Jones and J.A. Glasscock.

WHC-SD-WM-SDP-003, Surveillance Analysis Computer System (SACS) Temperature Database Software Project Management Plan (SPMP) by K.Y. Jones.

WHC-SD-WM-SAR-006, Single-Shell Tank Isolation Safety Analysis Report, by Westinghouse Hanford Operations.

WHC-SD-WM-TI-357 Rev. 1D, Waste Storage Tank Status and Leak Detection Criteria, by Westinghouse Hanford Company.

OSD-T-151-00013, Operating Specification for Single-Shell Waste Storage Tanks, by Westinghouse Hanford Company.

The following documents help define the business needs of the user but are not explicitly referenced in this document:

WHC-EP-0182, Tank Farm Surveillance and Waste Status Summary Report, by Westinghouse Hanford Company, monthly release.