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Section 6. Operate System

6.0 Operate System

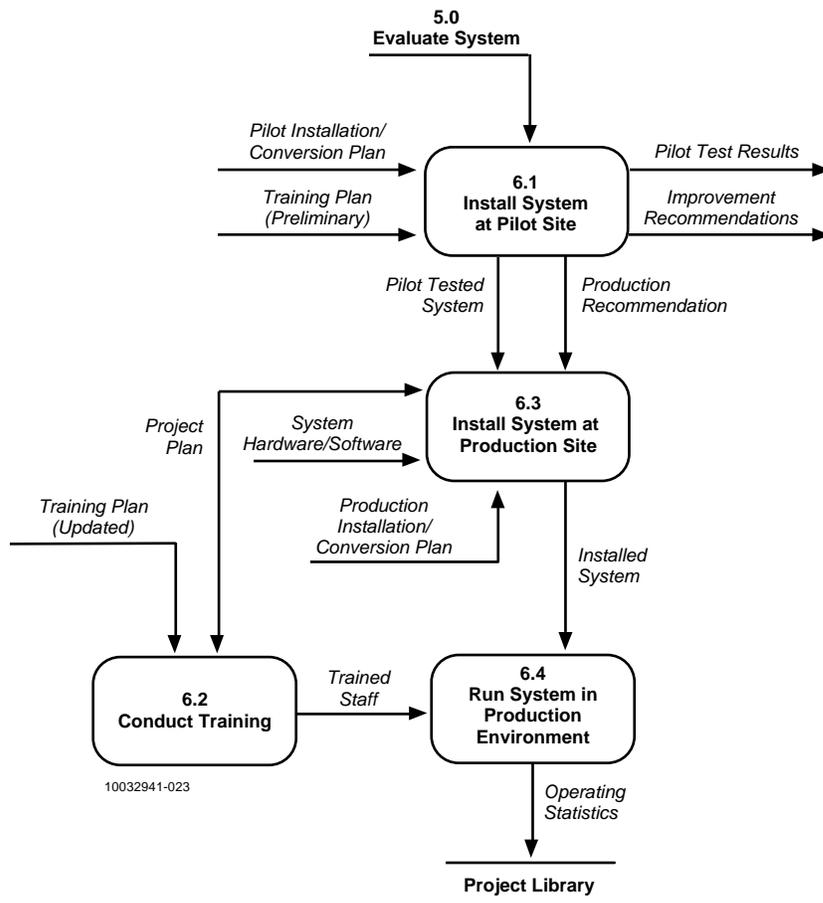


Figure 6-1. Process Flow for Operate System Phase

6.0 OPERATE SYSTEM

Purpose

The purpose of the Operate System phase is to put the system into production. The system is initially installed at a pilot site and eventually released into its full-scale production environment during the Operate System phase. All necessary training for using the system is accomplished, and the system's performance is monitored in a production environment. Figure 6-1 highlights the process flow for the Operate System phase.

Overview

Operate System is the final phase of the development lifecycle, when the certified and accredited system is released, initially to a pilot site and then into the full-scale production environment. The piloting of the system at a specified pilot site ensures that the system will perform all of its functions to meet full-scale operational requirements and serves as the vehicle for verifying that the system is acceptable to the users. The minimum time for piloting a system should be long enough to complete one full processing cycle.

During this phase, supporting organizations perform the following activities:

- Install the system at the pilot site.
- Upon completion of the pilot tests, release the system into operation at all sites originally specified in the project plan.
- Perform installation and conversion procedures at both the pilot and operation sites in accordance with the Installation and Conversion Plan.
- Hold training classes for user and operations personnel in accordance with the Training Plan. Complete the training modules, acquire the necessary training resources, schedule the training sessions, and notify the system users about the schedule.
- Perform project peer reviews of deliverables listed in Table 6-1.
- Upon request, present the System Decision Paper and all required supporting documentation to the appropriate review boards for approval.

Table 6-1. Operate System Phase Functions and Products

Operate System Functions		Products
6.1	Install System at Pilot Site	Pilot system Pilot Test Report
6.2	Conduct Training	Training material (updated)
6.3	Install System at Production Site	Production system
6.4	Run System in Production Environment	Project Plan (Complete)

Standards and Guidelines

HUD SDM documentation standards and project guidelines should be followed during the Operate System phase functions.

In accordance with the Federal Information Security Management Act (FISMA), HUD is required to comply with the guidance in the following NIST special publications:

- (SP) 800-12, *Introduction to Computer Security: the NIST Handbook*
- (SP) 800-14, *Generally Accepted Principles and Practices for Securing Information Technology Systems*
- (SP) 800-18, *Guide for Developing Security Plans for Information Technology Systems*
- (SP) 800-30, *Risk Management Guide for Information Technology Systems*
- (SP) 800-37, *Guide for the Certification and Accreditation of Federal Information Systems*
- (SP) 800-53, *Recommended Security Controls for Federal Information Systems*
- (SP) 800-60, *Guide for Mapping Types of Information and Information Systems to Security Categories*
- (SP) 800-64, *Security Considerations in the Information System Development Life Cycle*
- FIPS 199, *Standards for Security Categorization of Federal Information and Information Systems*

These publications are located at <http://csrc.nist.gov/publications/nistpubs/index.html>

The HUD *Enterprise Data Management Policy* (Handbook 3260.1) and *Total Information Quality Management Handbook* (3300.1) are also applicable to all HUD system development efforts.

Roles and Responsibilities

Throughout the Operate System phase, key personnel are required to perform various activities. Table 6-2 lists the types of personnel required and the activities for which they are responsible.

Table 6-2. Roles and Responsibilities for Operate System Phase

Roles	Responsibility
Project Sponsor	Approves project schedule revision, if necessary. Participates in review. Formally accepts pilot system for production use.
Project Manager	Revises project schedule, if necessary. Coordinates system installation activities. Coordinates the return of resources and project closeout. Presents pilot test results for user approval.
Project Development Team (User and Developer)	Produces necessary training materials. Schedules training classes. Finalizes training materials/ schedules, conducts training classes. Evaluates training classes and modifies them, as necessary.

	Updates system documentation. Installs system. Monitors system performance to ensure responsiveness to user's needs. Modifies system software, as necessary. Assists in readying pilot environment. Executes pilot Installation and Conversion Plan. Assists in readying production environment. Makes modifications and enhancements to system hardware, as necessary.
Computer Services	Ensures that pilot environment is ready. Performs pilot system installation and conversion. Performs day-to-day operations of system. Performs system installation(s). Ensures that production environment is ready. Performs production system installation and conversion. Processes problem tracking and resolution. Monitors system performance to ensure responsiveness to user community.
ADP Security	Conducts periodic security reviews on the system when in production.
Project Database Administrator	Supports data conversion activities.
Configuration Management	Performs change control activities. Establishes and maintains production baseline.
Quality Assurance	Monitors system installation and conversion activities. Audits controlled production baseline.

6.1 INSTALL SYSTEM AT PILOT SITE

Prepare the pilot site and install and/or convert the hardware, software, and databases by following the Installation and Conversion Plan and the HUD ADP Standard Release Procedures. Closely monitor the system during operation at the pilot site and document the results. Based on the documented results, make recommendations to the user and project sponsor organizations about the system's operational readiness in the production environment. Include the following activities:

- 6.1.1 Ensure pilot environment is correctly established.
- 6.1.2 Execute Installation and Conversion Plan.
- 6.1.3 Conduct pilot site training.
- 6.1.4 Operate system in a pilot environment.
- 6.1.5 Document results and make recommendations.

Table 6-3 lists personnel roles and responsibilities for installing the system at the pilot site.

Table 6-3. Roles and Responsibilities for Installing System at Pilot Site

Role	Responsibility
Project Sponsor	Reviews pilot test results and accepts pilot system for production.
Project Manager	Coordinates system installation activities. Presents pilot test results to system users.
User	Operates pilot system.
Developer	Installs system. Train pilot system users. Assists in readying pilot environment. Executes pilot Installation and Conversion Plan. Updates system documentation.
Computer Services	Ensures pilot environment is ready. Performs pilot system installation and conversion.
Project Database Administrator	Supports data conversion activities.
Configuration Management	Establishes controlled pilot environment. Establishes production baseline. Logs changes implemented during pilot activities. Controls approved system documents.
Quality Assurance	Monitors pilot site installation and conversion activities. Audits production baseline library. Verifies problem/change logs.

6.1.1 Ensure Pilot Environment Is Correctly Established

Review all equipment and site facilities to ensure that the pilot operation environment is secure and ready for the newly developed software and hardware to be installed. Notify affected personnel and organizations about the upcoming installation and conversion, and schedule meetings to ensure that all affected personnel are aware of any procedural changes.

Ensure That Physical Facilities Are Ready

At the pilot site, perform a review of the equipment and the physical environment where the equipment will be located to ensure that all safety regulations have been followed and that the installation and conversion procedures were carried out in accordance with the Installation and Conversion Plan.

Ensure That Affected Organizations Are Notified

Contact the organizations that will be affected by the pilot of the new system to ensure they are aware of the cutover date for the pilot program. Make sure that these organizations are aware of their responsibilities and of any revised operating procedures required during pilot activities, that they have completed the necessary preparations, and that they are ready for the pilot to begin.

6.1.2 Execute Installation and Conversion Plan

Install the hardware and software for the new system at the pilot site in accordance with the Installation and Conversion Plan. Verify the integrity of all configuration items. Convert or install the necessary data and databases and initiate system performance monitoring functions.

Execute System Installation in Accordance with Plan

Install the system at the physical location where the pilot test is to be performed. Ensure that the installation is carried out in accordance with the procedures described in the Installation and Conversion Plan. Verify that only the required hardware and software are installed in the pilot test environment. Conduct initial test checkout to verify correct integration of the installed components.

Execute Data Conversion in Accordance with Plan

Convert the data to be used in the pilot system to the media and format required by the new system. Ensure that data conversion is carried out in accordance with the procedures described in the Installation and Conversion Plan. Verify, by inspection and/or test, that data conversion has been implemented correctly. If problems are encountered during data conversion, follow the problem resolution procedures defined in the Installation and Conversion Plan.

Control Pilot Environment

Ensure that the integrity of the system is preserved during installation. Review the list of equipment to ensure that all components necessary for the pilot site are installed. Prepare software installation package from the configuration controlled software library. Maintain all records associated with the installation (e.g., problem reports, audit reports, and installation reports).

Pilot Readiness Review

When installation is complete, notify the project sponsor and user organizations that piloting activities are ready to begin. Be prepared to discuss the steps of the installation process, the equipment and software installed, and tests to be performed to show the users that the system is ready to be used in the pilot environment.

6.1.3 Conduct Pilot Site Training

Schedule and conduct training classes for all personnel affected at the pilot site. Perform pilot site training in accordance with the Training Plan. Monitor training activities to determine if the selected training techniques are achieving the desired results.

Analyze feedback received from personnel attending the pilot training sessions; and, based on this analysis, refine training procedures or materials to ensure that training objectives are met. Changes that occur during pilot system activities may require changing the Training Plan and related courses and materials.

6.1.4 Operate System in Pilot Environment

Operate the newly installed system in the pilot environment designed to mirror all aspects of the production environment. Closely monitor all aspects of system performance, including the effectiveness of security controls, for compliance with relevant system documentation, and report and correct any deviations before a full-scale production release.

Pilot operation should be run parallel to the existing system(s) so that the data output from the two systems can be compared to ensure that the new system is operating correctly. Review output reports and screens to ensure that the data content and presentation quality meets user community requirements.

Perform Day-to-Day Operation of Pilot System

During day-to-day operations at the pilot site, follow the procedures described in the User's and Operations Manual. Ensure the following:

- The system performs the transactions or functions for which it is designed.
- System performance meets or exceeds required capabilities.
- Security controls function effectively and as intended.
- Necessary computer time has been scheduled for the systems.
- Resources necessary for the system to run correctly are available (e.g., disk space, tapes, and computer paper).
- Personnel are available to run the pilot system in parallel with the existing systems.

Maintain System Logs

Ensure that operations personnel maintain proper system logs that meet the requirements of operations. These system logs identify any problems found or changes implemented during pilot activities. The system logs are to be used to verify that all problems have been identified, corrected, or deferred to a future system release. Use existing HUD automated tools for maintaining system logs.

Maintain and Follow System Documentation

Ensure that all changes made to the system in the pilot environment are updated in the system documentation. Use configuration version control procedures for all system documentation throughout the life of the system, including pilot operation.

Resolve Problems Found While Operating Pilot System

If error messages are received during the pilot operation of the system, document them as required, and follow the response procedures as outlined in the User's Manual or Operations Manual. If the response procedures do not have the desired effect or if the error message is

not listed in either guide, contact the system administrator for support in analyzing the cause of the message.

Report all errors detected during the pilot operation of the system to the project's development staff by using the agreed-upon discrepancy reporting procedures. Analyze problems determined to have an impact on system security and report promptly to the ADP security staff. Consider the associated risks and the potential need for additional controls.

6.1.5 Document Results and Make Recommendations

Document the results of pilot system operation in a Pilot Test Report. Use the system log to record any errors detected during the pilot operation and all feedback received from monitoring the system. Closely review the results and the actions taken to resolve errors, and develop and document any recommendations for improving system performance. Submit these recommendations to the appropriate management areas for consideration.

Document System Problems

Document problems that surface as a result of system diagnostic checks, system performance or security tests, user or operations personnel complaints, or detected errors. At a minimum, this documentation should include the following:

- List of any error messages that may have been received either at the terminal or at the operator's console
- Name and number of the application that was in use at the time of the problem
- List of the data being input to the application when the problem occurred
- Time and date of the occurrence
- Detailed description of the nature of the problem
- Function being performed and segment of the system in use at the time of the error

Document Results of System Operation

A continual record should be kept of the results of the system's performance in its pilot operational environment. At a minimum, include the following in this documentation:

- Time and date that the system was in use
- Types of applications that were run on the system, if applicable
- Number of users during various predefined times during the day or night
- Problems that may have been encountered
- Detailed description of any measurable degradation in response time

This documentation can usually be created by automated techniques, such as using the operating system's ability to dump information concerning CPU time, disk input and output, number of lines printed, elapsed time, and number of jobs or steps processed.

Approve System

System approval is the ultimate objective of the system development project. At the completion of the pilot operation, review pilot test results with the project sponsor and user organizations. Highlight project requirements and functions performed in the pilot environment, results of pilot operation, and any outstanding system problems. Upon successful review of the test results, the user should formally sign off for acceptance of the system before the system is released into production.

Establish Production Baseline

Upon system approval, the production environment is baselined. Maintain strict version and change control over this baseline. Conduct periodic audits to verify that only approved requirements and changes are incorporated into the baseline. Use automated CM tools for processing approved changes and generating change status reports on demand.

6.2 CONDUCT TRAINING

Finalize training materials, and schedule training classes for all affected personnel. Conduct all training sessions in accordance with the Training Plan, and monitor training activities to determine if the selected training techniques are achieving the desired results. Include the following activities:

- 6.2.1 Finalize training materials.
- 6.2.2 Finalize training schedule.
- 6.2.3 Conduct training sessions.
- 6.2.4 Evaluate effectiveness of training.
- 6.2.5 Modify training materials as necessary.

Table 6-4 lists personnel roles and responsibilities for conducting training.

Table 6-4. Roles and Responsibilities for Conducting Training

Role	Responsibility
Project Manager	Finalizes training materials. Schedules training sessions.
Developer	Conducts training sessions.
User	Attends training sessions.
Quality Assurance	Monitors training sessions.

6.2.1 Finalize Training Materials

Complete all materials necessary to support the scheduled training, including training booklets, online exercises, and presentation materials. Review these materials to ensure compliance with the project Training Plan. Modify training materials to reflect any

corrections or changes to the system that may have resulted from deficiencies found during systems acceptance and pilot tests.

6.2.2 Finalize Training Schedule

Complete scheduling of training sessions for all required personnel. Develop the training rosters and attendance sheets for each session. Notify all personnel to be trained about the time and location of their respective sessions. Ensure that the training facilities and equipment have been reserved in advance.

6.2.3 Conduct Training Sessions

Carry out the approved training sessions in accordance with the project Training Plan. At the completion of each training session, elicit feedback from personnel to ensure training objectives were met.

6.2.4 Evaluate Effectiveness of Training

Analyze all feedback received from personnel attending training sessions; and, based on this analysis, make recommendations for changes to training procedures or materials to ensure that training objectives are met, as described in the project Training Plan.

6.2.5 Modify Training Materials as Necessary

Respond to recommendations made as a result of analyzing feedback. Update or change training materials and course procedures to ensure compliance with all approved recommendations received. Changes to the system itself also may require updating the Training Plan and related courses and materials.

6.3 INSTALL SYSTEM AT PRODUCTION SITE

Perform inspections of all designated production sites. Detect and correct deficiencies in the production environment before installation of the new system. Perform all system installation and conversion procedures in compliance with the Installation and Conversion Plan. Include the following activities:

6.3.1 Ensure production environment is correctly established.

6.3.2 Execute Installation and Conversion Plan.

Table 6-5 lists personnel roles and responsibilities for installing system at production site.

Table 6-5. Roles and Responsibilities for Installing System at Production Site

Role	Responsibility
Project Manager	Coordinates system installation activities.
Developer	Assists in readying production environment. Executes installation plan.
Computer	Ensures the production environment is ready.

Services	Performs production system installation and conversion.
Quality Assurance	Monitors system installation and conversion activities.

6.3.1 Ensure Production Environment Is Correctly Established

Perform facility inspections of all areas designated as production sites for the new system. Document and correct any deficiencies detected during these inspections before the installation and conversion of the system at the production sites. Notify all personnel affected by the new system about the upcoming installation and conversion, and perform a review to ensure that all necessary staffing and training are complete.

Ensure That Physical Facilities Are Ready

Perform a review of the equipment and the physical environment where the equipment will be located to ensure that all safety regulations have been followed and that the installation and conversion procedures have been carried out in accordance with the Installation and Conversion Plan.

Ensure That Affected Organizations Are Notified

Contact the organizations that will be affected by operation of the new system to ensure they are aware of the cutover date for the production release. Make sure that they are aware of their responsibilities and any revised operating procedures affected by the new system, that they have completed the necessary preparations, and that they are ready for the system to become operational.

6.3.2 Execute Installation and Conversion Plan

Complete the installation of all system hardware and software. Verify the integrity of all configuration items. Complete all conversions of data and databases. Closely monitor installation and conversion procedures to ensure compliance with the project's Installation and Conversion Plan, CM Plan, and the HUD ADP Standard Release Procedures.

Execute System Installation in Accordance with Plan

At each site where it is to be operated, install the system in production mode and establish user password and security authorizations when required. Ensure that the installation is carried out in accordance with the procedures described in the Installation and Conversion Plan. Include installation procedures for all system components, including hardware, software, networks, and workstations. At the completion of the system installation at each site, obtain a final signoff to signify that the system has been thoroughly checked.

Execute Data Conversion in Accordance with Plan

Convert the data to be used by the system, when it is operational, to a media and format acceptable to the new system. This conversion should be performed following the procedures described in the Installation and Conversion Plan, including the following:

- Placing data files and their contents on the system
- Checking converted data with source data to ensure correctness
- Determining source data retention requirements should any problems arise during operation of the system

6.4 RUN SYSTEM IN PRODUCTION ENVIRONMENT

Schedule production runs for the new system. Perform all daily activities necessary to operate the system, including monitoring the system's performance to ensure adequate response time, system security, and problem-free operation. Take actions to correct any problems uncovered during system monitoring. Include the following activities:

- 6.4.1 Schedule production runs.
- 6.4.2 Monitor system performance.
- 6.4.3 Ensure system is responsive to users.
- 6.4.4 Ensure system is consistently available.
- 6.4.5 Report discrepancies for problem resolution.
- 6.4.6 Determine potential system modifications and enhancements.
- 6.4.7 Upgrade system as required.
- 6.4.8 Ensure security of environment.
- 6.4.9 Revise resource plan.
- 6.4.10 Close the development project.

Table 6-6 lists personnel roles and responsibilities for establishing a production environment.

Table 6-6. Roles and Responsibilities for Establishing Production Environment

Role	Responsibility
Project Manager	Monitors system performance activities. Closes out development project.
Developer	Monitors system performance to ensure responsiveness to users' needs.
ADP Security	Conducts periodic security reviews on production system.
Configuration Management	Retains records in project library.
Computer Services	Monitors system performance to ensure responsiveness to user community. Performs daily operation functions.

6.4.1 Schedule Production Runs

Schedule and execute the new system's runs in a production environment, and carry out all production personnel responsibilities in accordance with the requirements described in the Operations Manual. Ensure that records produced by the system are retained in the project library.

6.4.2 Monitor System Performance

Monitor the daily operation of the system to ensure the following:

- Capacity of the platform is not exceeded.
- System is operating with sufficient response time.
- Security controls are functioning properly.
- Sufficient transaction throughput occurs.
- Downtime is monitored (mean time between failures [MTBF] and mean time to failure [MTTF]).
- System is operating efficiently.

6.4.3 Ensure System Is Responsive to Users

Perform periodic reviews to assess responsiveness of the system. Address all facets of the system, including response time and throughput, system security, user satisfaction with functional and data requirements, technical performance, and system management. Document recommendations to ensure that the system continues to respond adequately to users' needs.

Conduct Review of System

Schedule and conduct periodic surveys of the system's users to determine their level of satisfaction with the current operation.

Identify Any New Requirements

Describe any new requirements that may be imposed on the system. Ensure that the description is of sufficient detail to enable maintenance programmers to make the necessary modifications.

Formulate Recommendations

Provide recommendations for updating the system to meet the new requirements or improve performance. Ensure that recommendations for change include changes to system documentation and to software and hardware.

Document Findings

Describe the recommended changes by providing as much detail as is available for developers to act on the recommendations. Document these recommendations and adhere to the applicable HUD standards and guidelines.

6.4.4 Ensure System Is Consistently Available

While the system is operational, ensure that all functions of the system are available to all users, as required, and that the users are interfacing with an error-free system. Measure availability based on the percentage of total time that the system is available to users.

Schedule for Maximum Use of System Resources

Ensure that operations personnel are aware of the user's requirements and that the operations schedule allows the user access to the system when needed. Schedule all activities that may result in an interruption of service to the user (e.g., system backup and updates) during the hours that will have the least impact on the user's needs.

Reduce Downtime for Performing Maintenance

Although periodic maintenance is required to keep the system responsive to the user's needs, perform such maintenance in a manner that will reduce the amount of time the system will be down. This may mean consolidating system updates so that they can be performed at one time, thus reducing the number of times the system needs to be brought down, or performing maintenance during off hours when the user has no need for the system.

6.4.5 Report Discrepancies for Problem Resolution

If system monitoring reveals areas of performance that need improvement, take the necessary steps to restore system performance to acceptable levels. Use the Service Ticket Action Resolution System (STARS), which provides IT a centrally located repository for logging computer-related requests and problems and provides a facility to track completion of problem resolution. Describe the problem, on a STARS form, in as much detail as possible based on information received during system monitoring. Provide as much information as possible to assist in resolving the problem.

6.4.6 Determine Potential System Modifications and Enhancements

Periodically assess the system to determine potential modifications and enhancements. Include findings and recommendations presented to management from the post-implementation review as input for the assessment. During these assessments, target the following areas:

- Parts of the system that did not meet user expectations or instances in which the implementation of a requirement is inefficient
- Risks associated with system operations and the need for additional security controls
- Parts of the system that do not function according to specifications
- Potential scheduling or process improvements
- Data definition, content and presentation quality; focusing particularly on data supporting Annual Performance Plans.
- Functions requested by the users as their familiarity with the system increases

6.4.7 Upgrade System as Required

Release upgrades of the system software and hardware into the production environment, when required, to ensure that the system remains responsive to the user's needs. Such upgrades may incorporate improved or additional functions or data, enhanced security measures, updated system hardware, increased capacity, or improved system performance.

Perform Software Releases and Obtain Release Approval

Perform software releases in accordance with HUD standards and guidelines. Submit all release requests to HUD Computer Services using HARTS. Computer Services verifies completion of appropriate testing, appropriate user notification, and necessary documentation to support the release. HUD Computer Services then verifies that all necessary preparations for releasing the software and supporting the software in production have been satisfactorily completed and that the release schedule does not conflict with any other data center activities or processing.

Upgrade Hardware in Accordance With Operations Procedures

Perform periodic monitoring to determine if an upgrade or replacement of hardware is required. If a determination is made to replace or upgrade hardware, develop a plan detailing the type of upgrade, the impact on the system, and the date on which the upgrade is required. Before the actual upgrade, Computer Services must approve the upgrade plan. Perform all hardware upgrades or replacements in accordance with Computer Services procedures.

6.4.8 Ensure Security of Environment

Periodically, review the system to ensure that all facets of the system, including hardware, software, communications, personnel, system procedures, standards, and contingency plans, still meet all requirements as outlined in applicable HUD, Office of Management and Budget (OMB), NIST, and other Federal policies, regulations, and standards.

Review System Security

Perform periodic reviews of system security. Evaluate software, hardware, the operating environment, and procedures for access to the system environment as well as the system itself (password procedures) to ensure that the system's security controls are still performing as designed. Any changes to HUD security requirements require that additional reviews be performed on the system to ensure that the system meets the new requirements.

Document Findings

Prepare a detailed description of the security review that was performed. Include the following information in the description:

- Name of the system that was reviewed
- Names of the individuals that performed the review
- Date and time of the review
- Specific areas of the system that were reviewed (i.e., computer room, password system, restart capabilities, other control criteria), including version numbers if applicable

- Review findings
- Reviewers' recommendations

6.4.9 Revise Resource Plan

Revise the project resource plan to reflect the reduction of development personnel required by the project at this point. Identify the personnel required to support maintenance of the system.

Release Personnel

When development is completed and the system is released, non maintenance-related personnel should be released from the development project. The most experienced team members should be kept until the development project is physically ended.

Identify Staff for Maintenance

If the project team is to maintain as well as develop the system, identify maintenance personnel for the project. When maintenance efforts are initiated, draw personnel resources from the identified individuals.

6.4.10 Close the Development Project

Before the system is officially turned over to production, develop a shutdown checklist. The checklist should include questions such as the following:

- Has the facilities organization responsible for the space been notified about the date for closing the development project?
- Have all field sites been notified about the person to call for maintenance, enhancements, or changes?
- Has the Internal Audit Plan been reviewed for completeness, and has the final System Decision Paper been delivered to the appropriate management officials?
- Have all project members been placed on new projects or returned to their functional organizations?

Complete the Project Plan with a section that contains software closeout data and characterizes the project effort. Finalize and include the project's historical records and lessons learned for use by other software development projects.

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