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7. Abstract

This document details the system requirements specification for SY-101 DACS. General factors which effect the overall system are also described.

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**COMPUTER SYSTEM REQUIREMENTS SPECIFICATION
FOR SY-101 HYDROGEN MITIGATION TEST PROJECT
DATA ACQUISITION AND CONTROL SYSTEM (DACS-1)**

September 1994 ✓

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**COMPUTER SYSTEM REQUIREMENTS SPECIFICATION
FOR SY-101 HYDROGEN MITIGATION TEST PROJECT
DATA ACQUISITION AND CONTROL SYSTEM (DACS-1)**

1.0 INTRODUCTION

The system requirements specification for SY-101 Hydrogen Mitigation Test Project (HMTTP) data acquisition and control system (DACS-1) documents the system requirements for the DACS-1 project. This data acquisition and control system is for the mitigation testing that will be conducted on Tank SY-101.

1.1 PURPOSE

The purpose of the DACS is to provide data acquisition and control capabilities for the hydrogen mitigation testing of Tank SY-101. Mitigation testing uses a pump immersed in the waste, directed at varying angles and operated at different speeds and time durations. Tank and supporting instrumentation is brought into the DACS to monitor the status of the tank and to provide information on the effectiveness of the mitigation test. Instrumentation is also provided for closed loop control of the pump operation. DACS is also capable of being expanded to control and monitor other mitigation testing.

The intended audience for the CSRS includes the SY-101 hydrogen mitigation test data acquisition and control system designers: analysts, programmers, instrument engineers, operators, maintainers. It is intended for the data users: tank farm operations, mitigation test engineers, the Test Review Group (TRG), data management support staff, data analysts, Hanford data stewards, and external reviewers.

1.2 SCOPE

The DACS will acquire data from SY-101 mitigation tests required by users. The DACS will acquire data necessary to:

- provide closed loop control of selected mitigation control elements
- provide test safety controls such as aborts of pump operation
- provide instrumentation monitoring

The system will provide closed loop control of the mitigation device (pump) with operator input parameters. The system will acquire digital data from signal conditioning equipment and will convert the acquired data to

engineering units. The form of the data handled by the software will be consistent with processing and storage requirements, the capabilities and limitations of the instruments, computer system, software, analysis requirements, and archival storage requirements. Operator log entries, manually taken data associated with tank farm surveillance operations, and special purpose instruments will not be recorded or monitored by DACS.

The system will operate as a single system but will include a mix of commercially-available software, Hanford site prepared modules, scripts, and parameter files. It will not include presentation software used to format the output for users that varies depending on use. The system produces output commonly understood to provide sufficient data for routine day-to-day operations and simple analyses but not for special purpose analyses or users such as statisticians, chemists, physicists, or other scientists.

1.3 OVERVIEW

The remainder of this SRS is divided into two main sections. General factors which affect the overall system are described in Section 2.0. These factors include the general user characteristics, any general constraints, and any assumptions and dependencies that are assumed during the development.

The specific requirements of the DACS are detailed in Section 3.0.

1.4 DEFINITIONS AND ABBREVIATIONS

The following are definitions of abbreviations and terms used in this document:

Archival	-	Saving the data resulting from mitigation testing; includes all of the data acquired by the computer system and any information needed to give the data its full meaning such as calibration and conversion factors, operational logs, and data quality reports. Archival is accomplished in approved DOE archival facilities.
CFM	-	Cubic feet per minute (cfm).
CSDD	-	Computer Software Design Descriptions as described in WHC-CM-6-1, Appendix O--sometimes shortened to SDD.

CSRS	-	Computer System Requirements Specification as described in WHC-CM-6-1, Appendix N. System Requirements Specification (SRS) when describing entire system.
DACS	-	SY-101 Data Acquisition and Control System.
GPM	-	Gallons per minute.
HLAN	-	Hanford Local Area Network.
INWG	-	Inches water gauge (pressure).
Mitigation	-	Describes the project objective of reduction of hydrogen in SY-101 to a safe nonexplosive level.
MPH	-	Miles per hour (wind speed).
PLC	-	Programmable Logic Controller.
PPM	-	Parts per million.
PSIA	-	Pounds per square inch absolute.
PSID	-	Pounds per square inch differential.
PSIG	-	Pounds per square inch gauge.
RPM	-	Revolutions per minute.
SCADA	-	Supervisory Control and Data Acquisition.
SDD	-	Computer Software Design Description.
SI	-	International System of Units.
SRS	-	See Computer System Requirements Specification.
TRG	-	Test Review Group: a team of managers responsible for review and oversight of the mitigation tests.
uIN/IN	-	Microinches per inch (micro-strain).

2.0 GENERAL DESCRIPTION

This section describes the general factors that affect the product and its requirements.

2.1 PRODUCT PERSPECTIVE

The DACS shall provide data monitoring, display, and storage for Tank SY-101 and alarm and control of the Tank SY-101 hydrogen mitigation testing systems, as well as ancillary systems and equipment. This may include heating, ventilation, and air conditioning (HVAC) and other support systems required to achieve safe and reliable operation of the testing systems in the tank.

The tank data includes physical or chemical properties of the waste and the gases in the dome space and ventilation system. It does not include tank integrity data such as the leak detection system and concrete and annular space temperatures. The DACS shall include automatic control, operation monitoring, test system operating condition indication, and selected displays to advise operating personnel of the current operating status of the systems. Emergency shutdown capabilities will be provided by a local manual push button in the DACS trailer, as well as a programmed shutdown controlled from the DACS. Emergency manual shutdown capabilities are included to provide safety backup for equipment and personnel.

The DACS will consist primarily of a computer-based system, including front-end I/O devices, central processing units, color cathode ray tubes (CRTs), user keyboards, data storage devices, as well as other peripherals to complete the system. The DACS shall be capable of displaying the data in real time on CRT monitors so that the information is easily understood. Graphics capabilities shall be provided by the system for the presentation of the data. Specific data scan and record rates will be data dependent.

The DACS data files shall be archived in the system and shall be backed up.

The DACS shall provide alarms and shall initiate corrective actions required to maintain the tank testing systems in a safe mode of operation. If conditions deteriorate, the DACS will safely shut down equipment to prevent equipment damage. The operator shall be able to interface with various test and auxiliary systems through operator stations located in a control area in an instrumentation trailer near the tank site.

All DACS equipment shall use state-of-the-art technology and be reliable. Where applicable, necessary instrumentation replacements shall be the same model and from the same manufacturer as original instruments. The

system equipment, including software, shall be modular in design to provide for easy expansion and upgrading as enhanced software and hardware become available during the system lifetime.

The design will allow for a 25 percent spare capacity of all signal types. Safety interlocks to prevent damage to equipment shall be provided as necessary. Standby equipment shall be automatically placed into service when conditions require such operation.

In addition to the computer system described above, the DACS shall use electronic devices such as signal amplifiers and filters for special high-speed signal channels that shall be mounted in instrument racks located near the DACS work stations inside the instrumentation trailer.

2.2 PRODUCT FUNCTIONS

The DACS shall be a microcomputer-based system consisting of the following:

- Signal and control I/O termination cabinets
- Auxiliary central processing units
- Control and operating software
- Operator interface hardware/software
- Data communications network for communication with other nodes
- Data storage devices
- Communications gateways to remote devices

The DACS will be able to provide the following functions, as a minimum:

- A real-time clock and calendar
- Contact relays, latched relays, and internal relays
- Transitional make-or-break contacts
- Timers
- Counters
- Mathematical operations
- Conversions between numbering systems
- Logic and comparison operations
- Sequencer
- Shift registers
- Proportional, integral, and derivative (PID) loop controls
- Interrupts
- Data transfers
- RS-232C ASCII communications or other standard communications protocol

The DACS shall include software that can be utilized for file maintenance, program development or modification, system configuration, system analysis, and report programming and generation.

Ultimately, the goal of the DACS is to keep the mitigation tests and data acquisition running safely and efficiently, to prevent undesirable conditions from occurring, and to archive all relevant data.

2.3 USER CHARACTERISTICS

There are several different users of this system. The users are:

- Engineers monitoring the tests
- Data evaluators/modelers reviewing the effectiveness of the tests
- Gas monitoring personnel
- Test personnel running the mixer pump

Each of these groups view the output of the system differently. The engineers are very knowledgeable about the system and need the data displayed real-time on screen and alarms and aborts to trigger for abnormal conditions. The data evaluators/modelers need the data and any relevant information to be stored for post processing analysis. The gas monitoring personnel review data that is collected from the gas samples. The test personnel will be in charge of running the pump and will need the data displayed real-time on screen and alarms and aborts to trigger for abnormal conditions.

2.4 GENERAL CONSTRAINTS

The major constraint governing the design, implementation, and installation of the DACS is time. This system must be designed, implemented, installed, and put into operation on an emergency time schedule. The result of this is that the system shall be built using components and software already available and known by an implementation team. No time is available for exploring alternative designs nor for consideration of long term flexibility and maintenance.

2.5 ASSUMPTIONS AND DEPENDENCIES

See Section 2.4.

3.0 SPECIFIC REQUIREMENTS

3.1 FUNCTIONAL REQUIREMENTS

The system must provide for several capabilities across all data types to be acquired. These requirements are designed to provide minimum functionality and flexibility supporting efficient operations. A summary of all I/O signals, with their signal name, description, signal type, signal range, signal subrange (if applicable), I/O location, Modicon (PLC) location, low alarm value, high alarm value, abort value, scan rate, instrument tag number, drawing number, history file (if archived), history period, and type of signal shall be documented in WHC-SD-WM-EL-001, "SY-101 Hydrogen Mitigation Test DACS Input/Output Channel List." These values will not be detailed in this document.

Input signal conditioning and acquisition rates must be designed to accommodate the signal and data requirements. Some sensors are more appropriately addressed by use of semi-independent subsystems, high-speed acquisition for selected short periods of time, with signal integration over long periods of time. For the different signal types, the engineers designing the signal conditioning, data acquisition and associated hardware and software have knowledge of the unique characteristics and needs of the sensors.

The data acquired from sensors may need further processing before it is useful. These signals include the signals that are used for alarm limit checking and control feedback signals. Averaging is another form of processing that might be used.

Selected sets of the sensor data only need to be available during mitigation tests or other periods of specific interest to the investigators. In a similar fashion selected portions of the data may not need to be archived, or could be archived in a compressed form without losing any information. Processing must provide for the appropriate combinations.

The outputs from one DACS function become the input to some other function, possibly outside the DACS. It is important to consider the functional needs at each step of data manipulation and storage. Different forms of the resulting data might then be used for DACS screen displays, hardcopy displays, short-term and long-term archival. In addition the output data may be manipulated to optimize system performance, such as might be realized in data compression algorithms.

The outputs from the various steps of DACS processing must have known and published levels of uncertainty. A consistent set of measures and terminology should be used to minimize misinterpretation. Total errors of outputs should either be published if constant, or calculated if variable. In

addition, the precision and accuracy components of the uncertainty must be described separately to provide for adequate analysis of the data.

Outputs must be self descriptive. Displays, reports, and archived data must represent unambiguous sensor descriptions.

3.2 EXTERNAL INTERFACE REQUIREMENTS

3.2.1 User Interfaces

The Tank SY-101 mitigation test systems shall be operated from a control area through operator stations composed of color monitors, keyboards, printers, a processor, and memory--backed up by selected controls and indications on a nearby control panel.

The operator-machine interface to the system shall be designed to contribute to effective interactions between the control operator and the computer-based control system. Emphasis shall be placed on the system parameters that an operator will view and use at the operator console. All screen displays shall deal consistently with the presentation and labeling of information and shall be based on the application of human factors and psychological principles, such as feedback, short-term memory, and reinforcement. Displays shall be modified by user needs and feedback to a system screen design.

Screen formats or contents, hardcopy page layout and contents, relative timing of inputs and outputs, and user provided data will be dependent on the needs of Test Engineering as they run the mitigation mixer pump.

The DACS system shall provide monitoring functions for use by the test engineers, operations, and the TRG. This function shall provide alarm notification for the limits as defined in WHC-SD-WM-EL-001.

The DACS system shall provide archive files of the data for use by the analysts and the TRG. This function shall store the data in a universal spreadsheet format such as a comma delimited file. The data shall be stored at the rates as defined in WHC-SD-WM-EL-001.

The optimum operating state is to have data stored constantly over any given 24-hour period. The minimum up-time rate for data storage shall be at least 90 percent, i.e., at least 90 percent of the data shall be stored in any given 24-hour period.

The archived data may include calculated variable such as the gas volume calculation. The archived data (either automatically recorded or manually

recorded and then transcribed to electronic form) shall also include the system log, test logs, test plans, test start time, test end time.

3.2.1.1 Human Factors. Human factor concepts as time allows, shall be applied in the following areas:

- Command language - This comprises command syntax and considerations for the different entry modes, such as menu selection and statement entry.
- Recovery procedures - Examples are error, status, and help message presentation.
- User entry techniques - These are user communication with the system for entries and the appropriateness of the hardware for operator entry.
- Display formats - This is the physical layout of the information on the screen, the positioning of data fields, highlighting, and graphics usage.
- Frame content - This is the information displayed on the screen and includes the use of feedback aids in the form of rules, examples, and graphics.
- Response times - This is the maximum response time requirements for specific user actions.

3.2.1.2 Displays. Most operator functions shall be implemented via interactive graphic representations of the various test processes. The following types of displays shall be considered for inclusion in the control and operating system design:

- Alarm summaries
- System overviews
- Graphic schematics of the test systems
- Trend displays
- Operator command menus

System configuration displays and displays presenting critical system parameters shall be password protected. A 50 percent expansion capability shall be provided in the computer memory to accommodate anticipated future growth.

3.2.2 Hardware Interfaces

3.2.2.1 I/O Termination Modules. The DACS shall include front-end I/O modules designed to receive or transmit the signal types required by the various tank testing and monitoring instrumentation. These signals are documented in WHC-SD-WM-EL-001.

The I/O system shall be capable of performing such functions as scaling, signal conditioning, digitizing analog inputs, converting binary output to analog voltages, sensing and setting switch states, and digitizing analog signals. The I/O system shall be modular in construction to ease repairs and enhance system flexibility and expandability. Malfunction of an I/O card shall not affect the performance of the local processor. A module failure shall be detected and an operator alarm issued.

The DACS shall include I/O modules that are designed to receive or transmit the signal types as required by the various monitoring instrumentation. These I/O modules shall condition and multiplex the data. Communication with the I/O instrumentation will employ a widely used protocol with a well-defined wiring standard.

3.2.2.2 Types of Signal Channels. The data signal types can be generally classified as low-speed, high-speed, or special signals.

Low-speed signals are signals from devices which have a slowly varying history. Examples are thermocouples, gas pressure and flow, analog control signal outputs, and binary control signal outputs. All of these types of channels will use Modicon I/O modules of an appropriate type.

High-speed signals include signals received from transducers such as hydrophones or vibration accelerometers. Data from these types of signals will be sampled at a rate of at least twice the frequency component the scientific investigator wishes to measure. For the ultrasonic investigations, this is greater than 80 kHz but less than 200 kHz. The high-speed data will pass through I/O cabinets with data transmission to the DACS via double-shielded coaxial cable and amplification as required.

Special signals include those from mass spectrometers, gamma ray spectrometers, and other unspecified systems. Access to these individual subsystems by the DACS will be handled on a case-by-case basis. Sampling rate for the special signals will be determined during detailed design.

3.2.2.3 Control Panel. A control panel shall be installed inside the control area and shall contain emergency stop capability. The control panel shall be interfaced to the DACS.

3.2.2.4 Engineers' Work Station. At a minimum, one operator station shall be capable of being used as an engineering work station for software maintenance, program development, database configuration, system analysis, and report programming and generation.

3.2.2.5 Control Room. A control room shall be established inside the instrumentation trailer that shall be located adjacent to the tank site. The control area shall provide space for the DACS equipment including operator stations, control panel, data processing units, data storage devices, and other peripherals. The room shall be arranged in a manner that facilitates the operation and control of the test system equipment.

3.2.2.6 Uninterruptible Power Supply. An on-line, uninterruptible power supply (UPS) shall be provided with the system to protect the DACS trailer equipment from normal power supply variations or interruptions. The UPS shall provide for 30 minutes minimum with 100 percent reliability of redundant power in case of loss of site power to the DACS trailer.

3.2.2.7 Hardcopy Output. A pin-feed, dot matrix alarm printer shall be available to provide a printout of each alarm event as it occurs if desired.

3.2.2.8 Emergency Shutdown. An emergency shutdown system shall be provided for the protection of personnel and test systems equipment. This system shall be hardwired throughout from sensors, inputs, logic, and output devices and will not rely on the DACS computer-based control and operating system. The emergency shutdown system shall be dedicated and segregated with its own secure redundant power supply. A "panic button" designed to activate the emergency shutdown system shall be located inside the control room. When this button is activated, audible and visible alarms shall warn the personnel that the system has been shut down in an emergency mode. The emergency shutdown can occur manually or from the DACS.

3.2.2.9 Closed Circuit Television System. Two CCTV systems shall be provided: one to view inside Tank SY-101 and another to view personnel activity at the tank site.

A camera already exists inside the tank and shall continue to provide video images of tank activity. The video images shall be transmitted to a new video monitor to be located inside the DACS trailer. A second camera shall be mounted in a location that will permit the surveillance of personnel activity at the Tank SY-101 site. Video images from this camera shall be transmitted to a monitor located inside the DACS trailer. Capabilities for controlling

camera tilt, pan, and zoom shall be provided for both cameras and shall be located inside the DACS trailer.

3.2.3 Software Interfaces

DACS shall use a Supervisory Control and Data Acquisition (SCADA) software system as its base system. Electronic data outputs from this system shall be available to other systems in a universal spreadsheet format such as a comma delimited file. If other auxiliary data acquisition systems (such as a high-speed data acquisition system) is required, they shall also produce electronic data files in a universal spreadsheet format such as a comma delimited file.

3.2.4 Communications Interfaces

The system will have the capability to transfer data to the Hanford Local Area Network (HLAN).

3.3 PERFORMANCE REQUIREMENTS

The system shall acquire data at the scan rates listed in WHC-SD-WM-EL-001. It shall archive data at the archival rates specified in WHC-SD-WM-EL-001.

3.4 DESIGN CONSTRAINTS

This section describes any design constraints imposed by standards, hardware limitations, or operational considerations.

3.4.1 Standards Compliance

The work delineated in this document shall be controlled per References 1 and 3, plus other applicable company policies or procedures. In addition, software designed/developed shall be done per the "Quality Assurance Manual," WHC-CM-4-2, Section QI-3.2, "Software Quality Assurance Requirements" (Reference 3) and the "Standard Engineering Practices," WHC-CM-6-1, Section EP-2.1, "Software Configuration Management" (Reference 1) as applicable for the Safety and Quality Impact Level 3.

3.4.2 Resource Limitations

The major resource limitation for the development of the DACS is time. The emergency development and installation schedule requires the use of known and existing components and limits the number of options that would normally be explored.

3.5 ATTRIBUTES

This section describes any additional attributes that are to be considered in the DACS-1.

3.5.1 Software Application Security Requirements

The system shall be designed and configuration control procedures implemented to ensure compliance with all applicable computer protection and security requirements, including those contained in DOE Order 1360.2, "Computer Security Program For Unclassified Computer Systems" (Reference 1).

The data will be protected from unauthorized access and modification by manned or locked trailer entry requirements. Once the data is transferred to the network, the use of a user name and password shall be required.

3.5.2 Maintainability

The system shall be designed such that a technical staff member with normal knowledge of personal computers and database packages can operate and maintain the system, including the implementation of nominal changes.

3.5.3 System Configuration Control

The final application software and all related files and documentation will be released via an Engineering Data Transmittal (EDT). Any changes made subsequent to the approval of this SRS shall be documented via an Engineering Change Notice (ECN).

3.5.4 Instrumentation

All instrumentation shall be fully calibrated.

3.5.5 Data Integrity

Documentation shall be provided along with the system that describes each reading from the system, how it is obtained, what error bands or accuracy is provided, along with specifications for the data path through the data acquisition system.

3.6 OTHER REQUIREMENTS

3.6.1 Data

Outputs from the DACS shall include volatile channel information displayed on operator interfaces, such as CRT monitors and hard copy from printers and DACS network transferrable disk files. These outputs are intended to inform the appropriate technical personnel of Tank SY-101's current or historical physical state in addition to providing a record of mitigation operations.

Current values of important measurements shall be written to magnetic disk as a means of archiving data. This archived data is called historical data. The DACS shall archive historical data so that the data can be easily retrieved and viewed. To view the historical data or selected portions of it, the DACS shall have a report generator that produces an ASCII file for display or printout. The retrieved data file shall be logically presented for ease of operator interpretation. The DACS historical data shall be accessible from an operator configurable reviewing screen which allows panning and zooming of the data.

The DACS shall be able to reformat the collected historical data into a form readable by other software applications, running on platforms different from the DACS platform. The commercial process control software shall supply access routines from a high-level language to the historical data files, or as an alternate shall be able to produce an acceptable ASCII report file for transfer to another platform.

The DACS shall provide a data storage and retrieval system with sufficient capacity to store an adequate amount of historical data and shall utilize conventional data storage devices such as disk drives or magnetic tape units (MTU). Ease of operator use and maintenance shall be a primary concern.

3.6.2 Operations

The system shall be able to support the following operating modes. Mode switching may be initiated by operator request, operator confirmation, or automatically.

- Manual - In the manual mode, the control operator dictates the output control signal to the final control device.
- Sequential - Sequential operation allows the control system to execute automatically a preprogrammed set of operations, one step at a time in a specified sequence.
- Semi-automatic - In semi-automatic mode, groups of steps are joined to form logical tasks. These tasks are then performed, one at a time at the control operator's initiation.
- Operator intervention - If possible in the sequential or semi-automatic modes, the operator shall have the ability to stop the equipment and assume manual control. The operator shall then be able to perform manual operations and restart the preprogrammed sequence at any point. This determination shall be made for every sequence considering safety and system integrity.
- Shutdown/emergency shutdown - Upon determination of a predefined internal or external shutdown condition, the mitigation systems shall be brought to a safe condition. Power shall remain on for all control and monitoring elements of the DACS if safety permits.

3.6.3 Site Adaptation

A trailer shall be provided by LANL to house the components of the DACS. The trailer shall have adequate area for the DACS control room and equipment. The trailer shall be designed with a raised floor to allow for the routing of instrument input/output wiring and data cables between the various interconnecting equipment.

The trailer shall contain adequate space for the following minimum equipment:

- Control panel
- Operator stations
- Printer
- Bookcase
- Two television monitors and recorders
- DACS central processing units
- I/O termination cabinets

The trailer shall be pressurized and air conditioned by an HVAC system designed to accommodate the heat loads of equipment and operation personnel.

3.6.4 Options

Due to the severe time constraints, no alternative proposals were investigated.

3.6.5 Scheduling

DACS is required to be operational 24 hours a day, 7 days a week. An up-time of over 90 percent is required.

3.6.6 Reliability and Recovery

All DACS equipment shall use state-of-the-art technology and be reliable. The system equipment, including software, shall be modular in design to provide for easy recovery. Standby equipment shall be automatically placed into service when conditions require such operation. Redundancy shall be provided in the following critical areas:

- . Processor for the PLC shall have a hot standby capability that shall detect the failure of the primary processor and automatically switch to the backup processor.
- . The station monitoring the I/O and the station controlling the pump shall have a manually switchable backup system to provide less than 30-minute recovery/restart should one of these stations fail.
- . Hardware inputs shall be connected to the PLC I/O modules such that a single PLC module failure shall not result in the loss of redundant hardware devices or adjacent readings (such as thermocouple readings at adjacent levels).

3.6.7 Audit

A log of operator actions shall be available. There shall be the capability of disabling the log, logging operator events to a display, or logging them to a disk file.

3.6.8 Priorities

There shall be the capability of interfacing independent data acquisition systems, such as the gas monitoring system, to the DACS computer via the PLC or some other interface. There shall be the capability of transferring data to HLAN for further data analysis using independent analysis packages.

3.6.9 Transferability

There shall be no consideration of use of DACS on multiple installations or its use at other DOE sites.

3.6.10 Conversion

There are no requirements to convert the output data files to any other format.

3.6.11 Testing and Acceptance Criteria

Prior to use of DACS, full scale acceptance testing and operational testing shall be performed. Test Engineering is responsible for writing, executing, and reporting of all testing. See WHC-SD-WM-CSCM-023 (Reference 7) and WHC-SD-WM-CSWD-067 (Reference 8) for further testing information.

3.6.12 Documentation

Per WHC-CM-3-10, the minimum set of documentation for "contract developed" software is:

- System requirements specification (this document)
- System design description
- User documentation
- Verification and validation records, including test procedures, test case specifications, and test results.

Also required are:

- Hardware documentation including schematics, wire lists, parts lists, system diagrams

3.6.13 Training

Training programs and documentation for the DACS will be provided and shall cover the following training areas:

- Operation
- Engineering
- Maintenance

3.6.14 System Hardware

The DACS system hardware will consist of central processing units, magnetic hard disk drives, floppy disk drives, adequate random access memory (RAM) to run the data acquisition and control software, a math co-processor, and external ports to support printers or other output devices. These shall be IBM-compatible units running on Intel 486 microprocessors.

Several process nodes shall be provided and system design may assign a primary task to each processor, thereby segmenting functionality.

At the data acquisition level, a programmable logic controller shall be used to acquire the field data and to provide fast response to abort conditions. At this level, a two-processor configuration shall be utilized. One processor shall be the primary, with the other in a hot standby condition. Internal interprocessor checks shall be continuously performed. If a system failure is detected, the hot standby processor shall automatically become the primary. Upon detection of a failure of one of the processors, an alarm shall be displayed at an operator's station.

3.6.15 System Software

The DACS shall employ the commercial SCADA control software as the primary software product. It shall be capable of providing basic process control functions, as well as the spectrum of data management functions. It shall communicate with PLC processors for data transfer and will be able to transfer data to other systems.

The DACS shall contain control and operation software that shall provide the control operator with various modes of operation, a selection of functions for use in system configuration and programming, and software that enables future program development.

4.0 REFERENCES

1) WHC-CM-6-1, "Standard Engineering Practices"

- EP-1.1 Engineering Document Identification, February 1992
- EP-1.6 Engineering Data Transmittal, September 1991
- EP-1.7 Engineering Document Approval and Release Requirements, September 1991
- EP-1.12 Supporting Documents, April, 1992
- EP-2.2 Engineering Document Change Control, February/December 1993
- EP-5.8 Engineering Document Contents, June 1992
- Appendix N Computer Software Requirements Specifications, June 1992

- 2) WHC-CM-3-10, "Software Practices," January 1993
- 3) WHC-CM-4-2, "Quality Assurance Manual"
QR-19.0 Software Quality Assurance Requirements, September 30, 1993,
Rev. 0
- 4) WHC-SD-WM-WP-264, "Work Plan for Transition of SY-101 Hydrogen
Mitigation Test Project Data Acquisition and Control System,"
- 5) WHC-SD-WM-CSDD-011, "Computer System Design Description for SY-101
Hydrogen Mitigation Test Project Data Acquisition and Control System
(DACS-1)"
- 6) WHC-SD-WM-EL-001, "SY-101 Hydrogen Mitigation Test DACS Input/Output
Channel List"
- 7) WHC-SD-WM-CSCM-023, "System Configuration Management Plan for SY-101
Hydrogen Mitigation Test Project Data Acquisition and Control System"
- 8) WHC-SD-WM-CSWD-067, "System Verification and Validation Plan for SY-101
Hydrogen Mitigation Test Project Data Acquisition and Control System
(DACS-1)"