Lessons Learned and Challenge from Chinshan NPP License Renewal

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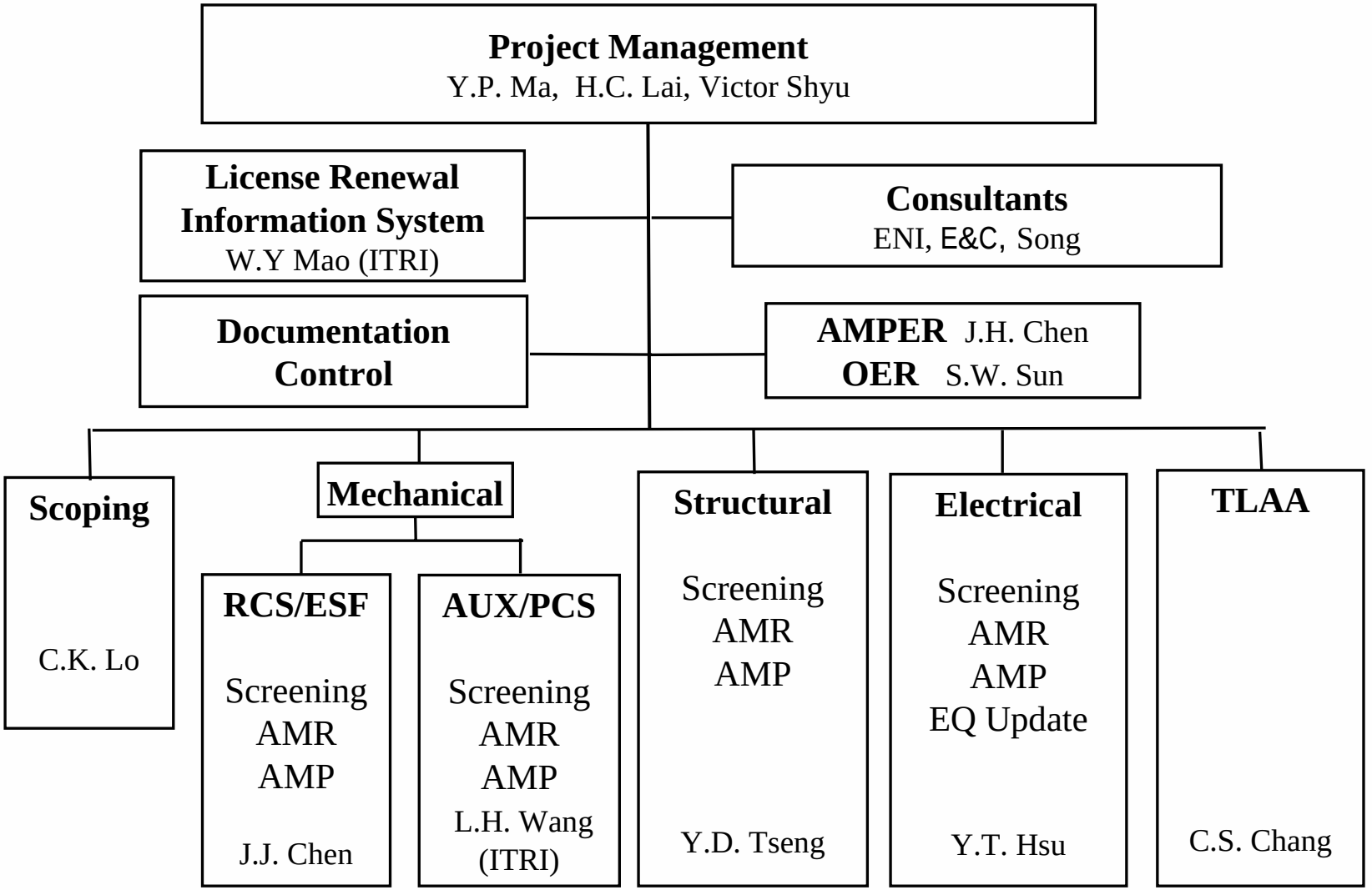
1. Introduction

- Up to date, 52 US nuclear units have been granted a 20 years license renewal, 18 under NRC review, 19 announced, based on 10CFR54 regulation.
- Taiwan Power Company (TPC) has planned to conduct license renewal for its 3 nuclear power plants in Taiwan, as are Chinshan, Kuosheng, and Maanshan in sequence within 10 year. (from 2005 to 2014)

Introduction (Cont.)

- For CSNPS (ChinShan NPS), the first NPS of TPC (Taiwan Power Company), the two units were commercially operated from 1978 and 1979, respectively. The license renewal process has being applied to them for a 20 years license renewal.
- The CS-TLIPA (Time-Limited Integrated Plant Assessment) Project was established under Ms. Fiona Wang's supervision of TPC in June 2005. It includes domestic participations, such as
  - INER (Institute of Nuclear Energy Research),
  - ITRI (Industrial Technology Research Institute),
  - E&C (E&C Eng. Co.),
  - Mr. Song,
  - International support from ENI (Entergy Nuclear Inc.).

CS-TLIPA Project Configuration



License Renewal Information System (LRIS)

at http://www.cs-tlipa.com.tw/tlipa/index.asp

2. Milestones

- April 2004, Ms. Fiona Wang of TPC came back to Taiwan from a 4 months studying on LR in US.
- June 7~10, 2005, Mr. Garry Young and Mr. Alan Cox of ENI were invited to Taiwan to give a five-day training course on LR process.
- June 20, 2005, TPC contracted out CS-TLIPA project to INER. It includes subcontract to ITRI, E&C and ENI.
- March 2006, Dr. P.T. Kuo and Dr. Kenneth Chang of USNRC were invited to introduce “US License Renewal Process” at ROCAEC.
- From April to June 2006, 17 members of CS-TLIPA team were sent to the US to observe the NRC audit on the LR application of Vermont Yankee and Pilgrim.
- Oct 2006, Mr. Garry Young and Mr. Alan Cox of ENI came to Taiwan to give an 5-day on-site review on the CS-TLIPA internal evaluation reports

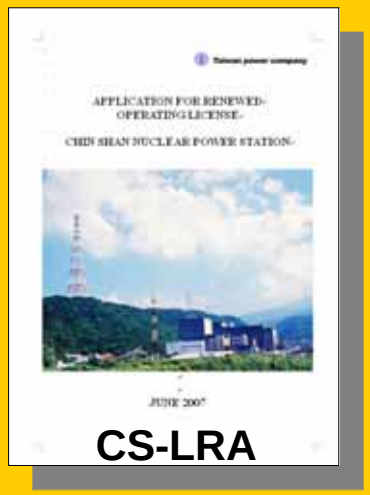
Milestones (Cont.)

- From Nov 2006 to Feb 2007, 34 CS-TLIPA internal evaluation reports were reviewed by ENI engineers and revised.
- May 2007, CS-LRA (License Renewal Application) was reviewed by TPC and revised.
- June 19~20 2007, CS-LRA was reviewed by Peer Reviewer from several US nuclear plants at NEI (Nuclear Energy Institute), 345 comments were resolved and incorporated into CS-LRA.
- Jan 18, 2008, TPC contracted out the TLIPA of KuoSheng NPS project (KS-TLIPA) to INER. It includes subcontract to ITRI, E&C, ENI, and PECL. The Fatigue Analysis Enhancement of CS NPS was also included in this project to re-calculate the fatigue usage factor of CS NPS.
- From Aug 2008, the informal discussions on CS-LRA with AEC were conducted in succession.
- Nov 2008, The QA program of TLIPA project was enhanced from ISO-9001 to nuclear grade to meet the requirements of 10 CFR 50 appendix B.

3. Project Reports

43 AMPERs
(PD-02)

Scoping
(PD-01)



CS-LRA

36 AMRRs

P&ID
Markup

OER
(PD-05)

TLAA
(PD-03)

Fatigue
(PD-04)

Project Reports (Cont.)

- Scoping Result
  - 29 out of 48 mechanical systems are scoped in.
    - 4/4 RCS systems
    - 8/8 ESF systems
    - 2/10 PCS systems
    - 15/26 AUX systems
  - 20 out of 95 structural systems are scoped in.
  - All 38 electrical systems are scoped in, then the active or short-lived components will be screened out in AMR (Aging Management Review) process.

Project Reports (Cont.)

- Mechanical
  - Aging Management Review (AMR): 29 AMRM reports in total.
    - RCS: 4
    - ESF: 8
    - PCS: 2
    - AUX: 15
  - Aging Management Program (AMP): 30 AMP reports in total.

Project Reports (Cont.)

- Structural
  - Aging Management Review (AMR): 6 AMRC reports in total.
    - Primary Containment
    - Combination Structure
    - Emergency Intake Structure
    - Process Facilities
    - Yard Structure
    - Bulk Commodities
  - Aging Management Program (AMP): 8 AMP reports in total.

Project Reports (Cont.)

- Electrical
  - Aging Management Review (AMR): 1 AMRE reports.
    - Insulated cables and connections
    - Transmission conductors
    - Switchyard bus
    - High voltage insulators
  - Aging Management Program (AMP): 5 AMP reports in total.

Project Reports (Cont.)

- AMPER (Aging Management Program Evaluation Report), summarize all the 43 programs, including mechanical, structural, and electrical.
  - New/Existing
    - 9 new programs
    - 34 existing programs
  - Consistent with NUREG-1801
    - 28 consistent with NUREG-1801 (18 with enhancement)
    - 13 with exception to NUREG-1801
    - 2 plant specific

Evaluation Results of AMP (Mechanical-1)

Item	Program Name	CSNPS AMP Consistency with NUREG-1801			Plant Specific
		Consistent with NUREG-1801	With Enhancement	With Exception	
1.	ASME Section XI ISI/IST	✓			
2.	Water Chemistry			✓	
3.	Reactor Head Closure Studs	✓			
4.	RPV ID Attachment Welds	✓			
5.	Feedwater Nozzle	✓	✓		
6.	CRD Return Line Nozzle			✓	
7.	IGSCC	✓			
8.	RPV Instrument Penetrations		✓	✓	
9.	RPV Internals		✓	✓	

Evaluation Results of AMP (Mechanical-2)

Item	Program Name	CSNPS AMP Consistency with NUREG-1801			Plant Specific
		Consistent with NUREG-1801	With Enhancement	With Exception	
10.	Thermal Aging and Neutron Irradiation Embrittlement of CASS	✓			
11.	Flow-Accelerated Corrosion	✓			
12.	Bolting Integrity	✓			
13.	Open-Cycle Cooling Water System	✓	✓		
14.	Closed-Cycle Cooling Water System			✓	
15.	Crane Inspection	✓	✓		
16.	Compressed Air Monitoring			✓	
17.	Fire Protection		✓	✓	
18.	Fire Water System		✓	✓	

Evaluation Results of AMP (Mechanical-3)

Item	Program Name	CSNPS AMP Consistency with NUREG-1801			Plant Specific
		Consistent with NUREG-1801	With Enhancement	With Exception	
19.	Buried Piping and Tanks Surveillance		✓	✓	
20.	Aboveground Steel tanks	✓			
21.	Fuel Oil Chemistry		✓	✓	
22.	Reactor Vessel Surveillance	✓	✓		
23.	One-Time Inspection	✓			
24.	Selective Leaching of Materials	✓			
25.	Buried Piping and Tanks Inspection	✓	✓		
26.	Class 1 Small-Bore Piping			✓	
27.	System Walkdown	✓	✓		
28.	Inspection of Miscellaneous Piping Components	✓	✓		
29.	Lubricating Oil Analysis	✓			

Evaluation Results of AMP (Structural)

Item	Program Name	CSNPS AMP Consistency with NUREG-1801			Plant Specific
		Consistent with NUREG-1801	With Enhancement	With Exception	
30.	ASME Section XI, Subsection IWE		✓	✓	
31.	ASME Section XI, Subsection IWL	✓			
32.	ASME Section XI, Subsection IWF	✓			
33.	10 CFR 50, Appendix J	✓			
34.	Masonry Wall	✓			
35.	Structures Monitoring	✓	✓		
36.	Inspection of Water-Control Structures			✓	
37.	Protective Coating	✓			

Evaluation Results of AMP (Electrical and TLAA)

Item	Program Name	CSNPS AMP Consistency with NUREG-1801			Plant Specific
		Consistent with NUREG-1801	With Enhancement	With Exception	
38.	Non-EQ Insulated Cables and Connections	✓			
39.	Non-EQ Inaccessible Medium-Voltage Cables	✓	✓		
40.	Non-EQ Electrical Cable Connections				✓
41.	High Voltage Insulators				✓
TLAA AMP					
42.	Metal Fatigue	✓	✓		
43.	Environmental Qualification (EQ) of Electrical Components Program	✓	✓		

Project Reports (Cont.)

- TLAA (Time-Limited Aging Analysis), includes
  - Reactor Vessel Neutron Embrittlement Analyses
  - Metal Fatigue Analyses
  - Environmental Qualification Analyses
  - TLAA in BWRVIP
  - Plant-Specific TLAA
- Three approaches
  - Enveloped in original calculation
  - Re-calculate
  - Need AMP management

Project Reports (Cont.)

- Fatigue Analysis
  - Reactor Pressure Vessel and internal component
  - Class 1 piping
  - Containment and suppression pool
  - Non Class 1 piping
- All mechanical components are complied with the requirement of extended operation except feedwater sparger and small portion of Class 1 piping. Will re-calculate the fatigue data.
- Existing GE design operation transient numbers may be exceeded during the extended operation. Will re-evaluate the anticipated design operation transient numbers for extended operation.

Project Reports (Cont.)

- OER (Operating Experience Review):
  - All Aging Effect Required Management (AERM) identified were consistent with NUREG-1801.
    - Corrective Maintenance (CM) records, RER, DCR, outage report, NRC Generic Letter, Information Notice, etc., in a period of the past 7 years, were reviewed.
    - Maintenance engineers of all systems were interviewed.
  - The effectiveness of existing AMP were verified.
    - Inspection records, NCD, outage report, and audit reports were reviewed.
    - Responsible engineers of applicable procedure were interviewed.

4. Lessons Learned

- LR evaluation has to envelope the planning Power Uprating: CS-LRA has covered the 1.7% power uprating by MUR (Measurement Uncertainty Recapture) and covered a few neutron fleuence analysis of future 10% power uprating.
- LR strongly depends on the implementation of MR: CS-TLIPA has executed the Structure Base-Line Inspection of CS NPS and adjust related results of CS-LRA.
- Some TLAA evaluation need more effort and time to be enhanced after LRA is completed: TPC has been conducting the CS fatigue analysis enhancement task to re-calcuate the loading and cumulated usage factor of class 1 component and piping.
- EQ program of a old plant need to be enhanced: TLIPA project has been helping CSNPS to enhance its EQ program.

5. Summary

- US supports from NRC and nuclear industry help to leverage the license renewal process for CS-TLIPA project.
- The peer review from several different utilities in the US adds confidence of CS-LRA to ROCAEC and the public.
- TLIPA project deeply appreciates the supports from NRC and utilities from the US and is willing to provide feedback if needed.
- The CS-LRA is still waiting to be submitted for AEC's review.

The Future Planning of TLIPA Project

The TLIPA project of ChinShan NPS

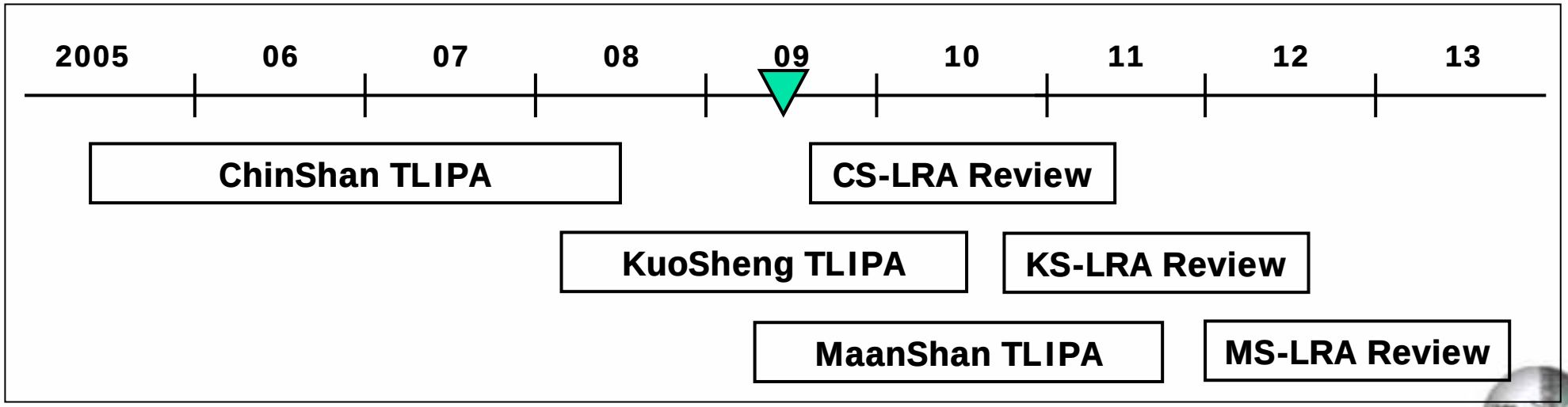
- The CS-LRA is ready to be submitted to AEC for review.
- The TLIPA team will support TPC in the CS-LRA review period.

The TLIPA project of KuoSheng NPS

- The KS-LRA will be completed in June 2010.

The TLIPA project of MaanShan NPS

- The MaanShan TLIPA will follow the same pattern in the future.



Thanks for Your Attention