S

# ENGINEERING CHANGE NOTICE



1. ECN 658042

Proj. ECN

| 2. ECN Category (mark one) | 3. Originator's Name, Organization, MSIN, and Telephone No. | 4. USQ Required? | 5. Date |
|---|---|---|---|
| Supplemental ○ | J. A. Glasscock, H8-41, 373-4302 | ○ Yes ◉ No | 2/10/00 |
| Direct Revision ◉ | | | |
| Change ECN ○ | 6. Project Title/No./Work Order No. | 7. Bldg./Sys./Fac. No. | 8. Approval Designator |
| Temporary ○ | SWITS | SWITS | Q |
| Standby ○ | 9. Document Numbers Changed by this ECN (includes sheet no. and rev.) | 10. Related ECN No(s). | 11. Related PO No. |
| Supersedure ○ | HNF-2357 Rev. 1 | EDT- 9a 624102, 650784 | N/A |
| Cancel/Void ○ | | | |

| 12a. Modification Work | 12b. Work Package No. | 12c. Modification Work Completed | 12d. Restored to Original Condition (Temp. or Standby ECNs only) |
|---|---|---|---|
| ○ Yes (fill out Blk. 12b) ◉ No (NA Blks. 12b, 12c, 12d) | N/A | N/A<br>Design Authority/Cog. Engineer Signature & Date | N/A<br>Design Authority/Cog. Engineer Signature & Date |

13a. Description of Change — 13b. Design Baseline Document? ○ Yes ◉ No

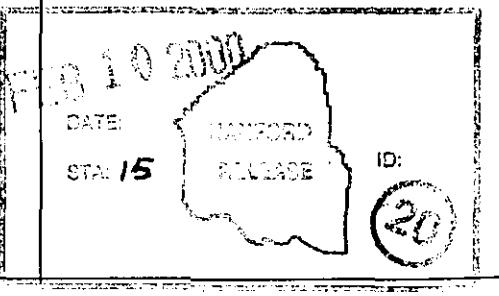
Replacement of SWITS PMP release 1 to reflect new baseline based of completed requirements collection.

| 14a. Justification (mark one) | 14b. Justification Details |
|---|---|
| Criteria Change ◉ | Project rebaselined at end of requirements collection phase. |
| Design Improvement ○ | |
| Environmental ○ | |
| Facility Deactivation ○ | |
| As-Found ○ | |
| Facilitate Const. ○ | |
| Const. Error/Omission ○ | |
| Design Error/Omission ○ | |

15. Distribution (include name, MSIN, and no. of copies)

See attached distribution sheet.

RELEASE STAMP



# ENGINEERING CHANGE NOTICE



1. ECN (use no. from pg. 1) ~~650784~~ 658042

| 16. Design Verification Required | 17. Cost Impact | | 18. Schedule Impact (days) |
|---|---|---|---|
| | ENGINEERING | CONSTRUCTION | |
| ○ Yes | Additional ○ $ N/A | Additional ○ $ N/A | Improvement ○ |
| ◉ No | Savings ○ $ | Savings ○ $ | Delay ○ 0 |

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

| | | | | | |
|---|---|---|---|---|---|
| SDD/DD | ☐ | Seismic/Stress Analysis | ☐ | Tank Calibration Manual | ☐ |
| Functional Design Criteria | ☐ | Stress/Design Report | ☐ | Health Physics Procedure | ☐ |
| Operating Specification | ☐ | Interface Control Drawing | ☐ | Spares Multiple Unit Listing | ☐ |
| Criticality Specification | ☐ | Calibration Procedure | ☐ | Test Procedures/Specification | ☐ |
| Conceptual Design Report | ☐ | Installation Procedure | ☐ | Component Index | ☐ |
| Equipment Spec. | ☐ | Maintenance Procedure | ☐ | ASME Coded Item | ☐ |
| Const. Spec. | ☐ | Engineering Procedure | ☐ | Human Factor Consideration | ☐ |
| Procurement Spec. | ☐ | Operating Instruction | ☐ | Computer Software | ☐ |
| Vendor Information | ☐ | Operating Procedure | ☐ | Electric Circuit Schedule | ☐ |
| OM Manual | ☐ | Operational Safety Requirement | ☐ | ICRS Procedure | ☐ |
| FSAR/SAR | ☐ | IEFD Drawing | ☐ | Process Control Manual/Plan | ☐ |
| Safety Equipment List | ☐ | Cell Arrangement Drawing | ☐ | Process Flow Chart | ☐ |
| Radiation Work Permit | ☐ | Essential Material Specification | ☐ | Purchase Requisition | ☐ |
| Environmental Impact Statement | ☐ | Fac. Proc. Samp. Schedule | ☐ | Tickler File | ☐ |
| Environmental Report | ☐ | Inspection Plan | ☐ | _____ | ☐ |
| Environmental Permit | ☐ | Inventory Adjustment Request | ☐ | _____ | ☐ |

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

| Document Number/Revision | Document Number/Revision | Document Number/Revision |
|---|---|---|
| N/A | | |

21. Approvals

| | Signature | Date | | Signature | Date |
|---|---|---|---|---|---|
| Design Authority | | | Design Agent | | |
| Cog. Eng. | J A Glasscock | 2/10/00 | PE | | |
| Cog. Mgr. | K J Willers | 2/10/00 | QA | | |
| QA | W L Jones | 2/10/2000 | Safety | | |
| Safety | | | Design | | |
| Environ. | | | Environ. | | |
| Other | | | Other | | |

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

# DISTRIBUTION SHEET

| To | From | Page 1 of 1 |
|---|---|---|
| Distribution | Systems Development & Integration | Date 2/10/00 |
| Project Title/Work Order | | EDT No. |
| Solid Waste Information and Tracking System (SWITS) Client/Server Design | | ECN No. 658042 |

| Name | MSIN | Text With All Attach. | Text Only | Attach./ Appendix Only | EDT/ECN Only |
|---|---|---|---|---|---|
| DL Hagel | T3-04 | Y | | | |
| JB Buckley, Jr. | T3-04 | Y | | | |
| WL (Bill) Jones | H8-43 | Y | | | |
| JL Springer | G3-30 | Y | | | |
| KJ Willers | H8-41 | Y | | | |
| DL May | H8-43 | Y | | | |
| JA Glasscock | H8-43 | Y | | | |
| GC Triner | T3-05 | Y | | | |
| LE (Butch) Williams | G3-35 | Y | | | |
| Central Files | B1-07 | Y | | | |
| DOE RL Reading Room | H2-53 | y | | | |
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# Solid Waste Information and Tracking System Server Conversion Project Management Plan

**Dwight May, Joseph Glasscock**
Lockheed Martin Services, Inc.
Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: 658042 UC: 2000
Org Code: SL620000 Charge Code: 101626AJ10 ja HMWM0281
B&R Code: EW3130020 W ja Total Pages: ~~35~~ 34 ja

Key Words: Solid Waste Information and Tracking System Project Management Plan (PMP) for conversion of Solid Waste Information and Tracking System (SWITS) to client-server architecture.

Abstract:
The Project Management Plan governing the conversion of SWITS to a client-server architecture. The PMP describes the background, planning and management of the SWITS conversion. Requirements and specification documentation needed for the SWITS conversion will be released as supporting documents.

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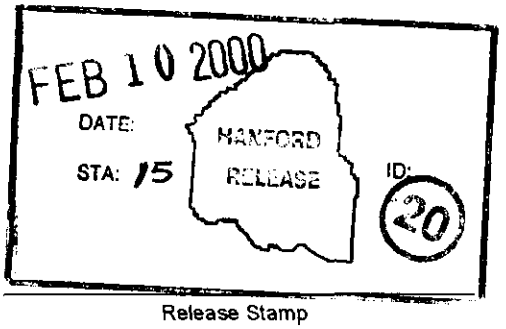


Release Approval — Date: 2-10-00

Release Stamp

**Approved For Public Release**

# RECORD OF REVISION

(1) Document Number: HNF-2357



(2) Title: Solid Waste Information and Tracking System Client-Server Conversion Project Management Plan

Change Control Record

| (3) Revision | (4) Description of Change - Replace, Add, and Delete Pages | Authorized for Release | |
|---|---|---|---|
| | | (5) Cog. Engr. | (6) Cog. Mgr. Date |
| 1 | (7) Complete Replacement | | |
| 2 RS | Complete Replacement per ECN 658042 | JA Blanco JA Blanco | KA. Wit 2/10/2000 KA Willers |
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Document Title: **SOLID WASTE INFORMATION AND TRACKING SYSTEM CLIENT-SERVER CONVERSION PROJECT MANAGEMENT PLAN, Revision 2**

Prepared by:

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Lockheed Martin Services, Inc.
Date: 1 FEB 2000

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Date: 2/1/2000

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Date: 2/10/00

L. E. (Butch) Williams
Production Systems Support
Lockheed Martin Services, Inc.
Date: 2/2/2000

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# 1. INTRODUCTION

## 1.1 Purpose

This Project Management Plan is the planning document governing the proposed conversion of the Solid Waste Information and Tracking System (SWITS) to a client-server architecture. This plan presents the content specified by American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE) standards for software development, with additional information categories necessary to describe the conversion of SWITS. This plan will be reviewed on a periodic basis and revised when necessary to reflect changes in baseline design concepts and schedules.

## 1.2 Scope

This Project Management Plan describes the background, planning and management of the SWITS conversion to a client-server architecture. It does not constitute a statement of product requirements. Requirements and specification documentation needed for the SWITS conversion will be defined in subsequent sections.

The planned conversion of SWITS represents a redevelopment of application software from host-based to client-server. Included in the redevelopment will be a change to the user interface of SWITS. A graphical user interface (GUI) will replace the current character mode front end. The target development tools, Oracle Developer[1] Revision 6 and Designer[2] Revision 6, will also require an upgrade to the SWITS database management system (DBMS).

Conversion to a GUI client-server architecture will influence all aspects of the SWITS application and project. The change in user interface will significantly alter the SWITS

[1] Trademark of Oracle Corporation
[2] Trademark of Oracle Corporation

menu structure, system navigation, screen formats and operation. Hardware requirements for a SWITS user will increase. Project procedures and practices will be affected. Documents for operations and maintenance, testing, configuration management and control, software quality assurance, and user training will need to be written or revised.

## 1.3 Overview

The mission of the Waste Management (WM) program is to characterize, treat, minimize, segregate, package, store, and dispose of radioactive, hazardous, and mixed solid waste in a safe, cost-effective, and environmentally acceptable manner, in accordance with applicable regulations. The Solid Waste Information and Tracking System (SWITS) was developed to support the Waste Management program at the Hanford site. SWITS was implemented in October 1991, replacing three solid waste tracking systems existing then. By combining the separate systems and fulfilling increased tracking requirements and new tracking methods, SWITS satisfied the requirements of "cradle to grave" real-time tracking of regulated solid waste. SWITS currently supports Hanford site-wide, multi-contractor waste generators and other Department of Energy sites. It provides on-line access and reporting capabilities for on-site generators, Solid Waste Services, Solid Waste Operations, and Warehouse, Transportation and Packaging groups.

Since the implementation of SWITS, the Waste Management program and the Hanford Site have undergone significant changes, while improvements in computing technology have displaced the technology with which SWITS was developed. The SWITS Client-Server Conversion project will address the challenges facing the SWITS application today:

- discontinued support of current development tools by Oracle[3]. Forms 3.0 was unsupported as of 31 Dec 1996. Database version 7.3, used for migrating, will be unsupported as of 31 Dec 2000.
- incompatibility between new releases of Oracle database management systems and current development tools.
- an outdated, character mode front end.
- modifications and enhancements to key processing modules (i.e., U101 screen) have outgrown the SWITS software design.
- the management and maintenance of SWITS, and the cost of both, in its current architecture will continue to be challenged by new waste tracking methods and requirements.

The SWITS Client-Server Conversion will incorporate current, established technologies and transform the SWITS application into a viable, cost-effective information management system for the future:

- client-server architecture.
- a common desktop user interface.
- application partitioning.

[3] Registered trademark of Oracle Corporation

- data integrity, business rules and application logic enforced with database triggers and stored procedures.
- Internet/Intranet capable development environment.

## 1.4 Deliverables

### 1.4.1 Documentation

All custom software documentation will adhere to Fluor Hanford (FH) policies and applicable ANSI/IEEE software engineering standards. All documents will be reviewed, approved and distributed in accordance with HNF-PRO-439, *Supporting Document Requirements*.

As required by the system development cycle the following documents, specific to the client-server conversion of SWITS, will be produced and issued as supporting documents:

- SWITS C/S Conversion System Requirements Specification (SRS)
- SWITS C/S Conversion Database Conversion Plan
- SWITS C/S Conversion Test Plan
- SWITS C/S Conversion Installation Plan
- SWITS C/S Conversion Training Plan

The following are existing SWITS documents that will be revised and issued as supporting Project Management documents (document number and current revision number listed):

- SWITS Configuration Management Plan - WHC-SD-WM-SWD-007 Rev. 0
- SWITS Maintenance Plan - WHC-SD-WM-PLN-040 Rev. 2
- SWITS Software Design Description - WHC-SD-WM-SWD-009 Rev. 8
- SWITS Training Handbook - Rev. 0

### 1.4.2 Client and Server Application Software

The client application software primarily controls the user interface and formulates requests for data from the server. The server application software along with the DBMS is responsible for administering data integrity and business rules. Application logic and algorithms are also coded in the server application software. Splitting the workload between the desktop client and application server in this manner provides several benefits:

- streamlines the user interface
- business and application rules are administered centrally:
  - eliminates replication of proprietary business logic
  - strengthens data quality and integrity processes
  - improves data planning
- reduces network traffic between the client and the server

An estimated 150 reports and 100 screens and menus will need to be converted to client application software. Many of the reports and screens represent a one-to-one conversion from the current Forms 3.0[4] and ReportWriter 1.1[5] tools. However, there was extensive business process redefinition during the requirements phase that will result in a larger change than predicted at the start of the project.

The decision to implement in standard Oracle Forms and Reports was made at the start of the design phase; the system will not be implemented using a Web interface. The implementation will be as a client-server, not an n-tier, application.

Recommended hardware for software development is a Pentium[6] with 128 MB of memory.

All components of the hardware and software platform will be certified as Year 2000 compliant by the vendors.

The system will need to support over 100 user accounts. The current SWITS has about 600 MB of disk space allocated. Of this, 300 MB is for data and 300 MB for the database indexes. The next version of SWITS is expected to require about the same amount of disk space for the database.

### 1.4.3 Server Hardware and Operating System Software

The redevelopment of SWITS from host-based to client-server will be done on new, site-standard HP computers running the HP-UX operating system. These computers will be shared with other projects (LEMIS and ACES) to divide the costs. During development the current Sun computers will need to remain in operation with different versions of the Oracle database software. Server hardware and operating system support will be provided by L. E. (Butch) Williams, Production Systems Support.

### 1.4.4 Database Management System (DBMS)

An upgrade of the DBMS is required for the client-server development tools. SWITS is currently using Oracle version 7.0.16 which is no longer supported by Oracle. New system development will be in Oracle version 8. Since Oracle Corporation periodically withdraws support for older versions of its software, long-term support will be best assured by the implementation of the latest version of the Oracle DBMS approved for use at Hanford.

[4] Trademark of Oracle Corporation
[5] Trademark of Oracle Corporation
[6] Trademark of Intel Corporation

Oracle provides tools to migrate data from one version of the database to the next. During development the SWITS project will require versions of databases in Oracle 7.0.16, 7.3.3, and 8.0.x to hold static data. Additional databases will be required for development, testing, and final deployment.

DBMS support for the existing and converted SWITS will be provided by L. E. (Butch) Williams, Production Systems Support.

## 1.5 Definitions & Acronyms

- Application Partitioning -- Separating an application into components that run on clients and server(s) in a client/server environment.
- CASE – Computer Aided Software Engineering.
- CCB -- Change Control Board.
- Centralized Processing -- Processing performed in one or more computers in a single location. All terminals in the organization are connected to the central computers. Contrast with distributed computing and decentralized processing.
- Character mode -- A method of display in which information is displayed in plain text, although sometimes with enhancements such as simple line drawing to simulate windows. SWITS is currently a character mode software application.
- Client -- Clients are devices and software that request information. Clients are objects that use the resources of another object. A client is another name for a PC on a local area network. It used to be called a workstation. Now it is the "client" of the server.
- Client/server architecture -- A network and application design that divides processing between clients and servers. In the database world, the client formulates a request for data. The server determines how to retrieve the data most efficiently, performs the retrieval, and the passes it back to the client.
- Concurrent – A software license that allows any number of people to have software but limits the number that may be using it at one time. Contrast with "Named."
- DBMS -- see Database Management System.

- Database engine -- The part of a database management system that actually performs the storage and retrieval of data. In a client/server system, the database engine runs on the database server and responds to a client-based front end. Database engines also support host-based systems.

- Database Management System -- Software that controls the organization, storage, retrieval, security and integrity of data in a database. It accepts requests from the application and instructs the operating system to transfer the appropriate data. Currently SWITS uses Oracle Version 7.0 for its DBMS.

- Database Server -- A computer in a LAN dedicated to database storage and retrieval. The database server is a key component in a client/server environment. It holds the database management system (DBMS) and the databases. Upon requests from the client machines, it searches the database for selected records and passes them back over the network.

- Database Trigger -- An SQL procedure executed when a record is added, deleted or modified. It is used to maintain referential integrity and business rules in the database. A trigger may also execute a stored procedure. Triggers and stored procedures are built into DBMSs used in client/server environments.

- Distributed Computing -- The use of multiple computers in an organization or application rather than one centralized system. Distributed computing implies that they are networked together, not just decentralized systems without any communications between them. In addition, client/server applications continue to disburse more computers throughout the enterprise. See client/server.

- Distributed Processing -- see Distributed Computing.

- FH -- Fluor Hanford, a Fluor Global Services Company.

- Front end -- Software that provides a user interface to a "back end" such as a database management system. Front ends usually support data entry forms, menus, reporting, and ad hoc query usage.

- Graphical User Interface (GUI) -- Software that uses the graphical capabilities of computers to display information. Besides text, GUIs use graphical objects such as pointing devices together with on-screen pointers, scrolling resizable windows, graphics images, and many other items to provide information to the user. Microsoft Windows[7] and Apple Mac[8] O/S are examples of software that are GUIs themselves and also allow GUI applications to run.

- GUI -- see Graphical User Interface.

- Host-based -- A software application that runs entirely on one machine, usually a remote computer that is being accessed with a dumb terminal or a workstation acting as such. SWITS is currently a host-based application accessed by users who run terminal emulation software on their PCs.

- IEEE -- Institute of Electrical and Electronic Engineers. A standards setting body for software engineering.

- IRM -- Information Resource Management

- LMSI -- Lockheed Martin Services, Inc. PHMC IRM preferred provider with right of first refusal.

- N-Tier Architecture - an extension of the client-server concept to multiple levels. A client talks to an application server that decides which of several back-end computers and systems can best handle the client's request.

- Named – A software license that assigns a copy of the software to a single individual. Contrast with "Concurrent."

- OSSP -- Organization Standard Software Practices. The standard software practices for the SD&I organization.

- PHMC -- Project Hanford Management Contract.

- RACI Matrix – A matrix of the functions required for a project and the organizations that will be involved in the performance of the functions. The title is an acronym for Responsible, Approve, Consult, and Inform, which are the duties defined in the matrix.

[7] Trademark of Microsoft Corporation
[8] Trademark of Apple Corporation

- SDD -- Software design description. A document containing the detailed design of an information system.

- SD&I – Software Development and Integration. A department within LMSI charged with software development and integration.

- SPMP -- System Project Management Plan. The controlling document for managing a software project.

- Stored Procedure -- In a database management system (DBMS), it is an SQL program stored in the database. The program is executed by calling it directly from the client or from a database trigger. Triggers and stored procedures are built into DBMSs used in client/server environments.

- SWITS -- Solid Waste Information and Tracking System. The primary information system for tracking solid waste on the Hanford site.

- Web Interface -- an implementation that uses a standard Web browser (like Internet Explorer) to access and update data in a database.

- WMP -- Waste Management Program

- WRAP -- Waste Receiving and Packaging. A facility in the Hanford 200 West Area that will receive, analyze, process, and repackage solid waste.

- WRAP DMS -- WRAP Data Management System. An information system used to track solid waste within the WRAP facility. Like SWITS, it is Oracle-based, and an on-line interface exists between them.

# 2. PROJECT ORGANIZATION

## 2.1 Process Model

A tailored version of the software life cycle model presented in the IEEE Software Engineering Standards will be followed on this project. Since this is an upgrade to an existing system, certain steps in the life cycle will be omitted; the use of a CASE tool has merged some steps. Those steps that are applicable, and will be followed in the SWITS Client-Server Conversion, are described below:

- Requirements Phase - The *redevelopment* is planned and the requirements for a system product, such as the functional and performance capabilities, are defined and documented in the Oracle CASE tool.

- Design Phase - The designs for architecture, components, interfaces, and data structures are created, documented, and verified to satisfy requirements. Forms and reports that can be created in the CASE tools are created and unit tested.

- Implementation Phase - The integrated product is created, debugged and prepared for formal testing. Using a CASE tool many of the tasks during this phase will overlap the Design Phase.

- Acceptance Phase - The product is evaluated to determine if requirements have been satisfied. If it passes the evaluation then the customer can accept the software.

- Installation Phase - The product is integrated into an operational environment and tested to ensure that it performs as required. If the product passes this test then the customer accepts the system.

## 2.2 Organizational Structure, Boundaries and Interfaces

The existing organizational structure of the SWITS project will be maintained. Fluor Hanford (FH) has responsibility for the overall SWITS operations and maintenance. SWITS software maintenance and development are provided by the Systems Development & Integration (SD&I) organization of Lockheed Martin Services, Inc. (LMSI).

The SWITS Change Control Board (CCB) is responsible for all planning, oversight and implementation activities for SWITS. The SWITS CCB membership, defined in *SWITS Change Control Board Charter*, HNF-IP-1259, represents all parties with an interest in SWITS. This project will also view the SWITS CCB as the focal point for all SWITS change activities. The periodic CCB meetings will be the primary forums for reporting project status. Additionally, the CCB will balance the urgency and importance of change

requests for the current application with the conversion project activities, taking into account available resources.

The SWITS Client-Server Conversion will coordinate with the Waste Receiving and Packaging (WRAP) project. Changes to the SWITS database architecture may require modifications to the WRAP Data Management System (DMS) tables and SWITS/WRAP DMS interface modules. Tasks will be included in the detailed project schedule for coordination of schema changes, testing and acceptance by WRAP DMS. WRAP DMS is also represented on the SWITS CCB.

SWEA also provides some feeds to SWITS. The maintenance and operation of the SWEA system is under WMH control. The SWEA interface will be maintained in the first release of SWITS.

The RADCALC program is approved DOT radioactive content calculator. It uses values duplicated in the ISOTOPE and PKG_ISOTOPE tables to perform its calculations. There needs to be an interface between the RADCALC program and the SWITS data to allow the RADCALC program to function.

The PERSON table is updated regularly from the PeopleCore database. This feed or interface needs to continue even though the PeopleCore database is being redeveloped.

Bar code scanners are used for tracking container movements. This interface must be maintained.

The BI/QUERY software is used for *ad hoc* queries against the database. The maintenance for this software is controlled by WMH. BI/QUERY works against an extract of the database. This extract (or view) needs to be maintained in the new SWITS.

## 2.3 Responsibilities

Table 1 shows the SWITS conversion deliverables and the division of responsibility between SD&I and FH. A RACI matrix, a more detailed division of labor, is in and Table 3.

**Table 1 SWITS Client-Server Conversion Activity Responsibility Matrix**

| Activity | FH | SD&I |
|---|---|---|
| PLANNING | | |
| Project Management Plan | | X |
| Configuration Management Plan – Revision | | X |
| Database Conversion Plan | | X |
| Test Plan | X | X |
| Installation Plan | X | X |
| Maintenance Plan - Revision | | X |
| Training Plan | X | |
| REQUIREMENTS and SPECIFICATIONS | | |
| System Requirements Specifications - Revision | | X |
| Software Design Description - Revision | | X |
| OPERATIONS AND SUPPORT | | |
| Training Handbook - Revision | X | |
| CONSTRUCTION and IMPLEMENTATION | | |
| Software Development | | X |
| Prepare Test Procedures | X | X |
| Unit Test | | X |
| System Testing | X | X |
| Customer Acceptance | X | X |
| Production Installation | X | X |
| Operational Testing | X | |

## Table 2 SWITS RACI Matrix Part 1

Organizations and managers to right / Tasks down

| | Business Management - Richard A. Olsen | Production Systems Support - L. E. (Butch) Williams | Configuration Management / Quality Assurance - Bill Jones | End-user Computing Support - Rich Huske | Engineering & Technology - Dale McElroy | Generator Services - Darlene Hagel | Human Resources & Administration - Janet Haase | LMSI Facilities - Ted Holmes (Bob Stubblefield) | PRRB - Bill Jones |
|---|---|---|---|---|---|---|---|---|---|
| Administer User Accounts on SWITS | | C | | | | A | | | |
| Barcode support | | | | C | | A | | | |
| Contract Management | R | | | | | I | | | |
| Contract Technical Response Preparation | I | | | | | | | | |
| Design Review for Application Changes | | C | | | | I | | | |
| Design review for DB Changes | | C | | | | I | | | |
| Developer Training | | | | | | AI | | | |
| Document Release | | | | | | | | | |
| Interface management to other computer systems | | C | | | | C | | | |
| Inter-group coordinator | | | | | | | | | |
| Network Management | | I | | | R | | | | |
| Office space | | | | | | | | R | |
| Oracle CASE Tools Maintenance | | R | | | | | | | |
| Oracle CASE Tools Upgrades | | R | | | | | | | |
| Oracle Database Administration | | R | | | | | | | |
| Oracle Database Application Administration | | CI | | | | | | | |
| Oracle Software Support Administration | | R | | | | | | | |
| PC Hardware Support | | | | R | | | | | |
| PC Operating System Support | | | | RC | | | | | |
| Requirements Management | | | | | | AC | | | |
| Software Configuration Management (SCM) | | | C | | | I | | | |
| Software Distribution | | | | | R | | | | |
| Software Procurement (Misc products) | | | | | | CI | | | |
| Software Quality Assurance (SQA) | | | I | | | | | | |
| Staffing | | | | | | I | R | | |
| SWITS Application Backup | | R | | | | I | | | |
| SWITS Application Maintenance | | I | | | | I | | | |
| SWITS Application Upgrades | | CI | C | | | A | | | A |
| SWITS Server hardware support | | R | | | | I | | | |
| SWITS Testing - Acceptance | | CI | C | | | AC | | | A |
| SWITS Testing - Integration | | CI | C | | | I | | | |
| UNIX Hardware Support | | R | | | | I | | | |
| UNIX Operating System Maintenance | | R | | | | | | | |
| UNIX Operating System Upgrades | | R | | | | I | | | |

**Table 3 SWITS RACI Matrix Part 2**

| Organizations and managers to right / Tasks down | Records & Information Management - Tom Anderson | SCR Originator | SWITS Change Control Board | SWITS Developers | SWITS Program Manager - Kyle Willers | SWITS Project Lead - Joe Glasscock | WRAP Engineering - Cary Blackburn |
|---|---|---|---|---|---|---|---|
| Administer User Accounts on SWITS | | | | R | | | |
| Barcode support | | | | R | | I | |
| Contract Management | | | | C | C | C | |
| Contract Technical Response Preparation | | | | C | CI | R | |
| Design Review for Application Changes | | | I | C | | R | CI |
| Design review for DB Changes | | | I | C | | R | CI |
| Developer Training | | | | CI | RA | CI | |
| Document Release | R | | | I | A | CA | |
| Interface management to other computer systems | | | | R | | C | C |
| Inter-group coordinator | | | | C | | R | |
| Network Management | | | | I | | | |
| Office space | | | | CI | | CI | |
| Oracle CASE Tools Maintenance | | | | I | | I | |
| Oracle CASE Tools Upgrades | | | | AI | | I | |
| Oracle Database Administration | | | | I | | | |
| Oracle Database Application Administration | | | | R | | | |
| Oracle Software Support Administration | | | | CI | | I | |
| PC Hardware Support | | | | I | | I | |
| PC Operating System Support | | | | | | | |
| Requirements Management | | | A | CI | | R | CI |
| Software Distribution | | | I | C | | R | |
| Software Procurement (Misc products) | | | | AC | | I | |
| Software Quality Assurance (SQA) | | | | C | A | R | |
| Staffing | | | | R | | C | |
| SWITS Application Backup | | | | C | AC | AC | |
| SWITS Application Maintenance | | | | CA | | I | |
| SWITS Application Upgrades | | | | R | | I | I |
| SWITS Server hardware support | | | I | R | | I | I |
| SWITS Testing - Acceptance | | | | C | | I | |
| SWITS Testing - Integration | | A | I | R | | I | |
| UNIX Hardware Support | I | I | A | RI | | I | I |
| UNIX Operating System Maintenance | | | I | AI | | I | I |
| UNIX Operating System Upgrades | | | | AI | | I | |

# 3. MANAGERIAL PROCESS

## 3.1 Management Objectives and Priorities

The primary project management goal is to deliver a high quality enhancement to SWITS within budget and schedule constraints. The project will adhere to IEEE standards and requirements defined in ANSI/IEEE Software Engineering Standards. Priorities for converting SWITS, listed in order, include:

- Meet all customer requirements as defined in the SWITS C/S SRS
- Follow established software development standards that ensure quality software that adheres to the LMSI SD&I Software Quality Assurance policy (draft)
- Complete the project on schedule
- Complete the project within budget
- Minimize costs

## 3.2 Assumptions, Dependencies, and Constraints

Ongoing support from Waste Management Services/Fluor Hanford personnel is assumed for all phases of SWITS redevelopment. The requirements, design and acceptance phases will rely heavily on user participation from several functional areas including Solid Waste Services, Solid Waste Operations and generators.

Ongoing support from the Production Systems Management and Support group is assumed as shown in the project plan and RACI Matrix. Basic support is funded from site overhead. Additional operations, like creating databases, are funded directly by the project.

A GUI application will involve considerable customer involvement in a design effort, since GUI interfaces are significantly different from those provided by character mode system. Training in GUI structures, design and standards for the developers will be necessary to design an effective front end for the SWITS client-server application. Extensive customer time has been scheduled during the design and implementation phases for reviews and testing.

Application partitioning and the design and implementation of server code objects are critical to the success of this project. Expertise must be brought to the project to address these needs.

The development tools, Oracle Designer and Developer, are complicated and will require developer training to use effectively.

Operations and maintenance support on the production system during the implementation, certification and installation phases will be reduced to a level of .6 FTE (full-time

equivalent) SD&I staffing. This will reduce the rate at which changes can be made to the existing SWITS system. At some point during development changes to the production system will be halted and no further changes to the production system can be made. This time for this cutoff will be set by the developers with concurrence from the CCB.

## 3.3 Risk Management

- Availability of software and database development staff

Every effort will made to maintain planned staffing levels with appropriate technical skills. Some of the developers are senior employees with large amounts of vacation; installation has been scheduled to work around known blocks of vacation.

- Funding

Funding levels are critical to maintaining the resources needed to complete tasks on schedule. Changes to customer funding should be communicated as soon as known to allow for necessary plan and schedule modifications.

- Schedule risk

Discussions of project status will be held at least weekly. The SWITS Change Control Board will be used as a forum for project status communication with the customer.

- User availability

User participation in most tasks will be critical, leading to the possibility of schedule modifications should user availability change. Project impacts due to this factor will be communicated during regular status meetings.

- System development environment

SWITS production operation will continue on its present server. The client-server development and production will be on two new machines now available (OBE, CUBS). The Oracle CASE tool relies heavily on an Oracle database for operation (rep8). This database must be available, stable, and supported for the developers by the Production Systems Support group.

## 3.4 Monitoring and Controlling Mechanisms

- The SWITS Change Control Board meeting will be used to communicate cost and schedule status to the customer.

- Weekly planning meetings will be used by the development staff to record progress and coordinate development activities.

- Informal communication among project staff and between developers and project management will be strongly encouraged. Informal channels between LMSI staff and users will also be used to address technical and other issues.

- Actions that are raised in review and planning sessions will be tracked to completion.

### 3.5 LMSI Staffing Plan

**Appendix C** specifies the planned SD&I staffing levels at different phases of the SWITS Client-Server Conversion project. The SD&I development team will consist of the following:

- Program Manager, .1 FTE
  Responsible for overall resource management, budget, schedule, staffing and training related to the SD&I project scope.

- Project Manager, .2 – 1.0 FTE
  Responsible for all aspects of the SWITS Client-Server Conversion design, implementation, testing and quality; directs all SWITS staff and works with Program manager to ensure that personnel are adequately trained to perform assigned functions; serves as the focal point of contact between SD&I project organization and FH personnel; and provides the reporting interface to LMSI management through the Program manager.

- Software Engineers, .2 - 4.0 FTE
  Responsible for the design, coding, documentation, configuration control, testing and quality of software and deliverables; works with the user organization and SWITS project manager to design and implement project deliverables.

## 4. TECHNICAL PROCESS

### 4.1 Methods, Tools, and Techniques

Applicable requirements set forth in HNF-PRO-241, *Engineering Specification Requirements*, and the LMSI SD&I Software Quality Assurance policy will govern the plans, documents and work activities on this project.

The planned development tools for the SWITS conversion are Oracle Designer and

Developer. Designer supports the modeling of systems with business process reengineering, analysis, and design diagrammers. Developer incorporates the necessary forms, reports and graphics tools for building the application. Both tool suites are client-server applications themselves and share a common repository of information and development methodology. Currently, Forms Version 6 and Reports Version 6 development tools are included in the Developer suite.

The database conversion will happen in several steps. Oracle provides software to migrate data from a 7.0.16 database to a 7.3.3 database, and from a 7.3.3 database to a 8.0.x database. Once the data are moved it will need to be transferred to the new table structure in SWITS. This will be performed using software developed by the SWITS development team.

## 4.2 Documentation

Documentation will be developed for the SWITS Client-Server Conversion project according to this project management plan and other governing documents. All documentation will be assembled in a consistent and controlled manner. The documents will be produced to maximize the benefits to the project design and implementation while reducing expenditure of staff resources. Section 1.4.1 lists required documentation for the client-server conversion project and existing SWITS Project Management documents that will be revised and issued as supporting documents.

Each document produced or revised in support of the SWITS Client-Server Conversion will undergo a peer review before being submitted for approval to the SWITS CCB. Design reviews of project deliverables will be conducted.

## 4.3 Configuration Control

SWITS change authority is defined in *SWITS Change Control Board Charter*, HNF-IP-1259. The SWITS CCB will continue as the responsible committee for all planning, oversight and implementation activities during and after the SWITS conversion.

Moving from a centralized host-based application to distributed client-server will necessitate a revision to the *SWITS Software Configuration Management Plan* (CMP), WHC-SD-WM-SWD-007. The revised CMP will be invoked in the development and testing environment(s) during this project and will replace the production procedures upon installation of the client-server software.

## 4.4 Acquisition

Under the current Oracle site license contract, new releases of development and DBMS software can be ordered at any time for no charge to SD&I. The contracts are maintained by Production Systems Management and Support group.

The January, 2000, site license from Oracle includes the development products as listed in Table 4. These licenses must be shared with other Oracle development projects on site. There is no limit on the number of runtime copies that may be distributed.

**Table 4 Oracle Site Licenses as of January, 2000**

| Programs | License Type | Quantity | Type of Use |
|---|---|---|---|
| Oracle Server Enterprise Edition | Full Use | 450 | Concurrent |
| Advanced Networking Option | Full Use | 12 | Concurrent |
| Designer | Full Use | 12 | Named |
| Developer | Full Use | 15 | Named |
| Programmer | Full Use | 25 | Named |
| SQL*Plus | Full Use | 30 | Named |
| Discoverer User Edition | Full Use | 10 | Named |
| Discoverer Administrator Edition | Full Use | 2 | Named |

Additional software may need to be purchased to support the conversion effort. A recent example is BarTender software (used for bar code support). These purchases will be managed by SD&I.

### 4.5 Data Management

The SWITS database structures are maintained in accordance with the data management requirements of the IEEE Software Engineering Standards. Modifications and enhancements resulting from the client-server conversion will continue to apply these standards during design and installation. Implementation will take place entirely within the latest version of the Oracle database management system.

## 5. WORK PACKAGES, SCHEDULE, AND BUDGET

### 5.1 Work Packages

**Appendix A** describes the major steps of the work breakdown structure (WBS) for the tasks to be completed on this work effort.

### 5.2 Dependencies

**Appendix B** describes the ordering of the project tasks. The major dependencies of the project are:

- User training, largely conducted by the customer
- Fluor Hanford support including preparation of planning, testing, and certification documents
- readiness of WRAP DMS to accommodate the new SWITS architecture
- limited modifications and enhancements to the production system during the

implementation, certification and installation phases.

## 5.3 Resource Requirements

**Appendix C** details the estimated resource requirements and proposed staffing plans for each major task in the WBS. All 1998 fiscal year cost estimates for the SD&I labor and training were included in the SWITS operations and maintenance task order. For FY 1999 and 2000 the Client/Server costs are broken out into a different task order. The assumption is that the Client/Server conversion will continue to be funded separately from SWITS maintenance. Table 5 lists the estimated hours for operations & maintenance activities and the client-server project by fiscal year.

**Table 5 Estimated Hours by Fiscal Year**

| | SD&I Labor Hours | |
|---|---|---|
| FY | Client-Server Conversion | Operations & Maintenance |
| 1998 | Actual 787 | Actual 4126 |
| 1999 | Actual 6578 | Actual 786 |
| 2000 | 4085 | 3859 |
| Totals | 10663 | 4645 |

The cost estimate and staffing plans do not include;

- Fluor Hanford general and administrative (G&A) overhead
- Fluor Hanford labor
- Hardware lease and maintenance costs (see sections 1.4.3 and 1.4.4 )

## 5.4 Schedule

Appendix B contains the project schedule.

## 6. SOFTWARE QUALITY ASSURANCE

The LMSI SD&I Software Quality Assurance policy and procedures will be followed during the SWITS Client-Server Conversion. The LMSI "Process SQA" methodology is defined in section 5.5 of the **LMSI SD&I Organization Standard Software Practices (OSSP)**. Process SQA shifts the focus of software quality assurance from the products (deliverables) to the processes (whats & hows). It is a Continuous Quality Improvement initiative aimed at improving both the software products and processes supporting them.

The support required from the SQA organization has been scheduled into the project plan. Tasks have been outlined in the RACI Matrix.

## 7. REFERENCES

Software Engineering Standards, American National Standards Institute for Electrical and Electronics Engineers, 1993 Edition
SWITS Change Control Board Charter, HNF-IP-1259
SWITS Configuration Management Plan, WHC-SD-WM-SWD-007
SWITS Maintenance Plan, WHC-SD-WM-PLN-040
SWITS Software Design Description, WHC-SD-WM-SWD-009, Rev. 8
SWITS Software Requirements Specification, WHC-SD-WM-SD-003, Rev. 1
SWITS System Project Management Plan, WHC-SD-WM-SWD-005, Rev. 1
Computer Desktop Encyclopedia, The Computer Language Co. Inc.
DBMS, "Trigger Happy: A look at the many implementations of database triggers", May 1996, Volume 9, Page 89
Database Programming & Design, "The Procedural DBA", December 1995, Volume 8, Page 40

APPENDIX A

## SWITS CLIENT-SERVER CONVERSION WORK BREAKDOWN STRUCTURE

This is a high-level structure showing the general flow of work. The details are in the project plan in Appendix B.

### 1.0 REQUIREMENTS PHASE

1.1 Project Planning
- 1.1.1 RACI Matrix Created
- 1.1.2 Project Schedule Created/Loaded
- 1.1.3 Issue Revised SWITS C/S Project Management Plan

1.2 Requirements Definition and Analysis
- 1.2.1 Model Current Functional Requirements
- 1.2.2 Model New Functional Requirements
- 1.2.3 Prepare SWITS C/S SRS
- 1.2.4 Issue Completed SRS

1.3 Revise Project Management Plan
- 1.3.1 Developer Review of Schedule
- 1.3.2 Release Revised SWITS C/S PMP

### 2.0 DESIGN PHASE

2.1 Database Design
- 2.1.1 Convert ERD to Database Design
- 2.1.2 Database Design Review

2.2 Detail Design Forms/Reports
- 2.1.1 Create Detail Design
- 2.1.2 Code Forms/Reports
- 2.1.3 Customer Review
- 2.1.4 Unit Testing

2.3 SDD Write/Release
- 2.3.1 Complete Requirements Traceability Matrix
- 2.3.2 Revise SWITS SDD
- 2.3.3 Review SWITS SDD
- 2.3.4 Release SWITS SDD (Rev. 9)

2.4 Data Conversion Planning
- 2.4.1 BI/Query Conversion Planning
- 2.4.2 SWITS Data Conversion Plan Development

2.4.3 Issue Completed Data Conversion Plan

2.5 Test Planning
- 2.4.1 Prepare SWITS C/S Conversion Test Plan
- 2.4.2 Issue Completed Test Plan

**3.0 IMPLEMENTATION PHASE**

3.1 Development Environment Setup and Configuration

3.2 Configuration Management
- 3.2.1 Revise SWITS Configuration Management Plan
- 3.2.2 Issue Revised Configuration Management Plan (Rev 1)

3.3 Database Conversion Construction and Testing
- 3.3.1 Conversion Construction
- 3.3.2 Conversion Testing

**4.0 ACCEPTANCE TEST PHASE**

4.1 Data Conversion Testing
- 4.1.1 Prepare Data Certification Procedures
- 4.1.2 Data Conversion Test Execution
- 4.1.3 Data Certification

4.2 System Testing
- 4.2.1 Prepare System Testing Certification Procedures
- 4.2.2 System Test Execution (beta-test)
- 4.2.3 Acceptance Test Execution
- 4.2.3 System Customer Accepts System ATP

**5.0 INSTALLATION PHASE**

5.1 User Training
- 5.1.1 Revise SWITS Training Handbook
- 5.1.2 Issue Revised Training Handbook (Rev 1)
- 5.1.3 Prepare SWITS C/S Conversion Training Plan
- 5.1.4 Issue Completed Training Plan
- 5.1.5 Conduct User Training

5.2 Operating and Maintenance Procedures
- 5.2.1 Revise SWITS Maintenance Plan
- 5.2.2 Issue Revised Maintenance Plan (Rev 3)
- 5.2.3 Production Server Recovery Plan in Place
- 5.2.4 Prepare Operational Test Procedure

5.2.5 Issue Operational Test Procedure
5.2.6 Prepare Software Installation Procedure

5.3 Production Installation
5.3.1 Prepare SWITS C/S Conversion Installation Plan
5.3.2 Issue Completed Installation Plan
5.3.3 Install Software
5.3.4 Customer Runs OTP

5.4 Customer Acceptance

**6.0 PROJECT MANAGEMENT & TRAINING**
6.1 Project Management
6.2 Developer Training

## APPENDIX B
## SWITS PROJECT PLAN SUMMARY

| Task Name | Start | Finish |
|---|---|---|
| Requirements Phase | 9/1/98 | 1/25/00 |
| Requirements Definition and Analysis | 9/1/98 | 1/25/00 |
| Model New Functional Requirements | | 1/7/00 |
| SRS to Customer for Review | | 1/25/00 |
| Revise Project Management Plan | | 1/25/00 |
| Design Phase | 8/2/99 | |
| SWITS Database Conversion Planning | 10/4/99 | 2/8/00 |
| Database Design | 12/13/99 | 1/26/00 |
| Database Created | | 1/26/00 |
| Data Clean-up Issues | 1/7/00 | 2/11/00 |
| Detail Design Forms/Reports | 11/8/99 | 4/16/00 |
| Form Look and Feel | | 1/26/00 |
| External Interfaces Complete | | 4/3/00 |
| SDD to Customer for Review | | 5/1/00 |
| ATP to Customer for Review | | 5/8/00 |
| Test Phase | 5/8/00 | 6/5/00 |
| Data Conversion | 5/20/00 | 5/22/00 |
| ATP Execution | 5/22/00 | 6/5/00 |
| Installation | 6/6/00 | 6/22/00 |
| New System Installed | | 6/8/00 |
| Customer runs OTP | 6/8/00 | 6/9/00 |
| Maintenance Plan to Customer for Review | | 6/22/00 |
| | | |

# APPENDIX C
# SWITS CLIENT-SERVER CONVERSION ESTIMATED HOURS AND STAFFING PLAN

| Fiscal Quarter | WBS Task | Staff FTE |
|---|---|---|
| 1 Q 00 | 1.2 Requirements Definition and Analysis | 2.0 |
| | 1.3 Revise Project Management Plan | .2 |
| | 2.1 Database Design | .2 |
| | 2.2 Detail Design Forms/Reports | 1.1 |
| | 2.4 Data Conversion Planning | .1 |
| | 3.1 Development Environment Setup and Configuration | .3 |
| | 6.1 Project Management | .1 |
| 2 Q 99 | 2.2 Detail Design Forms/Reports | 3.3 |
| | 2.4 Data Conversion Planning | .7 |
| | 2.5 Test Planning | 1.5 |
| | 3.2 Configuration Management | .3 |
| | 3.3 Database Conversion Construction and Testing | .3 |
| | 6.1 Project Management | .1 |
| 3 Q 00 | 2.3 SDD Write/Release | .5 |
| | 2.5 Test Planning | .2 |
| | 3.2 Configuration Management | .1 |
| | 4.1 Data Conversion Testing | .4 |
| | 4.2 System Testing | .5 |
| | 5.1 User Training | .7 |
| | 5.2 Operating and Maintenance Procedures | .7 |
| | 5.3 Production Installation | .5 |
| | 5.4 Customer Acceptance | .1 |
| | 6.1 Project Management | .1 |

# APPENDIX D
# JUSTIFICATION FOR SWITS CLIENT-SERVER CONVERSION

## D.1 OBJECTIVES OF CONVERSION

- Reliability of service

Because of the designation of SWITS as a PHMC mission essential system, its importance for scheduled regulatory reporting, and the dependence on it for daily operations, reliability is considered a prime objective for SWITS. The conversion to a client-server version addresses this objective by distributing processing workload, enabling the use of current, more reliable hardware and software environments, and by ensuring the availability of ongoing vendor support for upgrades, maintenance releases, and technical assistance.

- Avoid technological obsolescence

The hardware and software technology used by SWITS should be modern enough to be supported by vendors and a workforce with current skills. Software stability, compatibility with available high-performance hardware, and the ability to share data with other systems are all strong reasons to move SWITS into more current technology.

- Meet user community needs and expectations

Users expect information systems to assist them in solving business problems or fulfilling business needs. They have come to expect a high standard of usability and strongly prefer all systems they use to operate in a consistent manner. The graphical user interface development tools associated with client-server systems can be used to make SWITS work in ways that are more consistent with other systems.

- Minimize cost of software maintenance

Changes to the system should be easy to do and consume as little programmer time as possible. The design of the information system and the environment that supports it are key factors in meeting this objective. Revising the software architecture of SWITS to conform to client-server methodology will improve its maintainability.

## D.2 RISKS OF NOT CONVERTING

- Recovery from hardware failure

Rapid recovery from the failure of hardware components of a system depends on factors such as vendor support, availability of replacement parts, the extent to which hardware design addresses repairability and other considerations. The rate of advance in hardware technology has made vendors reluctant to support older systems indefinitely because of inventory and staffing costs. SWITS hardware is currently maintainable because vendor support for it has not yet been withdrawn. Replacement parts are available for now and limited upgrades can still be done. The vendor considers the equipment to be outdated, however, so it is uncertain how long they will be willing to provide support.

If a serious hardware failure occurred today that necessitated a complete system replacement, Hanford's equipment nationalization pool contains equipment that could be put to use. This available hardware tends to be older units of lower capacity, however. At best, such a replacement would take several days to set up and would only support a limited number of users.

The most significant risk to SWITS is therefore a major failure occurring after vendor support has been withdrawn and when there is no spare hardware onsite. Further risk is incurred because the type of hardware available at the time of failure may no longer support the operating system and database software versions needed for compatibility with the SWITS application as it now exists. These risks would be minimized by the use of newer hardware and the redevelopment of SWITS using software that is likely to remain supported for some time by software and hardware vendors.

- Recovery from software failure

Most software failures on mature systems are associated with minor application software defects. These are usually problems of limited scope rather than system-wide failures, and are repaired quickly by available technical support staff. A more significant risk to SWITS concerns the discovery of hidden problems in vendor-supplied software components for which the vendor no longer takes responsibility. In such a case, there is no known third party organization to resort to for the type of support that would be needed. Although the probability of such an event is small because of the maturity of the software environment used by SWITS, the impact of such an event could be severe.

Currently, Oracle Corporation no longer supports the application software environment used by SWITS, although the underlying database management software is still supported. Oracle recently began shipping a major new upgrade to its database software, however. Such major releases by Oracle have traditionally been followed at some point with a discontinuation of support for older versions.

- System capacity and performance issues

Most SWITS users consider the system's current performance to be barely acceptable. Meanwhile, new users continue to be added at the rate of a few each week. Access to SWITS is now available from networks operated by Washington Department of Ecology, Bechtel Hanford and PNNL. Because site computer security measures have been changed and new connectivity technology has been implemented, it is now possible for more users to connect to SWITS from offsite. Therefore, overall system load is expected to increase as time goes by.

Options to address this problem include exploiting the limited upgradeability of the current hardware, replacing the hardware entirely, and implementing a client-server architecture in which some of the processing load is shifted to client workstations. For now, an upgrade of the existing system could be undertaken without changing software, but hardware support staff do not predict great benefit from this measure. Hardware upgrades or replacements will not be available indefinitely that can support the older software used to operate SWITS. The time period during which SWITS hardware can be upgraded or replaced without disabling the software is predicted to be about one to three years. The strategy that minimizes the risk of capacity and performance problems is to replace the existing SWITS hardware with new technology equipment and develop a client-server version SWITS to run on the new machine

- Dissatisfaction with the user interface

User dissatisfaction with SWITS has existed since its inception. Although the dissatisfaction is partly attributable to the complexities of a system designed to address a broad set of business processes, discontent has increased over time because of the users' awareness of better interface technology in other systems. The risks associated with this factor include diminished productivity, lack of acceptance by new users, and disenchantment by existing users with the usability shortcomings of SWITS.

- Availability of technically qualified support staff

Many older applications, often referred to as legacy systems, become increasingly difficult to support as knowledgeable technical staff retire, change jobs, or upgrade their skills and move to newer systems. SWITS may be vulnerable to this problem at some time in the future. Maintaining SWITS in relatively current technology should make staffing issues easier to manage.

- Ability to meet new requirements

Certain proposed features for SWITS could not be addressed due to limitations posed by

the older generation software development tools used with SWITS. Examples of these features include complex reports requiring the integration of text and graphics with SWITS data, dynamic connections to a Geographic Information Systems (GIS), and Internet access to SWITS screens or data. Client-server software using a graphical user interface and better communication with other systems will be able to provide features well beyond the capabilities of the present software environment.