



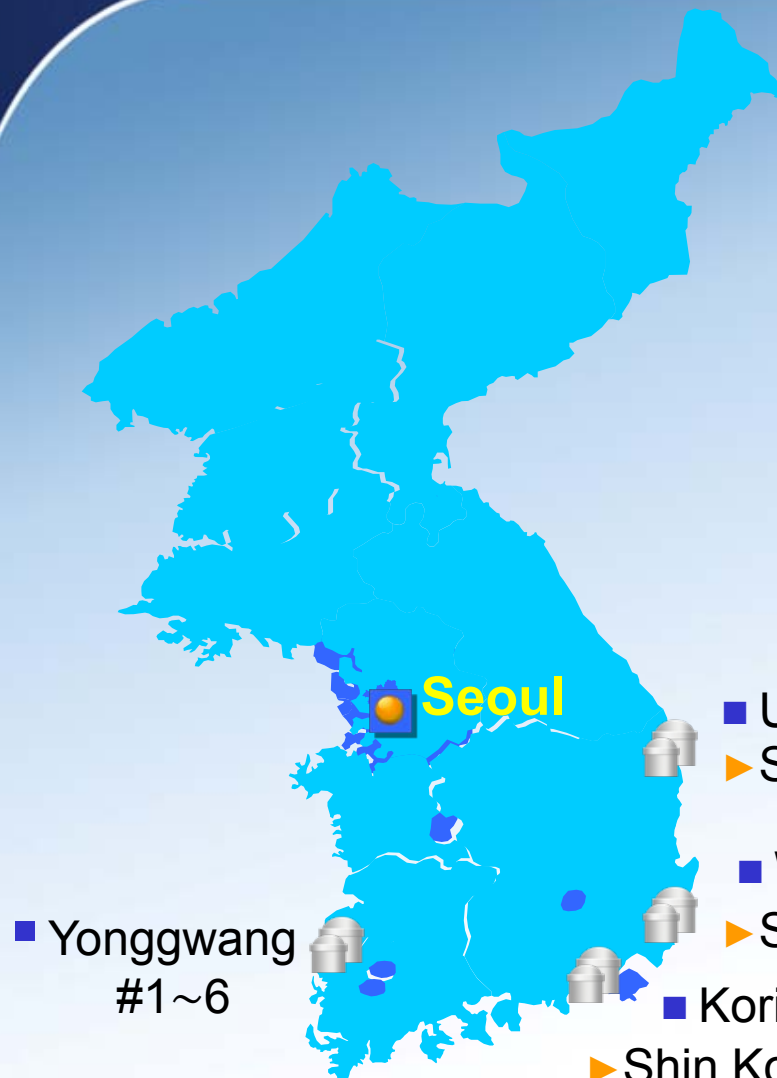
Design Features of APR 1400 on RP and Safety Performance

2010 ISOE International Symposium in UK



KOREA HYDRO & NUCLEAR POWER CO., LTD

Status of Nuclear Power Plants



(Unit: MW)

Site	In Operation	Under Const.	Total
Kori	4 (3,137)	4 (4,800)	8 (7,937)
Wolsong	4 (2,779)	2 (2,000)	6 (4,779)
Yongggwang	6 (5,900)	-	6 (5,900)
Ulchin	6 (5,900)	2(2,800)	8 (8,700)
Total	20 (17,716)	8 (9,600)	28 (27,316)

(As of the end of 2010)

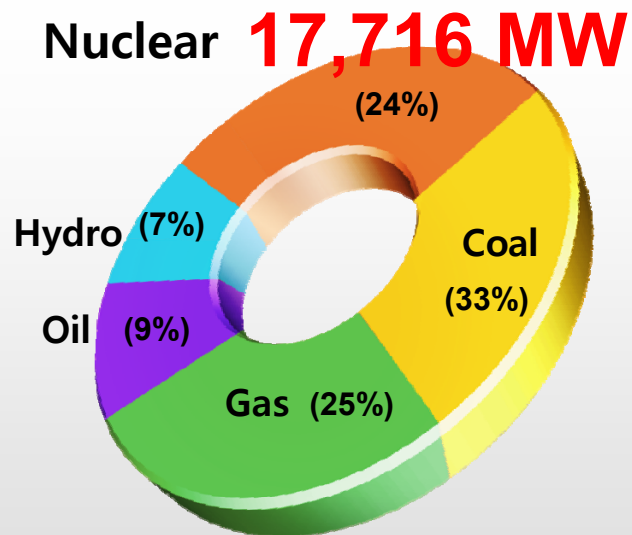
- In Operation
- ▶ Under Construction

Status of Nuclear Power Plants

Generation Mix

As of Dec. 2009

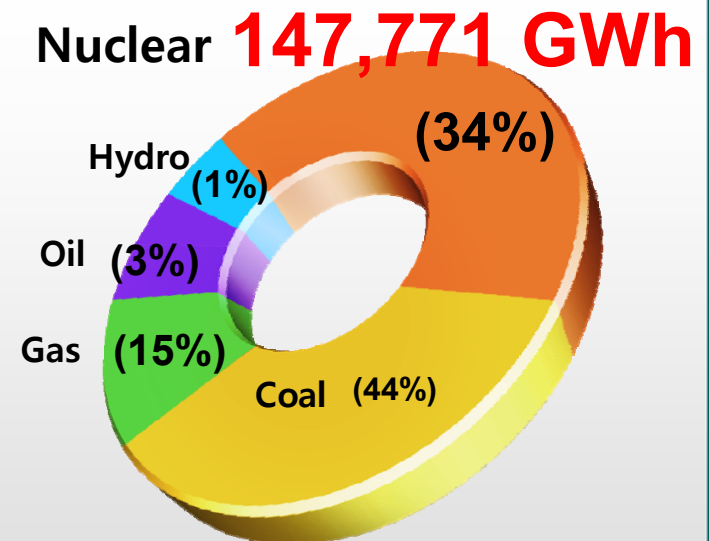
Installed Capacity



*Others : 1,136MW(1.5%)

Total : 73,470 MW

Electricity Generation



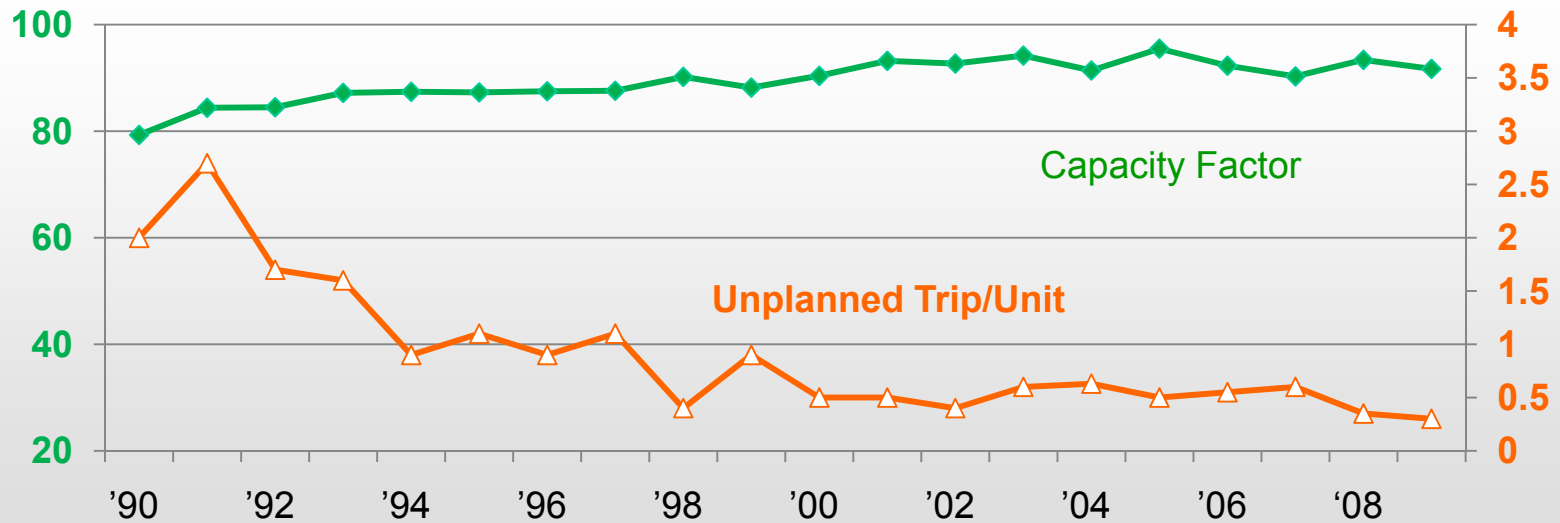
*Others : 7,618 GWh(1.8%)

Total : 433,604 GWh

Status of Nuclear Power Plants

Capacity Factor/Unplanned Trip

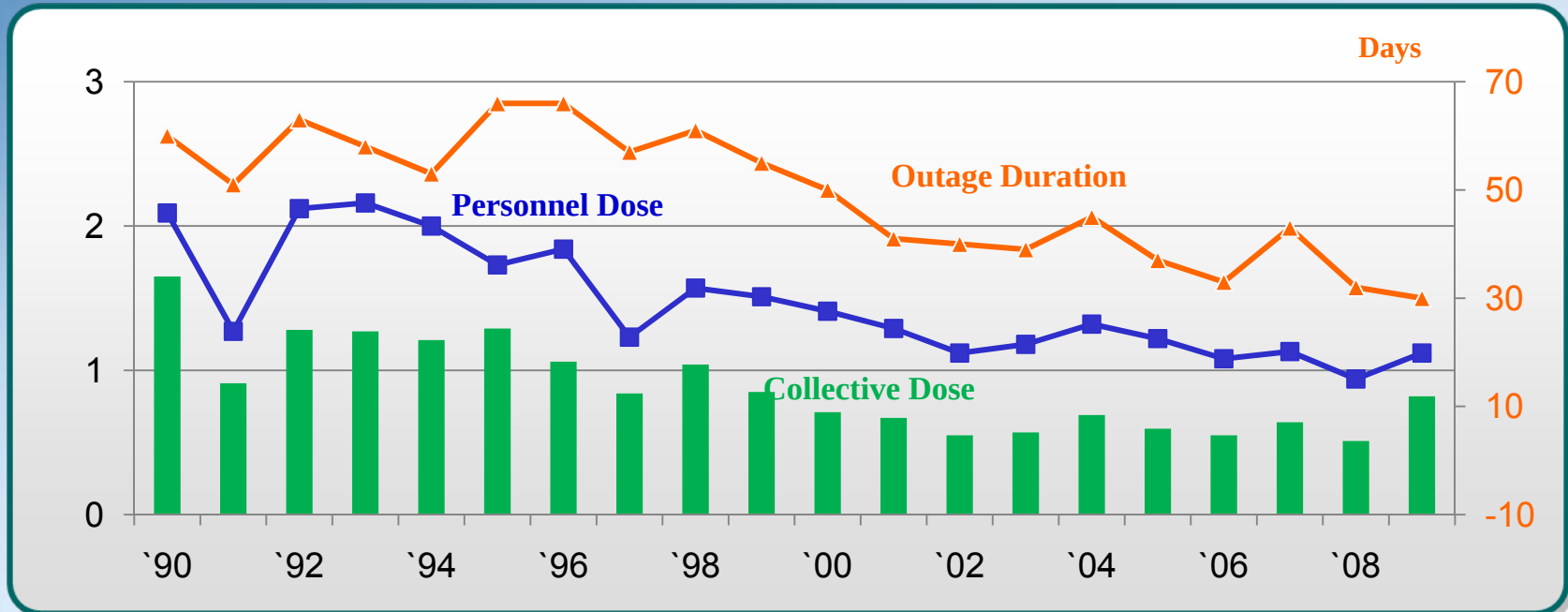
Capacity Factor(%)



Years	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09
Capacity Factor	79.3	84.4	84.5	87.2	87.4	87.3	87.5	87.6	90.2	88.2	90.4	93.2	92.7	94.2	91.4	95.5	92.3	90.3	93.4	91.7
Unplanned Trip/Unit	2	2.7	1.7	1.6	0.9	1.1	0.9	1.1	0.4	0.9	0.5	0.5	0.4	0.6	0.63	0.5	0.55	0.6	0.35	0.3

Status of Nuclear Power Plants

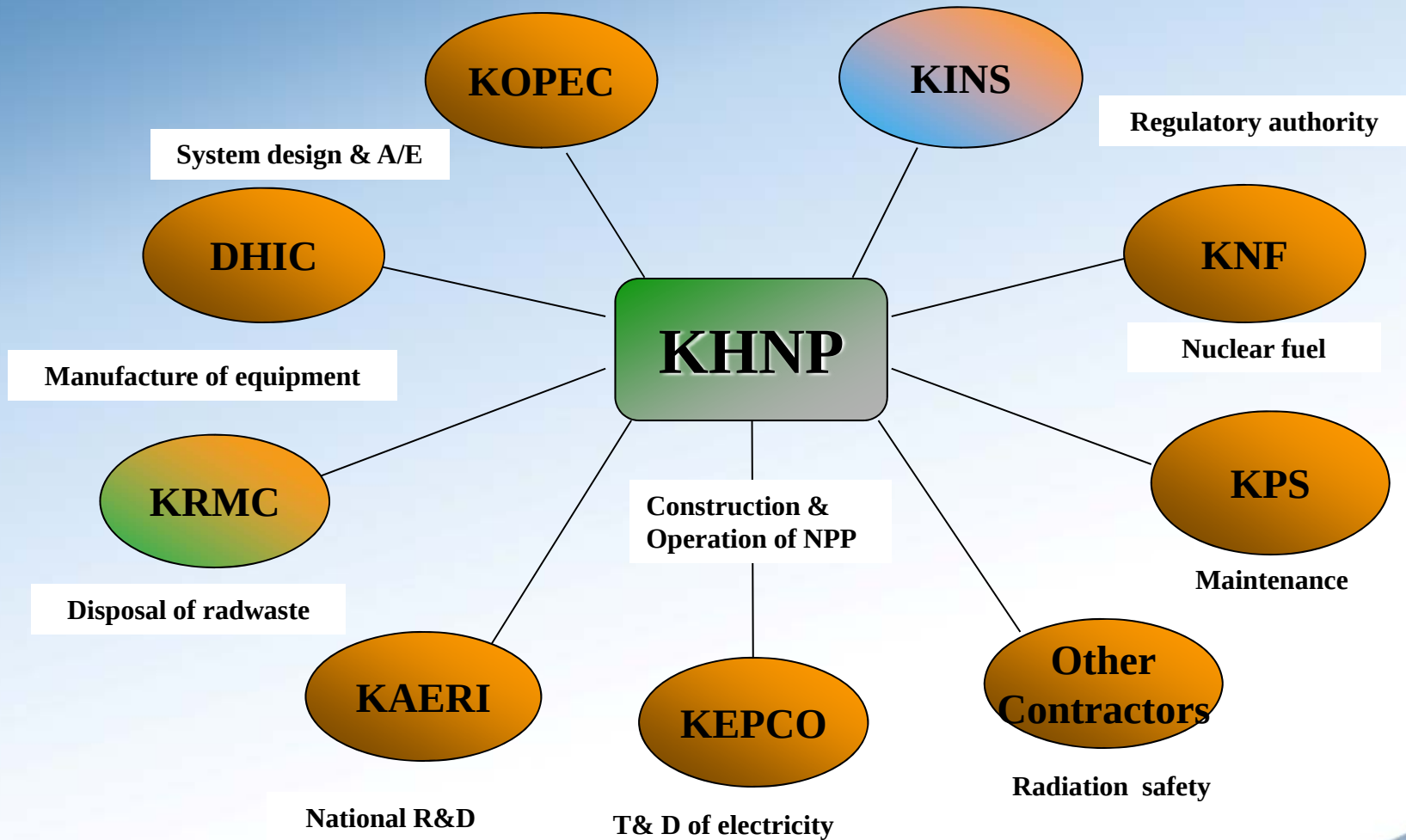
Occupational Dose



Years	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09
Collective Dose (man-Sv/Unit)	1.65	0.91	1.28	1.27	1.21	1.29	1.06	0.84	1.04	0.85	0.71	0.67	0.55	0.57	0.69	0.60	0.55	0.64	0.51	0.82
Personnel Dose (mSv/person)	2.09	1.27	2.12	2.16	2	1.73	1.84	1.23	1.57	1.51	1.41	1.29	1.12	1.18	1.32	1.22	1.08	1.13	0.94	1.39
Outage Duration (Days/Unit)	60	51	63	58	53	66	66	57	61	55	50	41	40	39	45	37	33	43	32	30

Nuclear Power Business

Business Network



Nuclear Power Business

History of NPP in Korea

1971~1978

Introduction of
Nuclear Power
Plant



- Turn-key Contract
- Foreign Contractor Lead

1978~1987

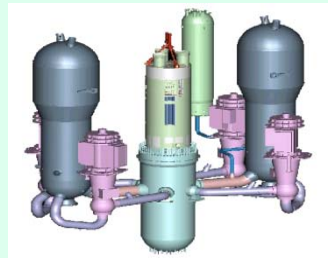
Promotion of
Localization



- Non -turnkey Contract
- Increased Local Participation

1987~1995

Technology
Self-Reliance



- Technology Transfer
- OPR 1000 Development

1995~

Advanced
Reactor
Development



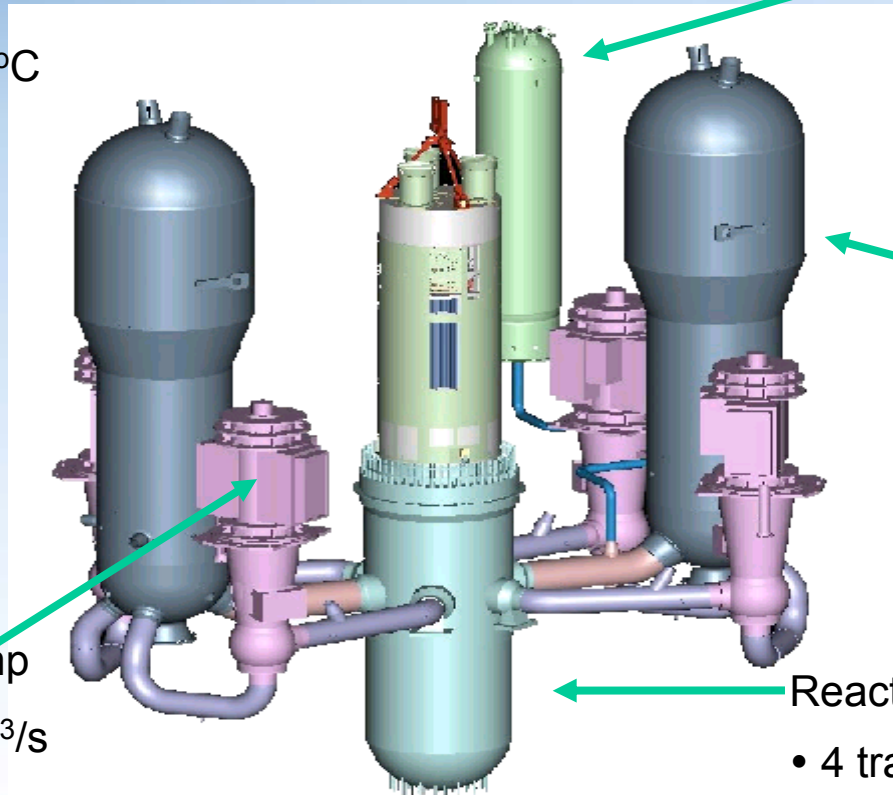
- Improvement of OPR1000
- APR1400 Development

APR1400 Design Characteristics

Reactor Coolant System Configuration

Power: 4,000MWt

Hot Leg Temp: 324°C



Pressurizer

- Large volume
- 4 POSRVs

Steam Generator

- Plugging Margin : 10%
- Tube Material : I-690

Reactor Coolant Pump

- Rated Flow: 7.67m³/s

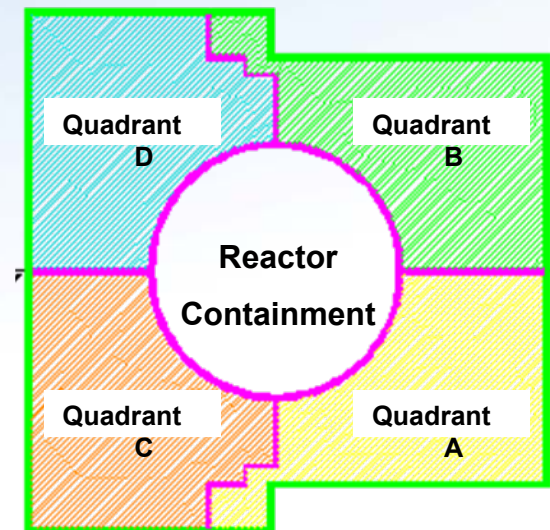
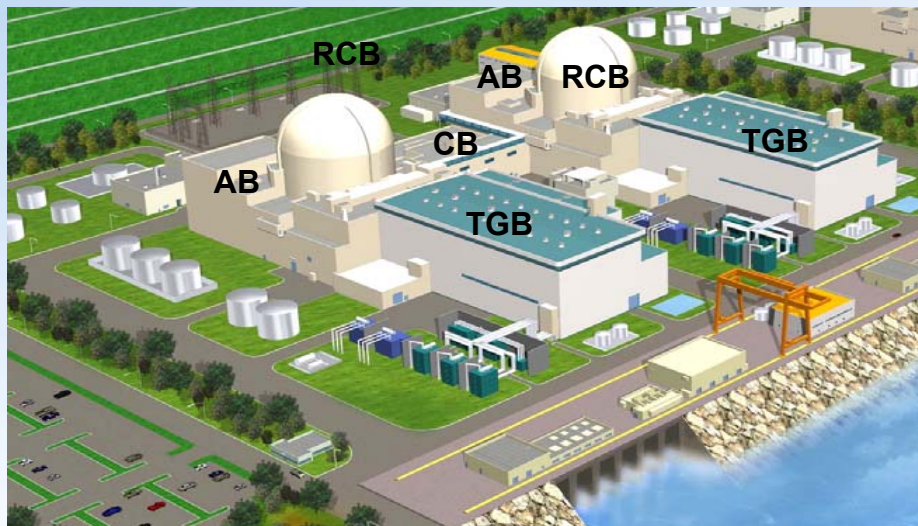
Reactor Vessel

- 4 train DVI
- Low RT_{NDT}

APR1400 Design Characteristics

Building Arrangement

- Twin-units and slide-along arrangement
- Compound building shared between two units
- Auxiliary building consisting of four-quadrants surrounding the containment building



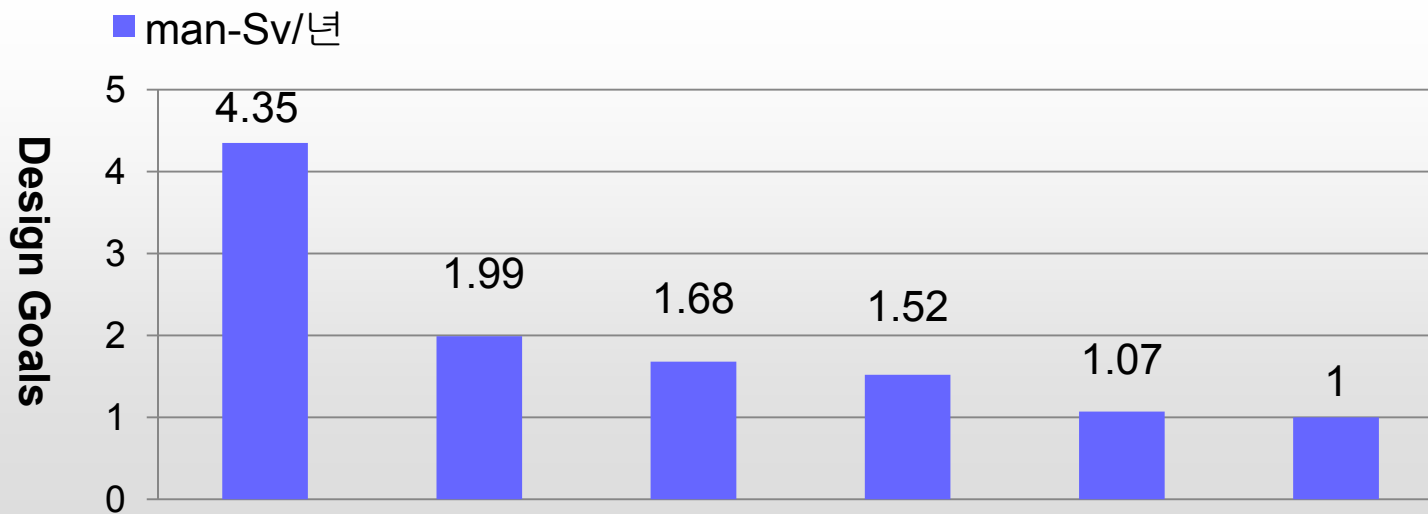
APR1400 Design Characteristics

Basic Design Parameters

Parameters	APR1400	OPR1000
[Performance Requirements]		
- Design Life	60 years	40 years
- Elec. Power	1400 MWe	1000 MWe
- Construction Period	58 months(2 units)	52 months(2 units)
- Refueling Cycle	18 months	12 ~ 18 Months
- MMIS (Control Sys)	Digital	Analog
[Safety Requirements]		
- CDF	$\leq 10E-5/RY$	$\leq 10E-4/RY$
- Seismic Acceleration	0.3g	0.2g
- Operator Action Time	30 minutes	10 minutes
- Coping time for SBO	≥ 8 hours	≥ 4 hours
- Emergency Core Cooling	4-train, DVI	2-train, Cold leg Injection
- Thermal Margin	$\geq 10\%$ (Inconel 690)	$\geq 8\%$ (Inconel 600)

APR1400 Design for Radiation Protection

Collective Radiation Exposure



Plant	<u>K1,2</u> <u>Y1,2</u> <u>K3,4</u>	Y3,4	U3,4	Y5,6	U5,6 SK1,2 SW1,2	SK3,4 SU1,2
Type	<u>W</u>	OPR100 0	OPR100 0	OPR100 0	OPR100 0	APR140 0
Oper. Year	'78~'88	1996	1999	2002	'05~'11	'12~

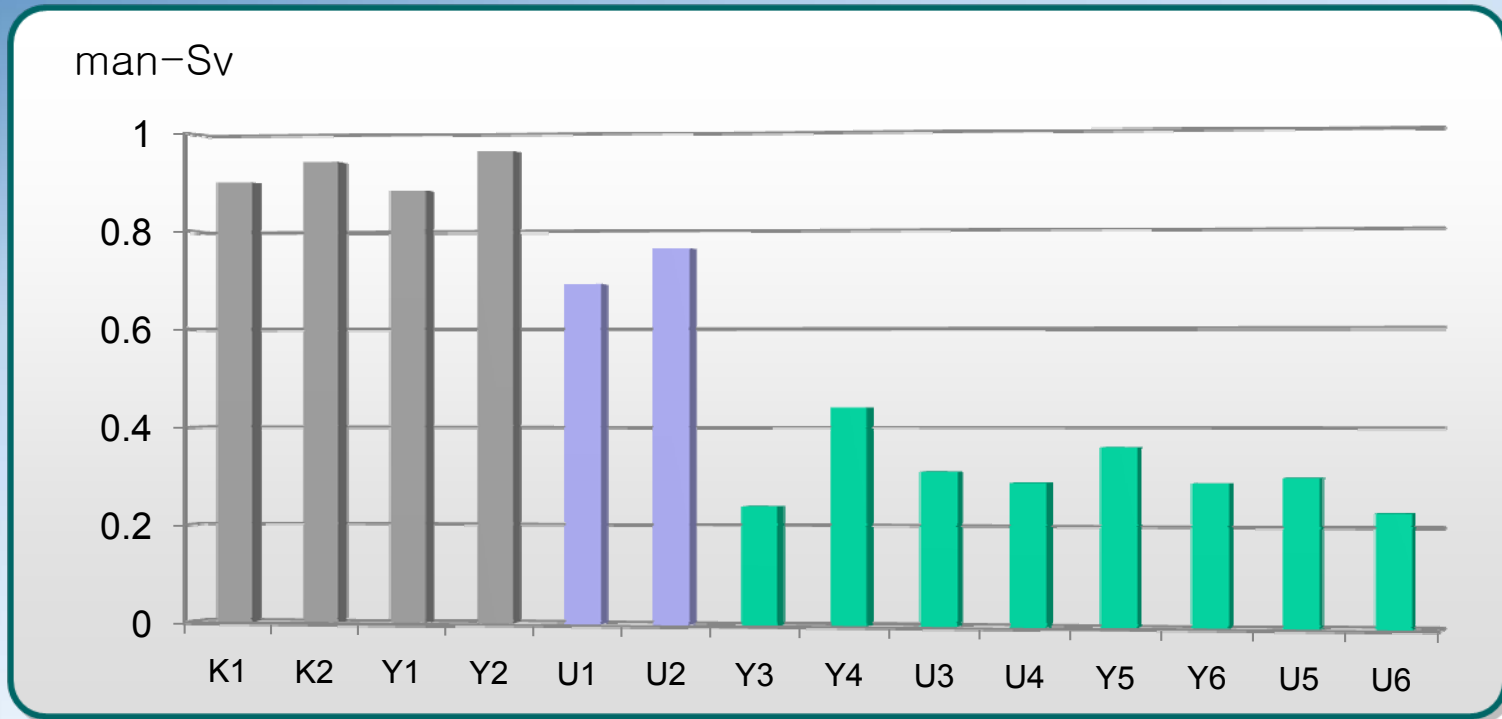
APR1400 Design for Radiation Protection

Radiation Shield Design

RCA Zone	Radiation Dose Rate (mSv/hr)				
	Westinghouse	Framatome	OPR1000 (ICRP26)	OPR1000 (ICRP60)	APR1400
1	0.005	0.0075	0.005	0.001	0.001
2	0.025	0.025	0.025	0.01	0.01
3	0.25	2.0	0.05	0.05	0.05
4	1.0	100	0.2	0.2	0.2
5	>1.0	>100	1.0	1.0	1.0
6			>1.0	10.0	10.0
7				5000	5000
8				>5000	>5000

APR1400 Design for Radiation Protection

First 3 Years Average Dose



Westinghouse
(**'78~'88**)

Framatome
(**'88~'89**)

CE Type(OPR 1000)
(**'96~'05**)

APR1400 Design for Radiation Protection

Source Term Reduction

- **S/G Tube Integrity improved by;**
 - ✓ **Inconel-690 Tubes with excellent corrosive resistance**
 - ✓ **Loose parts trapping device**
 - ✓ **Improved upper tube support bar and plate to prevent flow induced vibration**
- **Improvement of Fuel Integrity**
 - ✓ **Debris-filter bottom nozzle, Fretting wear resistant conformed Spring and Dimple**
- **Used Low Cobalt content in the base metal of the RV**
- **Low Sb materials for RCP Bearing to reduce hot particle**

APR1400 Design for Radiation Protection

Improvement of System Design

- **Integrated Head Assembly(IHA)**
 - ✓ **Head Area Cable Tray System, CEDM Air Handling Unit, Cooling Duct, Head Lift Rig, etc.**
- **Permanent Pool Cavity Seal**
- **Quick Opening Fuel Transfer Tube Blind Flange**
- **Improved Spent Fuel Handling Machine (High Speed)**

**Equipments design modification is considering
for the existing NPPs.**

APR1400 Design for Radiation Protection

Improvement of System Design

- **PZR POSRVs Directly Discharge to the IRWST**
- **Optimized length of pipe line including Radioactive Materials**
- **Remove Common Head of the Safety Injection System**
- **Reverse Osmosis(RO) System for the LRS**
- **Permanent extrancesupport device into S/G manway**
- **Size up of the S/G manway (18"→21")**

Thank you !

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