2008 AEC-NRC Bilateral Technical Meeting

Updated Risk-Informed Regulation and Application in Taiwan

Dr. Wei-Wu Chao
Atomic Energy Council, R.O.C

May 12, 2008

OUTLINE

- On-line maintenance (**OLM**) application
- Allowed outage time (**AOT**) extension for startup transformer replacement
- Risk-informed In-service Inspection (**RI-ISI**) pilot study
- Concluding Remarks

OLM Application

- AEC issued “Nuclear Power Plants Online Maintenance (OLM) Application Guideline” in Aug. 2002, stipulating OLM acceptance criteria and applicable systems
- Chinshan NPP RHR OLM was approved in Aug. 2003, followed by Kuosheng NPP in Sep. 2003 and Maanshan NPP in Oct. 2003

OLM Application (cont'd)

- Up to date, Taipower has successfully performed some OLMs, all completed within 60％AOT
  - For Chinshan NPP, RHR Pump, RHR Booster Pump
  - For Kuosheng NPP, RHR Valve & Instrument, AHU
  - For Maanshan NPP, RHR Valve & Instrument, Containment Spray System , Essential Chilled Water System

OLM Application (cont'd)

- Considering lack of OLM experience in Taiwan and not implementing maintenance rule, the aforementioned Guideline dictated the scope for OLM to be limited to 4 categories of systems: Residual Heat Removal, Emergency Cooling Water, Emergency Chiller, Core Spray System
- This guideline also regulates that OLM applications will be reviewed in case-by-case bases

OLM Application (cont'd)

- Based on the experience gained from previous successful OLMs, Taipower is proposing to extend OLM scope for further systems
- Taipower has implemented Maintenance Rule starting from 2008, which shall control OLM activities and risk management
- Plant-wide OLM is expected in the near future

AOT extension for startup transformer replacement

- Permanent risk informed Technical Specification (RI-TS) change can follow USNRC Regulatory Guidance 1.177
- Up to now, no related application was filed by Taipower
- However, one-time extension of 345KV Startup Transformer AOT been has requested by Taipower and approved by AEC

AOT extension for startup transformer replacement (cont'd)

- Chinshan NPP 345kV Startup Transformer experienced severe damage in April, 2007, which required for replacement
  - Taipower requested AOT temporary extension from 3 days to 30 days
  - Taipower's risk assessment proposed the risk was acceptable within 28 days, they also credited other analysis conservatism and requested for 30 days
  - AEC approved a 28 days one-time AOT and requested Taipower to perform detailed contingency analysis and take appropriate measures to manage the risk during maintenance.

AOT extension for startup transformer replacement (cont'd)

CHINSHAN ST-B Maint.	Base case		ST-B Maintenance Case	
IE\RiskMetrics	CDF	LERF	CDF	LERF
internal	3.93E-06	1.56E-06	1.50E-05	8.09E-06
seismic	5.27E-06	4.46E-06	5.32E-06	4.50E-06
Fire	7.38E-06	1.25E-06	7.72E-06	1.31E-06
SUM	1.66E-05	7.27E-06	2.80E-05	1.39E-05
Acceptance Criteria	△CDP＜5.00E-06		△LERP＜5.00E-07	
Acceptable Extension Based on △CDP/△LERP	**~160 days**		**~28 days**	

RI-ISI pilot study

- NRC Regulatory guide 1.178 provides guidance for using of PRA findings and risk insights for decisions on changes proposed to a plant's inspection program
- The RI-ISI process generally identifies few risk-significant welds for inspection. This translates to fewer inspections to be performed during outages and lower personnel exposures

RI-ISI pilot study (cont'd)

RI-ISI applications in some US plants

BWRs				PWRs			
Plant	Scope	Method	Inspection Reduced	Plant	Scope	Method	Inspection Reduced
Fitzpatrick	Class1&2&3	EPRI	82%	Beaver Valley-1	Class1&2	WOG	81%
WNP-2	Class1	EPRI	55%	North Anna-2	Class1	WOG	86%
Perry	Class1	EPRI	75%	Sequoyah-1	Class1&2	WOG	83%
Lasalle-1	Class1&2	EPRI	65%	Watts Bar-1	Class1&2	WOG	81%
Ferry-2	Class1&2&3	WOG	69%	India Point-2	Class1	EPRI	70%

WOG: WCAP-14572 EPRI: TR-112657

RI-ISI pilot study (cont'd)

- Taipower contracted INER (Institute of Nuclear Energy Research) a research project of RI-ISI pilot study for RHR systems at Kuosheng plant
- Adopt similar methodology as being implemented in US

RI-ISI pilot study (cont'd)

- RI-ISI for Kuosheng RHR system:
  - Current inspection ASME requirement, 113 of 900 welds
  - High risk piping welds, select 2 of 8 for inspection
  - Moderate risk piping welds, select 48 of 473 for inspection
  - Low risk (or no fracture mechanism) piping welds, no inspection for 419 welds
  - Total inspection reduction 58% (from 113 to 50)
  - △CDF:3.2E-8/yr, △LERF:-2.4E-11/yr

RI-ISI pilot study (cont'd)

- Based on this pilot study, INER has developed a RI-ISI implementation guideline for Taipower for setting up RI-ISI program
- Taipower is planning plant-wide applications for operating nuclear plants

Concluding Remarks

- Probabilistic Safety Assessment (PSA) has been introduced, developed, improved, refined near three decades in Taiwan
- Early applications were mainly used for betterment of plant systems and safety.
- PSA has been proved to be a useful tool for risk-informed assessment
- Full scale risk-informed applications are expected in near future for both regulatory decisions and utility operations

Concluding Remarks (Cont'd)

- Future Risk-Informed Applications
  - Risk-informed in-service inspection (RI-ISI), Testing (RI-IST), and technical specification (RI-TS)
  - Plant-wide OLM
  - Performance-based fire protection implementation (NFPA-805)

The End