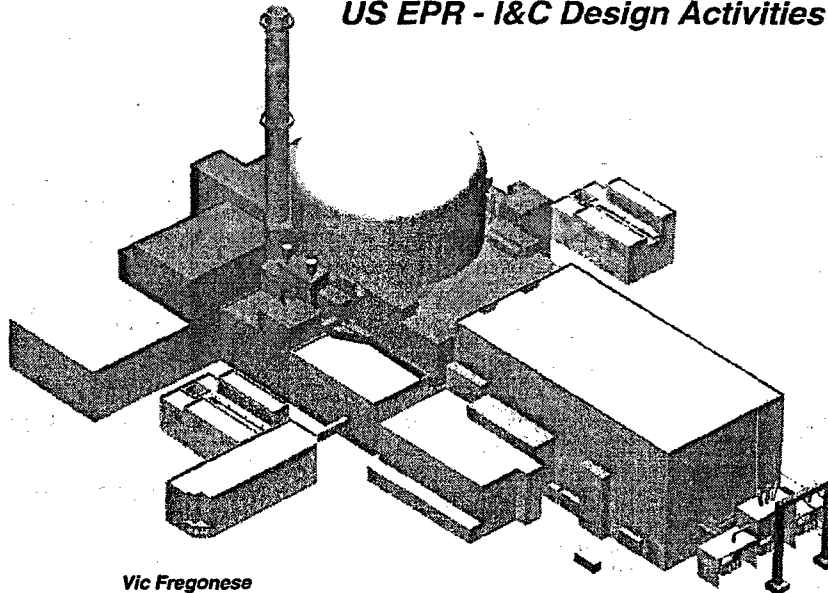


US EPR - I&C Design Activities



Vic Fregonese
I&C/Electrical Engineering Manager
US EPR Projects

Overview

- > **Digital I&C Goals and Objectives**
- > **Design Team Focus Areas**
- > **Current Activities**
- > **Future Activities**
- > **Timeline**
- > **Regulatory Interactions**
- > **Challenges**
- > **Potential Solutions**

Digital I&C – Goals and Objectives

Improved I&C Safety Performance and Reliability

- > **Improved Safety/Reliability**
 - ◆ Actuate Trips When Needed
 - ◆ Avoid Spurious Actuation
- > **Improved Maintainability**
 - ◆ On-Line Testing and Diagnostics
 - ◆ On-Line Maintenance Without Impact to Plant Operation or System Operability
- > **Improved Automation**
 - ◆ Automatic Limitation Functions to Avoid Protection System Actuation
- > **Improved Information Management for Operators**
- > **Support Advanced Plant PRA Goals**
- > **Support Advanced Plant Staffing Goals**
- > **World Wide Standardization to Maximum Extent Possible**
- > **Acceptance by International Regulatory Authorities**

Digital I&C – Design Team Core Focus Areas

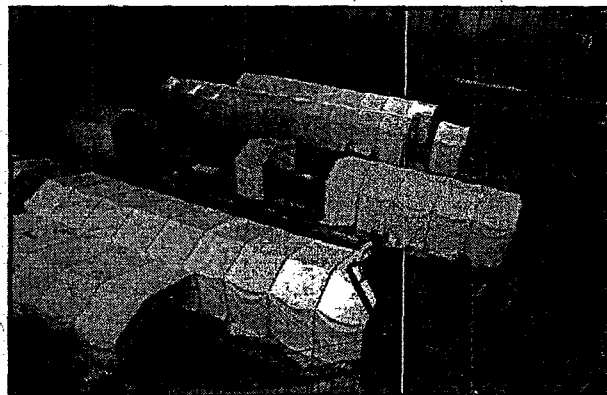
- > **Reactor Safety**
 - ◆ Understand the technology of the facility and maintain design conservatism.
 - ◆ Protect the Design Basis - Understand and maintain the design basis
- > **Configuration Control**
 - ◆ Assure that changes to design configuration conform to design requirements and are accurately reflected in the facility configuration information
 - ◆ Assure that alignment of in-service equipment is consistent with the design
 - ◆ Assure that equipment is procured and maintained in accordance with the design
- > **Plant Operations**
 - ◆ Ensure plant operators understand the functions, characteristics, and operating limits of the equipment, in order to safely control it.
- > **Plant Maintenance**
 - ◆ Ensure plant maintenance staff understands the equipment to support successful execution and control of maintenance required to keep the equipment within operating parameters.

Current Activities

- > **OL3 Reference Plant**
 - ◆ Under Construction in Finland
 - ◆ 2009 Commercial Operation
 - ◆ I&C Systems in Design Freeze Process
 - ◆ I&C Manufacturing Started
 - ◆ HSI Design Well Along
 - ◆ Simulator Development in Progress

- > **US EPR Deployment**
 - ◆ DCD Development for December 2007 Submittal
 - ◆ COLA Development for June 2008 Submittal
 - ◆ Design Continuum Development
 - ◆ I&C Licensing and Design Basis Reconciliation
 - ◆ I&C Global Competence Team Oversight

Olkiluoto 3: January 2006



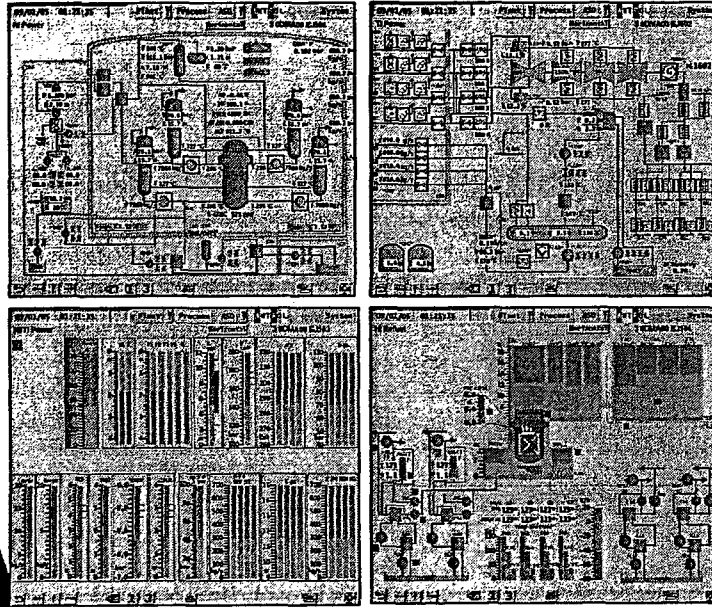
**Containment Structural Work
Inside the winter shelter**

February 2006

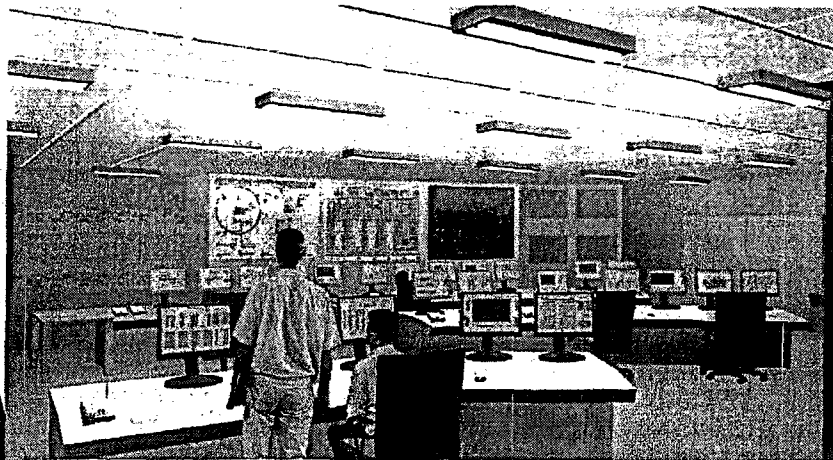


OL3 I&C cabinet #1

Plant Overview Displays



OL3 Control Room Development



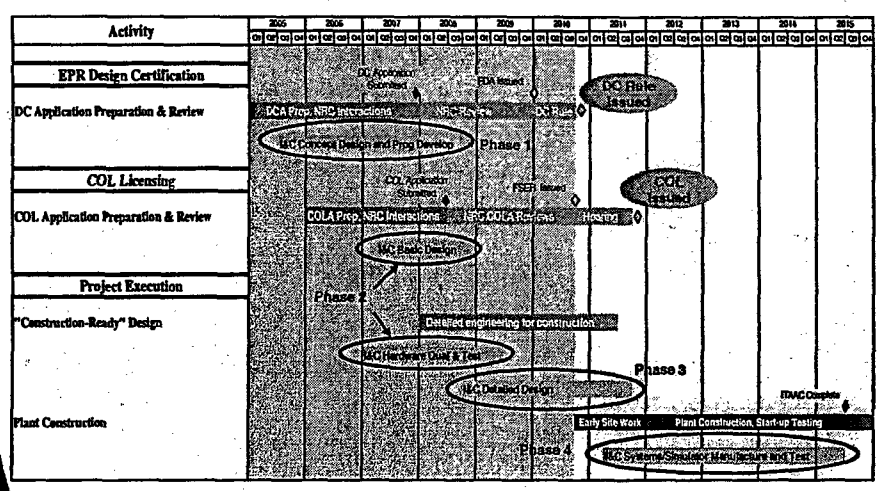
> EPR Meeting - March, 2006

Future Activities

- > I&C Design Process
 - ◆ Phase 1 – Conceptual Design
 - ◆ Phase 2 – Basic Design
 - ◆ Phase 3 – Detailed Design
 - ◆ Phase 4 – Manufacturing/Testing/Installation

> EPR Meeting - March, 2006

Future Activities



Regulatory Interactions

- > February 2006 Meeting on Early Resolution of Process and Design Issues
- > April 2006 Meeting on I&C System Design
- > August 2006 Meeting on I&C System Architecture
- > Topical Report Submittals (TBD) for areas such as:
 - ◆ Setpoint Methodology
 - ◆ Software Programs
 - ◆ HFE Programs
 - ◆ Diversity Analysis
 - ◆ RPS Design
 - ◆ EQ

Challenges – Design Process

- > Design being developed now to meet current regulations that may change later
- > Design being developed now based on previous industry precedent where the NRC position may change
- > Design being developed now that addresses a large body of guidance documents, some of which may conflict with one another or other guidance documents
- > Software processes which produce a large amount of documentation which needs to be reviewed in phases and in conjunction with other supporting documents (FMEA, D3, etc)

Challenges – Potential Technical Hardspots

- > Interaction, interface, & communications between non-safety related automation/HSI system and safety related I&C
- > Cyber-security
- > HSI – Concept of operations for use of non-safety HSI at all times (during accident conditions) if operable and available
- > Integration of automated operating procedures into HSI concept of operations

Challenges Numerous Guidance Documents for I&C Design

	Part 50	Reg Guides	Generic Letters	IEEE	SRP
BTP-14					
RG 1.173	10 CFR 50.55a(h)	RG 1.22	80-013	IEEE Std. C37.90.1	SRP 3.7.4
IEEE-1074	10 CFR 50.34(f)(2)(v)	RG 1.47	80-016	IEEE Std. C62.36	SRP 5.2.5
RG 1.169	10 CFR 50.34(f)(2)(xii)	RG 1.52	80-025	IEEE Std. C62.41.1	SRP 7.0
IEEE-828	10 CFR 50.34(f)(2)(xiv)	RG 1.53	80-035	IEEE Std. C62.41.2	SRP 7.0-A
RG 1.168	10 CFR 50.34(f)(2)(xvii)	RG 1.62	80-073	IEEE Std. C62.45	SRP 7.1
IEEE-1012	10 CFR 50.34(f)(2)(xviii)	RG 1.75	80-082	IEEE Std. 338	SRP 7.1-A
RG 1.172	10 CFR 50.34(f)(2)(xix)	RG 1.97	80-083	IEEE Std. 279-	SRP 7.1-B
IEEE-1028	10 CFR 50.34(f)(2)(xx)	RG 1.105	80-089	IEEE Std. 379-	SRP 7.1-C
IEEE-830	10 CFR 50.49	RG 1.118	81-005	IEEE Std. 384-	SRP 7.2
RG 1.171	10 CFR 50.62	RG 1.151	81-010	IEEE Std. 603	SRP 7.3
IEEE-1008	Appendix A GDC	RG 1.153	82-009	BTP	SRP 7.4
RG 1.152	GDC 10	NUREG	83-010	BTP HICB 1	SRP 7.5
IEEE-7.4.3.2	GDC 12	NUREG 0493	83-016	BTP HICB 2	SRP 7.6
RG 1.170	GDC 13	NUREG 0737	84-024	BTP HICB 3	SRP 7.7
IEEE-829	GDC 15	NUREG 0933	86-015	BTP HICB 4	SRP 7.8
NUREG/CR 6463	GDC 19	NUREG/CR-5560	87-012	BTP HICB 5	SRP 7.9
SECY/SRM Letters	GDC 20	NUREG/CR-6082	88-014	BTP HICB 6	SRP 10.2
SECY 93-087	GDC 21	NUREG/CR-6083	88-017	BTP HICB 8	SRP 11.5
SECY 92-053	GDC 22	NUREG/CR-6090	89-006	BTP HICB 9	SRP 12.3-12.4
SECY-91-178	GDC 23	NUREG/CR-6303	89-019	BTP HICB 10	SRP 18
SECY 90-377	GDC 24	NUREG/CR-6421	96-001	BTP HICB 11	
SECY 92-196	GDC 25	Info Notices	Info Notices	BTP HICB 12	
SECY 92-299	GDC 28	02-10	84-47	BTP HICB 13	
Other	GDC 29	03-14	84-70	BTP HICB 16	
MIL-STD-461C	EPRI	04-19	84-86	BTP HICB 17	
IEC std. 880-1996	EPRI TR 106439	05-20	85-09	BTP HICB 18	
ASME NQA-2a	EPRI TR 106453	80-12	85-40	BTP HICB 19	
	EPRI TR-107330	82-45	85-86	BTP HICB 21	
	EPRI TR-102323	83-17	86-10		

Challenges Software Life Cycle Documentation Review

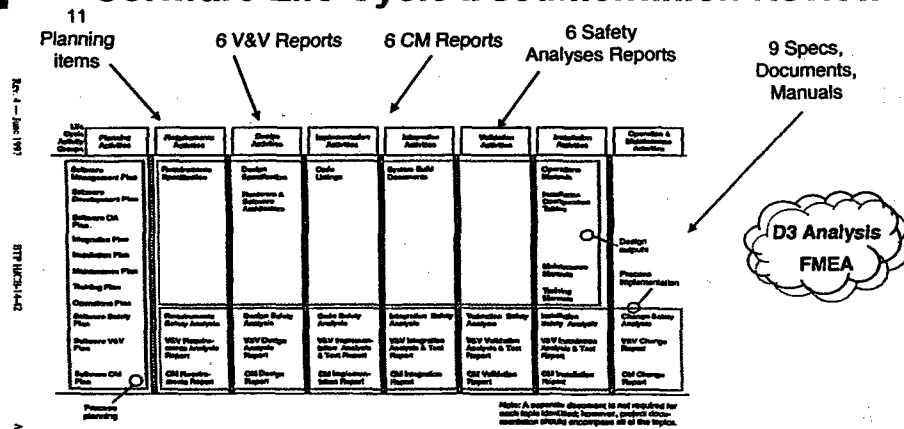


Figure 7-4-1. Flow of Documents Through the Software Life Cycle

6 Phases in Planning and Design = Potential 38 Separate Sets of Documentation

Potential Solutions

- > **Implement a more active and frequent interaction between the regulatory experts and I&C system designer throughout the design life-cycle**
- > **Industry working group to focus on key issues**
 - ◆ **Develop a roadmap to navigate through process and technical issues to ensure a successful implementation of digital I&C for new plants**
 - ◆ **Create a sense of urgency around issues that have a potential real impact on nuclear safety**
 - ◆ **Use of independent assessors/experts to verify I&C design adequacy**