*Logistics Management Institute*

# Quality Assurance Project Plan for the Interim Central Data Exchange System

EP005T7


EPA LMI

*Logistics Management Institute*

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# Section 1
# Introduction

## 1.1 Background of CDX

The Environmental Protection Agency (EPA) is responsible for collecting, verifying, and monitoring compliance reports from stakeholders and making them available to the public. The federal government requires that stakeholders convey their interactions with the environment to the EPA through compliance reporting. Historically, stakeholders have met this requirement by periodically submitting paper reports to EPA systems, which have multiple independent databases. The databases are diverse and generally do not conform to common data definitions for like data elements.

Recent mandates of the Government Paperwork Elimination Act of 1998 (GPEA) and the EPA's Reinventing Environmental Information initiative require the EPA provide convenient electronic options for stakeholders to submit these reports. These mandates stipulate the EPA must make progress in implementing electronic business, taking into consideration the following factors:

- Reduction of reporting burden
- Data integration
- Establishment of consistent procedures for electronic signatures
- Decreased public access time
- Improvement in data quality.

The Central Data Exchange (CDX) is a system that facilitates electronic data exchanges for EPA stakeholders and is a key component of EPA's strategy for addressing these mandates. As a single receiving point for all reports, the CDX ensures a baseline for standardization and compatibility of incoming data. In addition, the CDX provides electronic forms that are pre-filled (or pre-populated) with data that do not change or change infrequently (e.g., permit number or address)—thereby reducing the stakeholder's "burden" of filling in redundant information. The CDX also can allow a smooth transition to integrated compliance reporting and an integrated EPA database.

## 1.2 Purpose

This CDX Quality Assurance Plan (QAP) describes the quality assurance standards, guidelines, procedures, and activities used to support the development and enhancement of the EPA's CDX system and EPA applications developed and hosted at LMI. This plan outlines current and future quality assurance activities for the CDX system. This QAP does not address the details of any specific CDX program.

## 1.3 Scope

This CDX Quality Assurance Plan addresses the methods and processes LMI uses to support the design and development of the CDX system. This plan proceeds from the following assumptions:

- Quality is the concern of every individual working in support of EPA.
- A team effort with EPA promotes cooperative actions and common goals.
- Quality improvement enforces the principle that every individual can make improvements as time progresses.
- Aspiring to excellence promotes better products and services for the EPA, its partners, the regulated community, and the public. It also provides personal rewards and challenges of achievement for each individual working in support of this effort.

While this plan is based upon standard quality assurance practices, it is a dynamic document that must respond to particular demands. Therefore, as the development and operation of the CDX system continues, additions, deletions, and modifications will occur.

## 1.4 Quality Assurance/Quality Control Activities

This CDX QAP includes a number of standards, guidelines, procedures, and activities derived from International Organization for Standardization (ISO) standard procedures. The quality assurance, quality control (QA/QC) activities for the CDX team include the following:

- Metrics collection
- Tools and techniques
- Reviews and quality checks.

While the CDX team strives to maintain a standard set of quality assurance practices for all of its projects, certain practices may require tailoring for a particular

project. Thus, while the standards, guidelines, procedures and activities described in this document are generally true, the state, depth, and formality of some elements, and the details of some procedures and activities may be project-specific.

To support these standards, subordinate procedures and documents may be developed in accordance with the CDX team standards as project requirements and circumstances dictate.

## 1.5 Report Organization

This Quality Assurance Plan contains 7 sections and 10 appendixes and is organized as follows:

- Section 1, *Introduction*—This section includes the purpose, scope, background, and overview of this plan.
- Section 2, *Quality Overview*—This section describes the quality objectives for the quality assurance program. Section 2 describes management and quality assurance responsibilities, professional training and development, and the CDX quality assurance areas.
- Section 3, *Software Development*—This section describes the development activities for the CDX system. It also describes the components of the software development used for the CDX system, as well as the standards to measure against and the metrics to evaluate by.
- Section 4, *Customer Service and Technical Support*—This section describes the customer support process for the project. It also describes standards, metrics, customer activity tickets and the SCR process.
- Section 5, *System Operations*—This section describes the systems operation activities for the CDX system. Section 5 also describes the components, standards, and metrics for systems operation.
- Section 6, *Security and Risk Management*—This section describes the security for the CDX system. It also describes how risk is managed for the project and lists the major components of the risk management approach.
- Section 7, *Project Management*—This section describes the project management activities for CDX. This section also describes the supplier and subcontractor controls and the QA records kept for the project.
- Appendix A, *Software Requirements Checklist*—This appendix describes the elements reviewed for a requirements review.
- Appendix B, *Software Design Review Checklist*—This appendix describes the elements reviewed for a software design review.

- Appendix C, *Release Notes Template*—This appendix describes the contents and format for the Release Notes.

- Appendix D, *Bill of Materials Template*—This appendix describes the contents for the Bill of Materials.

- Appendix E, *Project Planning Checklist*—This appendix describes the elements that must be reviewed for a project plan.

- Appendix F, *References*—This appendix lists the materials used to produce the QAP and documents that are of specific relevance.

- Appendix G, *Tools and Techniques*—This appendix describes the tools and techniques used in the development and management of the CDX system.

- Appendix H, *Configuration Management*—This appendix details the configuration management process for the project. This appendix also includes the directory structure for the different environments.

- Appendix I, *Data Quality*—This appendix addresses the relationship of data quality and CDX.

- Appendix J, *Abbreviations, Acronyms, and Definitions*—This appendix lists and describes the abbreviations, acronyms, and definitions used within this QAP.

# Section 2
# Quality Overview

The mission of the CDX quality assurance program is to support continuous process improvement and the development of high-quality deliverables that are timely and cost-effective. This is accomplished by establishing software development life-cycle (SDLC) conventions, procedures, standards, and processes. This promotes the development of quality work products, and provides training, support, and assistance to project staff in the effective use of quality-related tools.

The objectives of the quality assurance program for CDX are as follows:

- Institute processes that result in the early detection of defects or problems.
- Implement formal and informal review and audit processes.
- Conduct scheduled reviews and audits.
- Ensure work is performed in accordance with contract requirements.
- Enforce ISO 9000 standards and procedures for software development.
- Implement metrics, where appropriate.
- Encourage project staff to obtain proper training for developing effective work processes and producing quality work products.

## 2.1 Quality Commitment

The CDX team is committed to strict adherence to practices that produce quality products. The CDX team achieves this by documenting selected activities in accordance with ISO guidelines; abiding by ISO development, system operation, and project management practices related to standards, methods, and procedures; passing reviews, quality checks, and audits; and performing testing and evaluation activities for all CDX products.

The accomplishment of these activities is measured in several ways. The most obvious metrics show if the project or specific task is completed on time, within budget and is accepted by the customer. Additional metrics include quantitative information related to specified development, operations, customer service, and project management of CDX activities. The CDX team members responsible for evaluating and measuring the success of CDX are project leaders, program managers, program directors, and—ultimately—EPA. Specific quality measures, metrics, and responsible officials for these activities are described in Sections 3–7.

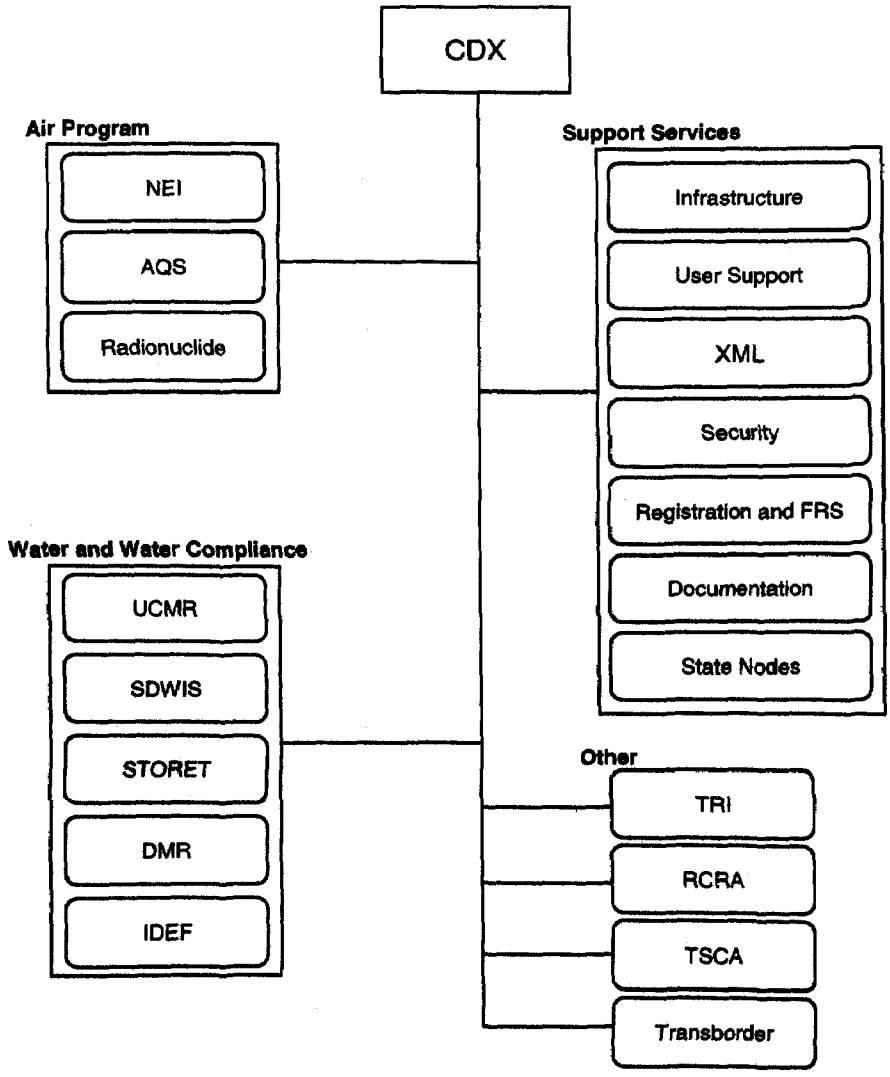
## 2.2 Management

The program and system life-cycle support and systems development and technical support provide overall project leadership and direction. The systems development and technical support staff conduct application development and manage system operation. The CDX QA staff provide support and QA/QC oversight to all levels of project staff.

### 2.2.1 ORGANIZATION

Figure 2-1 shows the CDX organization.

*Figure 2-1. EPA CDX Task Organization Chart*



### 2.2.2 RESPONSIBILITIES AND TASKS

Quality assurance responsibilities of the CDX team are based upon three important premises:

- Project requirements are the foundation from which software quality is measured.
- Specified standards define a set of development criteria that guide how software is engineered.
- The primary intention of producing a quality product is to ensure that it is reliable and conforms to standards.

### 2.2.3 QUALITY ASSURANCE RESPONSIBILITIES

The CDX staff fill a variety of positions, each providing a specific role in the management, development, process or product review, and support, as shown in Table 2-1.

*Table 2-1. Quality Assurance Responsibilities*

| Role | Responsibilities |
|---|---|
| Program Director for Program and System Life-Cycle Support business unit (PD–PSLSCS) | • Sets the strategies and goals for the group<br>• Ensures high quality work<br>• Ensures completion of projects on time and within budgets<br>• Makes efficient, effective use of staff and oversees other resources<br>• Briefs LMI management and clients on project |
| Program Director for Systems Development and Technical Support business unit (PD–SDTS) | • Sets the strategies and goals for the group<br>• Ensures high quality work, procedures, and standards<br>• Ensures completion of projects on time and within budgets<br>• Prepares proposals<br>• Makes efficient, effective use of staff and other resources |
| EPA Program Manager (PM–EPA) | • Ensures complete project plans (e.g., approach, analysis, data collection, reporting, budget, schedule, team assignments, and quality controls)<br>• Coordinates and directs the effort of research staff<br>• Briefs LMI management and clients on project<br>• Serves as primary point of contact for assigned project<br>• Prepares proposals<br>• Coordinates completion of project reports and other deliverables |

*Table 2-1. Quality Assurance Responsibilities (Continued)*

| Role | Responsibilities |
|---|---|
| Functional/technical leaders | • Manage schedule, budget, and deliverables<br>• Provide subject area knowledge<br>• Provide guidance and direction to developers<br>• Obtain requirements from the client<br>• Prepare project-related documents<br>• Attend the client status meetings<br>• Track and monitor problems and resolutions<br>• Provide status reports to EPA program managers<br>• Prioritize system changes requests<br>• Prepare project plans<br>• Prepare project reports and deliverables |
| EPA Program Technology Manager (PM–Technology) | • Contributes to team building<br>• Coordinates and directs the effort of technical research staff and subcontractors<br>• Briefs LMI management and clients on project<br>• Prepares technical portions of proposals<br>• Prepares project reports or other deliverables |
| CDX User-Support Leader | • Provides customer support<br>• Sets team standards<br>• Tracks and monitors problems and resolutions<br>• Provides status reports to the EPA program technical managers and functional/technical leaders |
| CDX Architecture Manager | • Provides oversight and direction for the development and maintenance of the CDX<br>• Ensures requested changes are documented and implemented<br>• Performs coordination across CDX projects using best practices<br>• Reviews and evaluates technology |
| CDX Configuration Manager | • Provides an environment for directory structure for all versions of software<br>• Maintains bookkeeping to record in which machines the different software versions (development, test, and production) reside<br>• Manages hardware and telecom communications<br>• Maintains hardware logs<br>• Maintains security logs |
| CDX Database Manager | • Provides the development and maintenance of the database structure and data<br>• Oversees security<br>• Establishes standards and procedures |

*Table 2-1. Quality Assurance Responsibilities (Continued)*

| Role | Responsibilities |
|---|---|
| Quality Assurance Lead | • Ensures high-quality work<br>• Conducts and documents quality reviews<br>• Conducts quality checks<br>• Provides QA status report<br>• Tracks and monitors SCRs<br>• Tracks and monitors problems and resolutions |

### 2.2.4 TASKS

QA involves systematic activities that provide evidence of the fitness-for-use of the total product. The CDX team achieves this through an assessment of the specifications and by following specific procedures.

The QA staff supports the CDX team by focusing on four major areas:

1. *Quality assurance* determines whether the software or software process conforms to established standards and identifies software or software processes that do not conform to standards. To determine conformity, the QA staff performs a series of checks against project deliverables, including verifying specific checklists against the actual artifacts. These checklists provide a baseline for the standards to adhere.

2. *Verification and validation* identifies any oversights or deviations from customer requirements and predecessors. The QA staff determines deviation by utilizing a series of checklists to determine the soundness of the requirements against project deliverables.

3. *Test and evaluation* checks for shortfalls within the requirements and design documents by exercising the coded form of software and identifies those deficits in deliverables. The QA staff determines the quality of the code by ensuring the customer requirements have been addressed.

4. *Configuration management* addresses the need to make changes visible and traceable, and supplies a formal way to control those changes. The need for change arises primarily from the application of the other three task areas. The QA staff ensures a baseline is established and deployed to the production environment. They then provide a software migration checklist to the technical lead to ensure deployment of the correct version of the software.

## 2.3 Professional Training and Development

All members of the QA staff have a background in quality assurance, testing, and training and an understanding of the software development processes. Training and professional development activities play an important role in helping the project staff use the current software development tools and techniques. Staff members are encouraged to attend professional training to remain current on the latest methods, procedures, and tools of the industry.

The CDX team is dedicated to ensuring employees receive the training necessary to perform their duties. Training is an integral part of ensuring quality of the products produced. For example, CDX team members attended GENTRAN, XML, and Rational training courses in the previous year because they were relevant to specific tasks.

## 2.4 CDX Quality Assurance Areas

Quality assurance is measured across five major areas of CDX:

- Software development
- Customer service and technical support
- System operations
- Security and risk management
- Project management.

The following sections discuss the objectives, definitions, quality measures, metrics, and process descriptions for each of these areas.

# Section 3
# Software Development

## 3.1 Objective

The objective of QA/QC is to ensure the CDX products produced and delivered in the development phase are in accordance with the SDLC model and are of a high quality. QA activities for this phase include product reviews and process recommendations.

## 3.2 Definition

CDX development focuses on the requirements gathering and analysis design of CDX data collection software and systems, file formats, and implementation guidance.

## 3.3 Quality Measures

Quality measures indicate how progress toward a project's goals and objectives is captured. They also help focus project efforts on achieving priority goals and objectives. CDX quality measures are the basis from which quality metrics are produced.

The CDX team uses proven development practices to produce quality software applications for the CDX system. These development practices are in accordance with ISO 9000 standards and recommendations.

During the software development phase, the CDX team applies quality measures in the following areas:

- Documentation
- Deliverables
- Standards and guidelines
- Reviews, quality checks, and audits
- Test and evaluation
- Problem resolution and corrective action.

## 3.4 Metrics

Metrics provide a quantifiable basis for evaluating the quality of software and other project deliverables. Qualitative judgments are more frequently used during the early SDLC phases, while quantitative metrics are used during the latter phases of development. In its implementation of ISO 9000 standards, the CDX team incorporates metrics into both its general project management practices and its software development processes.

The CDX team works closely with functional and technical project leaders to complete software development tasks. These tasks generate a number of metrics, as shown in Tables 3-1–3-3.

*Table 3-1. Software Development and Maintenance Quality Measure and Performance Metrics—Identify and Track Trends in the Software Change Request Process*

| Performance metric(s) | Goals(s) | Indicator(s) |
|---|---|---|
| Number of SCRs identifying critical deficiencies | Number of SCRs identifying critical deficiencies is less than or equal to 5 percent of total of SCRs | Number of SCRs identifying critical deficiencies is greater than or equal to 10 percent of total number of SCRs |
| Total number of SCRs (excluding enhancement requests) | Total number of SCRs (excluding enhancement requests) is less than or equal to 50 percent of the total number of requirements | Total number of SCRs (excluding enhancement requests) is greater than or equal to 65 percent of the total number of requirements |
| Number of SCRs identifying critical deficiencies in pre-deployment versus post-deployment phases of project | Number of SCRs identifying critical deficiencies in post-deployment phase of project is less than or equal to 25 percent of the number of SCRs identifying critical deficiencies in the pre-deployment phases of the project | Number of SCRs identifying critical deficiencies in post-deployment phase of project is greater than or equal to 40 percent of the number of SCRs identifying critical deficiencies in the pre-deployment phases of the project |
| Number of SCRs (excluding enhancement requests) that originated internally versus number of SCRs that originated externally | Number of SCRs originated internally (by either LMI or OEI) should represent 75 percent or more of the total number of SCRs (excluding enhancement requests) | Number of SCRs originated internally (by either LMI or OEI) represents 65 percent or less of the total number of SCRs (excluding enhancement requests) |
| Number of SCRs (excluding enhancement requests) for front end, middle area, and back end of the system | Percentage of total SCRs should be equal (33 percent) for each area: front end, middle area and back end | Percentage of total SCRs for any one area (front, middle, back) exceeds that of the other areas by 25 percent or more |

*Table 3-2. Software Development and Maintenance Quality Measure and Performance Metrics—Identify and Track Trends in the Requirements Management Process*

| Performance metric(s) | Goal(s) | Indicator(s) |
|---|---|---|
| Patterns of change in requirements, including the following: | Track trends, timing and patterns of requirement modifications | Cumulative number of requirement modifications exceeds number of original requirements |
| Cumulative number of requirement modifications | Shift distribution of requirement modifications to earlier phases of SDLC | Requirements modification for each of the later SDLC phases (Testing, Deployment, Operations) exceeds mean number of requirement modifications per phase by more than 1 standard deviation |
| Number of requirement modifications by phase of SDLC | Minimize number of requirement modifications | |
| | Track trends in code rewrites | Cumulative number of requirement modifications for later SDLC phases exceed cumulative number of requirement modifications for early SDLC phases (business case, requirements, development) |

*Table 3-3. Software Development and Maintenance Quality Measure and Performance Metrics—Identify and Track Code Modification Trends*

| Performance metric(s) | Goals(s) | Indicator(s) |
|---|---|---|
| Number of units of code significantly modified as a result of peer review | 10 percent or less than the total number of units of code | Greater than or equal to 25 percent of the total number of units of code |
| Number of units of code significantly modified as a result of SCRs | 10 percent or less than the total number of units of code | Greater than or equal to 25 percent of the total number of units of code |

The CDX Quality Assurance Lead is responsible for compiling information related to the metrics in this and following sections and for providing a monthly QA status report to EPA. Any anomalies that occurr during the reporting period are also described in the status report.

## 3.5 QA Process Description

The QA/QC activities for the development phase ensure the development staff follows standardized software development processes for the CDX system. The QA/QC process includes the following activities:

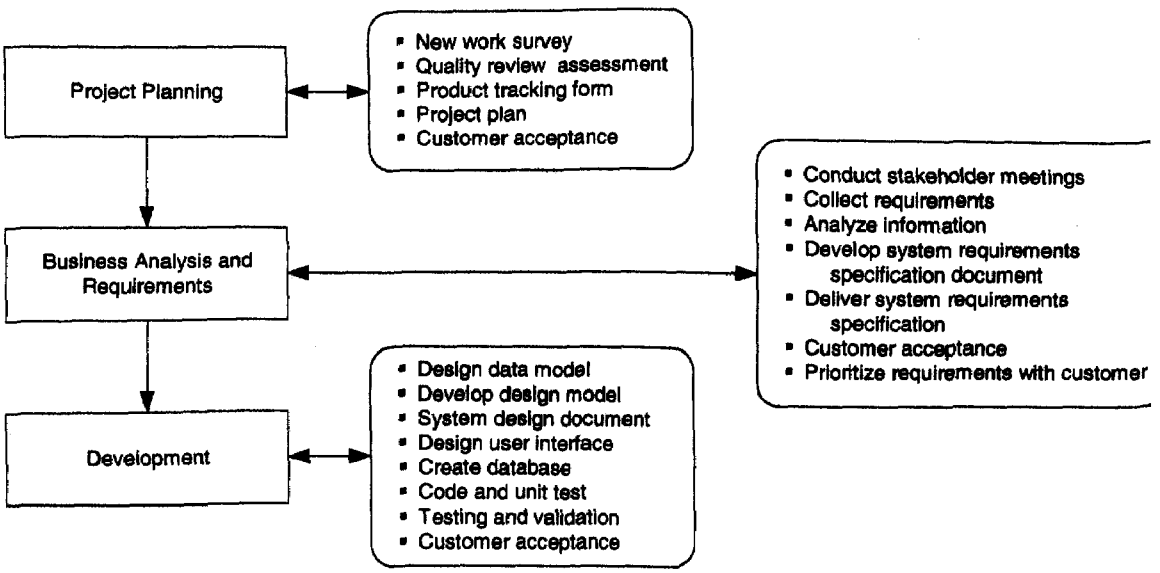
- Document and track requirements.
- Conduct and document design reviews.
- Conduct and document product peer reviews.

Accomplishment of these activities is measured in several ways. The most apparent metrics show if a project is completed on time and within budget according to the latest available requirements, specifications, schedule, and budget. The ultimate standard is whether the project deliverables are accepted by the customer. This information is provided by project leaders via Microsoft Project Gantt charts and is described in Section 7.

Other methods used by the CDX team to gauge success include manual review of Gantt chart status reports, documents, and deliverables by the QA Lead, program managers, and program directors, as well as internal "lessons learned" sessions with CDX team members and external sessions with EPA.

Figure 3-1 displays the process flow for activities occurring during the development phase.

*Figure 3-1. CDX Development Phase Activities*



### 3.5.1 DOCUMENTATION PROCESS

Documentation produced for CDX projects passes through several review processes to ensure it meets CDX project requirements and quality standards. QA staff review CDX documentation to verify it meets project requirements and SDLC standards. The technical consultant's editorial staff review and edit project reports to ensure they meet ISO 9000 standards for documentation.

The quality assurance staff review project documents on both a set schedule and as-needed throughout the SDLC. The results of the documentation reviews are captured on the Software Product Review Checklist. One QA person serves as coordinator for the review, documenting any notes as attachments to the checklist. This person also coordinates completion of the checklist. The results are tracked in the ISO information management system on the product review summary (see Figure 3-6).

### 3.5.2 DELIVERABLES

The QA staff review deliverables produced by other project staff. These may include the following:

- The *Requirements Document*—using a software requirements checklist to determine if the requirements are testable, verifiable, consistent, complete, unambiguous, and traceable (see Appendix A).
- The *Software Design Document*—utilizing the Software Design Review Checklist to ensure the design is congruent with the requirements document (see Appendix B).
- *User support documentation* (e.g., tutorials, instruction guides, and user guides)—ensuring they are representative of the system to be delivered. This review requires the QA staff employ the support documentation to use the system, then report any discrepancies.
- *Release notes*—utilizing the Release Notes Template (see Appendix C).
- *Bill of Materials* against the *Bill of Materials Template*—The bill of materials is the list of all hardware, software, and other assets used on the project. QA/QC verifies whether the bill of materials includes an inventory of materials, software contents, changes, installation instructions, and known errors and problematic features (see Appendix D).
- *Software product tested against CDX requirements*—using a Test Plan.

The practice of using these various checklists was instituted in May 2001. Less formal methods of QA were used before that date. (See Appendixes A and B)

QA procedures extend beyond the reviews conducted by the QA staff. All reports produced for the EPA CDX system are routed through a formal editorial review to ensure the proper use of grammar, templates, and graphics.

All deliverables are reviewed and signed by

- the program director for the Program and System Life-Cycle Support business unit, and
- LMI's EPA program manager.

For some technical documentation, the documents are also reviewed by

- the program director for the Systems Development and Technical Support business unit, and
- LMI's EPA program technical manager.

### 3.5.3 STANDARDS AND GUIDELINES

CDX software development adheres to standards and guidelines derived from ISO 9000 operating procedures for software development. These guidelines are implemented in two ways:

- Through the implementation of LMI's standards, methods, and procedures, which are certified as ISO 9000 compliant.
- Through the use of the Rational software development suite of tools, which are ISO 9000 compliant.

The ISO 9000 software development standards and the Rational software development suite complement one another. Our standards and procedures are followed by project personnel. Additionally, the Rational suite provides the tools that implement and automate software development.

The quality assurance staff uses a number of guidelines for creating and implementing QA standards, procedures, and tools. These guidelines, derived from SDLC best practices, may include

- maintainability,
- interoperability,
- testability,
- reliability,
- flexibility,
- correctness,
- integrity,
- usability,
- reusability,
- efficiency, and
- portability.

These guidelines form the basis for the checklists used by QA staff to review project documents and deliverables.

For the management of software development, the CDX team uses Rational ClearQuest™, an ISO 9000–compliant system change request (SCR)–tracking tool, to enter and track all SCRs. Using this tool, the CDX team summarizes and reports on a variety of SCR data, which also help identify different trends.

SCR data available for summary and analysis may include a subset of the following characteristics:

- Cumulative number of SCRs opened on the project
- Percentage of SCRs that have been closed
- Percentage of SCRs that remain open
- Date each SCR was opened
- Severity of each SCR
- Status of each SCR
- Average age of open SCRs
- Number of SCRs listed by severity, status, or keyword term.

The CDX team is currently researching the compatibility of Rational ClearQuest and the McAffee SQL™ tool. If these products are compatible, an interface will be developed, allowing the two tools to interact. This solution will potentially consolidate the SCR tools and allow more efficient use and tracking of SCRs. Figure 3-2 and Figure 3-3 show sample SCR forms.

*Figure 3-2. System Change Request Form*

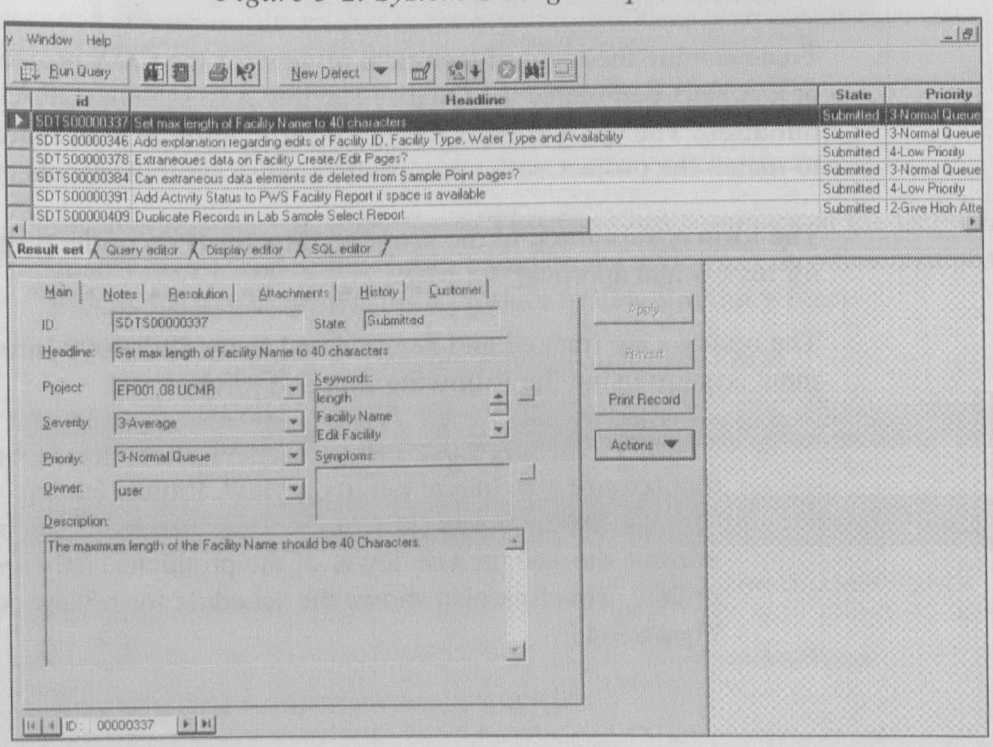
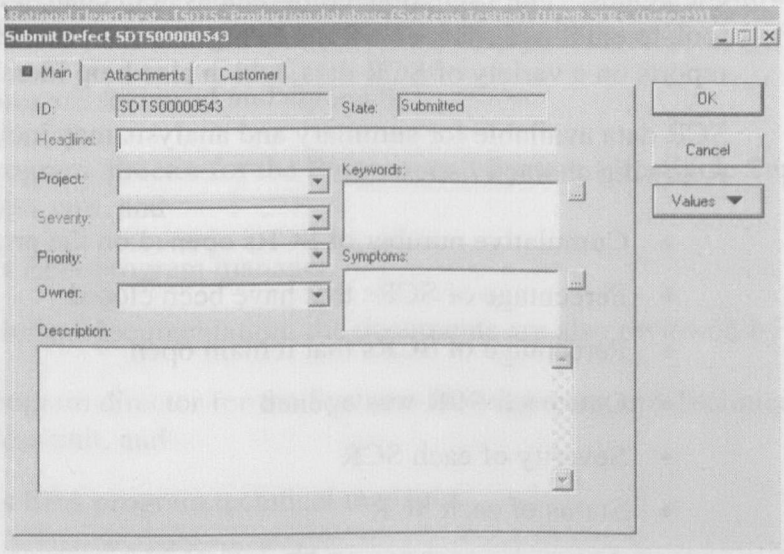


*Figure 3-3. System Change Request Blank Form*




### 3.5.4 REVIEWS, QUALITY CHECKS, AND AUDITS

As part of the ISO 9000 processes, CDX employs several quality planning and review requirements for the design and development of its software products. Although project leads and reviewers are responsible for completing the processes described below, the QA Lead is responsible for monitoring and documenting overall adherence to QA processes related to reviews, quality checks, and audits.

#### 3.5.4.1 Reviews

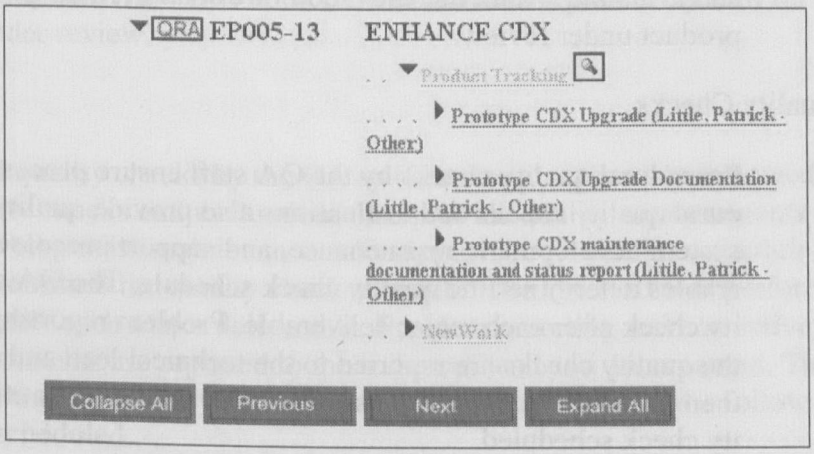
To determine the level of technical review for the CDX project, the project leader or QA staff completes the Quality Review Assessment (QRA) form during project initiation. The QRA solicits project identification as well as information intended to match the project with appropriate quality assurance tools and procedures.

The form is submitted to the program director (PD) or the program manager (PM) for review and approval.

The reviews are tracked and documented in the ISO 9000 Information Management System using the following link and forms:

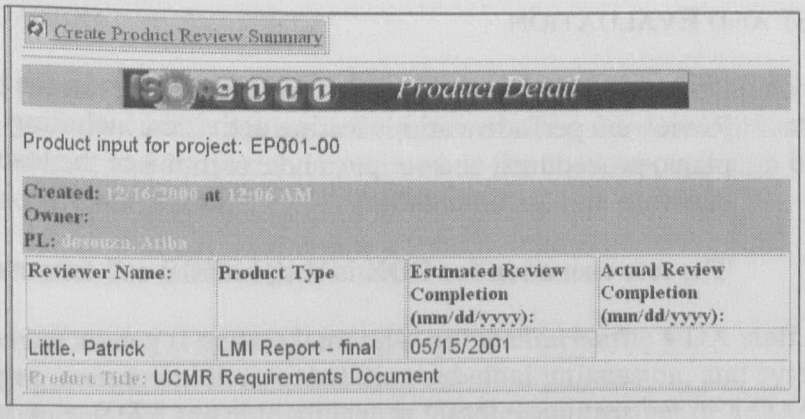
- *Product Tracking Link.* Project leaders select this link to identify products that require a technical quality review. Project leaders assign a reviewer for each product. The Information Management System automatically notifies the assigned reviewer of the product(s) they are responsible to review. This link also shows the schedule for review completion (see Figure 3-4).

*Figure 3-4. Product Tracking Link*



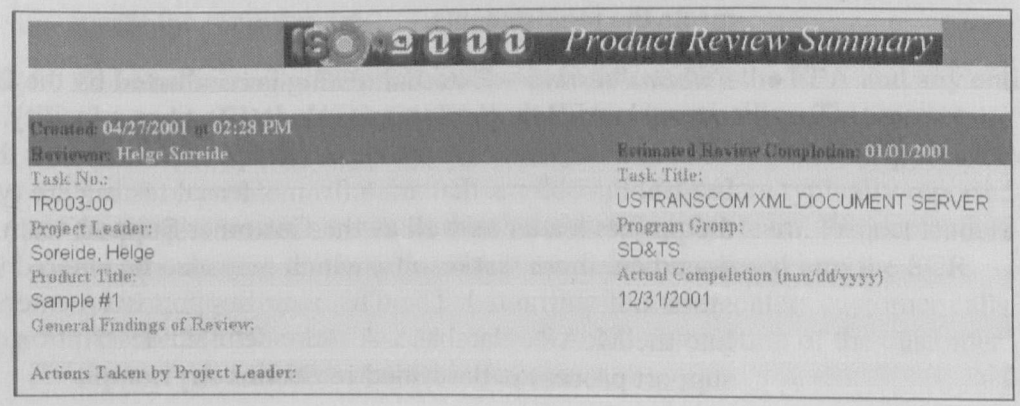

- *Product Detail Screen.* This form provides information about the product: product title, product type, quality reviewer, and an estimated review due date (see Figure 3-5).

*Figure 3-5. Product Detail Screen*




- *Product Review Summary Form.* This form is a summary of the technical quality review and actions taken based on the reviewer's recommendations. Figure 3-6 below represents a product review summary form.

*Figure 3-6. Product Review Summary Form*



The QA reviewer or designated quality reviewer ensures the forms are complete and available within the ISO 9000 Information Management System for the product under review.

#### 3.5.4.2 Quality Checks

Procedural quality checks by the QA staff ensure processes are followed. Procedural quality checks and evaluations also provide quality measurements of CDX system development, maintenance, and support processes. The schedule of deliverables determines the quality check schedule. The QA staff will perform a quality check after each major deliverable. Problem reporting and corrective action for the quality checks are reported to the technical lead and documented. The team is then given the opportunity to correct any non-conformities and a follow-up quality check scheduled.

#### 3.5.4.3 Formal Audits

As part of the ISO 9000 recertification, formal audits of the processes are required. These audits are performed by an external group.

### 3.5.5 TEST AND EVALUATION

Designated project personnel serve as reviewers in the test and evaluation process. Reviewers perform various testing activities, including the development of test plans, procedures, and scripts, and execution of the tests, through sign off on the software and documentation.

The test execution for CDX is both internal and external:

- *Internal testing*—Internal testing is conducted by the CDX staff. This testing includes unit, functional, integration, regression, and system testing. Internal testers include any CDX team member or a QA/QC member. Typically, a test plan and test scripts are developed and executed for this process. The test scripts usually include a checklist for documenting success or failure of specific requirements or functionality. This documentation is then included in the quality records associated with the CDX system. The QA/QC team ensures the software is functional and meets the requirements.

- *External testing*—External testing is conducted by the EPA and any entity external to EPA, which may include a state or a facility. This testing assures the client the software is acceptable and meets their requirements. Issues or problems that arise from external testing are typically reported to the project leader as well as the Customer Support team. Project leaders document these test results, which may also be entered into the SCR system, if warranted. The Customer Support team enters customer calls into the McAfee database. A more detailed description of the customer support process is described in Section 4.

The QA reviewer or designated quality reviewer ensures the forms are complete and available within the ISO 9000 Information Management System for the product under review.

#### 3.5.4.2 Quality Checks

Procedural quality checks by the QA staff ensure processes are followed. Procedural quality checks and evaluations also provide quality measurements of CDX system development, maintenance, and support processes. The schedule of deliverables determines the quality check schedule. The QA staff will perform a quality check after each major deliverable. Problem reporting and corrective action for the quality checks are reported to the technical lead and documented. The team is then given the opportunity to correct any non-conformities and a follow-up quality check scheduled.

#### 3.5.4.3 Formal Audits

As part of the ISO 9000 recertification, formal audits of the processes are required. These audits are performed by an external group.

### 3.5.5 TEST AND EVALUATION

Designated project personnel serve as reviewers in the test and evaluation process. Reviewers perform various testing activities, including the development of test plans, procedures, and scripts, and execution of the tests, through sign off on the software and documentation.

The test execution for CDX is both internal and external:

- *Internal testing*—Internal testing is conducted by the CDX staff. This testing includes unit, functional, integration, regression, and system testing. Internal testers include any CDX team member or a QA/QC member. Typically, a test plan and test scripts are developed and executed for this process. The test scripts usually include a checklist for documenting success or failure of specific requirements or functionality. This documentation is then included in the quality records associated with the CDX system. The QA/QC team ensures the software is functional and meets the requirements.
- *External testing*—External testing is conducted by the EPA and any entity external to EPA, which may include a state or a facility. This testing assures the client the software is acceptable and meets their requirements. Issues or problems that arise from external testing are typically reported to the project leader as well as the Customer Support team. Project leaders document these test results, which may also be entered into the SCR system, if warranted. The Customer Support team enters customer calls into the McAfee database. A more detailed description of the customer support process is described in Section 4.

There are four levels of testing performed against the CDX system:

- *Unit testing* verifies the smallest piece of a program (module) to determine the actual structure is correct and if the function of the code operates correctly and reliably. The CDX application developer(s) performs this test.
- *Integration testing* evaluates a group of units (modules) that have been implemented together. The CDX application developer(s) performs this test.
- *System testing* verifies the product by testing the application in the integrated system environment. The purpose of system testing is to ensure the CDX functional requirements are satisfied by the system. The CDX application developer(s) performs this test.
- *Acceptance testing* verifies the application is fit for deployment. This may include verifying that the application is reliable, meets the requirements for business, performs well, and has a consistent look and feel. This testing is performed by the CDX application developer(s). At this point, the functionality of the application is typically demonstrated at the CDX program management level.

The CDX program testing activities are both internal and external (by EPA and others). The testing efforts may include the following types of testing:

- *Performance testing* verifies that all software modules both individually and collectively, meet specified performance objectives, including maximum load and throughput.
- *Reliability testing* verifies that all of the possible operations in the application work without causing the software or the system to hang or crash.
- *Business-function testing* verifies that the crucial business functions are working in the application. The business rules are documented in a requirements document.
- *User-interface testing* verifies that the application under test is consistent throughout and meets the objectives of the user-interface design specification.
- *Installation testing* verifies that the application can be installed correctly.
- *Configuration testing* is performed using specific hardware and software combinations.
- *Documentation testing* verifies the accuracy and completeness of user documentation.

- *Regression testing* is the re-execution of tests after a fix, change, or enhancement has been made to the code and a new build has been delivered to QA. Regression testing verifies that previously identified problems have been fixed and changes to another part of the application have not introduced new problems.

The requirements and design documents are used to develop test plans, test procedures, and test scripts for evaluation. Interim and post-test documentation typically includes one or more of the following: status reports, problem reports, test summary reports, and recommendations.

Project leaders and the QA staff maintain testing results records.

### 3.5.6 Problem Resolution and Corrective Action

This EPA QAP incorporates review, testing, and documentation into all applicable phases of software development. These measures ensure problems can be identified, analyzed, and addressed quickly.

The following elements are at the core of our problem-resolution processes:

- Process and code reviews, as appropriate, within the project.
- Software test plan and test cases, as appropriate, within the project.
- Software change requests and their corresponding management system.
- Customer support and the corresponding trouble ticketing system.

Code reviews and software tests ensure anomalies are detected and identified expeditiously. Customer support incidents may also identify system anomalies. The SCR management system and the customer support trouble-ticketing system ensure problems are tracked, resolved, and analyzed for trend identification.

The SCR management process handles all hardware and software-related requests and problems. Input to the process may come from code reviews, software tests, or customer service incidents. Generally, SCRs originate from one of the following:

- Software testers and associated CDX team members, who identify problems and enhancements that merit SCRs
- Customer support personnel, who qualify customer incident reports and report system problems that have not already been identified; these problems may merit SCRs
- Technical personnel, who may identify software problems or enhancements that merit SCRs.

The resolution of SCRs is a cooperative process among team members. The management of SCRs is the joint responsibility of the project's technical leader and functional leader. These two team leaders designate one or more individuals to enter and track SCRs and to produce and circulate SCR reports. Periodically, the project technical leader and the project functional leader review all open SCRs, prioritize SCRs for resolution, assign new SCRs to appropriate team members for investigation and resolution, and identify SCRs that may require consultation with the customer. Team members who are assigned SCRs for investigation and resolution report their findings to the SCR trackers.

These change request trackers use the findings to identify SCRs that are provisionally resolved. An SCR is not formally resolved and closed until the provisional resolution can be independently verified by a team member other than the one initially assigned the SCR.

The QA staff uses Rational's ClearQuest to track all SCRs and generate SCR reports, which can be used to detect trends that may indicate systemic weaknesses in the project processes. If any such trend is detected, the project team identifies which elements or project procedures may be responsible for the trend, and recommends appropriate remedial action to the customer. After instituting appropriate corrective actions, the project team assesses the effect of the corrective actions. If there is no reversal in the trend, corrective actions are modified to increase their effectiveness.

SCRs are evaluated to determine potential cost or schedule consequences. The CDX project lead and EPA jointly evaluate enhancements to determine effects on cost and schedule before implementation.

# Section 4
# Customer Service and Technical Support

## 4.1 Objective

The objective of QA/QC is to ensure the CDX customer service and technical support activities are conducted and documented according to a set of standardized procedures.

## 4.2 Definition

Customer service and technical support help external customers who require assistance when using a CDX service, typically when there is inability to connect, failure to receive an expected confirmation, etc. User support also assists with performing CDX operations when documentation is unclear to the user.

User support does extend to program-specific assistance as it relates to CDX. For example, CDX assists a user in confirming their TRI submission was processed and sent to the EPA TRI reporting center. CDX user support would not assist users with the completion of the TRI form itself. User support will also manage the CDX web page and assist in user registration.

## 4.3 Quality Measures

The CDX Help Desk adheres to proven customer service practices to ensure excellent customer service and technical support. These practices are easily translated to quality measures:

- Help Desk operations
- Problem resolution and corrective action
- Customer evaluation
- Documentation
- Performance
- Testing and validation
- System operations.

The following sections describe these quality measures in more detail.

## 4.4 Metrics

The Help Desk staff uses McAfee SQL trouble-ticketing software, an automated application that logs, classifies, tracks, and reports contact with or requests to the Help Desk. Metrics maintained through this application are listed in Table 4-1.

*Table 4-1. Customer Service Quality Measure and Performance Metrics*

| Performance metric(s) | Goals(s) | Indicator(s) |
|---|---|---|
| Number of McAfee tickets opened (daily, weekly, monthly) | 95 percent or more of McAfee tickets are closed within one business day of origination | 5 percent or more of McAfee tickets remain open for more than one business day |
| Number of McAfee tickets opened for each CDX application within a reporting period | Number of McAfee tickets opened for each application represents 5 percent or less of the total number of users registered for that application | Number of McAfee tickets opened for each application represents 10 percent or more of the total number of users registered for that application |

The help desk currently operates according to the following service levels:

- "How to" questions about EPA CDX resolved within 4 hours
- Browser problems resolved within 1 day
- Software support problems corrected within 1.5 days
- The number of resolved or isolated on-site hardware problems are resolved within 1 day
- Isolated onsite Internet connectivity problems resolved within 1 day.

## 4.5 QA Process Description

The QA/QC activities for customer service and technical support staff follows a set of procedures developed for the CDX system. The QA/QC process includes the following activities:

- Logging daily CDX activities
- Documenting problems and issues
- Notifying users of resolutions to their problems:
  - Communicating promptly with users
  - Resolving problems in a timely manner
- Notifying users of system availability.

### 4.5.1 HELP DESK OPERATIONS

The CDX Help Desk provides customer support through e-mail, fax, and a toll-free number from 8:00 a.m. to 6:00 p.m. (EDT), 5 days per week, 52 weeks per year (except for federal holidays). Both the e-mail and voice mail offer 24-hour-a-day coverage for users to place their call and provide initial documentation.

### 4.5.2 PROBLEM RESOLUTION AND CORRECTIVE ACTION

Customer support constitutes the initial level of support on all EPA CDX problems and requests.

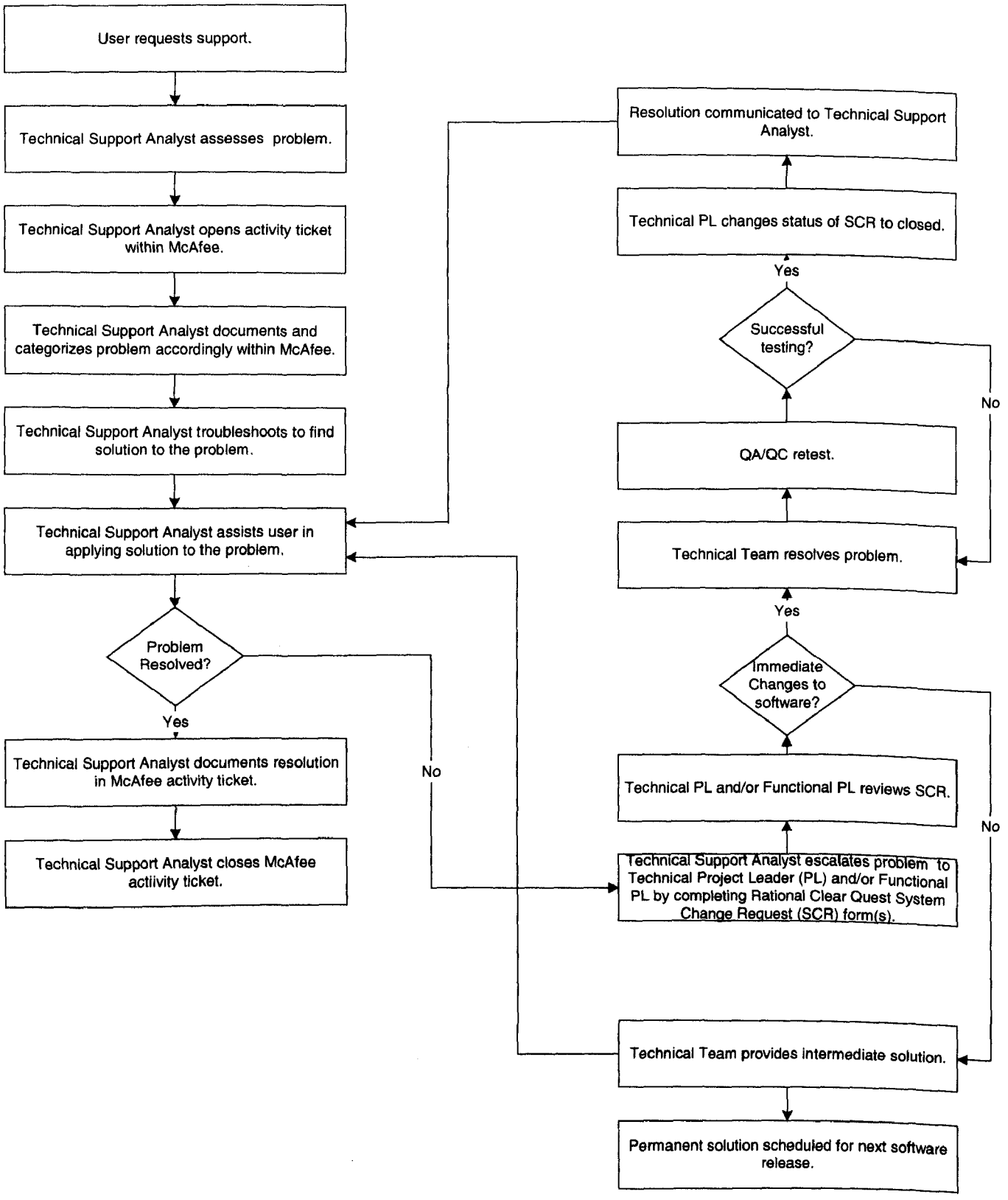
Every issue submitted to customer support for resolution results in a unique activity ticket number, which is issued to the user (users leaving voice mail or sending e-mail or a fax will be promptly contacted and provided with their activity number). The activity ticket is assigned to a technical support analyst for action. Users may refer to the ticket number when inquiring about the status of their support request.

CDX customer support personnel staffing the help desk use the McAfee SQL trouble-ticketing application to document, manage, track, and analyze technical support requests. The McAfee SQL trouble-ticketing application is used to log, classify, track, and report on all customer contacts to the EPA Help Desk. The Technical Project Leader responsible for the Help Desk also reviews trouble tickets in the McAfee system to ensure consistency and thorough customer service problem resolution. This process is documented in Figure 4-1.

If technical support is unable to resolve or is having difficulty resolving problems they escalate to the technical project leader, software developer, network engineer, and/or functional project leader. Depending on the severity of the problem, the technical support team may request initiation of an SCR.

The technical support staff uses an escalation process that allows them to resolve problems within their team. If the problems are not resolved then they inform their technical or functional lead.

*Figure 4-1. Customer Activity Tickets and SCR Process Flow*



### 4.5.3 ADDITIONAL QA/QC PROCEDURES

The Technical Project Leader tracks and monitors technical support activities. Additionally, the Technical Project Leader ensures service levels by spot-checking McAfee tickets to guarantee quality service to customers.

The Technical Project Leader meets with the technical support staff at least weekly; although meetings typically occur daily. These meetings are opportunities to discuss the status of open ticket activities, problems, issues or concerns. These meetings may also stimulate ideas on further enhancements or refinements to Help Desk operation procedures.

In addition to the weekly meeting, the Help Desk staff and the Technical Project Leader also attend a weekly meeting with the CDX EPA staff. This is typically a conference call.

### 4.5.4 DOCUMENTATION

The technical support staff document all activities. They document and track problems daily. Weekly, the technical support staff provide the following documentation:

- *Weekly CDX Report*—This report includes metrics and support calls. The support calls are classified as (1) How To, (2) Browser, (3) User Account, (4) Problem with Software. The report is distributed to the CDX EPA staff, Functional and Technical Leads, and (5) Problems with hardware during the reporting period.
- *Weekly TRI Log*—This report lists all of the submissions received. This report is available to the CDX EPA staff, functional and technical leads, and the Emergency Planning and Community Right-to-Know Act (EPCRA) Reporting Center.
- *Weekly Registrants List*—This report list all users who registered per program. This report is per request only and is available to the CDX EPA staff, functional and technical leads.

### 4.5.5 CUSTOMER EVALUATION OF PERFORMANCE

EPA stakeholders are the best gauge for measuring customer and technical support. Given that CDX is a public system that offers technical support as one of its features, EPA program offices and the CDX team are the first to learn of issues related to poor performance. To date, there have been no such reports regarding the technical support staff. The CDX team is committed to maintaining this level of service now and in the future.

Currently, there is no formal way to receive feedback from the users unless the Help Desk staff specifically requests this information during a phone call or it is

included in e-mail sent to the Help Desk. The CDX team is in the process of developing an online survey that will be used as a means to attain feedback on the EPA Help Desk support. This evaluation would assist in determining where improvements can be made in the Help Desk processes.

Additionally, the Technical Project Lead overseeing the Help Desk works very closely with the Help Desk staff, ensuring performance and activities are accomplished according to service-level agreements.

Any of the following techniques may be used to evaluate customer response. Given EPA and government concerns regarding client contact, none of the following have been implemented within CDX:

- Periodic reviews
- Online surveys
- Website e-mail
- Verbal comments from callers
- Gathering of customer feedback during trouble call
- Keeping CDX EPA staff and technical leads aware of user comments.

### 4.5.6 CROSS-TEAM SUPPORT

The Help Desk has its own specific responsibilities which were described above along with its procedures and QA/QC steps conducted to measure performance. However, the Help Desk itself performs QA/QC functions in support of the CDX application programming staff.

The Help Desk staff provides testing for CDX applications. Because the Help Desk team is trained in the use of all CDX applications, the team is well suited to perform testing activities that are integral to the CDX QA/QC framework. The Help Desk staff assists technical project staff and QA staff in QA testing and validation procedures described in Section 3. This provides the added benefit of giving the Help Desk staff hands-on experience using the applications from both the technical and user perspective.

The Help Desk staff also performs QA/QC activities related to CDX system operations. Daily, the Help Desk staff checks applications running on CDX using the Web interface. Any anomalies discovered during this check are reported to the CDX lead system engineer. If this consultation with the CDX lead system engineer establishes the need to initiate a software change request, an SCR is entered into ClearQuest to track the problem and its resolution.

# Section 5
# System Operations

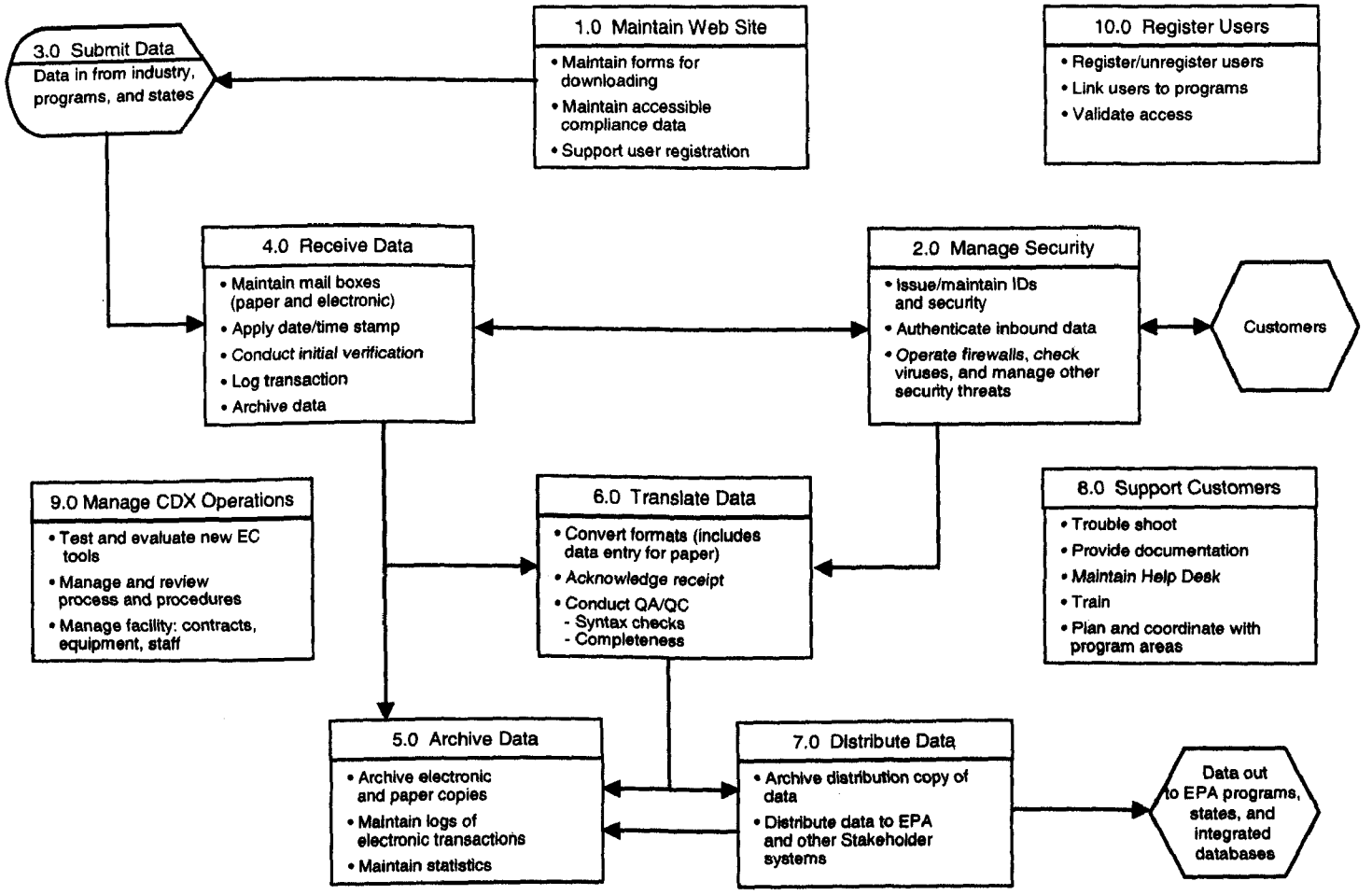
## 5.1 Objective

The objective of QA/QC is to ensure the quality and operation of CDX is maintained systematically according to a set of documented procedures.

## 5.2 Definition

CDX system operations include how the system is managed and maintained on a daily basis. The core CDX services are the underlying functions used by specific program area data flows. Figure 5-1 illustrates the 10 core functions.

*Figure 5-1. Details of CDX Functions and Data Flows*



## 5.3 Quality Measures

System operations involve several members of the CDX team. It is the responsibility of the systems engineers and the developers to ensure the CDX system is operational by monitoring the system's daily activity. The quality measures associated with monitoring and operating the CDX system include the following:

- Operations monitoring and reporting
- Problem resolution and corrective action
- Scheduled system maintenance
- Independent reviews.

## 5.4 Metrics

The aforementioned measures represent the many dimensions of quality necessary to determine the effectiveness of the CDX system and its supporting functions. Because of the complexities of the CDX system, it is not appropriate to tie individual metrics to specific quality measures—many interrelated components make up the whole. Rather, the CDX team ensures quality measures are monitored by conducting automatic and repeatable tests to demonstrate required properties are achieved and website behavior and performance meets expectations. Table 5-1 describes the metrics the CDX team uses to validate the quality measures. The operational definitions of and standards for many of these metrics are defined in the standard hosting agreement between the CDX team and EPA. The hosting agreement may contain additional performance standards and metrics, which are incorporated into this document by reference.

*Table 5-1. System Operations Measures and Metrics*

| Relevant CDX component(s) | *Quality measures* | Performance metrics for standard measurement period | Goal | Warning |
|---|---|---|---|---|
| 1.0 Manage Websites | Track CDX usage patterns | Number of pages<br>Number of changes to pages requested by program areas or users due to:<br>▪ Deficiencies in work<br>▪ New features or flows<br>Annual review of web-site for compliance with EPA web page standards | Less than 5 percent of changes due to deficiencies<br>Website meets all EPA web page criteria | More than 10 percent of changes due to deficiencies<br>Website achieves less than "good" rating in review |
| 2.0 Manage Security | See Section 5 | | | |
| 3.0 Submit Data | Track CDX usage patterns | Number of direct file uploads<br>Number of files submitted through web forms | User problems measured through user support | |

*Table 5-1. System Operations Measures and Metrics (Continued)*

| Relevant CDX component(s) | Quality measures | Performance metrics for standard measurement period | Goal | Warning |
|---|---|---|---|---|
| 4.0 Receive Data<br>7.0 Distribute Data | Track CDX processing patterns | Number of transactions received in in-box<br>Number of transactions made available for distribution<br>Number of transactions remaining available for distribution for one week. | Each inbound transaction accounts for either placement on distribution server or is rejected.<br>No transactions remain unclaimed on distribution server for more than 1 week | Identification of a single transaction not leaving the system<br>Any transaction remains unaccessed for more than 2 weeks. |
| 5.0 Archive Data | Track CDX performance patterns | Number of files archived<br>Number of archive attempts failing<br>Amount of disk space used | No archive failures | Any archive failures<br>Disk space reaches 75 percent of capacity |
| 6.0 Translate Data | Track CDX processing patterns | Number of files translated<br>Number of transactions rejected by translator<br>Number of pass-through files | Less than 5 percent of files are rejected for applications in production status.<br>Less than 30 percent of files are rejected in test status. | More than 10 percent of files are rejected for applications in production status.<br>Less than 50 percent of files are rejected in test status. |
| 8.0 Support Customers | See Section 4 | | | |
| 9.0 Manage CDX Operations | Track CDX system availability patterns | Number of times system was down for 1 hour or more due to CDX system failure<br>Percent of system downtime due to CDX system failure<br>Number of times system was down for scheduled maintenance | No unscheduled down time<br>100 percent system up time (discounting scheduled down time)<br>Scheduled down times used are no more than 2 per month | More than 2 unscheduled down times per month<br>System up time falls below 95 percent (discounting down time)<br>Scheduled down times used exceed 3 per month |
| | Track CDX performance patterns | Average throughput by CDX application after assessment of requirements<br>Overall average throughput (form receipt at inbox to placement on distribution server). | No more than 5 percent of transactions for that application exceed expected average | No more than 10 percent of transactions for that application exceed expected average |
| 10.0 Register Users | Track CDX registration patterns | Number of registered users<br>Number of status changes<br>Number of errors recorded in key fields | Less than 5 percent of key fields contain erroneous data. | More than 10 percent of key fields contain erroneous data. |

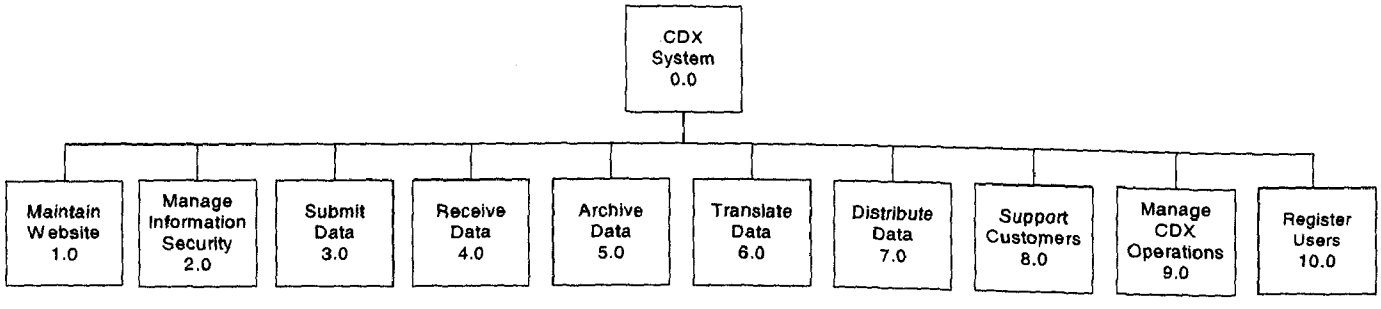
### 5.4.1 PERFORMANCE STANDARDS

Performance standards for operations (e.g., goals for minimal level of system up-time) are defined in the Service Level Agreement and the Contingency Operations Plan (COOP).

## 5.5 QA Process Description

The QA/QC activities for system operations ensure the CDX system is operating and maintained according to a set of guidelines defined by the project. Figure 5-2 displays the 10 core components associated with the CDX system.

*Figure 5-2. CDX System Components*




### 5.5.1 COMPONENTS OF SYSTEM OPERATION

The following sections describe the basic components of the CDX system.

#### 5.5.1.1 Maintain Website

This component provides requirements for developing and maintaining the content for CDX websites, including a homepage, registration pages, and submission pages. This functionality also contains a subprocess that provides capabilities for maintaining the sites (including the capability to add, modify, and delete forms and post announcements).

#### 5.5.1.2 Manage Information Security

Information security requirements address perimeter defense, authentication procedures, access controls, system software controls, virus scanning, and backup procedures. As technology progresses, additional functionality may be added to enhance the system.

This function establishes techniques for registering and validating users, authenticating incoming data, and protecting legacy data. Specific protocols are delineated and methods are identified for handling secured data.

This function contains four main subprocess areas. The first, *establishing and maintaining a user registration*, manages the user registration database for authorized users. The second subprocess, *user verification*, includes requirements for monitoring access to the system by creating procedures for user log-on, establishing the log-on passwords, and verifying the security for inbound messages. The third subprocess, *data authentication*, acquires digital certificates and facilities for handling electronic signatures. The final subprocess, *protection*, contains requirements for specific protocols and distinctions between types of data.

5.5.1.3 Submit Data

This function provides general capabilities for users to access, view, download, and update information through direct transmission, using the Internet or throughput on the CDX website. This function also enables the user's profile information (i.e., name and address) to pre-populate forms and send information to the CDX.

Four subprocesses fall within the submit data functional area. The *manage forms* subprocess provides capabilities for reviewing, printing, editing, and signing forms. The *pre-populate forms* subprocess supplies functionality to fill out forms automatically with information that is based on the user and previously supplied data. The other two subprocesses—*send electronic data* and *send paper*—establish techniques for users to send information electronically and on paper.

5.5.1.4 Receive Data

This function enables the CDX system to handle incoming data. This functional area has four subprocesses. Two of these subprocesses—*establish communication techniques* and *establish data formats*—delineate how data will be retrieved. The *receive transaction* subprocess details the complete flow of information through the function. The *receive paper* subprocess handles paper submissions.

5.5.1.5 Archive Data

This function delineates policy and procedures for the CDX to capture, store, and maintain data as well as control access to the archives. This function includes methods for storing data, logging transactions, archiving system backups, retrieving archived data, and measuring statistics and storage as well as general archiving information. The archive function provides the ability to maintain the submission in its original format and, in conjunction with the transaction log, to provide legal traceability of the document.

The archiving process for CDX electronically holds original transaction files received from a client, resulting files from a translation of the original submission, files signed by CDX to be sent to the client, and reports generated by EPA to be sent to the client. These are all stored in a secure database.

The archiving process is divided into four steps. Each program (AEI, TRI, UCMR, IDEF, etc.) uses one or more steps:

- *Archive 1* stores the original submission file in a secure database.
- *Archive 2* stores any digital signature file after that has been validated or verified in the secure database.
- *Archive 3* stores any resulting file from a translation in the secure database.
- *Archive 4* stores files to be sent to the client after being digitally signed by CDX and report files from EPA to be sent to the client in the secure database.

All programs use step one. Some programs require a digitally signed letter with their submission. Other programs require a digitally signed document to be sent back to the submitter as receipt acknowledgement. All programs require a positive or negative acknowledgement. Some programs require a notification by the submitter using the CDX inbox at the same time as SMTP mail.

Multiple files in a single submission are bound in a single zip file. If the file received is larger than 32 megabytes, the file is saved in a secure directory and a pointer is set in the archive table.

The CDX Help Desk is notified of every error sent to CDX via SMTP mail (see Table 5-2).

5.5.1.6 Translate Data

This function establishes mechanisms for transforming incoming stakeholder data and mapping or parsing the data to the appropriate EPA legacy database. The requirements relate to file structures expected as input, data setup and manipulation, data verification, standards, and multiple mapping solutions.

5.5.1.7 Distribute Data

This function establishes mechanisms for disseminating copies of received data to appropriate data systems, as well as providing a means for archiving and logging all transactions. Two initial subprocesses determine the recipient profile, verify security, and send the transaction.

*Table 5-2. Archive Administration*

| Function | Description |
|---|---|
| Archive security | The application is a Secure NT, password protected process. Connection to the database is established using SQLNET password protection. |
| Archive process management | The application(s) is on NT Scheduler and is activated every five minutes (time varies depending on the program). It creates a log file that can be retrieved for debugging purpose. |
| Archived information | The application(s) read the necessary information from an INI file. The INI file is located in the same directory as the application(s) resides. |
| Distribution of information | The information is distributed through SMTP mail and/or CDX inbox in the register database. |
| Error detection for archive process | The application(s) check for and log the following types of errors:<br>• An INI file was not found<br>• Connection to the database was not established<br>• The submitted file does not meet the naming convention requirement for that program<br>• The sender and client are not valid<br>• An e-mail address was not found in the Register for that sender<br>• The file was not properly saved in the database or moved to the archive directory (for large files)<br>• Acknowledgements and notifications are not sent<br>• Zip, unzip, move and copy files were not successful<br>All errors are logged in the log file, in the Transaction Log table or communicated to the Help Desk via SMTP mail. |

5.5.1.8 Support Customers

The support customers' function identifies user assistance requirements. The requirements for support are organized according to the following subprocesses:

- Troubleshooting
- Security management assistance
- Training

- Online documentation
- Maintenance of documentation.

Other subprocesses include tracking customer requests and responses, and the functionality needed to query status. See Section 4 for more details.

5.5.1.9 Manage CDX Operations

This function specifies requirements for managing and maintaining the CDX system, monitoring costs, and evaluating trend and performance data. This function has five subprocesses. The first sub-process provides *administrative tools* and specifies requirements for administering, collecting, and tracking system data. The *maintain mailboxes* subprocess relates to requirements for managing system mailboxes. The *monitor costs* and *maintain documentation* subprocesses refer to CDX requirements for cost reporting and general document maintenance. The *facility* subprocess outlines requirements for continuity of operations planning and shadow systems.

5.5.1.10 CDX Register Users

The register users function is an automated method of registering and tracking users who are permitted to use the CDX system and its specific programs. There are two types of registration: government pre-registration and user registration.

Government pre-registration allows the users to obtain their information using the following:

- EPA authorization
- Customer retrieval key provided in a letter sent by EPA
- Create username and password.

User registration allows the user to enter personal business data using an online data entry system.

Both the government pre-registration and the user registration typically follow the same process after the initial logon:

- Verify or edit organization information.
- Verify or edit role information.
- Complete registration.

### 5.5.2 Reviews, Quality Checks, and Audits

The QA Lead performs reviews, quality checks, and audits to ensure system operations are being monitored and maintained as required. Logs are generated by many of the automated system monitoring applications reviewed by the QA Lead, the Lead Systems Engineers, and other CDX team members.

### 5.5.3 Operations Monitoring and Reporting

The CDX system is monitored by the Systems Engineer using the following tools:

- *Compaq Insight Manager*—the Compaq application for easily managing network desktops and servers. Insight Manager delivers intelligent monitoring and alerts as well as visual control of Compaq servers and desktops.
- *Computer Associates ArcServe IT*—the tool used to perform backups. The Lead Systems Engineer, a systems engineer, and the Help Desk all monitor this tool. Full backups are performed weekly. Incremental backups are performed daily.
- *Cyber Cop*—this tool is a security assessment tool and intended for one-time use.
- *Lockit*—an EPA one-time tool used at build time to check several servers against a set of EPA standards and guidelines. The staff utilized a manual checklist before the use of this tool. This tool captures approximately 90 percent of what is required from the checklist.
- *Norton Antivirus Corporate*—virus protection software used for the CDX project. It is installed on all servers within the EPA domain. It protects servers 24 hours a day and alerts the system engineers when a virus is discovered. The servers are monitored and checked daily for any issues related to the Norton application.
- *Rdisk*—a Microsoft utility used to update the repair information saved when installing the operating system. This utility creates an Emergency Repair Disk. The repair information is used to recover a bootable system in case of failure. Rdisk is an operations tool that operates via manual process. A disk is created for each server in the EPA domain upon being built. The disks are stored in a locked cabinet and are updated on a monthly basis.
- *Stat Scanner*—monitors the servers; performs diagnostics on each server. This tool assists the staff in finding security leaks and indicates a solution. This tool is used on a monthly basis.
- *What's Up*—this tool continuously monitors the status of the network connections.

The system activity is tracked with the following logs:

- *Checkpoint Firewall Log* captures source and destination of users logging into the CDX programs. This log is checked daily.
- *IIS Logs* track public web server usage. The information captured for our purposes includes source IP, resource accessed, time, and action (get or post).
- *NT Application Log* captures information that indicates the application activity. This log is checked daily.
- *NT Security Log* captures the server activity; it captures which users have logged on to what specific server. When an invalid user is detected the LAN Administrators investigate. This may require some research and/or a phone call. This log is checked daily to ensure that there were no unexpected users logging on to the servers.
- *NT System Log*—This log captures information related to any system files. This log is checked daily.
- *What's Up Log* captures information about the Network. It is set up to automatically page the Lead Systems Engineers for specific problems. This log is checked daily.

These logs are checked periodically by the Network Administrator. When the Network Administrator detects an anomaly or is alerted by network monitoring tools, the anomaly is qualified and reported to appropriate CDX team members. The CDX team members investigate the anomaly and identify, troubleshoot, and resolve any underlying problems. Depending on the CDX application and staff assigned to specific applications, team members will vary accordingly. Typically, the application developer(s) are responsible for products during the entire life cycle. During troubleshooting and problem resolution, team members working the problem keep other CDX/EPA staff informed:

- Lead Systems Engineer interpret the error message and determine severity
- Contact the appropriate CDX/EPA team member(s) and determine if escalation procedures are necessary
- Investigate the problem
- Contact the appropriate CDX/EPA team member(s)
- Troubleshoot to solve the problem
- Solve the problem
- Contact the appropriate CDX/EPA team member(s)

There is a specific security-alert phone tree of persons contacted for specific problems. This information is detailed in the *EPA Security Plan*, dated March 5, 2001.

### 5.5.4 Problem Resolution and Corrective Action

The CDX problem resolution and corrective action process begins with the CDX Help Desk. Every issue submitted to customer support for resolution results in a unique activity ticket number, which is passed back to the user—users leaving voice mail or sending e-mail or a fax are promptly contacted and provided with their activity number. The activity ticket is assigned to a customer-support analyst for action. Users may refer to the ticket number when inquiring about the status of their support request.

Customer support constitutes the initial level of support on all EPA CDX problems and requests. If customer support is unable to resolve or is having difficulty resolving problems, they receive direction and support from the technical project leader, software developer, network engineer, or functional project leader. Depending upon the severity of the problem, the customer support team may initiate an SCR. Refer to Section 4 for more details.

### 5.5.5 Scheduled Maintenance

The CDX system requires down-time in order for the CDX team to perform software migrations or any hardware changes. These activities are performed according to the following guidelines:

- All major test migrations are coordinated and scheduled with EPA and the CDX development staff at least one week before migration.
- Scheduled downtime to accommodate migrations from the test to the production environments occur the 2nd and 4th Friday of each month, beginning at 7:00 p.m. through 8:00 a.m. the following Monday.
- For minor migrations, if a team member needs to migrate to test or production during 12:00–1:00 p.m. on a business day, an e-mail is sent from the technical project lead to the EPA development staff by 11:00 a.m. on the day of migration.

### 5.5.6 Additional QA Measures

The CDX team conducts automatic, repeatable internal tests to ensure quality measures are attained. However, additional external measures are necessary to ensure that the CDX system (as a whole) is meeting the expectations of its stakeholders. Local execution of tests is fine for quality control, but not for performance measurement work, where response time measurements must include Web-variable delays that reflect real-world usage.

The CDX system requires additional monitoring from entities not normally associated with the CDX team, thus providing the degree of independence necessary to ensure an outsider's perspective. These independent reviews should include internal and external risk assessments as well as security penetration tests. Examples of independent reviews and assessments that have already taken place include the following:

- LMI staff running STAT Scanner, NMAP, and NESSUS
- Sytex Security risk assessment
- SAIC Security Assessment penetration test.

# Section 6
# Security and Risk Management

## 6.1 Objective

The objective of QA/QC is to ensure security practices are implemented and practiced in a procedural and systematic manner according to a set of documented procedures.

## 6.2 Definition

Security policies and procedures proceed from the requirements of each project and can be assessed only within the context of the project. Security is properly considered a major component of any risk management plan.

## 6.3 Quality Measures

As noted in Section 5 of this document, the QA staff plays no direct role in developing or implementing security policies and procedures. As part of their checks of any risk management plan, the QA staff ascertain the following:

- Are security policies and procedures required as part of any Risk Management Plan?
- If required, are they implemented in accordance with standard documentation review processes (described in Section 3 of this document)?
- Are records of security tools and procedures maintained and available for inspection and audit?

## 6.4 Metrics

Several security metrics are collected as part of the system operations process, (see Table 6-1). See Section 5 for specific details.

*Table 6-1. System Security Metrics*

| Quality measure | Performance metrics | Goal | Warning |
|---|---|---|---|
| External Security Measures | Annual Vulnerability Review | All risks assessed to be very low | Any risks assessed at high or more than 3 at moderate. |
| | Number of identified O/S vulnerabilities that have been addressed by service packs or patches | Monthly survey of each host shows O/S includes all current stable, relevant system patches or service packs | Monthly survey of each host shows O/S lacking one or more current stable, relevant system patches or service packs |
| | Number of viruses detected | | "Significant" increases in number detected |
| | Number of viruses penetrating | 0 penetrations | Any penetrations |
| | Number of intrusions attempted | | "Significant" increases in number detected |
| | Number of successful intrusions | 0 intrusions | Any intrusion |
| User logon processes | Number of logons | | |
| | Number of accounts locked due to login failures | Less than 1 percent of logons rejected | More than 5 percent of logons rejected |
| | Number of valid signatures | | |
| | Number of invalid signature attempts | Less than 1 percent of signatures rejected | More than 5 percent of signatures rejected |
| | Number of files with validated certificates | | |
| | Number of files with certificates not validated | Less than 3 percent of signatures failing validation | More than 10 percent of signatures failing validation |

### 6.4.1 PERFORMANCE STANDARDS

There are no clear performance measures for these items. Clearly, the first successful penetration of a virus or intrusion is cause for serious concern. The best means for both preventing and measuring these risks is to conduct intrusion detection tests. Currently the CDX is funded to conduct one such test a year. Additionally, the EPA conducted an independent test in June of 2001 and the CDX was rated as a LOW security risk.

## 6.5 QA Process Description

The CDX security has two levels: basic security and procedural security. Basic security consists of the logon security, which allows users into the system and the programs they can access. Procedural security determines which user is allowed to perform functions against specific programs. Security precautions and implementations are maintained throughout the life of a project, just as all aspects of the CDX infrastructure security are strictly enforced. Additional security is detailed in the *EPA Security Plan*, dated March 5, 2001.

### 6.5.1 INTRUSION DETECTION

The CDX intrusion detection process is currently a manual process. This process includes examining firewall logs, virus alerts, monitoring machine failures, looking for patterns, and malicious activity. The only process that is currently automated is when an intruder attempts a port scan on the CDX internet protocol (IP) range. If this type of intrusion occurs, the systems engineers are automatically paged.

This manual process will be replaced by an automated tool in the near future. The tool selected is Internet Security Systems' RealSecure. This is a powerful, automated, real-time intrusion protection system for computer networks and hosts. RealSecure provides unobtrusive, continuous surveillance.

### 6.5.2 USER VALIDATION

All CDX users are validated and classified in two categories, NT users and Oracle users. For each application the user must log on using a valid user name and password. If an invalid user is detected, the systems engineers are notified and a follow-up determines whether or not the user is valid.

### 6.5.3 DISASTER RECOVERY

The Continuity of Operations Plan (COOP) provides policy and guidance for personnel assigned to the Central Data Exchange (CDX) to ensure that essential operations are continued in the event of an emergency or threat of an emergency.

It is EPA policy that EPA employees be prepared to respond efficiently and effectively to the full range of emergencies, so the agency can continue performing its essential functions. A more detailed statement of this policy is found in the EPA policy statement, *EPA Continuity of Operations Plan Policy*, dated December 20, 1996.

The CDX team is likewise committed to protecting its own employees and essential functions.

The EPA COOP details the procedures and required steps needed in case of emergency situations. Some of the procedures outlined in the COOP include the following assumptions:

- Emergencies, or threatened emergencies, will adversely affect CDX's ability to continue to perform essential operations.
- The event will be limited to a 30-day emergency period.
- The event will require physical relocation from current facilities.
- Resources from EPA will be made available to LMI, if required, to continue essential operations.
- LMI corporate support (i.e., corporate network, the contracts department, etc.) is available to aid in executing the COOP.

EPA CDX interim system-production servers are the essential point of service for operational continuance.

The following personnel are responsible for the continuity of operations planning as it pertains to CDX:

- The CDX Project Officer directs the activation of the COOP. Activation consists of initiating the alert roster or contact tree, as illustrated in Appendix B, of the COOP.
- The LMI CDX Program Manager contacts (voice-to-voice) the EPA CDX Project Officer and the LMI Technical Program Manager. If voice contact is not made, the LMI CDX program manager will leave a message (voice- or e-mail) and then call the next contact on the alert roster. The person contacted calls the next person in the chain on the alert roster. This succession of calls continues until all personnel on the alert roster are contacted.
- The LMI System Manager:
  - directs the development of the COOP;
  - ensures that the COOP is maintained and updated annually;
  - directs the development, conduct, and evaluation of COOP exercises twice per year; and
  - provides ongoing training in COOP procedures for personnel assigned to emergency staff positions and continually evaluates the effectiveness of the training program.

### 6.5.4 ROUTINE BACKUP

The interim CDX system has a dedicated local tape backup for the application software and database. An incremental backup is performed daily, and a full backup is done weekly. These backup tapes are stored off-site to ensure data recovery in the event of a catastrophe.

The CDX Oracle database is also backed up nightly to another hard drive. The backups are not accessed directly during normal operation of the CDX application. The backups are cumulative incremental backups that occur every evening at 8:00 p.m. This nightly backup is achieved through the use of a command line interface to Oracle's Recovery Manager utility. The Oracle DBA uses the Recovery Manager to

- configure frequently executed backup operations;
- generate a printable log of all backup and recovery procedures;
- use the recovery catalog to automate both media restore and recovery operations;
- perform automatic parallelization of backups and restores;
- find data files that require a backup based upon user-specified limits on the amount of redo that must be applied; and
- backup the database, individual table spaces, or data files.

### 6.5.5 DATA PROTECTION

Data protection is controlled by using the following:

- Firewalls
- User level security
- Tape backups
- Physical security (access control); room is locked
- Virus protection.

## 6.6 Risk Management

Risk management determines the risk level of the CDX project or any components of the project. Other components of the project may include risk determination of a software/hardware product or of unplanned requirement changes. The PD has the responsibility to determine the project's risk level.

LMI's risk management approach may include the following components:

- Assess program or project plans
- Establish critical path
- Identify and rank key risk areas
- Quantify risks
- Develop risk migration strategies
- Conduct risk reviews.

Risk management is not a function of the QA staff; however, the QA staff has the responsibility of ensuring the risks have been determined and documented in a risk management plan via internal quality checks.

# Section 7
# Project Management

## 7.1 Objective

The objective of QA/QC is to ensure the CDX activities for each phase of the system development life cycle are performed and delivered with the highest quality.

## 7.2 Definition

Project management is a means of tracking a project through the project life-cycle process. This involves the ability to assess the risk associated with meeting customer requirements. It also involves the ability to define resources and track the budget.

## 7.3 Quality Measures

Project management quality measures indicate how progress toward deadlines, timely deliverables, and project oversight are managed. The CDX project leaders manage requirements, project plans, project documentation and other responsibilities in accordance with ISO 9000 standards and recommendations. CDX project leaders are, therefore, integral to the success of the project.

## 7.4 Metrics

For general project management, the CDX team uses standard project management and tracking tools, such as Microsoft Project which generate a number of standard metrics. These metrics, shown in Table 7-1, gauge future tasks by providing better estimates for assignments.

*Table 7-1. Quality Measure and Performance Metrics*

| Quality measure | Performance metrics[a] | Goal | Warning |
|---|---|---|---|
| Track CDX project requirements, milestones and deliverables | Number and percentage of tasks completed | Provide all deliverables | Miss 1 major deliverable |
| | Number of client requested changes in deliverables, cost, and schedule | | |
| | Estimated cost vs. actual cost | Complete all tasks and be within budget | Exceed budget by 10 percent |
| | Number of days project is ahead of or behind schedule | Complete all tasks and be within schedule | Exceed schedule by 10 percent |

[a] In order to measure quality, all metrics must differentiate between customer-initiated changes to scope and requirement versus meeting or not meeting stable requirements.

With the exception of the last metric, all metrics listed in the table are tracked and reported to the customer on a monthly basis. The last metric is collected and used internally for CDX project management purposes.

As described in Section 3, project leaders also use the Rational suite for documenting requirements, developing use cases, and tracking SCRs, to name just a few high-level responsibilities. Additionally, project leaders use the tools and techniques described in Appendix G to facilitate QA. These include the real-time task status and labor information systems, which provide data for tracking and monitoring the level of effort of LMI staff and contractors.

## 7.5 QA Process Description

The QA/QC activities for project management ensure that updates to the project plan have been incorporated and also determine, document, and track requirements. QA ensures the project leader is documenting and tracking requirements (i.e., QA does not track requirements). Project leaders also work closely with the LMI subcontracting staff to issue task orders and purchase orders for additional technical support.

## 7.6 Non-Software Document Review

Function project leaders are responsible for overseeing production of a number of documents that can be related to either project management or program area (e.g., As-Is process flows). These documents can range from short (one–two page) documents to large reports. They can also be in briefing, project-schedule, or document formats. The extent of review can vary by document size and its

importance to the project. In general, the following steps are performed with all reports:

- A document outline or table of contents is agreed upon between the LMI and EPA project leader.
- An initial draft is developed. This draft will typically be reviewed by peers and the LMI project manager.
- Draft is reviewed and approved by the EPA.
- Final version is developed by the author.
- Final version is edited by LMI editor.
- Final version is proof read.
- Final version is reviewed by author.
- Final version is reviewed by project manager or program director.
- Final version is reviewed and accepted by EPA.

## 7.7 Supplier and Subcontractor Controls

Subcontractor staff members generally perform many of the CDX development tasks. The CDX staff uses subcontractors whenever there is a need for a specific skill not available in-house.

The research staff is responsible for monitoring the subcontract technical performance related to the specific task, as well as monitoring the number of hours used for tasks. It is the subcontractor's responsibility to monitor the expended authorized hours and costs incurred on task orders to ensure that hours worked are not in excess of contracted limit.

The Subcontract Administrator performs the following functions related to the labor information system:

- Input the purchase order (PO) number, task number, subcontractor, period of performance, and total number of hours authorized for all new purchase orders and task orders.
- Add more hours and extend the period of performance after issue modifications to existing orders.

Real-time software tracks subcontractor's invoices paid to date.

The process for the Subcontract Administrator is described below.

### 7.7.1 SUBCONTRACT TASK ORDERING PROCEDURE

When the CDX functional leader or technical project leader wants to procure the services of a subcontractor, a task order request is sent, via e-mail, to the subcontract administrator. The request must contain the following:

- Task number
- Subcontractor name
- address
- Statement of work
- List of deliverables
- Period of performance
- Price proposal or quote.

The Subcontract Administrator then determines whether

- subcontracting is allowable under the task,
- there are sufficient funds to support the task order, and
- the period of performance falls within the prime contract.

If all three conditions are met, the task ordering procedure will continue. If not, the requestor will be contacted and informed of the problem.

If the CDX staff has not received a quote from the subcontractor, the Subcontract Administrator may issue a RFQ to the subcontractor who will then provide a quote containing labor categories and the number of hours to be worked by personnel in each labor category, as well as any other direct costs (ODCs) that may be incurred.

If the subcontractor's quote is determined to be fair and reasonable and sufficient funding exists, a task order is issued. Copies are distributed to accounting and the CDX Technical Project Leader. A copy is filed with Contracts.

### 7.7.2 SUBCONTRACT TASK ORDERING PROCEDURE (NON-SCHEDULE)/ MISCELLANEOUS PURCHASING

When a CDX project leader wants to procure the services of a subcontractor who is not on the schedule, a request to subcontract is sent via e-mail to the Subcontract Administrator. The request must contain the following:

- Task number
- Subcontractor name and contact information

- Statement of work
- List of deliverables
- Period of performance
- Proposal or quote.

The Subcontract Administrator then determines whether

- subcontracting is allowable under the task,
- there are sufficient funds to support the task order, and
- the period of performance falls within the prime contract.

If all three conditions are met, the task ordering procedure will continue. If not, the requestor will be contacted and informed of the problem.

If the CDX staff has not received a proposal from the subcontractor, the Subcontract Administrator may issue a request for proposal (RFP) to the subcontractor who then provides a technical and price proposal. The price proposal must include information about labor categories and rates, the number of hours to be worked by personnel in each labor category, as well as any ODCs that may be incurred.

If the subcontractor's proposal is determined to be fair and reasonable and sufficient funding exists, a task order is issued. Copies are distributed to accounting and the CDX Technical Project Leader. A copy is filed with Contracts.

### 7.7.3 Modifications to Existing Orders

When the CDX technical project leader deems it necessary to modify an existing task or purchase order, a request for modification is sent via e-mail to the subcontract administrator. The request must contain the following:

1. Purchase order number or subcontract and task order number
2. Description of the modification requested
3. Price proposal or quote (if necessary).

Depending on the nature of the modification, it may or may not be necessary to request a proposal or quote from the subcontractor. If it is necessary to obtain a proposal or quote and the research staff has not already received one, the Subcontract Administrator will issue an RFP to the subcontractor who then provides a technical or price proposal. The price proposal must include information about labor categories and rates and the number of hours to be worked by personnel in each labor category as well as any ODCs that may be incurred.

Following receipt of a request for modification and—if necessary—a subcontractor proposal, the Subcontract Administrator determines whether

1. additional subcontracting is allowable under the task;
2. there are sufficient funds to support the purchase order;
3. the period of performance falls within the period of performance of the prime contract; and, if necessary,
4. the subcontractor's proposal is technically acceptable and cost reasonable.

If all four conditions are met, a modification is issued. Copies are distributed to accounting and the Project Leader. A copy is filed with Contracts.

## 7.8 Quality Records

The QA staff performs periodic checks to ensure the following quality records are being kept for CDX and other applications associated with CDX. The records are evaluated to ensure they are ISO 9000 compliant. The QA staff also ensures the following quality records are kept for the CDX and other applications, and reports to management when these items are not available for the project:

- *Project Plan*—describes the tasks to be performed. It lists the deliverables and the resources required to perform the tasks.
- *Quality Review Assessment Form*—determines the type (Approved Category 1, Approved Category 2, Draft, Under Review, and Returned) of technical quality review that a particular project warrants based on the sensitivity or visibility of the project. Project leaders complete this form and submit it to their program director (PD) or program manager (PM) for review and approval. The rating that a project receives is automatically calculated by the application.
- *Product Tracking Form*—includes the product review summary form for each product.
- *Product Review Summary Form*—completed after the final review of the software.

# Appendix A
# Software Requirements Checklist

**Software Requirements Checklist**

Last updated 4/20/01

| | | Yes | No | N/A |
|---|---|---|---|---|
| **A.** | **The following basic issues are addressed:** | | | |
| | **Functionality—** | | | |
| A1. | The application/system behavior has been operationally defined. | | | |
| A2. | The data, meta-data, input, output and processes are described for each module. | | | |
| | **External interfaces—** | | | |
| A3. | Application/system interaction with external entities and processes are identified and operationally described. | | | |
| | **Performance—** | | | |
| A4. | Performance parameters such as throughput, processing speed, resource availability, response time, recovery time and other parameters have been identified and operationally described. | | | |
| | **Attributes—** | | | |
| A5. | The portability, correctness, maintainability, security, etc. considerations have been identified and described. | | | |
| | **Design constraints imposed on an implementation—** | | | |
| A6. | The required organization standards, implementation language, policies for database integrity, resource limits, operating environments, etc. are in effect. | | | |
| **B.** | **Requirements that are outside the bounds of the System Requirements Specification (SRS) are not specified:** | | | |
| B1. | The SRS correctly defines all of the software requirements. | | | |
| B2. | The SRS does not define any design or implementation details. | | | |
| B3. | The SRS does not impose additional constraints on the software. | | | |
| **C.** | **The SRS properly limits the range of valid designs without specifying any particular design.** | | | |
| **D.** | **The SRS exhibits the following characteristics:** | | | |
| | **Correctness—** | | | |
| D1. | Every requirement stated in the SRS is a requirement that the software should meet. | | | |
| | **Unambiguous—** | | | |
| D2. | Each requirement has one, and only one, interpretation. | | | |
| D3. | The customer's language has been used. | | | |
| D4. | Diagrams are used to augment the natural language descriptions. | | | |

**Software Requirements Checklist**

Last updated 4/20/01

| | | Yes | No | N/A |
|---|---|---|---|---|
| | **Completeness—** | | | |
| D5. | The SRS includes all significant requirements, whether related to functionality, performance design constraints, attributes, or external interfaces. | | | |
| D6. | The expected ranges of input values in all possible scenarios been identified and addressed. | | | |
| D7. | Responses been included to both valid and invalid input values. | | | |
| D8. | Types and ranges of input have been described. | | | |
| D9. | All figures, tables and diagrams include full labels and references and definitions of all terms and units of measure. | | | |
| D10. | All TBD's have been resolved or addressed. | | | |
| | **Consistency—** | | | |
| D11. | The SRS agrees with the Vision document, the use-case model and the Supplementary Specifications if applicable. | | | |
| D12. | The SRS agrees with other higher level specifications. | | | |
| D13. | The SRS is internally consistent, with no subset of individual conflicting requirements. | | | |
| | **Ability to Rank requirements—** | | | |
| D14. | Each requirement is tagged with an identifier to indicate either the importance or stability of that particular requirement. | | | |
| D15. | Significant attributes for properly determining priority have been identified. | | | |
| | **Verifiable—** | | | |
| D16. | Every requirement stated in the SRS is verifiable. | | | |
| D17. | A finite cost-effective process with which a person or machine can check that the software product meets the requirement exist. | | | |
| | **Modifiable—** | | | |
| D18. | The structure and style of the SRS, is such that any changes to the requirements can be made easily, completely, and consistently while retaining the structure and style. | | | |
| D19. | Redundancy has been identified, minimized and cross-referenced. | | | |
| | **Traceable—** | | | |
| D20. | Each requirement has a clear identifier. | | | |
| D21. | The origin of each requirement is clear. | | | |
| D22. | Backward traceability is maintained by explicitly referencing earlier artifacts. | | | |
| D23. | A reasonable amount of forward traceability is maintained to artifacts spawned by the SRS exist. | | | |
| D24. | Comments: | | | |
| **Reviewer:** | | **Date:** | | |

# Appendix B
# Software Design Review Checklist

This checklist is to be used in a design review of application software. Each checklist item is to be given a rating in terms of the compliance of the design with the item.

Rating Definition

1 = Total Compliance  4 = Major Deviations

2 = Minor Deviations  5 = Critical Deviations

3 = Moderate Deviations

| Evaluation Items (Ratings) | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Is the design described in a document? | | | | | |
| 1a. Does the design meet the criteria established for the application? | | | | | |
| 1b. Is the design consistent with the approach described for the application development project? | | | | | |
| 1c. Does the design conform to the standards described for the application development project? | | | | | |
| 1d. Are all of the application elements traceable to functional requirements? | | | | | |
| 2. Does the design appear to meet the performance requirements for the application? | | | | | |
| 3. Do the assumptions made in the design appear to be relevant and correct? | | | | | |
| 4. Does the design convey a consistency of symbols and terms? | | | | | |
| 5. Does the list of inputs/outputs, source/destination, units and range appear to be correct? | | | | | |
| 6. Does the functional breakdown of the design appear valid? | | | | | |
| 7. Does the relationship and hierarchy of the units described in the design appear correct? | | | | | |
| 8. Does any flow chart logic shown appear to be incorrect? | | | | | |
| 9. Does the design appear to correctly handle abnormal inputs to avert fatal errors to the system? | | | | | |
| 10. Are the computer storage and processing estimates correct? | | | | | |

| Evaluation Items (Ratings) | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 10. Are the computer storage and processing estimates correct? | | | | | |
| 11. Are other real-time processing considerations valid? | | | | | |
| 12. Are all of the modules of the application accounted for? Do all of the possible control paths end (that is, "no endless loops")? | | | | | |
| 13. Are all logic statements syntactically and semantically valid? | | | | | |
| 14. Are all of the calls made by each module shown in a calling hierarchy? | | | | | |
| 15. Do all of the calls made by a module follow the calling conventions of the programming guidelines? | | | | | |
| 16. Do all names defined in modules follow the conventions of the programming guidelines? | | | | | |
| 17. How would you characterize the adherence of the design to the following software quality factors: | — | — | — | — | — |
| 17a. Maintainability? | | | | | |
| 17b. Interoperability? | | | | | |
| 17c. Testability? | | | | | |
| 17d. Reliability? | | | | | |
| 17e. Flexibility? | | | | | |
| 17f. Correctness? | | | | | |
| 17g. Integrity? | | | | | |
| 17h. Usability? | | | | | |
| 17i. Reusability? | | | | | |
| 17j. Efficiency? | | | | | |
| 17k. Portability? | | | | | |

# Appendix C
# Release Notes Template[1]

## Introduction

*[The introduction of the **Release Notes** should provide an overview of the entire document. It should include the disclaimer of warranty, purpose, scope, definitions, acronyms, abbreviations, references, and an overview of this **Release Notes**.]*

## Disclaimer of Warranty

<Company Name> makes no representations or warranties, either express or implied, by or with respect to anything in this document, and shall not be liable for any implied warranties of merchantability or fitness for a particular purpose or for any indirect, special or consequential damages.



## Purpose

The purpose of the Release Notes is to communicate the major new features and changes in this release of the <Project Name>. It also documents known problems and work-arounds.

## Scope

This document describes the <Project Name>
*[Click to enter the release identifier here]* .

[1] The Release Notes template is extracted from the Rational Software Corporation tool suite.

## Definitions, Acronyms, and Abbreviations

*[This subsection should provide the definitions of all terms, acronyms, and abbreviations required to properly interpret the **xxx**. This information can be provided by reference to the project Glossary.]*

## References

*[Any external references are presented here. This may include references to user manuals, policies and procedures, external web sites, or the like.]*

## Overview

*[This subsection should describe what the remaining **Release Notes** contain and explain how the document is organized.]*

## About This Release

*[A description of the release is presented here, including release-defining characteristics or features. The description should be brief and simply clarify the release definition.]*

## Compatible Products

This product has been tested on the following platforms (or with the following products):

- *[Click to enter a product or platform name here]* [Also list any product operating environment requirements here.]
- Upgrading

[Describe the process for upgrading from previous product releases.]

# Appendix D [1]
# Bill of Materials Template

## INTRODUCTION

*[Provide an overview of the entire document.]*

### Purpose

*[Describe the purpose of the software to which this document applies.]*

### Scope

*[Identify the recipients for the items identified in the **Bill of Materials**, for example, the source code is typically not released to all recipients]*

### Definitions, Acronyms, and Abbreviations

*[This subsection should provide the definitions of all terms, acronyms, and abbreviations required to properly interpret the **Bill of Materials**. This information may be provided by reference to the project Glossary.]*

### References

*[This subsection should provide a complete list of all documents referenced elsewhere in the **Bill of Materials**. Each document should be identified by title, report number (if applicable), date, and publishing organization. Specify the sources from which the references can be obtained. This information may be provided by reference to an appendix or to another document.]*

### Overview

*[This subsection should describe what the rest of the **Bill of Materials** contains and explain how the document is organized.]*

[1] The Bill of Materials template is extracted from the Rational Software Corporation tool suite.

## Version Description

*[Version description includes the following:*

- *Identification of version, number, date, and name,*
- *Summary of changes from previous version of the product including additions, updates, and deletions,*
- *Where appropriate, disposition instructions for new version and previous version.]*

## Inventory of Materials

*[List all the physical media (CDs, floppies, etc) and associated documentation that make up the software version being released. Identify numbers, titles, abbreviations, dates, versions and release numbers as applicable.]*

## Handling Considerations

*[Describe safeguards for handling the material, such as concerns for static and magnetic fields, and instructions and restrictions regarding duplication and licensing.*

## Inventory of Software Contents

*[List all the files that make up the software version being released. Identify numbers, titles, abbreviations, dates, versions and release numbers as applicable.]*

# CHANGES

*[List all the changes incorporated into the software version since the previous version. Identify, as applicable, the problem reports and Change Requests associated with each change. Describe the effect of each change on software use or operation as applicable.]*

# ADAPTATION DATA

*[Identify any site-unique data contained in the software.]*

## Installation Instructions

*[Provide or reference the following information:*

*Instructions for installing the software, procedures for determining whether the version has been installed properly, and known errors and problematic features [Identify any possible problems or known errors with*

*the software at the time of release. Describe steps that can be taken to recognize, avoid, correct or handle the problematic features.]*

# Appendix E
# Project Planning Checklist

**Project Planning Checklist**

| | Yes | No | N/A |
|---|---|---|---|
| **A. Project Plan** | | | |
| A1. Project Plan is current. | | | |
| A2. Project Plan includes modifications. | | | |
| A3. Kickoff meeting is scheduled. | | | |
| A4. Project Plan is in ISO-IMS. | | | |
| A5. Project Plan is ISO-9000 compliant. | | | |
| **B. Statement of Work** | | | |
| B1. The SOW is defined. | | | |
| B2. Scope of the work is defined. | | | |
| B3. Specifications/approach is defined. | | | |
| B4. Assumptions are defined. | | | |
| B5. Period of performance is defined. | | | |
| B6. Staff are defined. | | | |
| B7. Security issues are defined. | | | |
| B8. The budget has been defined. | | | |
| **C. Risks** | | | |
| C1. Risk have been defined. | | | |
| C2. Risk mitigation is defined. | | | |
| C3. Risk avoidance is defined. | | | |
| C4. Contingency plan has been defined. | | | |
| **D. Deliverables** | | | |
| D1. Task deliverables have been defined. | | | |
| | | | |
| Comments: | | | |
| **Reviewer:** | **Date:** | | |

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# Appendix F
# References

The following materials were used to produce this QAP:

- Logistics Management Institute Quality System Manual (November 16, 2000).
- Central Data Exchange for Electronic Reporting Prototype System Requirements; Version 3 (December 2000).
- The Rational Unified Process.

Documents of specific relevance to this QAP are:

- EPA CDX Continuity of Operations Plan (April 2001).
- Environmental Protection Agency Government Paperwork Elimination Act Risk Assessment, EP005T5 (March 2001).
- EPA CDX Security Plan (March 5, 2001).
- EPA Network Blueprint (October 30, 2001).
- OMB Report: M-97-12, Evaluation of Agency Implementation of Capital Planning and Investment Control Processes (April 25, 1997).

# Appendix G
# Tools and Techniques

The EPA CDX system team uses a number of tools to facilitate QA activities. These tools consist of specialized software for application system testing and change reporting, a version management system, and a physical library of application software and the following related documents:

- The ISO 9000 information management system (IMS) is one of the major tools used for documenting and monitoring projects and products. This tool tracks the quality records for projects from initiation through closeout. The LMI SDTS group is responsible for maintaining this system, which operates from the LMI intranet.

- Rational RequisitePro is a requirement repository that organizes requirements and provides traceability and change management throughout the project lifecycle. A RequisitePro project includes a requirements database and related documents. CDX requirements reside in RequisitePro, which maintains and tracks requirements as they evolve. Project leaders are responsible for updating the requirements as necessary. The Rational suite of products is installed on each project leader and program manager's desktop. Project leaders save RequisitePro files to a shared directory that is accessed by all CDX team members.

- Rational ClearQuest is an automated change reporting system for tracking software defects and requests for software enhancements. It operates as an integrated unit within the Rational development suite of software. The QA staff, project leaders and the Help Desk staff enter software defects or enhancements into the ClearQuest tracker. The QA staff is responsible for monitoring the status of the SCRs. The Rational suite of products is installed on each project leader and program manager's desktop. ClearQuest files are saved to a shared directory that is accessed by all CDX team members.

- Real-time Task Status tracks and monitors the budget for contracts, tasks, subtasks, and sub-subtasks. Project leaders and program managers typically use this application. This application operates from the LMI network and is maintained by the LMI Corporate Information Systems staff.

- McAfee is a (SQL database) tool used by the Help Desk to track trouble calls. Each submission is tracked using a unique trouble ticket. This application operates from the LMI network (protected by a firewall) and is maintained by the CDX Lead Systems Engineer.

- Microsoft Project produces timelines for deliverables and other project related materials. This application is installed on each project leader and program manager's desktop. Project leaders are responsible for updating project plans for CDX as necessary. MS Project files are typically saved to a shared directory that is accessed by all CDX team members.

- Labor Hour Information System (Lotus Notes/Domino application) is used to track subcontractor hours. This web-enabled tool allows subcontractors and consultants to enter their hours worked on projects. This system does not replace the subcontractor and consultant invoicing process. It is intended to give project leaders and program managers a "real time" view of hours used on projects for these labor categories. The LMI SDTS group is responsible for this application, which is maintained on the LMI network.

- Microsoft Visio 2000 is a tool designed to develop:

  - Flowcharts

  - Organizational Charts

  - Basic network Diagrams.

  Project leaders and developers use this tool to diagram CDX information flows and processes. Visio is installed on individual PCs. Visio files are typically saved to a shared directory that is accessed by all CDX team members.

- Project templates and checklists include, but are not limited to:

  - *Project Planning Checklist* (Appendix E)

  - *Software Requirements Checklist* (Appendix A)

  - *Bill of Materials Template*(Appendix D)

  - *Release Notes Template* (Appendix C)

Project templates are stored in a shared directory and are accessed by CDX QA staff, developers, project leaders and program managers. Several checklists are currently under development or under review, including a test and evaluation checklist and a code peer-review checklist, among others.

# Appendix H
# Configuration Management

The CDX staff employs a directory structure for tracking and managing the different versions of the software for the CDX system. This configuration process is currently a manual process. The structure consists of three environments: (1) new development, (2) test, and (3) production. These environments minimize the possibility of promotion of incorrect versions of the software into the production environment. Figure H-1 and Figure H-2 display the configuration management directory structures.

The folders shown in Figure H-1 exists on the D drive of the epa_web_dev1 server.

*Figure H-1. epa_web_dev1 Directory Structure*

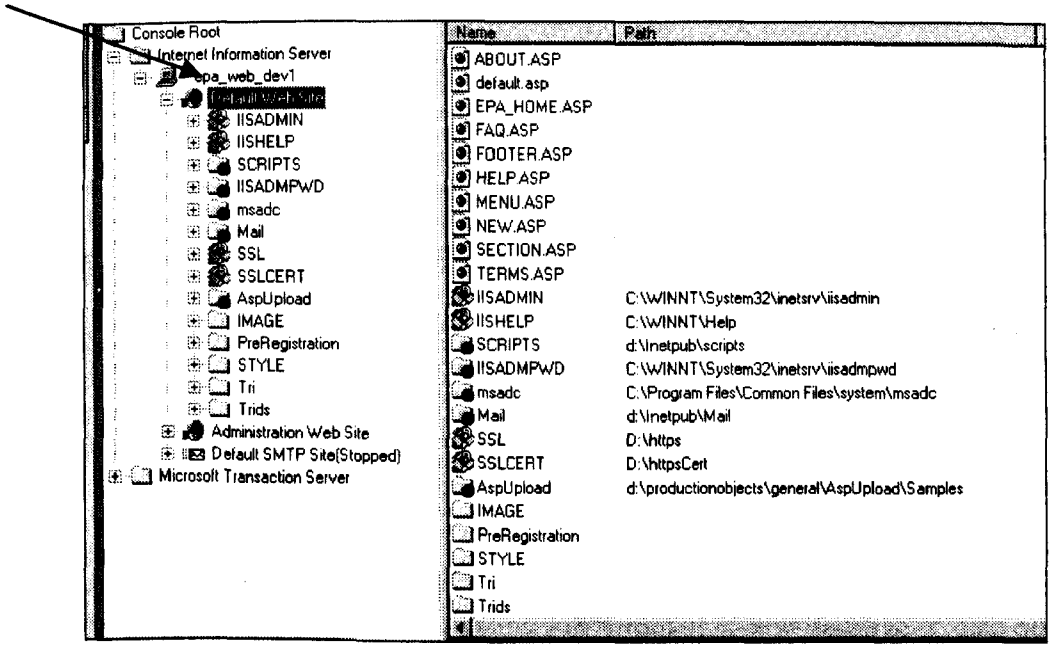


*Figure H-2. Configuration Management Directory Structures*

Each of these folders has the following subfolders, with the exception of the HTTP folder:

- Aei
- Cdx
- Dmr
- Idef
- Tri
- Ucmr

The HTTP folder contains only a HOME folder.

*DevelopmentObjects*—All code resides here.

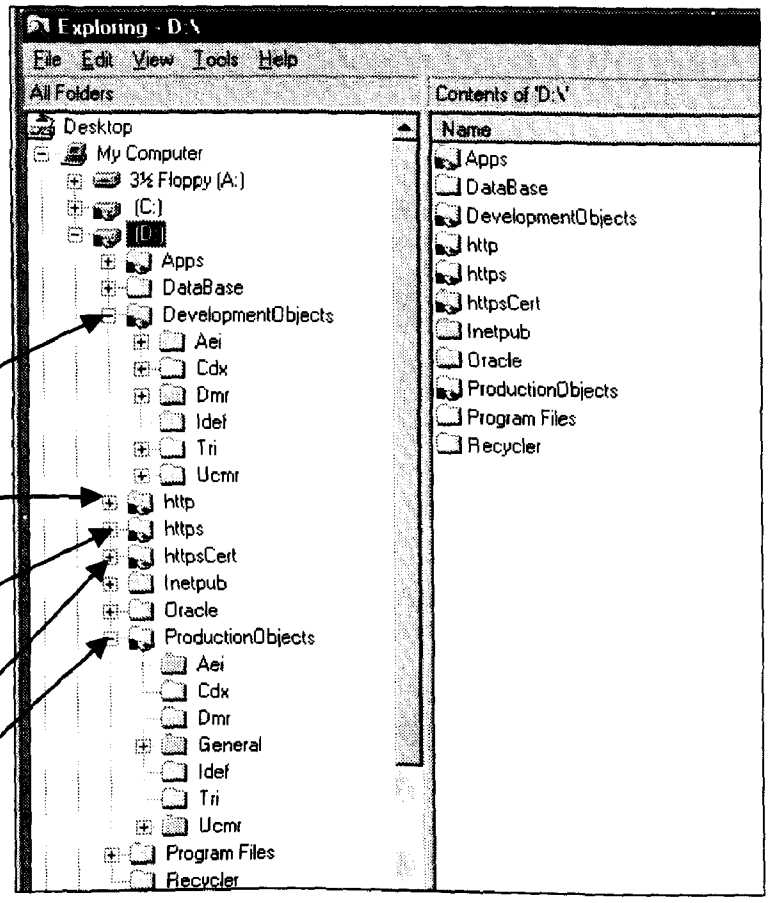
*http*—All non SSL CDX asp/html docs reside here.

*https*—contains all asp/html docs for any project that do not require digital certs.

*httpsCerts*—contains ONLY asp/html docs that require digital certs.

*ProductionObjects*—contains all objects that are registered on the server including third party and objects commonly used by multiple CDX programs.

The ProductionObjects Folder contains a subfolder, called *General*, that will be the home for any third party or commonly used Dlls/Exe.




In the test and production environments under the D drive, the directories construction uses the same set of folders, as represented in Figure H-2.

The CDX staff utilizes the Rational RequisitePro tool to document the CDX requirements. This tool is also used to track and monitor the requirements as they change.

The CDX staff is working toward automating the configuration management process by utilizing a configuration management tool such as Rational ClearCase LT. Such tools allow a designated staff member to access, distribute, and control different versions of source code and documentation.

# Appendix I
# Data Quality

The EPA takes the issue of data quality very seriously. With the creation of the Office of Environmental Information, added focus has been placed on the implementation of quality systems within the EPA. In support of this top agency priority, the Quality and Information Council has requested that specific system information on data quality be collected as part of the IT Capital Planning and Investment Control process. This appendix addresses the following questions from this process:

- Does this project involve the production, collection, storage, analysis or presentation of environmental measurement or facility-related information? If so, does the project have a documented "Quality Assurance Project Plan" or equivalent document, which includes easily identifiable planning procedures which address IT and information/data quality indicators, planning processes, implementation processes, and assessment processes?

- What features of your system or application ensure an appropriate level of quality of data?

- Does this project include specific procedures for the identification and correction of errors in existing data systems by internal or external customers? Is this system covered by the Integrated Error Correction Process, etc.? If yes, describe the process.

- What validation checks are present in the system to verify the integrity of transmitted data?

## Overview of the Quality Assurance Project Plan

CDX presents EPA with the opportunity to establish a new baseline of data quality that is standardized across program data collections. The implementation of data quality in CDX is addressed through the CDX Quality Assurance Program. In general terms, the CDX quality assurance program consists of establishing and maintaining a standard set of objectives, quality indicators, performance standards, planning, implementation and assessment processes, and problem resolution activities across the broad range of CDX activities.

The general objective of our quality assurance program is to establish and maintain QA standards and procedures that lead to achieving quality products in

particular timeliness and "freedom from defect." The quality assurance program addresses the development of CDX in four general areas:

- Data collection, design and implementation
- Operations and maintenance
- Security
- Customer service.

Project management applies across the four general functional areas. Specific instances of CDX components that contribute to data quality include the following:

- *Error reduction*—Reducing common data submission errors is critical to ensuring quality data entering our systems. Detecting errors and reconciling data post-receipt can involve costly and complex rework by both the submitter and CDX and should be avoided. In the course of supporting EPA data collections, CDX will strive for error reduction by leveraging electronic data collection technologies, such as
  - designing and testing new data collections through an incremental and highly structured quality assurance process to ensure new collections are deployed that are user friendly,
  - pre-populating data from previous submissions and providing intelligent tips to guide reporters on the proper format for the data being submitted,
  - instituting data standards and establishing standard data exchange templates and user guidance, thereby reducing the opportunity for confusion and incorrect data entering EPA systems, and
  - maintaining a CDX customer service, on line help systems, and related program help desks to coach submitters on the proper entry of data into our systems through CDX.
- *Error detection/data validation*—Although the primary responsibility for quality data originates with the submitter, CDX can minimize data entry errors by early detection edit checks. All data collections submitted through CDX shall be subjected to a series of standard edit checks focused on the structure, syntax, and formatting of the data received and, where appropriate, more rigorous data quality check of the content of the data.
- *Data reconciliation*—An opportunity exists for leveraging CDX capabilities to facilitate reconciliation of the data with our external community. In the past, programs relied on a long and often arduous process of printing data received from the submitter and providing hard copies of these data

back to the submitter for review and reconciliation, CDX can leverage our customers "online" access through CDX to view and revise data almost in real time. While a number of procedural and policy issues need to be resolved, CDX is currently developing this approach with the new UCMR reporting requirements for the drinking water program. In this scenario, laboratories submit data to CDX for review, reconciliation and approval online by local and state regulatory agencies before loading the data into production UCMR databases. This provides a new and efficient approach for the identification and reconciliation of data errors and holds a great deal of promise for other collections supported by CDX.

## CDX Data Quality Features

In a broad sense, data quality may be defined both in terms of the quality of the "content" of the data (precision of estimates, method of determination, etc.), and in terms of quality "delivery" (timeliness, degree of freedom from defect). The CDX primarily focuses on new, high-quality approaches to delivering data to EPA's program systems. Therefore, CDX is primarily interested in measuring attributes of data quality associated with data delivery, such as processing time, data entry errors, data quality checks, error notifications, and valid authentications of submitters. Because CDX is currently in prototype, the current data quality effort focuses on establishing and testing a baseline of data quality attributes, to track performance of the "final" CDX system. The data quality attributes where measurements are under development and testing include the

- percentage of data elements checked for compliance with CDX basic data quality parameters (field length, field type, completeness of transaction, etc.) across agency data exchanges processed through CDX (presently under prototype system—data quality goal is 100 percent basic data quality checks),
- frequency of error reports from CDX provided to agency systems on those exchanges,
- time required to access electronic archive to aid reconciliation of all transactions occurring between EPA and its partners,
- processing time of data entering our systems by automating data entry processes that are currently manual,
- number of customer service calls received on CDX application deployment, and
- number of successes and failures of registration/installation of clients through CDX.

Because CDX is in the prototype phase and will not reach full "production" until FY 2003, CDX attributes of the quality control features are still under development and the "metrics" associated with these attributes are not yet finalized. A preliminary set of metrics on these attributes is provided in more detail as part of this quality assurance plan.

## CDX and the Error Correction Process

CDX is the data exchange portal for EPA. If, in the course of registering or submitting data through CDX, the submitter discovers an error, our technical support can direct them to the error correction process. Additionally, CDX provides "viewing features" by allowing access for states and industry to select reports for review. CDX is also working with FRS and agency program systems to determine the long-term relationship of CDX and the Agency's error correction process.

## CDX Data Validation

CDX is attempting to introduce intelligent checks to the webforms and highly specific attributes to the XML and EDI files that will reduce errors in transmission. Once transmitted however, CDX, at a minimum, is performing general conformance checks to specific data elements (e.g., field length, alpha numeric). In some cases (e.g., PCS/IDEF) highly sophisticated edits are performed to assess content (e.g., code values) against accepted values. In the latter case, these checks are tied to "intelligent" middleware currently under development with guidance from the program.

# Appendix J
# Abbreviations, Acronyms and Definitions

| | |
|---|---|
| Bill of Materials | A Rational Unified Process template which describes the version description. This document describes the inventory of materials, installation instructions, software changes, known errors, and problematic features. |
| CDX | Central Data Exchange |
| COR | Copy of Record, one type of data flow through CDX |
| COTS | Commercial Off The Shelf software |
| EPCRA | Emergency Planning and Community Right-to-Know Act |
| GOTS | Government Off The Shelf software |
| IMS | Information Management System |
| ISO | International Organization for Standardization |
| New Work Survey | This is the initial form to be completed for all IT Development projects. This is an overview assessment of the project. This information is used to determine if the work will be performed. |
| Project Files | Collections of files related to or associated with the CDX project and stored in a central repository in a shared workspace. |
| PD | Program director |
| PM | Program manager |
| Prototype | Software and supporting hardware and network components that are designed to evaluate the feasibility of a product. The prototype may not include the full functionality of the system. |
| Quality Assurance Quality Control (QA/QC) | The process of performing checks and balances against a software process or product. This process requires the use of various reviews, audits and evaluations, and testing steps to ensure best practices are being conducted. |

| | |
|---|---|
| Quality Review | An assessment of all relevant project deliverables, documentation and procedures to ascertain their degree of compliance with project requirements. A Quality Review may be scheduled for certain phases of the Software Development Life Cycle, or it may be conducted on a periodic, calendar basis to ensure continued compliance with project requirements. A Quality Review may vary in scope, depth, and formality, depending on project requirements and available resources. |
| Quality Review Assessment (QRA) Form | A form used to determine the type of quality review that a particular project warrants based on the sensitivity or visibility of the project. |
| Rational RequisitePro™ | A requirements depository, which organizes requirements and provides traceability and change management throughout the project lifecycle. A RequisitePro project includes a requirements database and its related documents. |
| Rational ClearCase LT™ | A configuration management system that manages multiple variants of evolving software systems. It enforces site-specific development policies, offers multiple developer workspaces, and provides advanced support for parallel development. |
| Rational ClearQuest™ | An automated change reporting system for tracking software defects and requests for software enhancements. It operates as an integrated unit within the Rational development suite of software. |
| Rational Software | Suite of software tools being used to support the software development process. Included in the suite are tool mentors, guidelines, checklists, best practices and suggested workflows for software development activities. |
| Release Notes | Release notes identify changes and known bugs, in a version of a build, or deployment unit, that has been made available for use. |

| | |
|---|---|
| SCR: System Change Request | An SCR is used during the tests and validation phase of the SDLC to identify requested changes and/or problems related to the design and development of software tools and to track corrective actions. Specifically, the SCR records a description of the problem or suggested enhancement, the date submitted, the priority and severity of the issue, and other pertinent information. SCR information is maintained electronically in the project files for each software development project. |
| SDLC | Software Development Life Cycle; The LMI SDLC consists of phases for software development, including: project planning, business analysis and requirements, design, development, testing and validation, customer acceptance, and operations and maintenance. The LMI SDLC follows an iterative approach to the development of software products. Some projects may not include all phases of the life cycle in accordance with the project's Statement of Work (SOW). |
| Software Product | Complete set of computer programs, procedures, and associated documentation and data developed for delivery to a customer. Includes—where applicable—databases, web pages, and other programs developed using COTS or GOTS applications development tools. A product can contain multiple deployment units, and may be accessible as a downloadable commodity, in shrink wrap or on any digital storage media formats. |
| SRS: Software Requirements Specifications | The SRS is a technical document that identifies all the known functional and technical requirements of the software product being developed. This document assists the software developer in determining specific, detailed requirements for the development and implementation of the product. The technical project leader is responsible for initiating and maintaining the SRS as a part of project files. |
| Test Case | A scenario that assesses the software product's compliance with software requirements, use cases, and other relevant requirements. A test case is derived from a Test Plan. |
| Test Plan | A document that describes how a software product will be tested to ensure its compliance with the SRS, Use Cases and other relevant requirements documents. |

| | |
|---|---|
| Test Scripts | Instructions for the execution of a test case. They are created by programming or recording, or are written manually. Test scripts are usually forms of software, and therefore, need to be designed, created, tested, and maintained like any other software artifact. |
| Use Case | Use Cases are a method of capturing and documenting requirements. A use case describes user interactions with a system. Use cases define "what" a system should do, not "how" a system works. A use case defines a sequence of actions the system performs that yields an observable outcome of value to the user. |
| XML | Extensible Markup Language |

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**14. ABSTRACT**
The Central Data Exchange (CDX) is a system that facilitates electronic data exchanges for EPA stakeholders and is a key component of EPA's strategy for addressing federal mandates. As a single receiving point for all reports, the CDX ensures a baseline for standardization and compatibility of incoming data. In addition, the CDX provides electronic forms that are pre-filled (or pre-populated) with data that do not change or change infrequently (e.g., permit number or address)—thereby reducing the stakeholder's "burden" of filling in redundant information. This CDX Quality Assurance Plan (QAP) describes the quality assurance standards, guidelines, procedures, and activities used to support the development and enhancement of the EPA's CDX system and EPA applications developed and hosted at LMI. This plan outlines current and future quality assurance activities for the CDX system. This QAP does not address the details of any specific CDX program.

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