CENTER CONFIGURATION

89001137

AUG 17 1990

NOTE FOR: Shirley Fortuna
CNWRA Deputy Program Manager
Program Management, Policy Devevelopment
and Analysis of Staff, NMSS

FROM: Philip Altomare
WSE&I Program Element Manager
Engineering Branch
Division of High-Level Waste Management, NMSS

SUBJECT: CENTER CONFIGURATION MANAGEMENT AND CONTROL MANUAL

A copy of the subject manual is attached. Although this is a CNWRA control document, their ADP system directly affects NRC. Accordingly, I would appreciate any comments that you may have by September 1, 1990, that would be useful for the Center in controlling the ADP.

/S/

Philip Altomare
WSE&I, Program Element Manager
Engineering Branch
Division of High-Level Waste Management, NMSS

Enclosure: As stated

DISTRIBUTION

D. Brooks, HLGP	R. Neel, HLGP	J. Pohle, HLGP
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S. Fortuna, PMDA	P. Brooks, HLGP	K. Hooks, HLPD
W. Brown, PMDA	S. Mearse, CAB	J. Lambert, RES
L. Abramson, RES	Central Files	Branch r/f
NMSS r/f	J. Bunting, HLEN	R. Ballard, HLGP
J. Linehan, HLPD	R. Browning, HLWM	B. Youngblood, HLWM

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NAME	:PAltomare/wd	:JLinehan	:	:	:		
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WM-11
NH19 1/1

9001137

CENTER CONFIGURATION

AUG 17 1990

NOTE FOR: Donald L. Chery, Jr.
Senior Hydrologist
Hydrologic Transport Section
Division of High-Level Waste Management, NMSS

FROM: Philip Altomare
WSE&I Program Element Manager
Engineering Branch
Division of High-Level Waste Management, NMSS

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NAME	:PAltomare/wd	:JLinehan	:	:	:		
DATE	:08/15/90	:08/17/90	:	:	:		

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NOTE TO HOOKS

AUG 17 1990

NOTE FOR: Kenneth R. Hooks
Section Leader
Quality Assurance Section
Division of High-Level Waste Management, NMSS

FROM: Philip Altomare
WSE&I Program Element Manager
Engineering Branch
Division of High-Level Waste Management, NMSS

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J. Linehan, HLRD	R. Browning, HLWM	B. Youngblood, HLWM

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NAME	:PAltomare/wd	:JLinehan	:	:	:		
DATE	:08/16/90	:08/17/90	:	:	:		

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CENTER CONFIGURATION MANAGEMENT AND CONTROL MANUAL

Prepared for

Nuclear Regulatory Commission
Contract NRC-02-88-005

Prepared by

R. Johnson
P. Breaux
Center for Nuclear Waste Regulatory Analyses
San Antonio, Texas

Revision 0

July 1990

Reviewed by:

Budhi Sagar

Approved by:

Allen R. Whiting, Director
Waste Systems Engineering & Integration

Wesley C. Patrick
Technical Director

Bruce Mabrito, Director
Quality Assurance

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BACKGROUND

This manual is provided to cover the four categories of CNWRA computer systems described herein to assure that configuration management and control procedures are followed in their development and operation. It is envisioned that in the future, the policy portions of this manual will be incorporated in the Center QA Manual, Section 3.6, Software Quality Assurance, contractually related matters will be incorporated in the ADP Plan, and the specific guidelines for each category of CNWRA computer systems under Configuration Management and Control will be issued as procedures.

This document outlines the principles, procedures, approach, activities, and anticipated results of implementing this suggested Configuration Management and Control Manual for CNWRA Computer Systems.

1. SCIENTIFIC, ENGINEERING, AND MATHEMATICAL MODELS AND CODES

The technical assistance and research activities of the Center, in support of the High-Level Waste Management Program at the NRC requires technical computing support. Scientific, Engineering, and Mathematical models and codes are being transferred to the Center from NRC contractors for ongoing development and operations. Additional models and codes are being developed at the Center. Codes and database that will be used to support license review will be included in configuration management and control for validation and verification of the codes and results from computer processing.

2. INFORMATION MANAGEMENT SYSTEMS (IMS)

The IMS staff in the Center is developing the Program Architecture Support System which includes Systematic Regulatory Analysis, Project Management, Document Control, and Office Automation Applications. This system is being developed in phases and data is being loaded and verified as work evolves on the High Level Waste (HLW) Program to ensure regulatory requirements are met through the resolution of uncertainties in the technical review and hearings planned for DOE's license submittal to construct and operate the HLW repository.

3. CNWRA PERSONAL COMPUTERS, PERIPHERALS, AND SOFTWARE

The workstations in the Center that are used for office automation, technical computing and access of mainframe computer systems have been controlled contractually to meet NRC standards. This has been accomplished by publishing a list of current types of items in use and review and approval both technically and financially prior to purchase or lease of additional items.

4. SwRI IBM 4381 SOFTWARE VERSIONS

Since the electronic communications between the Center and the NRC is host-to-host using IBM PROFS on the SwRI IBM 4381 and the NRC's IBM 9370, a configuration list of the current versions of software operating on each mainframe is maintained at CNWRA. Prior to any upgrades and installation of new products the change is described and agreed upon by both the Center and NRC staff.

Configuration management will assure integrity of results in using the codes and databases that are resident on the affected computers. This work will be accomplished in a manner that is consistent with fulfilling the long-term goals of (a) staff access to these and other codes and databases and (b) implementation of a configuration management and control program to ensure the integrity of codes and databases that are intended to be used in the high-level nuclear waste regulatory process.

Procedures and attached lists of the configuration items for each of the four categories described above are included in Appendices A, B, C, and D, respectively. Appendix E lists the titles of the CNWRA Configuration Control Board (CCB) members and identify major activities in the implementation of the plan and procedures.

PRINCIPLES

The fundamental principles that will be employed by the Center in accomplishing configuration management for codes and databases during development and operation are outlined below.

- Prevent loss of codes and databases. With the changing of computer systems during technology transfer, this principle is of most immediate concern. Those codes and databases that must be immediately and continuously available to the NRC and Center staffs will be placed in a "safe" and accessible mode as soon as possible.

- Minimize unnecessary expenditure of effort in code and database transfers. To prevent unnecessary commitment of resources, it will be necessary to identify those codes and databases which are needed to accomplish the regulatory mission of the NRC and its contractors under the NWPAA of 1987. Those codes and databases that are no longer needed or that are judged to be incapable of meeting programmatic needs (currently or with appropriate modifications) will be archived without any effort being expended to convert and/or transfer them.

- Maintain or enhance ease of access. Access at one or more central locations, the role of "gateway" systems, and PC-based codes will be evaluated as options.

- Maximize cost-effective availability of codes and databases. Options will be evaluated to determine the most effective and resource-efficient mode for making codes and databases available to the NRC and the Center. Federal versus private computer facilities will be evaluated.

- Provide for code and database integrity. A code validation, verification, and configuration management program will be developed and implemented as an essential feature of the regulatory program.

- Configuration control in development of software, upgrades, and allocation of commercial software and hardware systems to meet HLW Program requirements, NRC Policy and Center Standards and Procedures will help ensure:

  - reliable products
  - low software maintenance costs
  - proper system construction with up-to-date modules
  - compatibility among systems
  - a manageable upgrade process
  - maintenance of an audit trail and change history
  - only authorized changes to modules

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES (CNWRA)
CONFIGURATION MANAGEMENT AND CONTROL PLAN
FOR
CNWRA COMPUTER SYSTEMS

1. PURPOSE

The purpose of this plan is to identify the procedures for managing the configuration of computer systems during their development and for controlling maintenance of the systems throughout the life cycle process. This plan is applicable to internal development and maintenance of all computer systems in support of the Center.

2. RESPONSIBILITIES

2.1 ORGANIZATION

The organizational support for CM and control within the CNWRA will be provided by Information Management Systems (IMS), the involved Operating Elements and Quality Assurance. The Director of IMS will use experienced SWRI support on a part time basis to plan and implement CM. The Operating Element Managers (EM) will assign support staff to perform all project related CM tasks to insure proper CM guidelines are followed through the systems development and maintenance process. A Configuration Control Board (CCB) (Appendix E, Attachment 1) comprised of CNWRA staff members will meet as necessary to review and approve change requests, and to resolve problems. The configuration management and control processes are shown in Figure 3.1.

2.2 CM RESPONSIBILITIES

The Director of IMS is responsible for the overall configuration management process in support of the Center. This entails development of CM procedures, chairmanship of the CCB, custodial responsibilities of the physical files, audits and reviews, and status accounting. The EM and assigned staff are responsible for each configuration item and compliance with the CM procedures in providing the necessary documentation and reports during the development and maintenance life cycles of the computer systems. CM will also aid in the verification and validation of codes performed by the EM and technical staff.

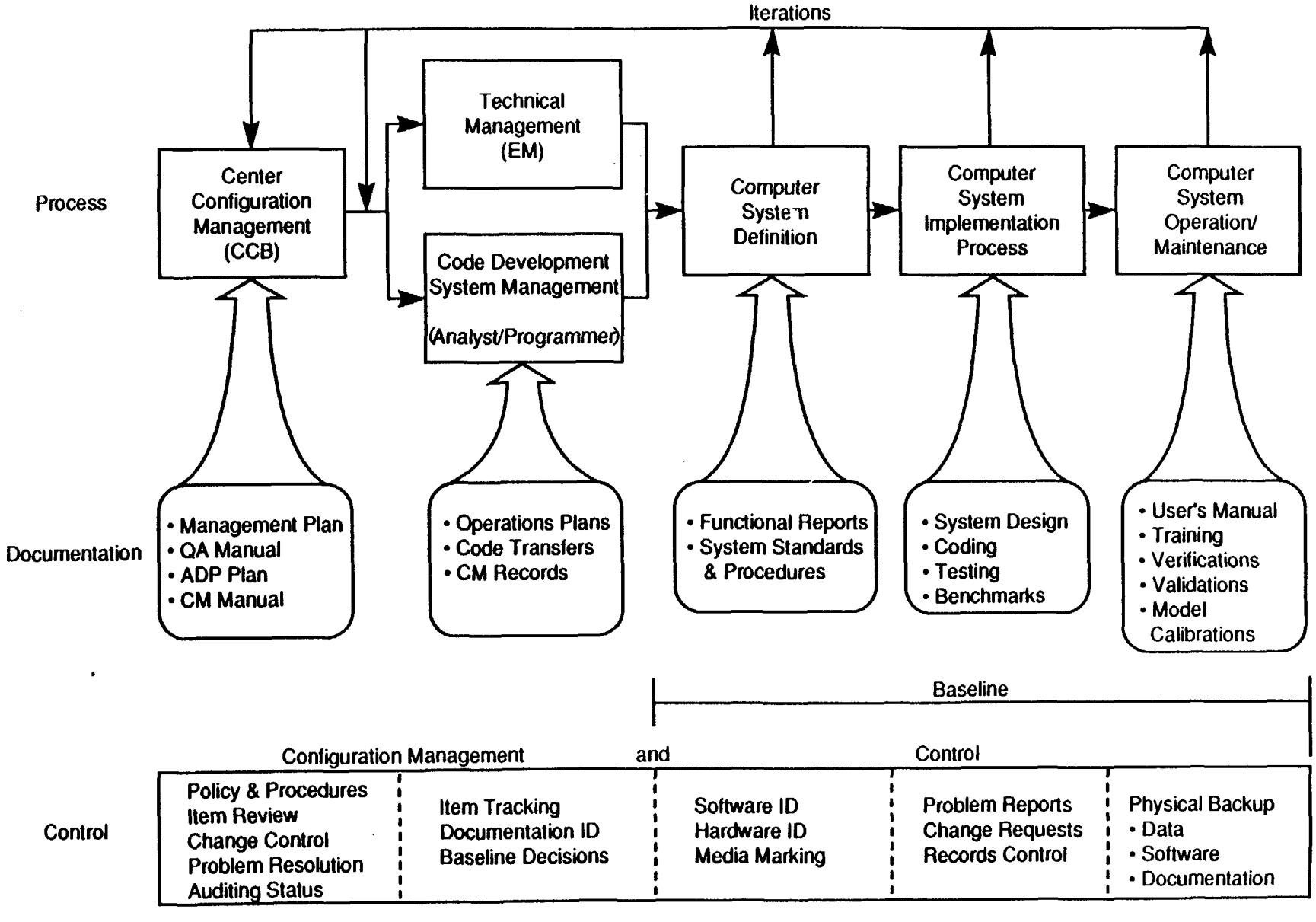


FIGURE 3-1 Configuration Management and Control Process

3. DEFINITIONS

3.1 DEFINITIONS

Baseline - A configuration identification document (hardcopy or other media) including computer source code or a set of such documents formally designated and fixed at a specific time during a configurations item's life cycle. Baselines, plus approved changes from those baselines, constitute the current configuration identification.

Baseline, Functional - The authenticated functional configuration. The functional baseline is established by the authenticated System Requirements Specification (SRS).

Baseline, Allocated - The authenticated allocated configuration. The allocated baseline is established by the authenticated System Design Document (SDD), System Standards and Procedures (SSP), and System Verification and Testing Description (SVTD).

Baseline, Product - The authenticated product configuration. The product baseline is established by the authenticated System User's Manual (SUM), System Input/Output (I/O) Product Specification (SPS).

Computer Hardware (or hardware) - A combination of associated computer system components required to enable the system to perform computational or control functions.

Computer Software (or software) - A combination of associated computer instructions and computer data definitions required to enable the computer hardware to perform computational or control functions.

Computer Software Documentation - Technical data or information, including computer listings and printouts, which documents the requirements, design, or details of computer software, explains the capabilities and limitations of the software, or provides operating instructions for using or supporting computer software during the software's operational life.

Configuration Item - Hardware or software, or an aggregation of both, which is designated by the CCB for configuration management.

Modular - Pertaining to software that is organized into limited aggregates of data and contiguous code that perform identifiable functions.

System - Pertaining to all of the components, software and hardware, that combine to perform one or more common goals.

Top-down - Pertaining to an approach that starts with the highest level of a hierarchy and proceeds through progressively lower levels. For example, top-down design, top-down coding, top-down testing.

3.2 ACRONYMS

CAS	Code Assessment and Support
CCA	Change Control Authority
CCB	Configuration Control Board
CDL	Continuing Documentation and Code Listings
CM	Configuration Management
CMP	Configuration Management Plan
DMM	Description of Mathematical Numbers and Numerical Methods
IMS	Information Management Systems
NRC	Nuclear Regulatory
PE	Program Element
QA	Quality Assurance
SSP	System Standards and Procedures
SCR	System Change Request
SDD	System Design Description
SPS	System I/O Product Specification
SRS	System Requirements Specification
SSD	Software Summary Document
STR	System Test Report
SUM	System User's Manual
SPR	System Protection Report

3.3 APPLICABLE POLICIES, DIRECTIVES AND PROCEDURES

The following policies are used for configuration management within the Center:

NUREG-0856	Final Technical Position on Documentation of Computer Codes for High-Level Waste Management
NUREG/CR-4640	Handbook of Software Quality Assurance Techniques Applicable to the Nuclear Industry
NUREG/CR-4369	Quality Assurance (QA) Plan for Computer Software Supporting the U.S. Nuclear Regulatory Commission's High-Level Waste Management Program
SAND87-2254	High-Level Waste Management Code Maintenance and Quality Assurance
CNWRA IMS022789	Security Plan for Program Architecture Support System, dated 2/27/89
CNWRA IMS122189	ADP Plan for the CNWRA, dated 12/21/89
CNWRA QA Manual	Center Quality Assurance Manual

4. PROCEDURES

4.1 CONFIGURATION IDENTIFICATION

The EM will assign the responsible person for each code. This will normally be the author of the code, or the person maintaining it. The EM will review and provide all documentation, software, data item, and system support items for filing in the CM physical file. This includes maintaining a current description of the specific project system's, software/hardware, configuration and documentation.

The IMS Director and staff will review all configuration items and will provide these items for CCB and QA review where appropriate.

4.1.1 Configuration Management Tracking Numbers

The problem report tracking numbers will be labeled YYXX0000 (YY = last two digits of year, XX = two digit month designator, and 0000 represents a number up to four digits) and will be entered in sequence as problems are reported through the interactive CM system.

4.1.2 Documentation Identification

All documentation will be prepared on electronic text processing equipment and stored on electronic storage media. When possible, the electronic file names shall be identical to the Document ID number (see paragraph 4.1.2.1 below). When this is not possible, due to limitations of the equipment or medium, a naming convention shall be used to reflect the Document ID number.

4.1.2.1 Documentation Identification Number

All documents and software generated shall be uniquely identified using an Identification Number and the date of issue. The documentation identification number shall be included at the top of each page opposite the binding edge. Computer programs and computer media copies of documents shall have labels affixed to provide the identification number and date. The identification number shall consist of characters separated by a period in the following form:

V2SYSH2A.110

Example:

The following information would appear as a document heading for the PASS/PADB Systems Requirements Specification with the documentation identification number provided on the top of each page opposite the binding edge:

Definition:

The "V2" represents the version number, in this case version 2, and is tied to the version release of the system being developed or enhanced for delivery. The IMS Director and staff will track all version release numbers as part of the CM system.

The "SYS" represents the function/subfunction being addressed by the specific document. In this case "SYS" represents the systems function for the PASS/PADB system.

The "H2A" represents the overall systems table of contents cross-referencing information. The "H" represents a major category and the "2A" are subcategories in the table of contents. In this case, if we check the table of contents, the "H" specifies the Systems Standards and Procedures (SSP) document for this system, the "2" specifies the Subsystem Specification Standards and Procedures section in the SSP, and the "A" specifies the Subsystem Definition subsection in the SSP for the PASS/PADB system.

The ".110" represents the table of contents cross-referencing information for the document specified in the major category and subcategory representation scheme. In this case, if we check the SSP table of contents, the "110" represents the Standards for Subsystem Specification in the SSP for the PASS/PADB system.

Appendices A, B, C, and D specify the documentation identification numbering scheme as it is defined for a specific CM functional area.

4.1.2.2 Documentation Marking/Change Procedures

All documentation identification data will appear at the top of each page opposite the binding edge. If this identification data is applied to an item that is not a paper document, the number shall be placed on a physical label attached to the storage medium.

In addition, there will be a change bar provided on the right hand side of the page next to the updated documentation change on each page. At the end of the change bar will be the version release number.

For example:

this is original data in the documentation
that did not change.
this is new data that is being provided because |
of a modification to the existing computer software |
or to correct an error in the original documentation. |
1.10

4.1.3 Software Identification

This section describes the methods for identifying the actual software. Software identification will be made using the standard version release numbering system. The IMS Director and staff will track all version releases using the interactive CM system.

The major version release number is the formal release number of a software component. Generally, the initial release of a software component will be version 1.00, the next release will be version 2.00 and so on.

The minor version release number reflects an interim release (the incorporation of interim changes) of a software component. Each interim release will result in an increase of the minor version release number. For example, a minor versions release number may be 1.10.

4.1.4 Media Marking

Physical labelling is required on all storage medium (magnetic tape, disk, and so on) used to release or distribute the software. A sample label for software and documentation diskettes is provided below.

Example of diskette label:

```
┌──────────────────────────────────┐
│    CNWRA CM Tracking System      │
│         Version  1.00            │
│                                  │
│ Host: IBM PS/2 50        80 Tracks │
│ Density: High          Backup Format │
└──────────────────────────────────┘
```

4.2 Configuration Control

4.2.1 Baseline Control

Authority for approving changes to baselines varies in accordance with the baseline being changed.

Authority for approving changes to Center controlled baselines (Functional, Allocated, and/or Product baselines) resides with the Technical

Director and reviewed by the Waste System Engineering and Integration Manager and the appropriate EM.

Authority for approving changes to the EM support staff internal controlled baselines (Developmental baseline) resides with the EM.

4.2.2 Change Processing

Changes will be accomplished through the interactive CNWRA Problem Report (PR)/System Change Request (SCR) Tracking system. System users will logon to the system to initiate either a PR or SCR. The PR and SCR will be entered into the appropriate CM database and a tracking number will be assigned. This tracking number will be provided the PR/SCR initiator and should be used when making follow-up inquiries about a specific PR or SCR. All problems and/or changes to the Center approved baselines shall be processed using a PR or SCR. Figure 4.1 and Figure 4.2 on the following pages provide data flow diagrams of the SCR and PR process respectively.

4.2.2.1 System Change Requests

Approval for the SCR changes will be obtained through the Configuration Control Board (CCB). The CCB will meet as required and review all SCR initiatives. The IMS Director will chair the CCB. Each EM or representative will have one vote regarding the approval or rejection of a SCR initiative. The IMS Director will provide the agenda, take minutes, and provide a listing of SCR actions and PR status. All changes should, if possible, be scheduled for implementation during preestablished version releases.

4.2.2.2 Problem Reports

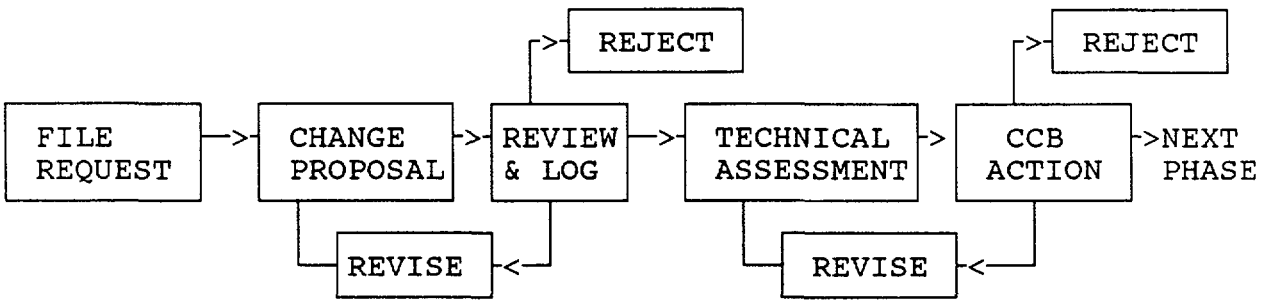
The IMS Director will provide the PR to the appropriate PE support staff for analysis and test case development. If analysis proves that a problem does exist, the EM support staff will provide a projected date when the problem will be fixed. If analysis shows that the problem is really an enhancement, the PR will be returned to the originating user with an explanation. The user may initiate a SCR if a change is required. All transactions regarding PRs and SCRs shall be tracked in the CM system. All changes should, if possible, be scheduled for implementation during preestablished version releases.

4.3 Audits and Reviews

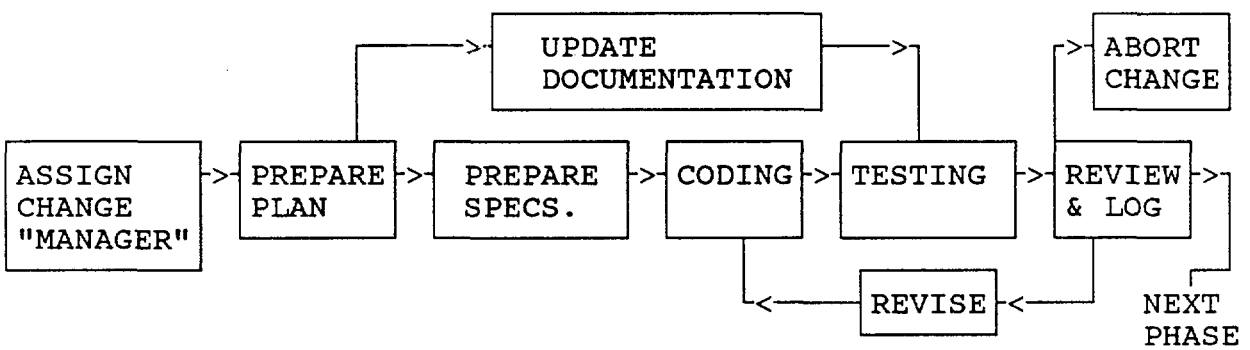
4.3.1 Audits

The Center shall conduct, audits of the software, hardware, and documentation inventory control databases. The NRC may observe or participate in such audits, or may conduct independent audits, as they deem appropriate.

SCR STUDY/ANALYSIS PHASE:



SCR CHANGE PREPARATION PHASE:



SCR CHANGE IMPLEMENTATION PHASE:

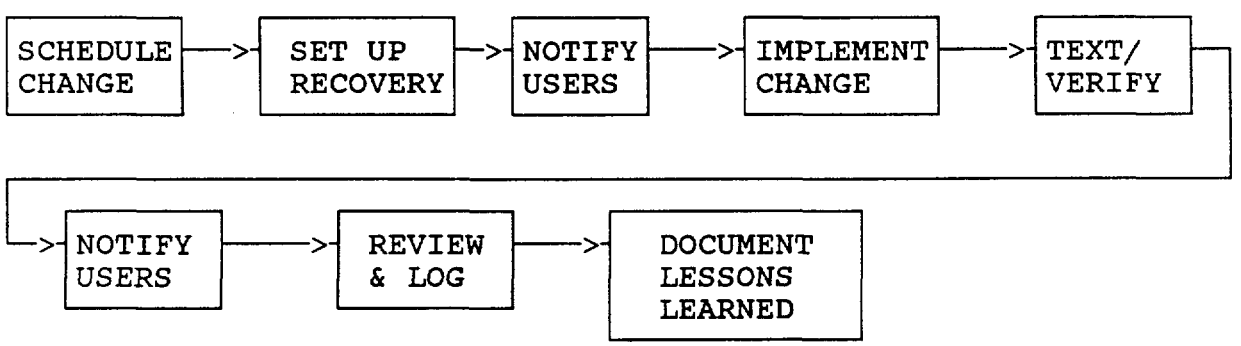
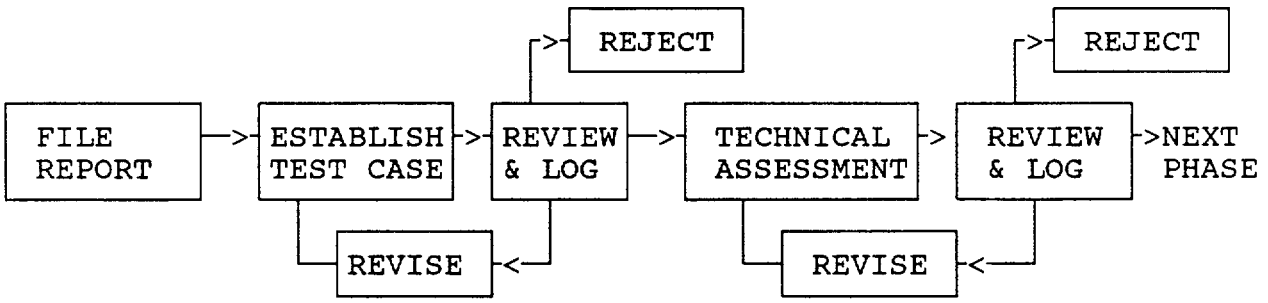
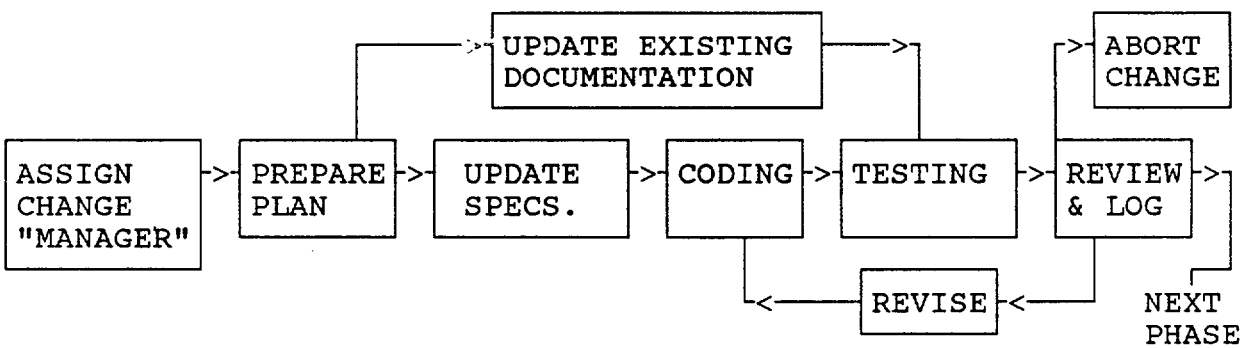


Figure 4-1 System Change Request Process

PR ANALYSIS PHASE:



PR CHANGE PREPARATION PHASE:



PR CHANGE IMPLEMENTATION PHASE:

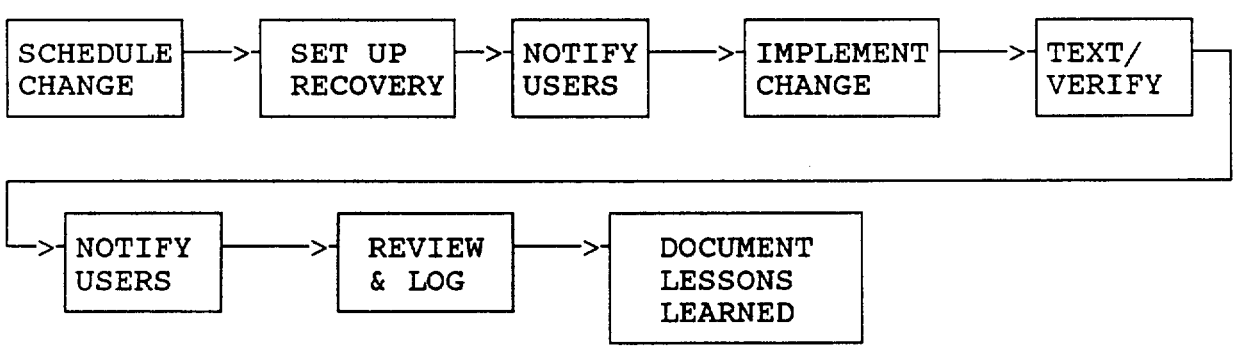


Figure 4-2 Problem Report Process

4.3.2 Reviews

The Center will conduct periodic reviews of the software, hardware, and documentation inventory control databases to insure accuracy, currency, and access availability.

4.4 Configuration Status Accounting

Status reports for CM will be provided in an interactive mode using the CM system which will take advantage of current database technology. The CM system will provide the appropriate reports required to meet configuration status accounting.

4.4.1 Records

The CM system is a central element in configuration accounting. This system shall establish records of all transaction affecting PRs and SCRs.

4.4.2 Reports

The CM system shall have the capability of providing appropriate reports, on demand, to support the complete CM process.

5. ANTICIPATED RESULTS

Employing the principles outlined at the beginning of this document, the Center intends to provide continued access to those codes and databases that are judged to be relevant to the high-level nuclear waste regulatory mission of the NRC. It is important to recognize, however, that because of uncertainties in resource (people and facilities) availability, there are risks associated with this or any other approach. Therefore, the outlined approach will need to remain flexible and responsive to these changing needs and situations.

APPENDIX A

SOFTWARE DEVELOPMENT AND DOCUMENTATION PROCEDURES FOR SCIENTIFIC, ENGINEERING AND MATHEMATICAL MODELS AND CODES

1. PURPOSE

To establish computer software development and modification engineering practices oriented toward structured programming techniques and provide procedures for documentation development and maintenance regarding scientific, engineering, and mathematical models and codes. The overall intent is to assure that performance requirements will be achieved with a minimum of costing, scheduling, designing, and technical risk through the use of good programming methodology. In addition, the application of these procedures will assist minimizing life-cycle costs, and establishing/maintaining effective documentation in support of software developed by and for the Center.

2. RESPONSIBILITIES

2.1 Organization

The organizational support for software/documentation development and the enhancement/modification of existing software/documentation will be provided by Information Management Systems (IMS) and the involved Operating Elements and Quality Assurance. The Director of IMS is responsible for providing guidance and systems support with regard to Center software development environments. EM staffs are responsible for defining specific technical computing requirements and staff support providing feedback for software development and documentation.

2.2 Element Manager

The EM is responsible for ensuring that assigned analyst/programming staff follow the appropriate procedures in the development and/or enhancement/modification of computer software and appropriate documentation in support of Center initiatives.

2.3 Analyst/Programmer

The analyst/programmer is responsible for using appropriate procedures in the design, development and implementation of software/documentation developed to support Center initiatives. Approval for major development of new software applications and/or enhancing/modifying existing software applications will be provided through the Configuration Control Board. The analyst/programmer is responsible for developing software that is efficient/effective and supports cost effective, yet timely, maintenance objectives.

2.4 Scope of Items

Attachment A to this procedure lists the scope of items in this category.

3. DEFINITIONS

SSD	Software Summary Document
DMM	Description of Mathematical Numbers and Numerical Methods
SUM	System User's Manual
CAS	Code Assessment and Support
CDL	Continuing Documentation and Code Listings

4. PROCEDURES

4.1 Software Development

The following sections describe the means and techniques the programmer, analyst, management personnel, and others must use to interact with the programming environment and facilities. Procedures, rules and constraints defined herein will be used for program design, coding, and data structures which enhance the readability and reliability of programs and that minimize rework during the development process. [Specific software development procedures are being evaluated and will incorporate appropriate design and coding standards in addition to and instead of those stated below.]

4.1.2 Top Down Program Design and Implementation

Fourth Generation Languages use block structuring, control structures, and statements to ensure users follow top down program design specifications. Third Generation language computer programs consisting of a logically related set of segments will follow top down program design and be arranged as follows:

Programs will be designed and implemented in a top down hierarchical manner, where the levels of the hierarchy correspond to levels of control of the tasks performed by the program.

The essential characteristic of a top down hierarchical design is that each level of detail of the program is logically complete in itself. It should be noted that some segments may appear on more than one level in order to retain logical completeness at each level.

Control of execution between segments is restricted to segments on the level immediately above or below the segment in question.

Where useful for early testing, a segment may be coded out of turn after the design hierarchy has been established.

Coding critical segments at subsumed levels of the software system hierarchy will be restricted to those segments which require early testing or for other special reasons.

4.1.3 Modular Design

A subset of top down program design is the utilization of modular design. Program modules should be as specific in their functions as possible. It should be possible to test a module as a stand-alone entity, without the presence of other system modules. It should also be possible to modify one program unit of a system without affecting any other unit. There might be a situation where program length is critical or some other compelling reason exists that will affect using modular design. Every step taken away from modularity is a step toward complicated maintenance. Also, a review of existing modular design should be accomplished in order to simplify system maintenance. Depending on system implementation, every effort should be made to provide system modularity.

4.1.4 Structured Coding

With the exception of error conditions, all segments will be designed with one entry and one exit.

4.1.5 Coding Conventions

All code written will conform to the following conventions:

All scructured segments should include header information that includes information such as Function Name, Programmer, Version Identifier, Date, and a Description of each PR fixed in that function. EXAMPLE:

```
Function Name: f_item
   Programmer: Paul J. Breaux
      Version: 2.1
       Date: 1 May 88

Version 2.1 Changes:

PR 88-03-1; Changes refine option to pass the table name
and query as separate data strings.
```

All code should clearly denote logical levels.

No special function keys will be used, if possible. No special characters will be used, if possible. (This will ensure maximum transportability of the software).

Include in all segments sufficient annotation (i.e., comments) to explain inputs, outputs, branches and other items not obvious in the code itself. Explanatory notes will be uniformly indented, precede the segment being explained, and offset by black lines.

All variable names used in any segments must be explicitly declared in the variable name declaration section and defined in the comments section. Variable names must be designed in accordance with established naming conventions.

Statement/Paragraph labels or names should be meaningful; if line numbers are used, they must be in ascending order from beginning to end this includes non-executable statements (e.g., Format).

Data declarations, if applicable, must be grouped and arranged in a meaningful order in the code (e.g., columnar rather than horizontal string).

Use meaningful data names and procedure labels.

Each line of source code will contain one statement only.

Formats for error and diagnostic messages must be standardized and will require no additional interpretation, such as table lookups.

Insertion of machine language patches during testing especially at remote stations in the field) must be rigidly controlled by the project manager.

Do not alter loop indexes during loop execution.

Unnecessary assignment of a constant value to a variable (especially within a loop) is prohibited.

Code must be written so that no code can be modified during execution.

Subroutines, function, etc. that provide error clauses such as (on error go to, or ERR=) must be utilized with a clear, understandable explanation of the error being displayed (output) before clean program termination.

Planned use of diagnostic print statements is encouraged (debug statements). Position at key points in the program, these statements aid in tracking during development. However, these "debug" statements must not be executed in the released (final) version (commented out). If debugs cannot be commented out, they will be deleted in the final program. However, if comments are allowed, they must be used on the debug statements as they are beneficial for resolving future errors and making modifications.

All loop routines must be clearly indented.

For example:

```
while(current_items)
{
   printf("%-23.20s", current_items->i_rn);
   printf("%-8s\n", current_items->i_fc);
}
printf("\n                    END OF REPORT");
```

4.2 Software Documentation Procedures

This section establishes scientific, engineering and mathematical models/codes computer software documentation procedures for use by Center personnel in the publishing of documentation that supports computer software being developed or maintained by the Center.

4.2.1 Documentation Requirements

All scientific, engineering and mathematical models/codes support documentation will follow. The following list of documents are required for all major systems developed in support of Center initiatives. The guidance is provided in NUREG-0856.

SSD	Software Summary Document
DMM	Description of Mathematical Numbers and Numerical Methods
SUM	System User's Manual
CAS	Code Assessment and Support
CDL	Continuing Documentation and Code Listings

ATTACHMENT A
LISTING OF ENGINEERING, SCIENTIFIC, AND MATHEMATICAL MODELS AND CODES FOR CONFIGURATION MANAGEMENT

PERFORMANCE ASSESSMENT

Code Name	Description	System/Language
DCM-3	SNL's Unsaturated Flow Code	FORTRAN
NEFTRAN III	SNL's Transport Code	FORTRAN
Unnamed	NRC's System Code	FORTRAN
PORFLO-3	Flow, Heat, and Mass Transport Code	FORTRAN
	RDCO	
SPECTROM-331	3D Finite Element Seismic Analysis	FORTRAN
DECICE	3D Discrete Element Seismic Analysis	FORTRAN
BEST3D	3D Boundary Element Seismic Analysis	FORTRAN
	GS	
TOUGH	Coupled two-phase flow and heat transport	FORTRAN
BIGFLOW	Unsaturated Flow Code	FORTRAN

EBS

Code Name	Description	System/Language
CONVO	EBS Performance Assessment	FORTRAN
TOPAZ3D	3D Finite Element Heat Transfer Analysis	FORTRAN
INGRID	Finite Element Mesh Generation	FORTRAN
FACET	Radiative View Factor Calculations	FORTRAN
TAURUS	Graphical Display of Finite Element Results	FORTRAN

APPENDIX B

SOFTWARE DEVELOPMENT AND DOCUMENTATION PROCEDURES FOR INFORMATION MANAGEMENT SYSTEMS

1. PURPOSE

To establish computer software development and modification engineering practices oriented toward structured programming techniques and provide procedures for documentation development and maintenance. The overall intent is to assure that performance requirements will be achieved with a minimum of costing, scheduling, designing, and technical risk through the use of good programming methodology. In addition, the application of these procedures will assist project managers in maintaining the continuity and integrity of software design, ensuring the suitability of the software for its intended application, minimizing life-cycle costs, and establishing/maintaining effective documentation in support of software developed by and for the Center.

2. RESPONSIBILITIES

2.1 Organization

The organizational support for software/documentation development and the enhancement/modification of existing software/documentation will be provided by IMS and the involved Operating Elements and Quality Assurance. The Director of IMS is responsible for providing guidance and systems support with regard to Center software development environments. EM staffs are responsible for providing feedback that will assist IMS in providing the aforementioned software development support.

2.2 Element Manager

The EM is responsible for ensuring that assigned analyst/programming staff follow the procedures below in the development and/or enhancement/ modification of computer software and appropriate documentation in support of Center initiatives.

2.3 Analyst/Programmer

The analyst/programmer is responsible for using the following procedures in the design, development and implementation of software/documentation developed to support Center initiatives. Approval for major new software application development and/or enhancing/modifying existing software applications will be provided through the Configuration Control Board. The analyst/programmer is responsible for developing software that is efficient/effective and supports cost effective, yet timely, maintenance objectives.

2.4 Scope of IMS Items

Attachment A to this procedure contains the list of Information Management Systems being developed and operated in the Center.

3. DEFINITIONS

CCB Configuration Control Board
DBMS Data Base Management Systems
IMS Information Management Systems

4. PROCEDURES

4.1 Software Development Procedures

IMS software development procedures are contained in Section H of the System Design Notebook for PASS/PADB V2.0.

4.2 Software Documentation Procedures

This section establishes computer software documentation procedures for use by Center personnel in the publishing of documentation that supports computer software being developed or maintained by the Center.

4.2.1 Documentation Requirements

All support documentation will following the procedures below. The following list of documents are required for all major systems developed in support of Center initiatives.

SRS Systems Requirements Specifications
SSP Systems Standards and Procedures
SDD Systems Design Description
SPS Systems I/O Product Specification
SUM Systems User's Manual
STR System Test Report

4.2.2 Documentation Page Headers/Footer

All documentation will have headers and footers on every page of the document. The header will specify system, document, and function identification including the documentation identification and page numbers. The system identification title will include the current version that the documentation supports. The following is an example of the table of contents functional header for the PASS/PADB system.

At the bottom of each page in support documentation will be a footer. The footer will consist of "BY:" and a "REV:" information. The data to the left of the "BY:" prompt reflects the person who originally wrote the information on a specific page. The initials of the person, "JHC", and the appropriate date, "04/05/89", that the page was written will be provided next to the "BY:" prompt. On the opposite side of the bottom of the page will be the "REV" prompt. The data to the left of the "REV" prompt reflects by whom and at what date and time, information of that specific page was changed. For example, "REV: JHC-03/13/90 - 13:00" reflects that the person with the initials "JHC" revised the page at 1:00 p.m. on March 13, 1990. The following is an example of the functional footer for the PASS/PADB system.

BY: JHC-/04/05/90 REV: JHC-03/13/90 - 13:00

4.2.3 Documentation Identification Number

In addition to page headers/footers, all documents generated shall be uniquely identified using an identification number. The documentation identification number shall be included at the top of each page opposite the binding edge. Computer programs and computer media copies of documents shall have labels affixed to provide the identification number and date. The identification number shall consist of characters and separated by a period as in the following form:

V2SYSH2A.110

Example:

The following information is an example of a document heading for the PASS/PADB Systems Requirements Specification with the documentation identification number provided on the top of each page opposite the binding edge:

PASS/PADB VERSION 2.0
SYSTEM REQUIREMENTS SPECIFICATION V2SYSH2A.110
TABLE OF CONTENTS Page 1

Definition:

The "V2" represents the version number, in this case version 2, and is tied to the version release of the system being developed or enhanced for delivery. The Configuration Manager will provide and track all version release numbers as part of the CM system.

The "SYS" represents the function/subfunction being addressed by the specific document. In this case "SYS" represents the systems function for the PASS/PADB system.

The "H2A" represents the overall systems table of contents cross-referencing information. The "H" represents a major category and the "2A" are subcategories in the table of contents. In this case, if we check the table of contents, the "H" specifies the Systems Standards and Procedures (SSP) document for this system, the "2" specifies the Subsystem Specification Standards and Procedures section in the SSP, and the "A" specifies the Subsystem Definition subsection in the SSP for the PASS/PADB system.

The ".110" represents the table of contents cross-referencing information for the document specified in the major category and subcategory representation scheme. In this case, if we check the SSP table of contents, the "110" represents the Standards for Subsystem Specification section of the SSP for the PASS/PADB system.

ATTACHMENT A
INFORMATION MANAGEMENT SYSTEM ITEMS

Document Control

1. Correspondence Control System
2. Technical Document Index and Review

Program Architecture Support Systems

3. Regulatory Text Search and Reference
4. Systematic Regulatory Analysis
5. Open Item Tracking (TBD)
6. Functional View (TBD)
7. Alternative Program (TBD)

Project Management

8. Periodic Cost Reporting
9. Operations Planning
10. Commitment Control
11. Project Scheduling

APPENDIX C

SOFTWARE AND HARDWARE CONFIGURATION MANAGEMENT PROCEDURES FOR CNWRA PERSONAL COMPUTERS, PERIPHERALS AND SOFTWARE

1. PURPOSE

To establish configuration management of purchased CNWRA Personal Computers (PCs), peripherals and software. The overall intent is to assure that performance requirements will be achieved with a minimum of costing, scheduling, designing, and technical risk through the use of good contract policy and procedure. In addition, the application of these procedures will assist project managers in maintaining the continuity and integrity of software design, ensuring the suitability of the software for its intended application, minimizing life-cycle costs, and establishing/ maintaining effective documentation in support of systems developed by and for the Center.

2. RESPONSIBILITIES

2.1 Organization

The organizational support for Center PCs, PC software development/ application utilization, peripherals and application software, will be provided by Information Management Systems (IMS) and the involved Operating Elements and Administration. The Director of IMS is responsible for providing guidance and systems support with regards to the PC environment. EM staffs are responsible for providing feedback that will assist IMS and administration in providing the aforementioned definition of needs and system support.

2.2 Element Manager

The EM is responsible for ensuring that assigned analyst/programming staff follow the appropriate procedures in the development and/or enhancement/ modification of PC software, PC software application utilization, and appropriate documentation in support of Center initiatives.

2.3 Analyst/Programmer

The analyst/programmer is responsible for using appropriate procedures in the design, development and implementation of PC software/documentation developed including PC/peripheral acquisitions that support Center initiatives. Approval for developing new PC/peripheral and application software acquisitions, PC software development and/or enhancing/modifying existing PC software will be provided through the Configuration Control Board. The analyst/programmer is responsible for developing software that is efficient/effective and supports cost effective, yet timely, maintenance objectives.

2.4 Scope of Personal Computers Peripherals and Software

Attachment A to this procedure lists the scope of items in this category.

3. DEFINITIONS

CASE	Computer Aided Software Engineering
CCB	Configuration Control Board
DBMS	Data Base Management Systems
IMS	Information Management Systems
PC	Personal Computer
PDL	Program Design Language

4. PROCEDURES

4.1 PC Software Development

All PC software development/modifications will follow the procedures established in Appendix A paragraph 4.1 of this document and for Appendix B, paragraph 4.1.

4.2 PC Software Documentation

All PC software development/modifications supporting documentation will follow the procedures established in Appendix B paragraph 4.2 of this document for IMS applications and NUREG-0856 for technical applications.

4.3 PC Software/Hardware Acquisitions

All acquisitions of PC software applications, including compilers, CASE tools, PDLs, assemblers, spreadsheet, DBMSs, and other applications, either through commercial sectors and/or government shareware, and PC hardware, including PCs/peripherals, must be approved and tracked through IMS and must conform to NRC contract policy and procedures. If the PC software application and/or PC hardware has wide range use throughout the Center and support organizations, the acquisition request must be approved through the CCB.

4.4 PC Software/Hardware Implementation

Before any PC software/hardware items are installed or attached to a Center's system it must be approved through IMS. No software will be installed on a Center PC that has been obtained through a communications network or available on magnetic media, tape and diskettes, that is provided by an outside source until formal approval by IMS. Depending on the situation, IMS may initialize sanitizing procedures to guard against viral infections of operational applications including databases. In addition, the installation of expansion boards and PC peripherals must be cleared through IMS to insure proper CM tracking and guard against possible harmful interface problems.

ATTACHMENT A
LIST OF CENTER PERSONAL COMPUTER HARDWARE AND SOFTWARE

MICROCOMPUTERS

IBM PS/2 Model 50, 60, 70, and 80, with 30 MB, 120 MB, and 70MB Hard Disks, respectively

NEC Portable

Compaq Model 386 DeskPro and Portable

Standard 286

PERIPHERALS

IBM 4869 External 5-1/4" Drive

IBM Proprinter II

Data Products Laser Printer, Model LZR 2600

HP Laserjet II Printer

Bernoulli Disks II 5-1/4" Cartridge

ADACOM Switching Box, Model CP150

3 Com Etherlink Adapter Cards

OPTIONS

IBM 3274 61C Controller

Ven-Tel 24/2 Modem

AT&T Dataphone II Digital 2500

IBM Token Ring LAN Adapter Cards for PS/2 Server and Workstations with Bridges, Modems, Multistation Access Units, Cables, and Connectors

SOFTWARE

IBM DOS 3.3 Operating System

IBM PC/PASF

IBM PC/LINK Version 1.1

IBM PC 3270 Entry Emulator

IBM Displaywrite 4.2

IBM Office/Vision/VM - PROFS

IBM Token Ring LAN Software

Ventura Publisher Version 2.0

Ventura Professional Extensions

Wordperfect 5.0

RDOC

DBASE4

IBM Displaywrite 5.0

PC/TCP Network Software Version 2.21 for DOS

Adobe Illustrator 88

APPENDIX D

SOFTWARE DEVELOPMENT AND DOCUMENTATION PROCEDURES FOR SWRI IBM 4381 SOFTWARE VERSIONS

1. PURPOSE

To establish computer software configuration management and control procedures for documentation and maintenance on SwRI's IBM 4381 mainframe computer system. The overall intent is to assure that performance requirements will be achieved with a minimum of costing, scheduling, designing, and technical risk through the use of good programming methodology on the IBM 4381. In addition, the application of these procedures will assist project managers in maintaining the continuity and integrity of software design, ensuring the suitability of the software for its intended application, minimizing life-cycle costs, and establishing/maintaining effective documentation in support of software developed by and for the Center on the IBM 4381.

2. RESPONSIBILITIES

2.1 Organization

The organizational support for software/documentation development and the enhancement/modification of existing software/documentation on the SwRI IBM 4381 will be provided by IMS, CTC and Quality Assurance. The Director of IMS is responsible for providing guidance and systems support with regard to Center software development environments on the aforementioned computer platform. EM staffs are responsible for providing feedback that will assist IMS in providing the aforementioned software development support.

2.2 Element Manager

The EM is responsible for ensuring that assigned analyst/programming staff follow the appropriate procedures in the development and/or enhancement/modification of software, and appropriate documentation in support of Center initiatives that are developed using the IBM 4381.

2.3 Analyst/Programmer

The analyst/programmer is responsible for using the appropriate procedures in the design, development and implementation of software/documentation developed on the IBM 4381 that support Center initiatives. Approval for major development of new application software and/or enhancing/modifying existing software, and the use of system development tools/utilities on the IBM 4381 will be provided through Center IMS and SwRI Computer Telecommunications Center (CTC). The acquisition request for additional hardware/software support regarding the IBM 4381 must be formally approved through IMS, CTC and the CCB. The analyst/programmer is responsible for developing software that is efficient/effective and supports cost effective, yet timely, maintenance objectives.

3. DEFINITIONS

CASE	Computer Aided Software Engineering
CCB	Configuration Control Board
CTC	Computer Telecommunications Center
DBMS	Data Base Management Systems
IMS	Information Management Systems
PC	Personal Computer
PDL	Program Design Language

4. PROCEDURES

4.1 IBM 4381 Software Development

All IBM 4381 software development/modifications will follow the procedures established in Appendix A paragraph 4.1 of this document and/or Appendix B, paragraph 4.1 of the document.

4.2 IBM 4381 Software Documentation

All IBM 4381 software development/modifications supporting documentation will follow the procedures established in Appendix A and/or B paragraph 4.2 of this document.

4.3 IBM 4381 Software/Hardware Acquisitions

All acquisitions of IBM 4381 software applications, including compilers, CASE tools, PDLs, assemblers, spreadsheet, DBMSs, and other applications, either through commercial sectors and/or government shareware, and hardware must be approved and tracked through IMS and approved by the CTC. If the software application and/or hardware has wide range use throughout the Center and support organizations, the acquisition request must be approved through the CCB.

4.4 IBM 4381 Software/Data Implementation

Before any software/data is installed or loaded on the IBM 4381 it must be approved through IMS. No software/data will be installed/loaded on the SwRI IBM 4381 that has been obtained through a communications network or available on magnetic media, tape and diskettes, that is provided by an outside source until formal approval by IMS/CTC. Depending on the situation, IMS/CTC may initialize sanitizing procedures to guard against viral infections of operational applications including databases. In addition, all request for access to the SwRI IBM 4381 must be cleared and tracked through IMS before being submitted to the CTC.

ATTACHMENT A
LISTING OF SOFTWARE LEVELS FOR SWRI (IBM 4381)/NRC VM2 (IBM 9370/90)

AS	5767-032	APPLICATION SYSTEM	1.5.0	.....	1.5.0
AS	5767-032	APPLICATION SYSTEM NATIONAL LANGUAGES	.....	.....	1.5.0
AS	5767-038	APPLICATION SYSTEM PROJECT MANAGEMENT COSTING	1.1.0	.....	.....
CFSSEARCH	5664-329	CONTEXTUAL FILE SEARCH/370	1.3.0	.....	.....
CMS/DMS	5748-XXB	DISPLAY MANAGEMENT SYSTEM FOR CMS	1.2.0	.....	.....
DCF	5748-XX9	DOCUMENT COMPOSITION FACILITY	.....	.....	1.3.1
DIRMAINT	5748-XE4	DIRECTORY MAINTENANCE	1.2.0	.....	1.2.0
DW	5664-370	DISPLAYWRITE/370	1.1.1	.....	.....
EREP	5654-260	ENVIRONMENTAL RECORDING EDITING & PRINTING	3.3.0	.....	3.3.0
GDDM/ PCLKF	5664-200	PERSONAL COMPUTER LINK FACILITY	2.2.2	.....	.....
GDDM/PGF	5668-812	PRESENTATION GRAPHICS FACILITY	2.1.0	.....	2.1.0
GDDM/VM	5664-200	GRAPHICAL DATA DISPLAY MANAGER	2.2.0	.....	2.1.0
IPF/VM	5664-318	INTERACTIVE PRODUCTIVITY FACILITY	2.2.0	.....	.....
ISPF	5664-282	INTERACTIVE SYSTEM PRODUCTIVITY FACILITY	2.2.0	.....	2.2.0
PC/DW		DISPLAYWRITE/PC	4.00	.....	.....
PC/GDDM/PCLK		PERSONAL COMPUTER LINK FACILITY	1.10	.....	.....

PC/PASF		PC ACROSS APPLICATION SUPPORT FACILITY	2.2.1	.....	.....
PC/370		PC3270 ENTRY EMULATOR	1.21	.....	.....
PCFT	5664-281	3270 PC FILE TRANSFER	.....	.....	1.1.0
PL/I	5734-PL3	PL/I OPTIMIZING COMPILER AND LIBRARIES	5.1.0	.....	5.1.0
PROFS	5664-309	PROFESSIONAL OFFICE SYSTEM	2.2.1	.....	2.2.1
PROFS	5664-309	PROFS APPLICATION SUPPORT FEATURE	2.2.1	.....	1.1.0
PTF/VM	5748-RC1	PASS-THROUGH FACILITY	1.3.0	.....	1.3.0
REXX/SQL	5798-DXT	REXX INTERFACE TO SQL/ DATA SYSTEM	1.1.1	.....	.....
RSCS	5748-XP1	REMOTE SPOOLING COMMUNICATION SUB-SYSTEM NETWORKING	1.3.0	.....	.....
RSCS	5664-188	REMOTE SPOOLING COMMUNICATION SUB-SYSTEM NETWORKING	.....	.....	2.2.0
RTM/VM	5796-PNA	REAL TIME MONITOR	1.1.7	.....	.....
SQL/DS	5688-004	STRUCTURED QUERY LANGUAGE/DATA ENTRY	2.2.0	.....	.....
VSAM	5746-AM2	VSE/VIRTUAL STORAGE ACCESS METHOD	1.3.0	.....	1.3.0
TCP/IP	K 200	SPARTACUS KNET (ETHERNET)	.....	.....	.....
ACF/VTAM		SYSTEM NETWORK ARCHITECTURE (T/R SUPPORT)	.....	.....	.....
GDDM-REXX					

APPENDIX E

CNWRA CONFIGURATION CONTROL BOARD AND ACTIVITIES

APPENDIX E

With the implementation of a Configuration Management Plan and Control and Procedures for the Center currently underway, Center management has determined that Center staff in the following Center positions function in their roles on the Configuration Control Board. The duties of the responsible parties on the CCB will be the review and approval of change requests and problem reports for the four categories of configuration items.

Function
Technical Director
IMS Director
Database Administrator
Quality Assurance
Manager Waste Systems Engineering and Integration*
Operating Element Manager*

(*) Voting members

The following CNWRA CM activities are being implemented by the CCB with monthly review meetings.

CNWRA CM ACTIVITIES

1. Meet with IMS Documentation Control personnel and establish policies and procedures as Appendix B.

2. Meet with Center QA personnel and fine tune CM Plan to meet specific NRC requirements.

3. Meet with each of the four identified CM areas to obtain information regarding specific CM requirements and/or identify application/ procedural support available. Start with the IMS area, then work on the Center PC, peripherals and software, next the SwRI IBM 4381 and finally with the Scientific, Engineering, and Mathematical Models and Codes area. Specific procedures if required, will probably be placed in appendices of the Center's CM Plan.

4. Review interactive CM software system that will run on appropriate VAX and PCs to use as tools for managing source documentation, version control and maintenance of an audit trail and change history.

5. Work with the Center's Data Base Administrator to establish a CM tracking system using existing applications and get a final review and comment on the document.

6. Assign responsibilities for the Center's CM Plan and obtain a final review and comment on the document.

7. Hold the first Configuration Control Board meeting that will address the formal ratification of the Center's CM Plan and evaluate and decide on first set of developmental and/or change initiatives.