



PAPER PRESENTED
at
SYMPOSIUM 2008 IN RIO DE JANEIRO, BRAZIL

**"CONFIGURATION MANAGEMENT –
NUCLEAR PLANTS"**

LATIN AMERICAN SECTION — AMERICAN NUCLEAR SOCIETY

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Washington Division



Configuration Management

How CM can be applied in Nuclear Industry

June 2008

Narendra P. Singh

URS Corporation - Washington Division, Princeton (NJ), USA

- Forty-six (46) years engineering, design and project management experience in financial and technical management of major nuclear and fossil fuel generating projects in U.S., Mexico, India and U.K. Four (4) years experience in manufacturing and heavy fabrication industry.
- Currently responsible for URS Corp/Washington Group's technical support and project development activities for Laguna Verde Nuclear Power Plant in Mexico. These activities include power uprate program, EDMS & Configuration Management system, Plant Modifications & Upgrades, Engineering and technical support.
- May 1981 – Present **Senior Project Manager – URS Corporation / Washington Group / Raytheon Engineers & Const. / Ebasco Services.** Laguna Verde Nuclear Units 1 & 2 (Mexico) May 1974– May 1981 **Project Engineer - Ebasco Services (New York).** Laguna Verde Nuclear Project Units 1 & 2 (Mexico) Chin Shan Nuclear Units 1&2 (Taiwan) Allens Creek Nuclear Project Units 1&2(USA).Apr 1972– May 1974 **Power Engineer – Stone & Webster Eng. Corp (Boston).** Beaver Valley Nuclear Project Unit 2 (USA)Mar 1965– Dec 1971 **Asst. Chief Engineer – Bharat Heavy Electricals Ltd.(Bhopal, India)** Several Fossil Power Plants & Candu Reactor Units (India)Mar 1962– Mar 1965 **A. E. I./GEC (Manchester, UK)** Engineering & Design – Power Projects Jul 1957 – Dec 1961 **Texmaco Industries (Kolkata, India)** Fabrication & Machinery Shops

Overview of URS Corporation

- One of the World's Leading Engineering and Construction Services Firms
- Approximately 56,000 Employees in More Than 30 Countries
- Proforma Annual Revenue of \$9 Billion
- Fully Integrated Services Support Full Project Life Cycle
 - Leader in Engineering, Construction, Facilities Management, and Environmental
 - Serves Federal, State and Local Government Agencies, and Multinational Fortune 500 Companies



URS Corporation

2007 Financial Highlights*

- Gross Revenues: \$5.38 billion
- Operating Income: \$311.2 million
- Net Income: \$132.2 million
- Cash on Hand: \$256.5 million
- Shareholders Equity: \$3.5 billion
- Backlog: \$18.71 billion
- NYSE symbol: URS

***URS Corporation is the 4th largest publicly held
E&C company in the U.S.***

* Results include six weeks of operations from the former Washington Group International, Inc.

Washington Division

- Fully integrated engineering, construction and technical services organization with the capabilities to support the project life cycle—from inception through start-up and operation to decommissioning and closure
- Over 90 years of experience performing projects around the world and throughout the United States

Formed from a Rich Heritage

Rust

Isbill

Litwin

Kasler

Ebasco

Catalytic

Gibbs & Hill

HK Ferguson

Stearns-Roger

Morrison Knudsen

Centennial Engineering

Washington Construction Group

United Engineers & Constructors

Westinghouse Government Services

Raytheon Engineers & Constructors

Washington Group international



Washington Division

What is Configuration Management (CM)

- Process of Identifying and Documenting
 - Facilities Structure
 - Systems
 - Components
- Process of Changes
 - Follow predefined approved process
 - Assessed
 - Approved
 - Issued
 - Verified
 - Recorded
 - Incorporated in the facility documentation

Configuration Management—Definitions

Definition No. 1

A management process that assures full consistency between existing plant design and licensing requirements and controls changes to ensure that the plant is configured, maintained, operated and managed that is completely in conformance with the design bases and licensing commitments.

Definition No. 2

An integrated set of activities consisting of processes, practices and tools for establishment and subsequent maintenance of the design integrity of a plant throughout its life cycle.

Definition No. 3

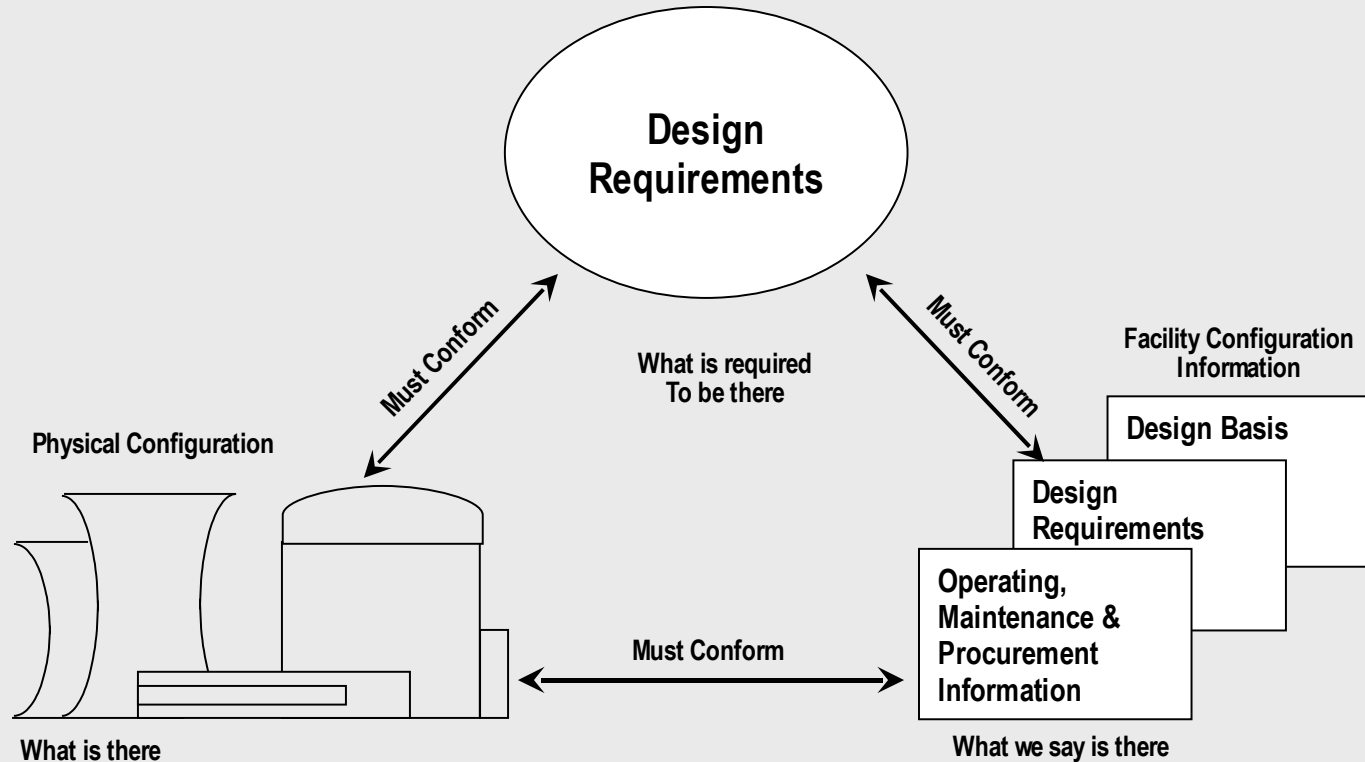
An integrated management process involving engineering, construction, operation and maintenance to achieve the ultimate conformance and equilibration between the design requirements/bases, plant documentation and the physical configuration of the facility.

Configuration Management—Definitions

(Cont'd)

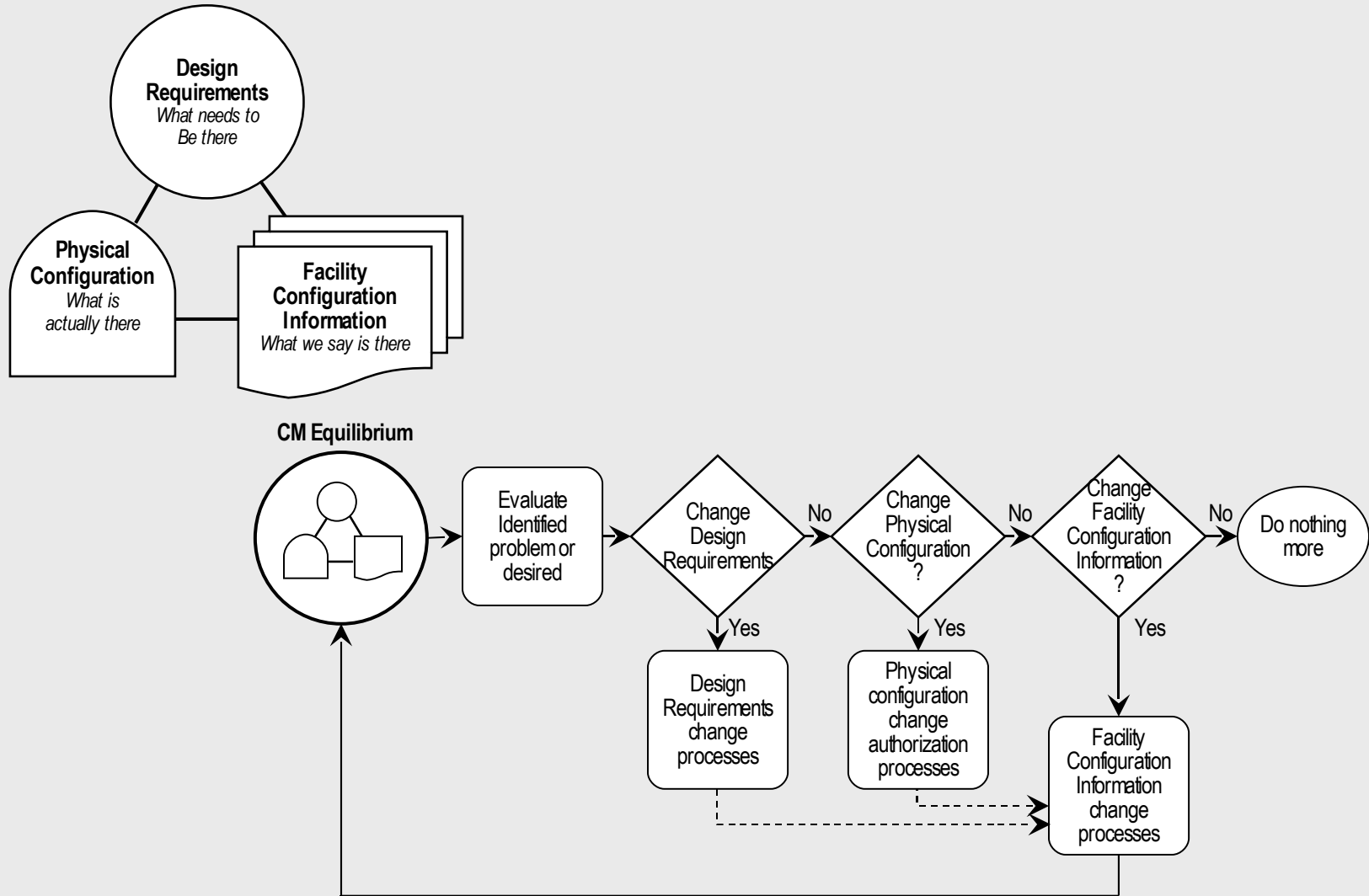
- The simplest **definition** of Configuration Management is what we do to assure ourselves and our regulators that we are doing everything we said we would do
- The **objective** of Configuration Management is the conformance of the three elements represented by the CM Equilibrium Model

Configuration Management Objectives



Work Processes must ensure that:
 Elements conform all of the time
 All changes are authorized
 Conformance is auditable

Discussion of CM Objectives and Process



Results of Inadequate CM

- Loss of ability to perform safety actions
- Reliability of the plant
- Not having right information at the right time leads to human errors having potential safety consequences
- Expenses which has direct impact on the economic operations of the facility
- Management ownership and support of duplication of the effort
- Worker exposure to radiological and hazards

Current Situation

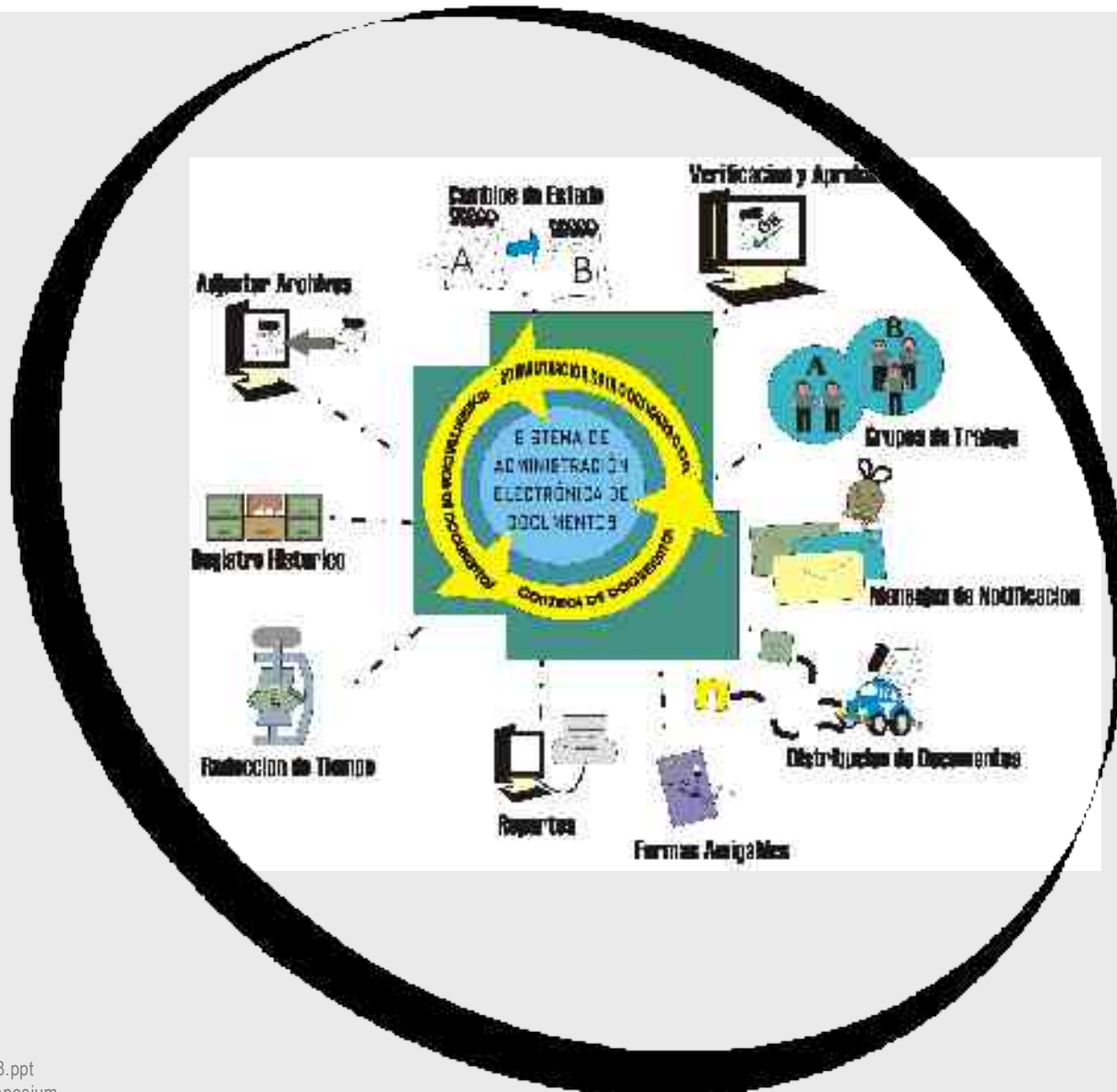
- Many nuclear power plants, particularly older facilities have not fully consolidated design bases and the relevant documentation
- Disappeared original Documentation
- The original “know-why” is not readily available
- Many modifications have been made but the cumulative effects of the changes have not been consolidated
- The modification and maintenance, management of the plant does not have a high degree of assurance that the facility documentation reflects actual plant status

How Information Technology Can Help?

- Document Management
- Workflow
- Maintain, Manage and Control Configuration

Laguna Verde Nuclear Power Station – Units 1 & 2

Electronic Document Management System



Application Framework

Document Management



Security



Process Monitoring

Workflow



Records Management

Integration Middleware



Configuration Management



Electronic Forms

Document Management

- Document and Records Management
 - Flexible Indexes
 - Searchable Libraries
 - Electronic Document Storage
 - Version Control



Configuration Control

- Configuration Control
 - Interrelationship Management
 - Procedures
 - Specifications
 - Vendor Documents
 - Modification Packages
 - Documents
 - Components
 - Tags
 - Buildings
 - Parts (Inventory)
 - Disciplines
 - Corrective Action Requests
 - QA Controls
 - Regulatory documents



Configuration Management

Workflow Management



- Workflow Designer
- Configurable Workflow Routing Mechanism
- Process Administration and Reviews
- Collaboration with Users and Roles
- Electronic Approvals
- Interdisciplinary Reviews
- Dynamic Routing
- Document and Process Audit Archival

Imaging

- Tightly Integrated Image Management
- Electronic Images
- Multiple Layers
- Image Manipulation through browser
- Electronic Forms
- PDF Rendition and Rollup Services
- Support for native format images

Security

- Delegation of Authority
- Electronic PIN Authorization
- Secured Socket Layer SSL
- Role based access to documents and participation in the business processes
- Password Policies
- Encrypted Passwords



Security

External Systems

- Integration with External Systems
 - Inventory and Parts
 - Purchasing
 - Financial Systems
 - Human Resources
 - Inventory and Parts
- Integration using
 - Standard Web Services
 - Direct Database Links

Interface

- Easy to use browser based interface
- Security Controlled Web Pages
- Integrated Electronic Forms
- Client Rich AJAX

C-97 Project at CFE Mexico

- The nuclear power plant in Mexico (CFE) successfully implemented Configuration Control, Document Management Systems and Workflow System
- Key Selection Factors
- Did Market analysis and determined that there is NO out of the box solution readily available in the market to implement the system
- A base document management and work flow engine was selected to be the base repository for documents, images and the driver for the workflow processes

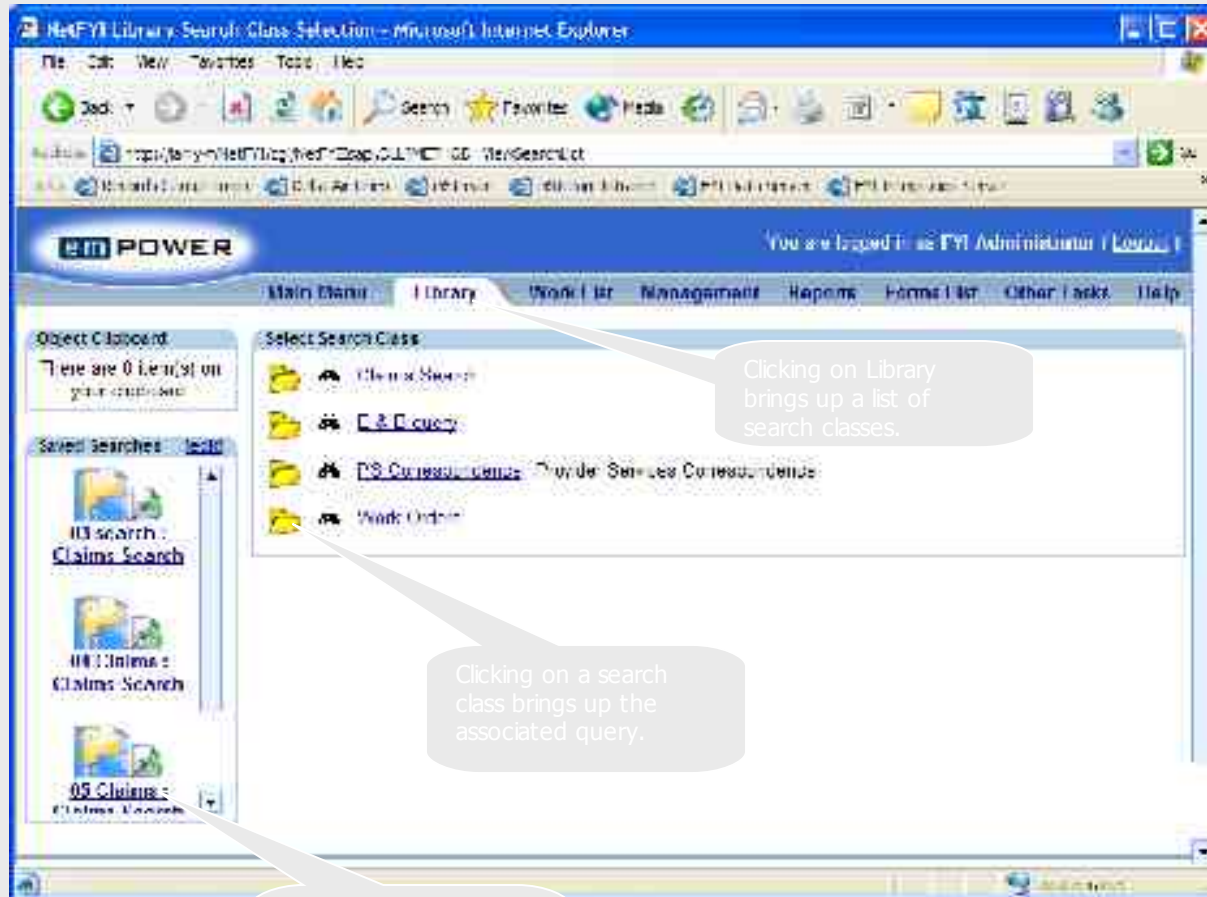
C-97 Project

- Washington International, CFE and iSIGMA, Inc started the process of detailed analysis and integration options and determined that following are the critical building blocks to support the requirements of CFE and built the functionalities
 - Solid Application Framework
 - Configurable intelligent Forms
 - Bi-Directional relationship capabilities
 - A Driver to monitor and control the workflow process
 - Inter disciplinary reviews and External Reviews

C-97 Project (contd.)

- Analyzed of various types of documents available including hard copy documents
- Prepared detailed practical business process documents - clearly defining the business process
- Detailed analysis of inter relationships between various entities
- Consolidated information from multiple sources

Powerful Library Search

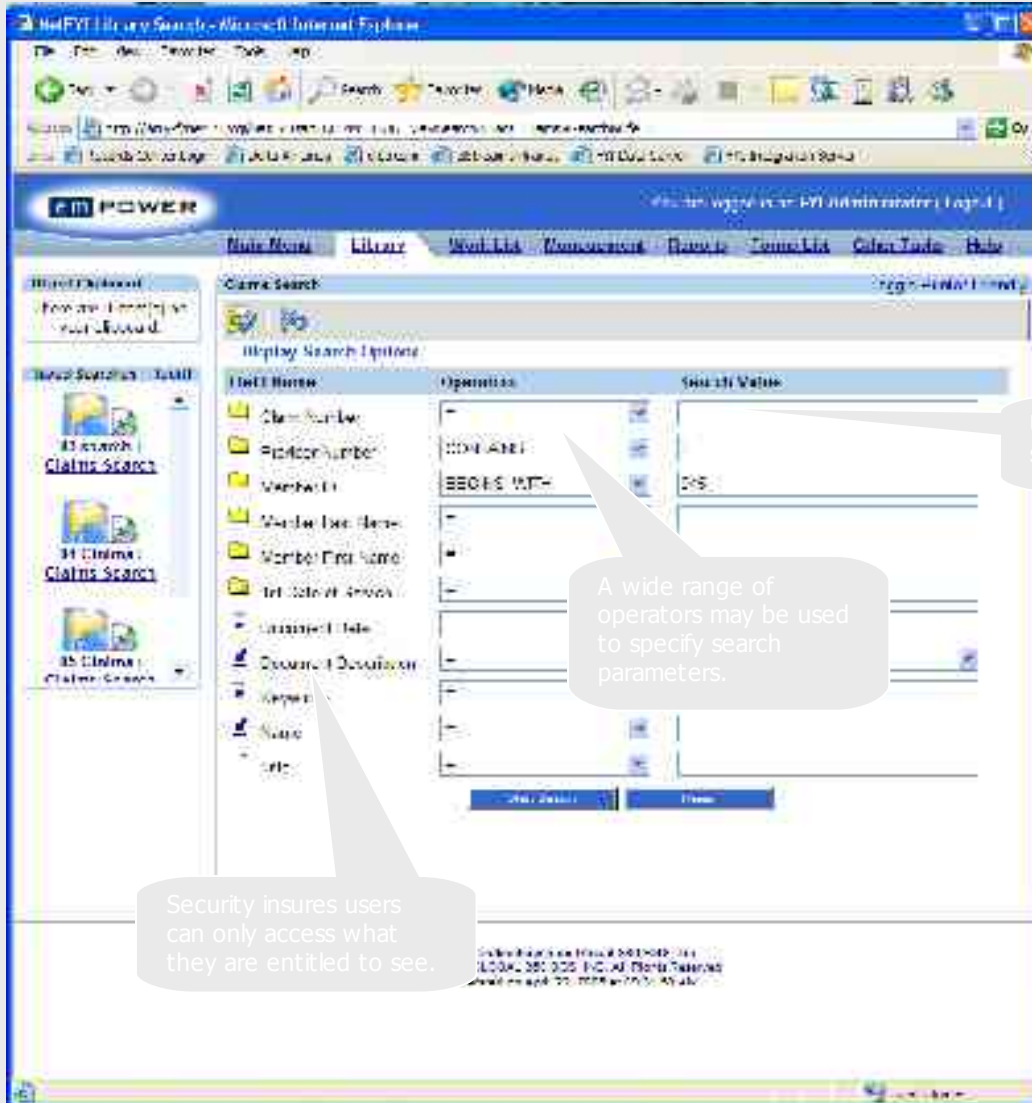


Clicking on Library brings up a list of search classes.

Clicking on a search class brings up the associated query.

Security insures users can only access what they are entitled to see.

Performing a Search

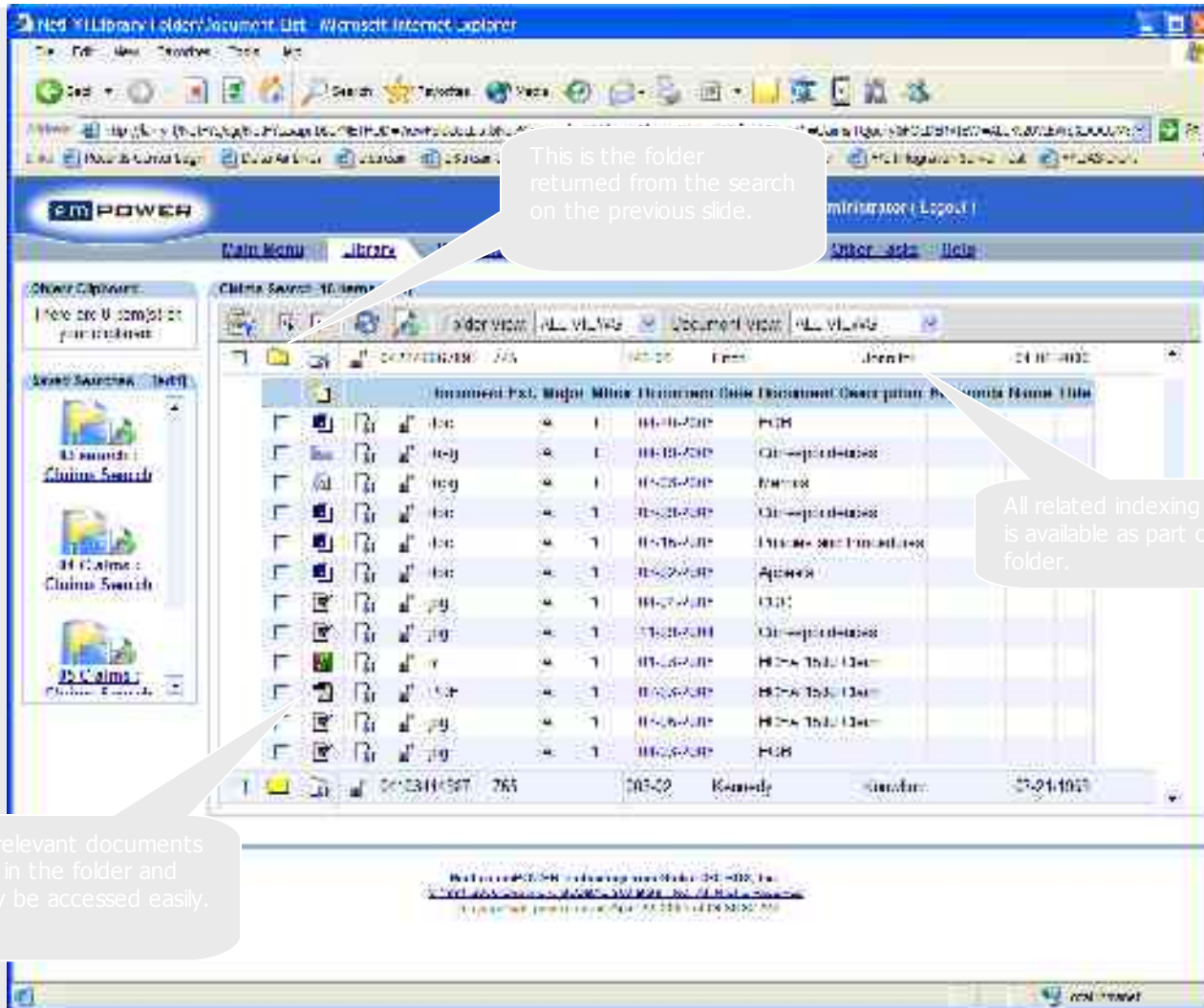


Users can easily enter search values.

A wide range of operators may be used to specify search parameters.

Security insures users can only access what they are entitled to see.

Search Results

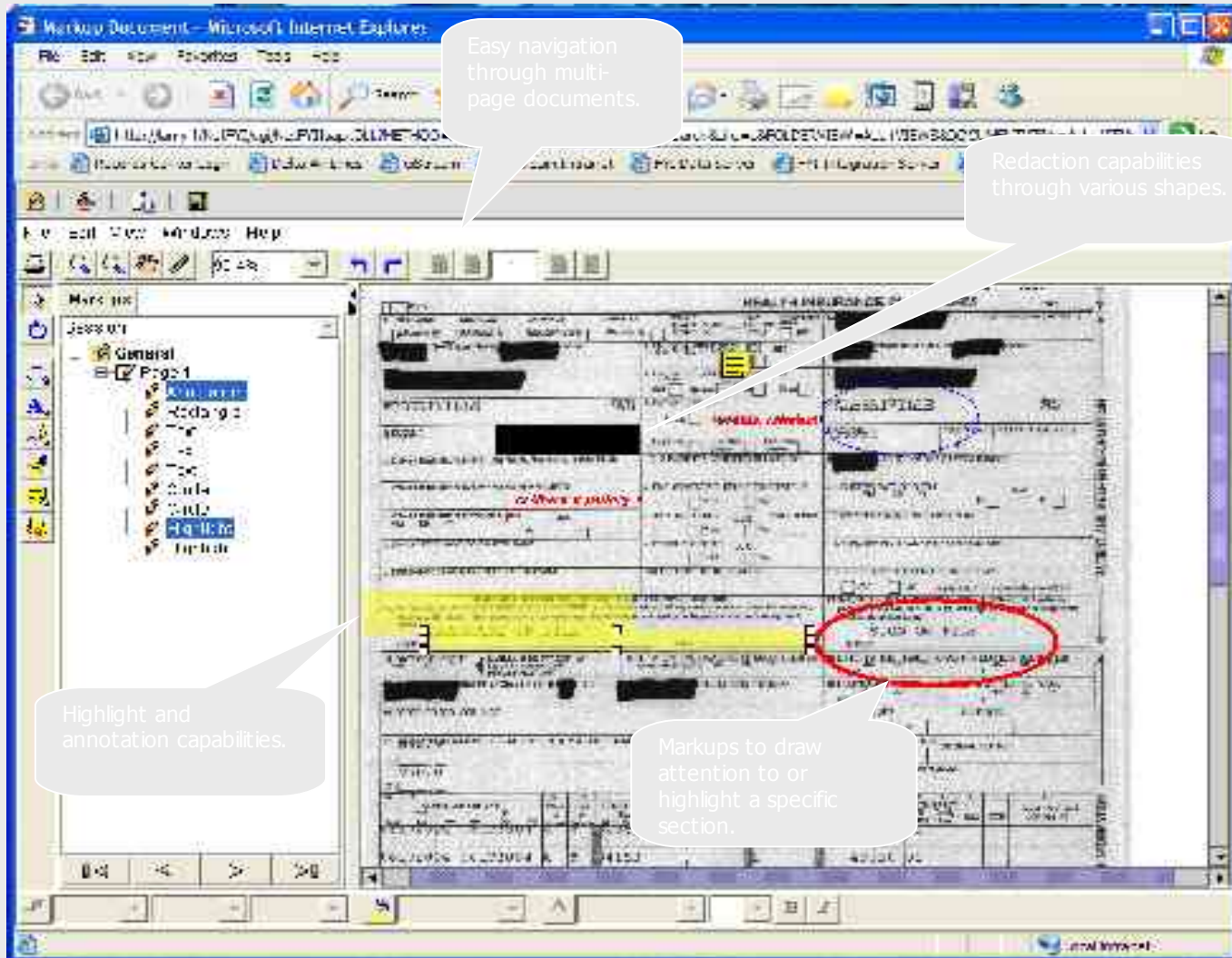


Content Services

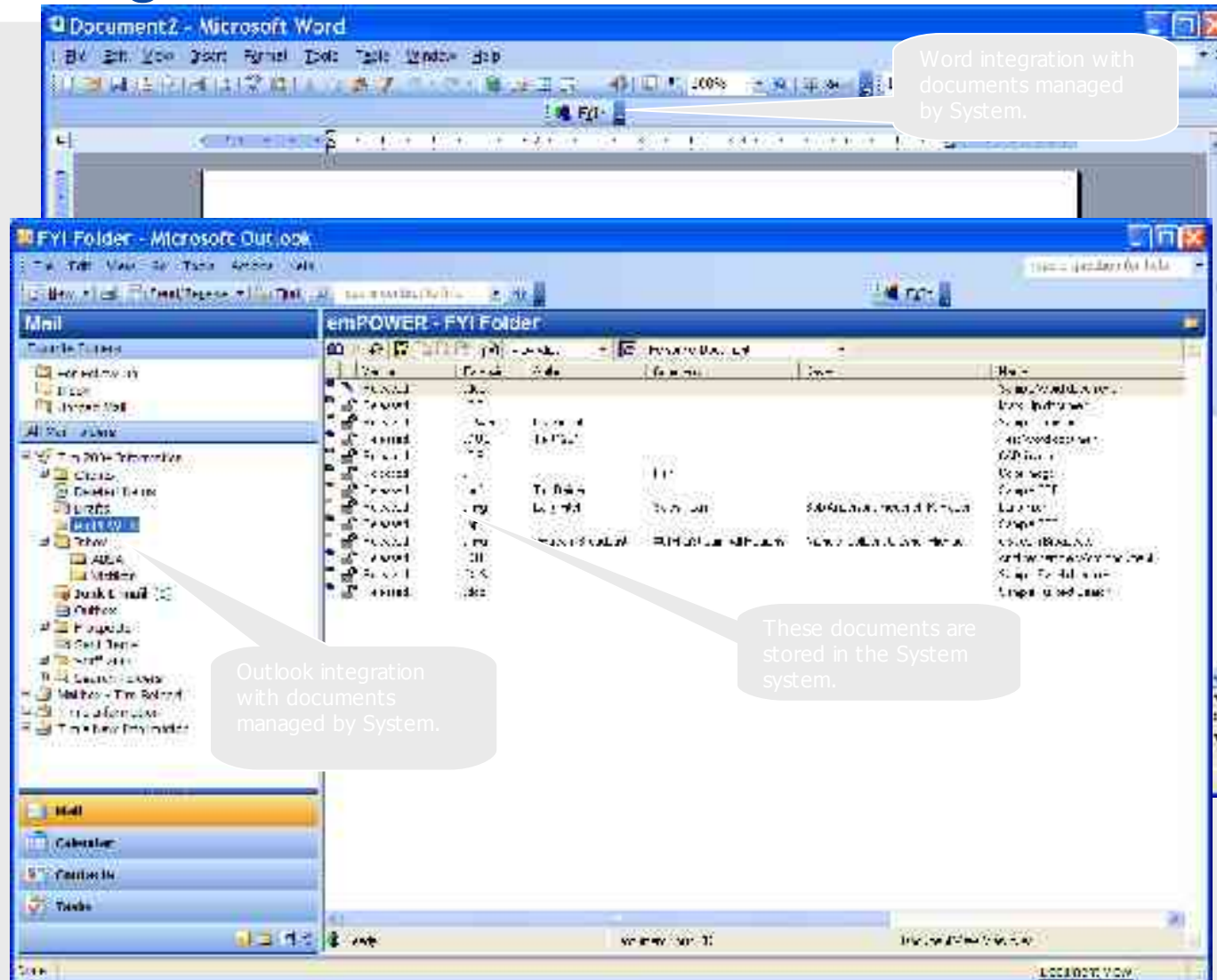
The screenshot displays the EMPOWER web application interface. The top navigation bar includes 'Library', 'Work List', 'Management', 'Reports', and 'Custom'. The main content area shows a table of documents with columns for Document Ext., Major/Minor, Document Date, Document Description, Keywords, Name, and Title. A callout box on the left states: 'View, Edit and Locking Functions available via permissions.' A callout box on the right states: 'Version control is applied to every object.' A callout box at the bottom left states: 'Multiple renditions are supported.'

| Document Ext. | Major | Minor | Document Date | Document Description | Keywords | Name | Title |
|---------------|-------|-------|---------------|--------------------------|----------|------|-------|
| doc | A | 1 | 04-20-2002 | LOI | | | |
| msg | A | 1 | 04-19-2002 | Correspondence | | | |
| mpg | A | 1 | 04-01-2002 | Memos | | | |
| doc | A | 1 | 07-09-2002 | Correspondence | | | |
| doc | A | 1 | 05-16-2002 | Tutorials and Procedures | | | |
| doc | A | 1 | 05-02-2002 | Appendix | | | |
| doc | A | 1 | 04-04-2002 | COI | | | |
| doc | A | 1 | 11-09-2004 | Correspondence | | | |
| doc | A | 1 | 01-01-2002 | CLA EEO Claim | | | |
| doc | A | 1 | 02-01-2002 | CLA EEO Claim | | | |
| doc | A | 1 | 02-06-2002 | CLA EEO Claim | | | |
| doc | A | 1 | 04-01-2002 | LOI | | | |

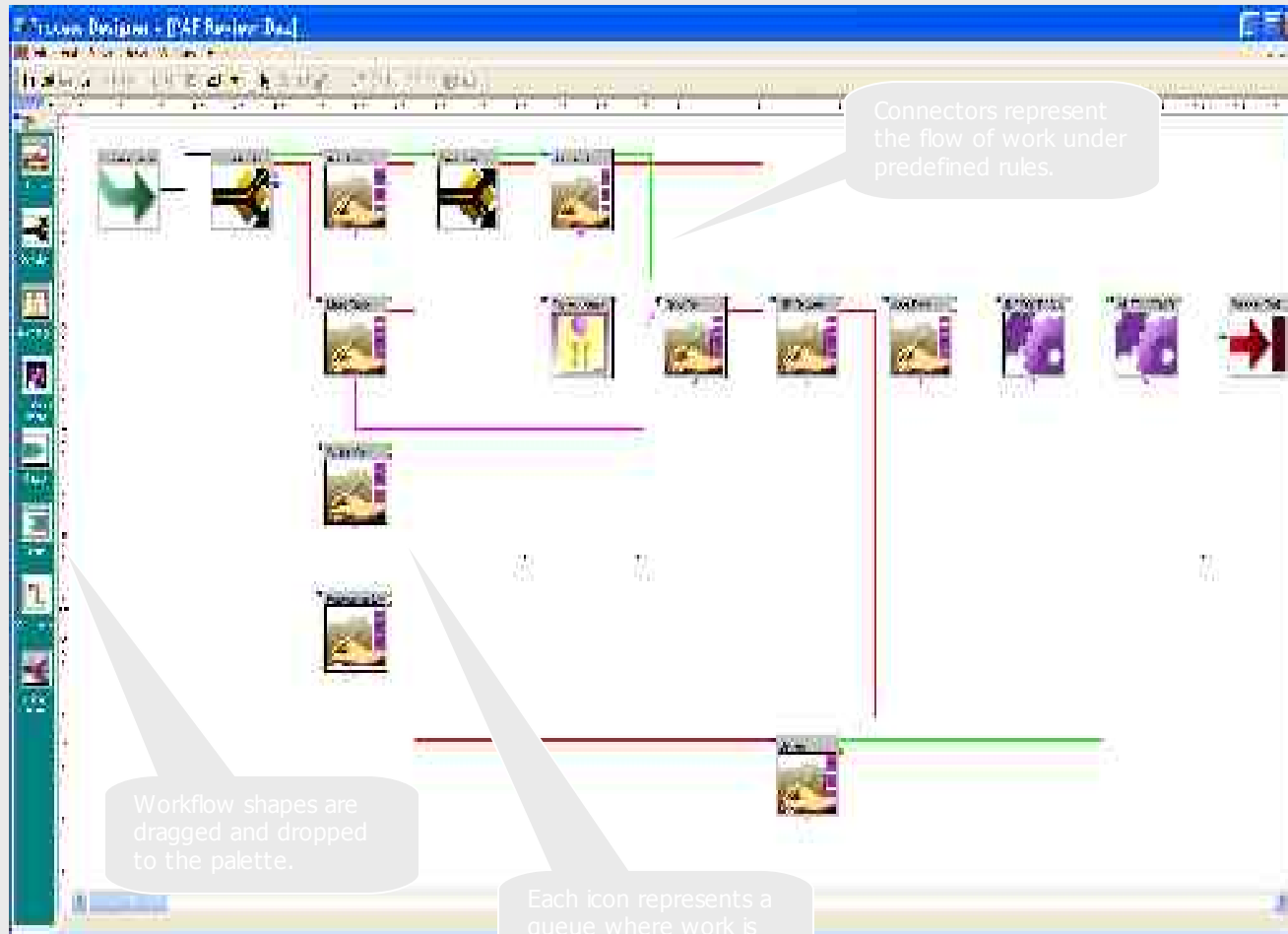
Image Manipulation and Viewing



Integration with Microsoft Office



Process Modeling (Workflow)



Connectors represent the flow of work under predefined rules.

Workflow shapes are dragged and dropped to the palette.

Each icon represents a queue where work is processed.

Building Workflow Rules

Step Properties [Decision]

Sophisticated decision and routing logic are easily defined.

Field Name: Division Name

| Operators | Value | AND/OR |
|-----------|------------------|--------|
| Output 1 | 0? Division Name | - |
| Output 2 | 0? Division Name | - |
| Output 3 | 0? Division Name | - |

Step Properties [Normal]

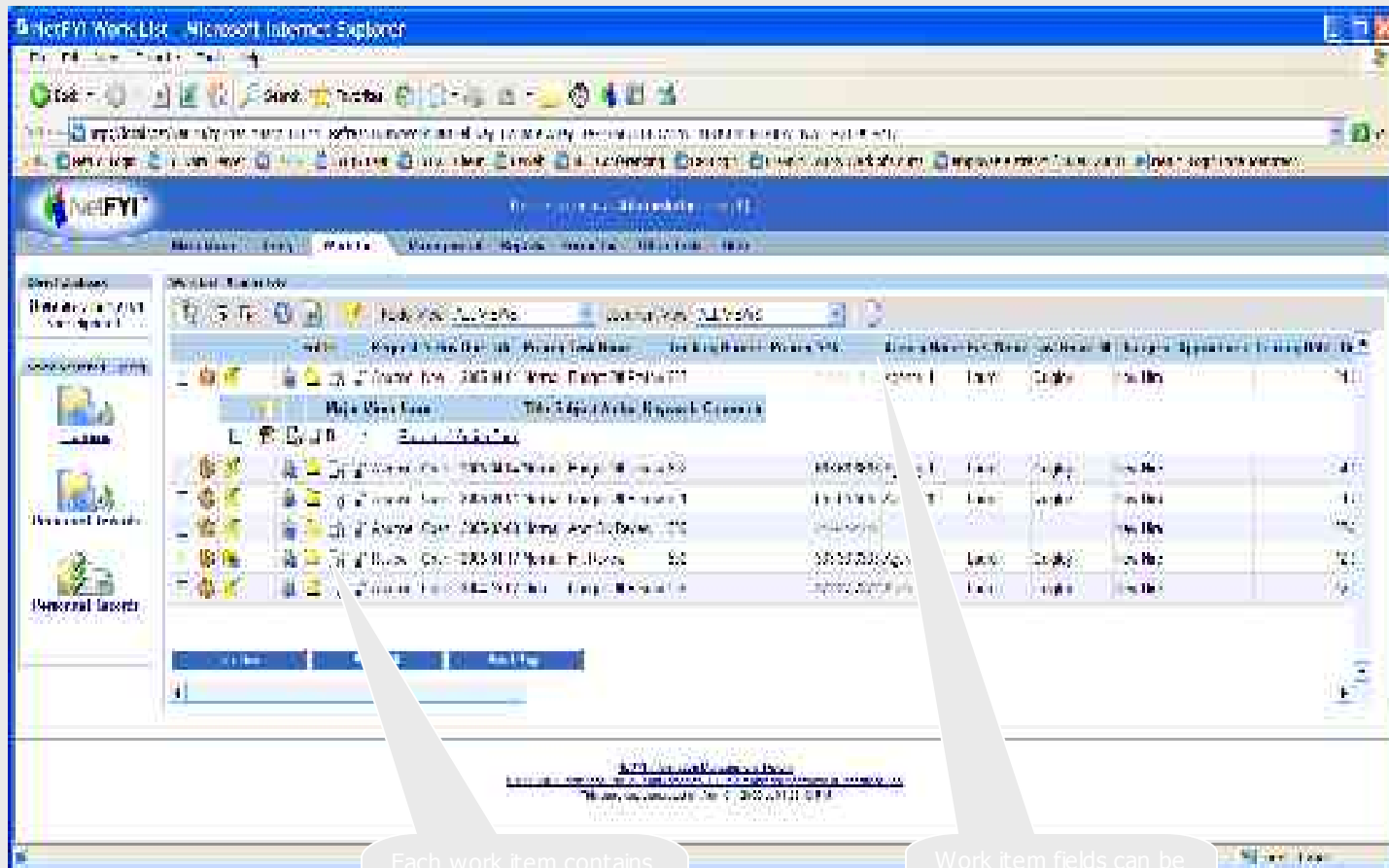
Escalation notification can be done via email.

Notification of work assignment can be done via email.

Sophisticated exception processing and escalations are easily defined.

| Property | Value |
|-----------------------------------|---|
| Step Name | And / Or / Or |
| Flow Type | Alternate 1 |
| Number of open or closure req. | 1 |
| Number of positive responses req. | 1 |
| Priority | Normal |
| Change Type | Approve |
| Duration | 0 |
| Unit | Days |
| Send email | No |
| Step Menu | Review, Send Action Item, approve or deny |

Presenting Work via a Work List



Each work item contains all required data and content required for processing.

Work item fields can be automatically created upon capture.

Workflow Audit Trial

The screenshot shows a web browser window displaying a workflow audit trail. The browser address bar shows a local host URL. The page title is "Complete Audit Trail" and the content is a table with columns for "Event", "Workflow Item", "Created On", "Modified On", and "Priority".

Callout 1 (top right): "Provides a time/date stamp of all activity." - Points to the "Created On" and "Modified On" columns.

Callout 2 (bottom left): "Tracks all events that occur during task processing." - Points to the "Event" column.

Callout 3 (bottom center): "Tracks who worked on the workflow item." - Points to the "Workflow Item" column.

| Event | Workflow Item | Created On | Modified On | Priority |
|--------|----------------------|------------|-------------|----------|
| Task 1 | Task Name: [unclear] | 2005-04-04 | 2005-04-04 | Normal |
| Task 2 | Task Name: [unclear] | 2005-04-04 | 2005-04-04 | Normal |
| Task 3 | Task Name: [unclear] | 2005-04-04 | 2005-04-04 | Normal |
| Task 4 | Task Name: [unclear] | 2005-04-04 | 2005-04-04 | Normal |
| Task 5 | Task Name: [unclear] | 2005-04-04 | 2005-04-04 | Normal |

Portfolio Views

Control de la Configuración

Vendedor
(A) N 00001 Rev 02 (+-Vigente)

| | | | |
|---------------------------|--------------------------------------|---------------------------------------|--|
| Tipo | A | Código | CRB |
| Núm. de Documento | M 00001 | Revisión | 02 |
| Título | I.L.D. REV. CURRENT VALVE PART LIST. | Observaciones | |
| Descripción | MECANICA | Estado revisado como parte de: | Original |
| Descripción del Documento | Carta | Nivel de Incorporación | 0-Actualizar cuando se cumpla la Sba. Absorbente |
| Clase Seguridad | N/R | Condición de Documento | As built |
| Anotar PEAR/OSSE | NO | Función | 00 |
| Seguridad Física | NU | Estado | 1-Vigente |
| Seguridad Física | SN | Actividad | 0 |
| Tier del Proyecto | B | Número de Fundador | 830010 |
| Responsable | | Estado de Fundador | 1.1 |
| Responsable de Fundador | A | Fecha de Cambio de Nivel | |
| Código de Control | 0069704/03 | Fecha de Expiración | 16/02/1984 |
| Expiración | | Fecha expirada de sistema de archivos | |
| Fecha de Inicio | | Fecha de creación | 27/02/1984 |
| Fecha de Término de Con | | | |

Descripción

Proveedor: 006_0060/04/85 Fecha: 15/12/1983 Idioms:
 ELECTROVENTILACION IND.
 URSALTS @ 50 146.PERSO COL THART
 Contacto:

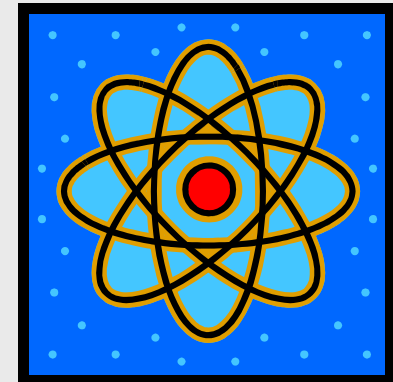
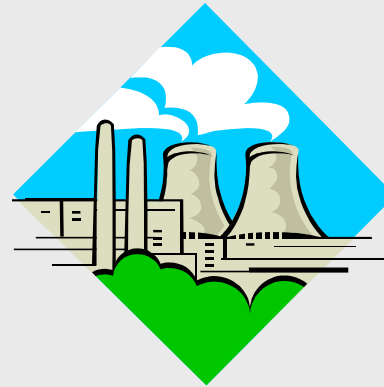
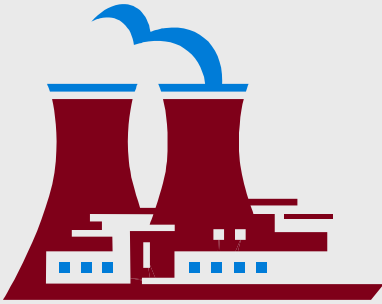
Revisión: Límites Asociados Diagramas Asociados **Ver el CCL**

| Historial (2) | | |
|---------------|---|-------------------|
| Rev | Estado | Fecha de creación |
| 02 | 1-Vigente | 26/10/1986 |
| 00 | NO-MODIFICADO POR REVISIÓN AL DOCUMENTO | |

Technology

- FYI Core Workflow Engine
- SQL Server / Oracle – Data Repository
- Cold Fusion – Web server and Data Access
- XML / XSL Frame Work – Presentation and Web Services
- VB / .net
- Crystal Reports - Reporting

Solutions can be applied to



Configuration Management

Reference Documents

ANSI Standards

| | |
|--------------------|---|
| ANSI/NIRMA CM 1.0 | Configuration Management of Nuclear Facilities |
| ANSI/ANS 3.2-1994 | Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants |
| ANSI N18.7-1976 | Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants |
| ANSI N45.2.9-1974 | Requirements for Collection, Storage, and Maintenance of Quality Assurance Records for Nuclear Power Plants |
| ANSI N45.2.11-1974 | Quality Assurance Requirements for the Design of Nuclear Power Plants |

DOE Standards

| | |
|-------------------|--------------------------|
| DOE-STD-1073-2000 | Configuration Management |
|-------------------|--------------------------|

EPRI Documents

| | |
|------------------------------|--|
| TR-103586-R1 Power Plants | Guidelines for Optimizing the Engineering Change Process for Nuclear |
|------------------------------|--|

IAEA Documents

| | |
|---|---|
| IAEA-TECDOC-1335 Draft Safety Report | Configuration Management in Nuclear Power Plants Application of Configuration Management to Nuclear Power Plants Draft TECDOC Guidance for Design Basis Documents in Soviet VVER plants |
|---|---|

Configuration Management

Reference Documents

INPO Documents

| | |
|-------------|--|
| INPO 87-006 | Report on Configuration Management in the Nuclear Utility Industry |
| INPO 05-003 | Performance Objectives and Criteria (May 2005) Section II |
| INPO AP-929 | Configuration Control Process Description Revision I |

NEI Documents

| | |
|-------------------------------|---|
| NEI 96-07 Rev 1 | Guidelines for 50.59 Evaluations |
| NEI 97-04, Rev 1 10CFR50.2 | Design Basis Program Guidelines Design bases as defined in the (see Reg. Guide 1.186 & NUMARC 90-12) |
| NEI 98-03 | Guidelines for Updating Final Safety Analysis Reports |
| NEI Report | NEI Configuration Control Process Benchmarking Report - August 2001 |

Position Papers

| | |
|-----------|---|
| PP02-1994 | Configuration Management • Defines CM |
| PP03-1992 | Implementing CM Enhancement in a Nuclear Facility |
| PP04-1994 | Configuration Management Information Systems |

Technical Guidelines

| | |
|-----------|---|
| TG11-1998 | Authentication of Records and Media |
| TG13-1986 | Records Turnover |
| TG14-1992 | Support of Design Basis Information Needs |
| TG15-1998 | Management of Electronic Records |
| TG16-1998 | Software Configuration Management and Quality Assurance |

Configuration Management

Reference Documents

Technical Guidelines (cont'd.)

| | |
|-----------|---|
| TG17-1993 | Management of Nuclear Training Records |
| TG18-1994 | Guideline for Implementing VTIC Programs |
| TG19-1996 | Configuration Management of Nuclear Facilities |
| TG20-1996 | Drawing Management Program Principals and Processes |
| TG21-1998 | Electronic Records Protection and Restoration |
| TG22-1999 | Identifying Quality Assurance Records (Draft) |

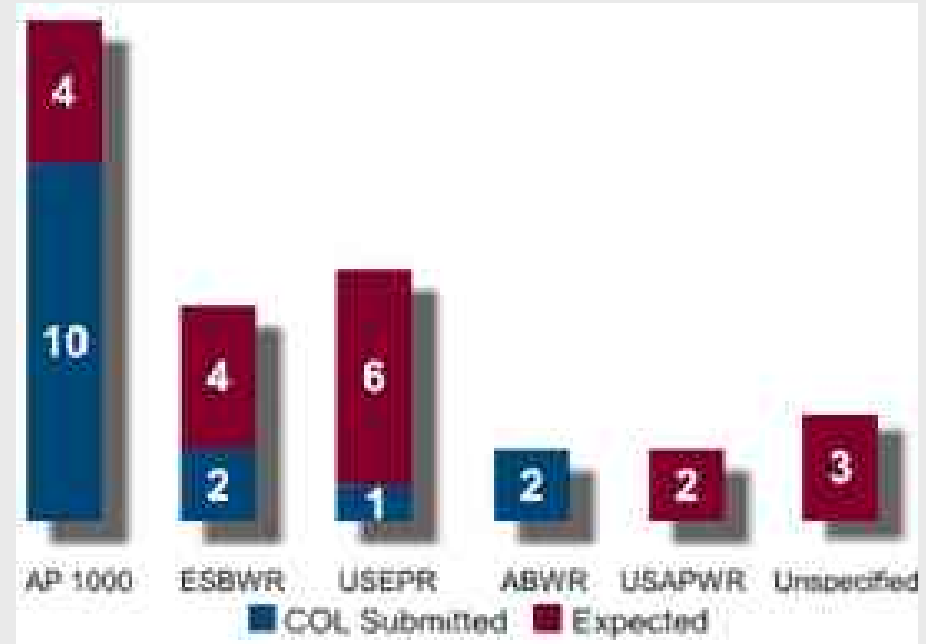
NRC Documents

| | |
|------------------|--|
| GL 88-18 | Plant Record Storage on Optical Disks. |
| IE 98-22 | Fundamental Attributes of a Practical Configuration Management Program for Nuclear Plant Design Control - June, 1988 |
| NUREG/CR-5147 | Fundamental Attributes of a Practical Configuration Management |
| NRC; 1987 | Program for Nuclear Plant Design Control - June, 1988 |
| Reg. Guide 1.186 | Design Basis Information |
| RIS 00-18 | Guidance on Managing Quality Assurance Records in Electronic Media |
| 10CFR50 | Configuration Management 50.2 Definitions 50.54(f): 50.59 Changes: 50.71 Maintenance of Records: Appendix A General Design Criteria |

Number of Planned Reactors (34)

Vendor Technology Under Consideration

- **General Electric**
 - **Advanced Boiling Water Reactor (ABWR), 1,356 MWe (certified 10CFR52 App A)**
 - **Economic Simplified Boiling Water Reactor (ESBWR), 1,560 MWe**
- **Westinghouse**
 - **Advanced Passive Pressurized Water Reactor (AP1000), Twin units 1,117 MWe each (certified 10CFR52 App D)**
- **AREVA**
 - **United States Evolutionary Pressurized Water Reactor (US EPR), 1,600 MWe**
- **Mitsubishi Heavy Industry**
 - **United States Advanced Pressurized Water Reactor (US APWR), 1,700 MWe**



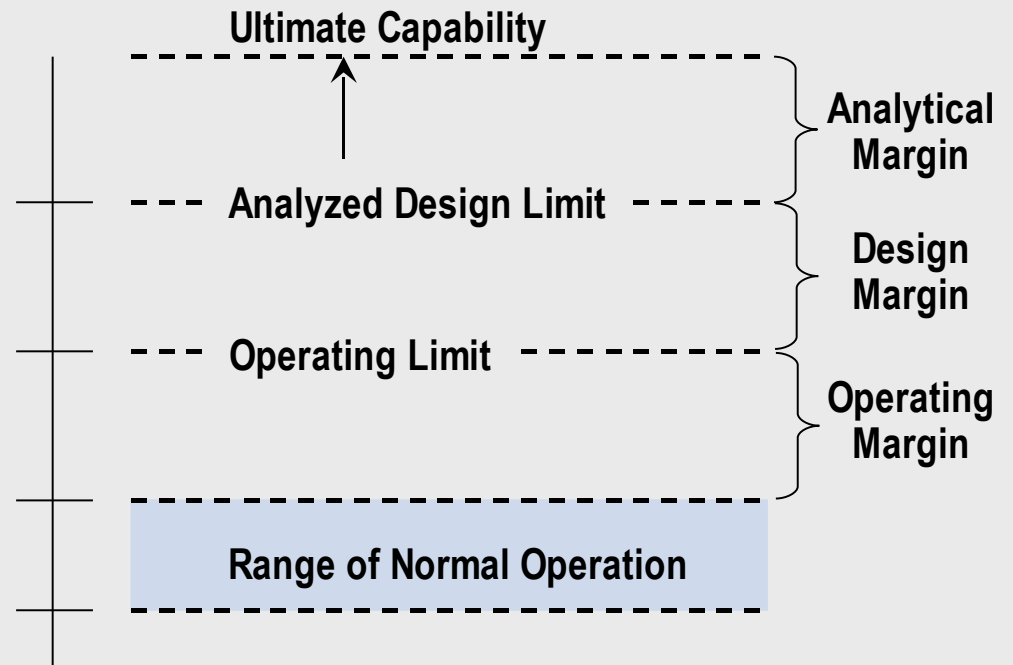
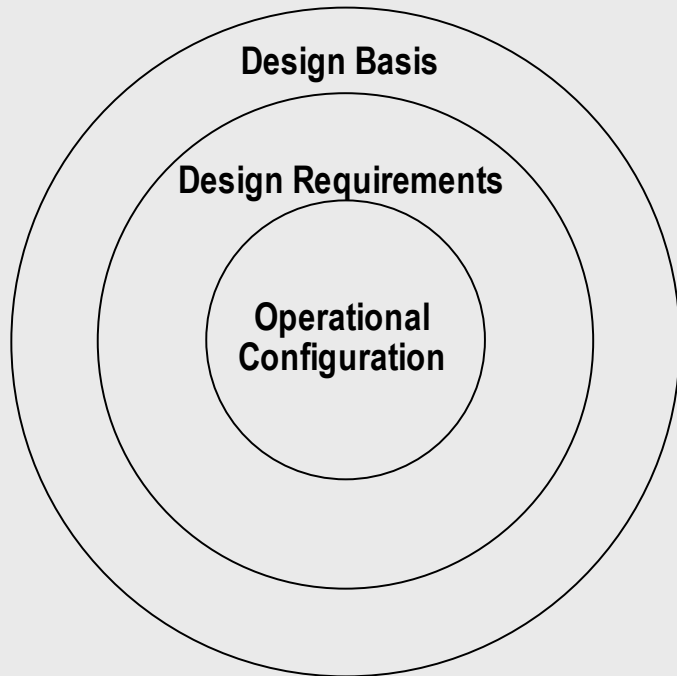
Status of License Applications (23)

Quick Statistics

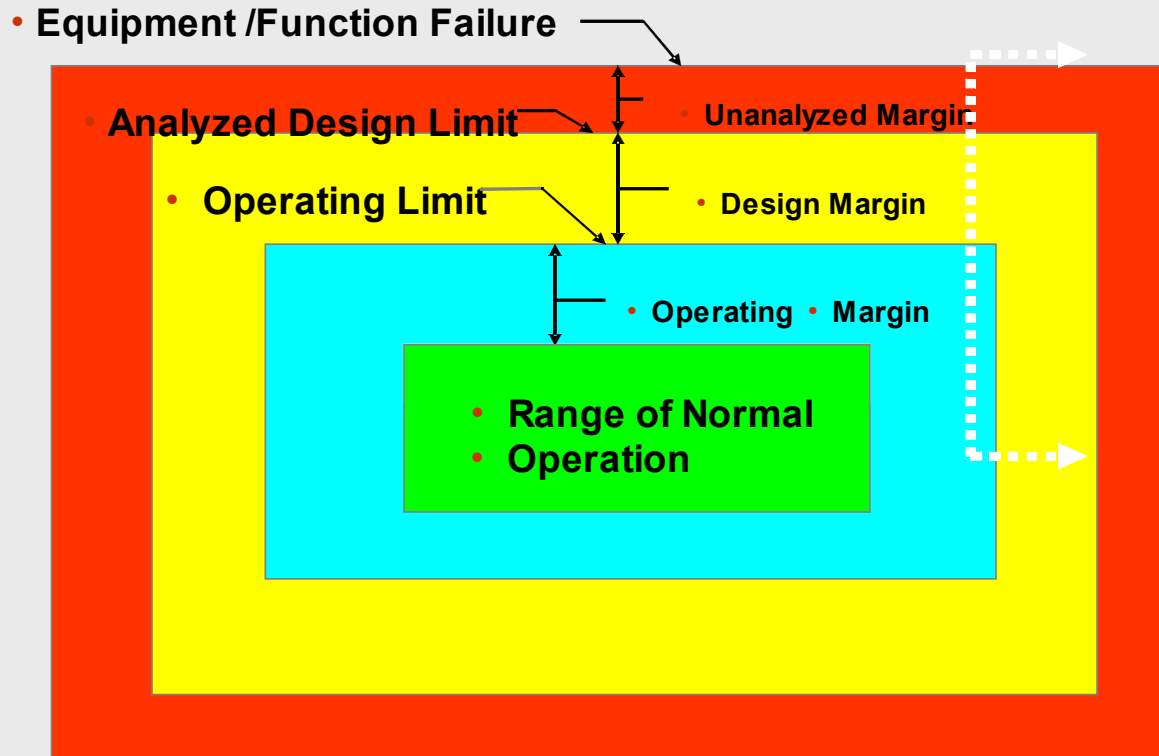
- Early Site Permits issued—3
- Permits under review—1
- Total COL applications submitted—9
- COL applications docketed—8
- Certified reactor designs—2
- Reactor designs under review—4
- Expected license applications—23
- Expected number of reactors—34
- Nuclear plant locations—20
- Companies applying for COL—20



Margin Limits



INPO Margin Model



IRS Data

- Incident Reporting Systems data shows
 - Errors in original design or design modifications
 - Inadequate corrective actions
 - Inadequate testing
 - Documentation discrepancies

Principles of a CM

- CM is a management discipline that applies technical and administrative direction to
 - Development
 - Production
 - Support life cycle
- Applicable to
 - Hardware
 - Software
 - Processed materials
 - Services
 - And related technical documentation
- CM is an integral part of life-cycle management

Document Management

- Categorization of Documents
- Index, Digitize and Store Documents
- Version Control
- Check-in Checkout

Workflow

- Automation of many business processes results in the elimination of many unnecessary steps
- Improved management of business processes achieved through standardizing working methods and the availability of audit trails
- Improved Consistency in the processes leads to greater predictability in levels of response to customers
- Flexibility – software control over processes enables their re-design in line with changing business needs
- Streamlining and simplification of Business Process

Configuration Control

- Maintain bi-directional relationships with
 - Systems
 - Facilities
 - Components
 - Documents
 - Design Documents
 - Tech Specs
 - Vendor Manuals
 - Drawings
 - Procedures