

2005 KEPIC -Week

I&C 가

KEPIC

800 830 9 2
가 ' 2005 KEPIC-Week '

< >

I.

. Upgrade

(I&C)

I&C Upgrade

Analog

I&C

30~50

[1].

Analog

Analog

(Upgrade)

I&C

가
(Analog)

가

I&C

Analog

I&C

I&C Upgrade

가

가 I&C

- 가

(Deregulation)

Upgrade

KEPIC

- 가 , 가 PWR Foxboro Spec 200
- 가 . Babcock Wilcox (B&W) PWR
- / Bailey 721
- , .
- 가
- [2].
- Boiling Water Reactor (BWR)
- GEMAC
- Pressurized Water Reactor
- (PWR) 7100 7300
- Combustion Engineering
- PWR Foxboro Spec 200
- Babcock Wilcox (B&W) PWR
- Bailey 721
- Plant Protection Systems (PPS)
- Engineered Safety Features Actuation Systems (ESFAS).
- condensate polishing system
- Pneumatics
- demineralizer circulating water screen wash
- diesel generator sequencers refueling crane

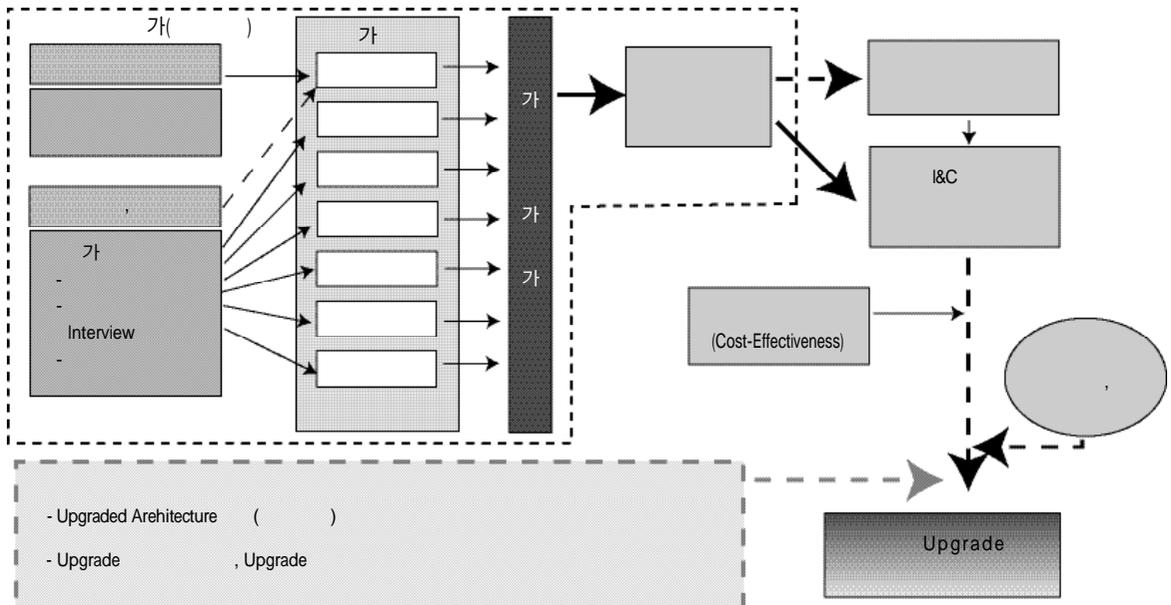
1 | I&C Upgrades

#1		1998		KOPEC	Invensys
#1,2		2004/2005	"	KEPRI	Woodward
		2001		Gamma- Matrix	/
		1998/2002		KOPEC	/
	S/G	1992/1993	"	Invensys	I/A series
#3,4		2005/2004	"		
	S/G	1998/1997	"	Invensys	I/A series
		1998/1997		Gamma - Matrix	/
		2005/2004		KEPRI	
#1,2		2002/2001			WEC(Ovation)
		2000		Gamma -Matrix	/
		2001			
	S/G	2000	"	Invensys	I/A series
#1	1,2	2001/2004	"	AECL	
#1,2		2000	"		
	S/G	2006/2005	"	Invensys	I/A series

	I&C	가	KEPIC
- logic functions, protection feature actuation systems, element actuation circuitry	safety end-	Upgrade	,
	-	Upgrade	.
- Analog strip chart		가	가 Commissioning
- Analog (hard wired) remote link fashion		가	가 가 .
가		outage	cable pulling outage
- Hard-wired digital inputs to		가	.
		-	가
		가	가
가 15	50% ,	9 Table 1	- Upgrade
[3].			
Table 1	Upgrade	-	
Upgrade	1	Upgrade 1 2	
Upgrade	1		Upgrade
	가		
	가		
	Upgrade		가
	Upgrade		
[4].			
- (outage)		가	

- Upgrade 가 (#2-4, #1-2, #1-2) 가
- Upgrade Road Map 가 (1 가
- Upgrade 가 (가, , ,) 가
- Upgrade 가 (5 , 1) 가
- Upgrade 가 (가)
- Upgrade 가 (FMEA) .2) 가
- Upgrade 2004 가
- Upgrade 가 , , .3)
- Upgrade 가 가 .4) 가
- Upgrade outage
- I&C Upgrade Grouping .5)
- Upgrade Upgrade

1 | 가



	I&C	가	KEPIC
--	-----	---	-------

Upgrade (,) FMEA .
 (, Outage 2가 가 “
 , 가,) . ” “ ” 가 가 . 가
 가 가 100% 50% 가 가
 가 가 “ ” “

$$= \sum_{i: \text{가}} (\text{가} \quad i \times \text{가})$$

“ ” “ ” 가
 가 , “ ” “ ; “ ” ;
 가 가
 가 .

Table 2. 3,4 I&C ()
 FMEA . 14

Table 2. 3,4 I&C FMEA

								(100)	(50)	
1	Digital Flux Mapping System	0	10	10	10	10	40	20	30	11
2	W7300	40(2/4)	30	10	10	20	10	80	20	2
3		0	20	10	20	20	10	30	25	9
4		40	20	10	10	20	30	70	30	2
5		0	10	10	20	10	30	20	30	11
6		30	20	10	10	10	30	60	25	7
7	DRMS	30	30	10	10	20	20	70	25	4
8		0	10	10	10	20	20	20	25	14
9	가	0	10	10	15	20	30	20	33	10
10		40(2/4)	30	10	10	10	10	80	15	4
11		30	30	10	10	10	10	70	15	7
12	SSPS & ESF Protection System	50	30	20	10	10	10	100	15	1
13		40	20	10	20	20	10	70	25	4
14		0	10	10	20	10	30	20	30	11

(NIS) FMEA
 (Safety Function)
 (Reactor Trip)
 NIS가
 (FSAR) 16 3, 4.3.3.2

II.A. 가

가 2~4 ,
 1~2 , 1~2
 Table 3
 3,4 7300 가
 () , 7300 가 82.15
 Table 4 3,4
 , 2 가

Table 3. 3,4 7300 가 ()

Evaluation Factor	Total Grade of the Factor (A)	Allocated Weight (B)	Final Value(C) C=A*B
System Importance	2.5	0.3	0.75
Performance	68.0	0.2	13.6
System Maintenance	71.8	0.2	14.36
System Aging	66.0	0.3	19.8
Economical Efficiency	30.0	0.2	6.0
Obsolescence	77.5	0.3	23.25
Others	44.0	0.1	4.4
			Total: 82.16

Table 4. 3,4 가

Steam Generator Leak Monitoring Digital Flux Mapping System Digital Radiation Monitoring System Heater Drain System W7300 Fisher Nuclear Instrumentation System Solid State Protection System Safe Guard Test Cabinet

Table 3
 가 82.15
 100
 51.35가 , 2
 가
 () 가
 Upgrade 가
 Grouping
 Upgrade
 가
 가 outage
 Guideline
 1)
 , 2)

I&C

가

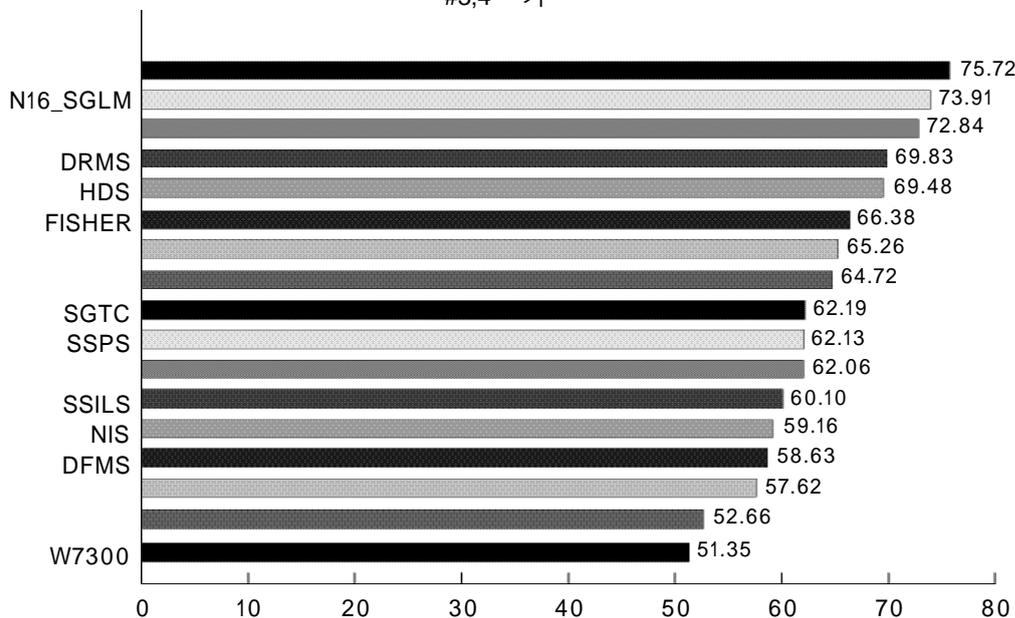
KEPIC

2 |

3,4

가

#3,4 가



, 3) , 4) , 가 , 2)
 5) Outage , 6) Level , 3) .
 , 7) (가) 1,2
 . KEPIC2000 Version ,
 KEPIC 2000 Version

KEPIC

III. KEPIC

KEPIC

IEEE

ISA, ASME

Upgrade

KEPIC

Upgrade

가

KEPIC

Upgrade

5,6

5,6

KEPIC

KEPIC 95 96 Version

IEEE ISA

KEPIC

, 1) KEPIC

가

KEPIC() 2000
 Analog
 Digital 가
 가
 KEPIC

IEEE-730(02)	SOFTWARE QUALITY ASSURANCE PLAN
BTP HICB-1	GUIDANCE ON ISOLATION OF LOW PRESSURE SYSTEMS
BTP HICB-18	BTP HICB-18
BTP HICB-19	GUIDANCE ON EVALUATION OF D-I-D & DIVERSITY
BTP HICB-21	GUIDANCE ON DIGITAL COMPUTER REAL-TIME PERFORMANCE
SRM To SECY 93-087	USNRC STAFF REQUIREMENTS MEMORANDUM
EPRI TR-106439(96)	GUIDANCE ON EVALUATION AND ACCEPTANCE OF COTS

Table 5. KEPIC

IEEE-730(02)	SOFTWARE QUALITY ASSURANCE PLAN
IEEE-828(98)	SOFTWARE CONFIGURATION MANAGEMENT PLANS
IEEE-829(98)	SOFTWARE TEST DOCUMENTATION
IEEE-830(98)	GUIDE TO SOFTWARE REQUIREMENT SPECIFICATION
IEEE-1012(98)	STANDARD FOR SOFTWARE VERIFICATION AND VALIDATION
IEEE-1016(98)	RECOMMENDED PRACTICE FOR SOFTWARE DESIGN DESCRIPTIONS
IEEE-1228(94)	SOFTWARE SAFETY PLANS
IEEE-1008(87)	SOFTWARE UNIT TESTING
IEEE-1028(97)	STANDARD FOR SOFTWARE REVIEWS
IEEE-1042(87)	GUIDE TO SOFTWARE CONFIGURATION MANAGEMENT
IEEE-1074(97)	DEVELOPING SOFTWARE LIFE CYCLE PROCESSES

Table 5 가

IV.

Upgrade I&C
 가
 가 가
 KEPIC

	I&C	가	KEPIC
--	-----	---	-------

		I&C Upgrade 가	KEPIC KS	가
IEC 가	IEEE (ISA, ASME)			<ol style="list-style-type: none"> 1. IAEA, " Managing modernization of nuclear power plant instrumentation and control systems", IAEA-TECDOC-1389. Feb. 2004. 2. EPRI, " I&C Upgrade- Implementation Experience and Perspective ", EPRI Technical Interim Report(NMAC), Dec. 2001. 3. " (05.11.30)" 4. Hang-Bae Kim, Jae-Hack Kim, Ho-Joon Seo, Jai-Bok Han, " Upgrade of Control, Protection and Computer System at Kori Unit 1 ", International Topical Meeting on Nuclear power Instrumentation, Control, and Human-Machine Interface Technologies(NPIC&HMIT 2000), Washington D.C., Nov.,2000.
	(KS) KEPIC		KEPIC	
	IEC IEEE		(
)KS				