2011 AEC-NRC Bilateral Technical Meeting

Overview of Recent Regulatory Activities in Taiwan

10th AEC-NRC Bilateral Technical Meeting

Washington DC, USA

May 03-05, 2011

Current Nuclear Regulatory Issues

- Review of Chinshan's License Renewal Application
- Stretch Power Uprate Review of Chinshan NPP
- Transient Analysis Methodology Licensing Applications
- Underground Water and Piping Monitoring
- Safety Re-evaluation and Enhancement Plan for Seismic Resistance
- Risk-Informed Application Review
- BWR ECCS Suction Strainer Issues
- Amendment of Nuclear Facility Regulation Law
- Domestic Fire Protection Standard for NPPs
- Continue Improvement of AEC Inspection Procedures
- Transparency and Openness of Regulatory Measures
- Taiwan Benefits from the Transparency and Openness of NRC regulation

Review of Chinshan′s License Renewal Application (1/3)

- According to “Regulation on the Review and Approval of Applications for Operating License of Nuclear Reactor Facilities”, timeliness of application is from 5 to 15 years before the expiration of the operating license.
- The operating licenses of Chinshan (CS) NPP units 1&2 will be expired in Dec. 2018 and July 2019 respectively. TPC submitted CS’s License Renewal Application (LRA) in Sept. 2009.
- U.S. regulatory guidance and related documents are the major references for the review of CS application.
- AEC has organized a review task force. The review timeframe was originally planned to be 24 months.

Review of Chinshan′s License Renewal Application (2/3)

- Review status of Chinshan NPP's LRA
  - Have conducted 6 site audits and issued 540 RAIs.
  - Major findings
    - Poor QA process & incomplete EQ data
    - Structure Monitoring Program needed to be enhanced
    - Reanalysis of Containment basemat structure strength due to water seepage in torus floor
  - TPC submitted SPU application and at the same time requested suspension of CS LRA in Dec. 2010.
  - Review of CS LRA has been suspended since Dec. 2010.

Review of Chinshan's License Renewal Application (3/3)

- The contents of application and review criteria should be updated and/or modified based on lessons learned from Fukushima Daiichi accident when the review process of CS LRA resumed.
  - Re-evaluation and Enhancement Plan for Seismic & Tsunami Resistance should be completed before issuing renewal license.

Stretch Power Uprate Review of Chinshan NPP (1/3)

- According to Nuclear Reactor Facilities Regulation Act Article 13 “During the construction or the operation period of nuclear reactor facilities, neither of the design amendment nor equipment change, if involved in the significant safety items, shall be made without an application therefor submitted to and approved by the competent authorities.” TPC submitted Chinshan’s Stretch Power Uprate (SPU) application in Dec. 2010.
- Chinshan’s OLTP is 1,775 MWt and CLTP is 1, 804 MWt (1.66 % OLTP) due to Measurement Uncertainty Recapture (MUR) Power Uprate on 2009.2.24 and 2008.7.9 for unit 1 and unit 2 respectively.
- Chinshan’s SPU will raise to 1,858 MWt (104.66% OLTP or 102.99% CLTP) in 2012.4 and 2012.12 for unit 1 and unit 2 respectively.
- There is no major changes to equipment (or modification).
- The maximum operating pressure of the reactor is the same (CPSPU).
- Implement Steam dryer vibration monitoring (SDVM) at one unit

Stretch Power Uprate Review of Chinshan NPP (2/3)

- The detailed SPU review guidance are generally according to the "Review Standard for Stretch Power Uprate/Extended Power Uprates of Boiling-Water Reactor" which is mainly reference the USNRC RS-001, "Review Standard for Extended Power Uprates".
- In the process of acceptation review, the licensee's evaluation of the temperature and pressure conditions in the containment due to a spectrum of postulated LOCAs documented in FSAR is base on 105% power, so TPC does not need to re-analysis it. But AEC found out that in FSAR the Design Evaluation is addressed "The reactor is operating at VWO condition (105 percent original NB rated) with all valves in the recirculation system open.", the NB rated can be power, flow or others, it does not actually mean power. Based on the above, AEC requested TPC for additional information. After two rounds of RAIs, TPC conservatively uses the 105% flow as the base and re-analysis for this evaluation.

Stretch Power Uprate Review of Chinshan NPP (3/3)

- In May 2010, NRC approved BWRVIP-182 and EPRI issued the BWRVIP-182-A (BWR Vessel and Internals Project, Guidance for Demonstration of Steam Dryer Integrity for Power Uprate). The main difference in the BWRVIP-182-A is in the min. alternating stress ratio ≥ 2.
- The TPC's opinion is that BWRVIP-182-A applies to EPU, but does not specifically mention SPU. So Chinshan will implement SDVM at one unit and use the Justification of Continued Operation (JCO) to ensure the safe operation of the steam dryer at SPU conditions.
- **AEC disagree with the opinion of TPC.**
- After the acceptation review, AEC will organize a review task force and the review schedule was originally planned to be 18 months.

Transient Analysis Methodology Licensing Applications

- Transient Analysis has mainly been performed for Taipower by the fuel vendors.
- In order to develop its own safety analysis capability, Taipower submits a series of topical reports of TITRAM (TPC/INER Transient Analysis Methods) for licensing review.
- Totally 40 reports, 22 have been approved (2006-2010), and part of them had been implemented in the MUR applications. Others will be reviewed in the following years. Some are prepared for supporting the SPU projects.

Underground Water and Piping Monitoring

- TPC was requested to implement a groundwater protection program due to many foreign incidents of tritium leaks
- Buried pipes of potential leakage were identified firstly
- Site-specific conceptual models of groundwater transport and buried pipes monitoring management will be established for Chinshan, Kuosheng and Maanshan NPPs, respectively

Safety Re-evaluation and Enhancement Plan for Seismic Resistance (1/2)

- Background
  - Hengchun Earthquake(M_L=7.0) induced two major shocks to Maanshan NPP on Dec. 26, 2006
  - New active fault identified
    - Sanchiao Fault (fault length 34 km or longer) of Northern Taiwan near Chinshan and Kuosheng NPPs
    - Hengchun Fault (fault length 16 km or longer) of Southern Taiwan near Manshan NPP
  - Experience from KK and Hamaoka NPP in Japan
  - Experience from Fukushima Daiichi NPP in Japan

Safety Re-evaluation and Enhancement Plan for Seismic Resistance (2/2)

- Scope of Plan
  - Geologic survey on land and marine region (~ August 2012)
    - To get geologic characteristics of active fault
  - Seismic hazard re-analysis (~ April 2013)
    - Design base earthquake re-evaluation
    - Site effect analysis of NPP would be included as well.
  - Re-evaluation of seismic resistance margin (~ August 2013 or earlier)
  - Reinforcement of seismic resistance on SSCs.

Risk-Informed Application Review (RI-ISI) (1/3)

- Scope of RI-ISI
  - Only for class-1 and class-2 piping
    - -Class-1 piping on B-J and B-F welds
    - -Class-2 piping on C-F-1 and C-F-2 welds
  - NOT include
    - -augmented inspection from FAC (all the piping segments classified as category A and B in TPC's Long-term FAC Program will be regarded as suspected piping)
    - -PWSCC welds

∗RPV/PZR welds subject to AMP-139 inspection

∗after Weld Overlay, return to ISI or RI-ISI program

Risk-Informed Application Review (RI-ISI) (2/3)

- Status of RI-ISI
  - A pilot study just for RHR system of Kuosheng NPP (2004)
  - RI-ISI review guidance developed by INER (2005)
  - Now, RI-ISI programs are prepared by TPC
  - Tentative schedule for RI-ISI program submittal
    - Kuosheng: 2012 (EOC-22)
    - Chinshan: 2011 (EOC-25)
    - Maanshan: 2015 (EOC-22)

Risk-Informed Application Review (Status of OLM) (3/3)

- TPC Self-management guideline and self-assessment reports for on-line maintenance have been reviewed and approved in 2010
- AEC will conduct routine or special inspection to monitor and check maintenance effectiveness of NPPs in the future

BWR ECCS Suction Strainer Issues (1/3)

- According to “ NRC Bulletin 96-03 ”and “Utility Resolution for ECCS suction strainer blockage （from BWR Owners’ Group）” , Kuosheng power plant has installed new strainers to replace the old ones for post LOCA long-term cooling in 2003 for unit 2 and in 2003 for unit 1.
- Since the last cleanup of the suppression pool was performed 20 years ago, Kuosheng plant staff decided to clean both units in 2010.

BWR ECCS Suction Strainer Issues (2/3)

- The sludge being pulled out are 573.5 kg (1263.2lbm) for unit 2,and 1116.8 kg (2459.9lbm) for unit 1. Both of them exceed the suction strainer design criteria (450 lbm)
- AEC conducted team inspection in February 2011 and requested Kuosheng plant to take appropriate action to constantly keep suppression pool condition meeting the suction strainer design criteria.

BWR ECCS Suction Strainer Issues (3/3)

item	ECCS suction strainers design criteria	weight
1	Miscellaneous fibrous debris	2.4 lbm
2	Sludge	450 lbm
3	Drywell dust and dirt	150 lbm
4	Paint chips from Zone of Influence(ZOI)	85 lbm
5	Iron oxide rust	50 lbm
6	Calcium Silicate from insulation on sample lines, valve leak off lines and piping of NCCCW coolers	32 lbm
7	Reflective Metal Insulation RMI	saturation thickness

Amendment of Nuclear Facility Regulation Law (1/2)

- AEC is going to make amendments of Nuclear Reactor Facilities Regulation Act (Promulgated on Jan.15, 2003) and its subsidiary rules and regulations, with emphasis area as follows:
  - Safety Responsibility of Nuclear Utility
  - Reactor Design Certified by Country of Origin
  - Fire Protection Program

Amendment of Nuclear Facility Regulation Law (2/2)

- License Amendment Request (LAR)
- Maintenance Rule
- Violation and Administrative Process
- QA personnel qualification and non-conformance notification
- Operating License Termination
- Design Change of Safety-Related Components
- Site Selection Criteria

Domestic Fire Protection Standard for NPPs (1/3)

- The current fire protection programs in Taiwan's Nuclear Power Plants are in accordance with GDC 3, R.G. 1.120, NFPA Standards...
- However, National Fire Agency of Taiwan has also a general fire standard, which shall be applied to the Nuclear Power Plants too.
- NPPs have difficulty to meet regulations applied to other industries.

Domestic Fire Protection Standard for NPPs (2/3)

- According to AEC inspection findings, NPPs still have many noncompliances with current licensing basis, mainly in Appendix R, certain features cannot even fully satisfy regulations from National Fire Agency of Taiwan.
- Due to these facts, AEC is developing a new regulation designated to NPPs, that is, fire regulation effective only within power block of NPPs.

Domestic Fire Protection Standard for NPPs (3/3)

- The new regulation refers to NFPA-805, other relevant NFPA Standards, R.G. 1.189, and 10CFR50.48(c).
- The draft version is under review by the stakeholders.
- The program is scheduled to be completed before the end of this year.

Continued Improvement of AEC inspection procedures

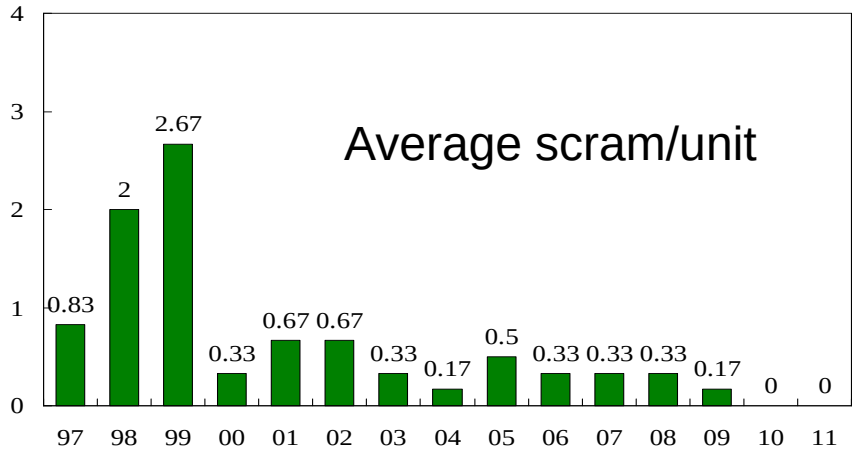
- Establish procedures for Nuclear Regulation:
  - Reactor Oversight Process (22)
  - Inspection Guideline (55)
  - Construction Inspection (19)
  - Initial Test Inspection (53)
  - Administration Control (30)
  - Accident Evaluation (2)
- Procedures above are mainly based on NRC inspection manual chapters and procedures
- Continue to add more procedures for future needs

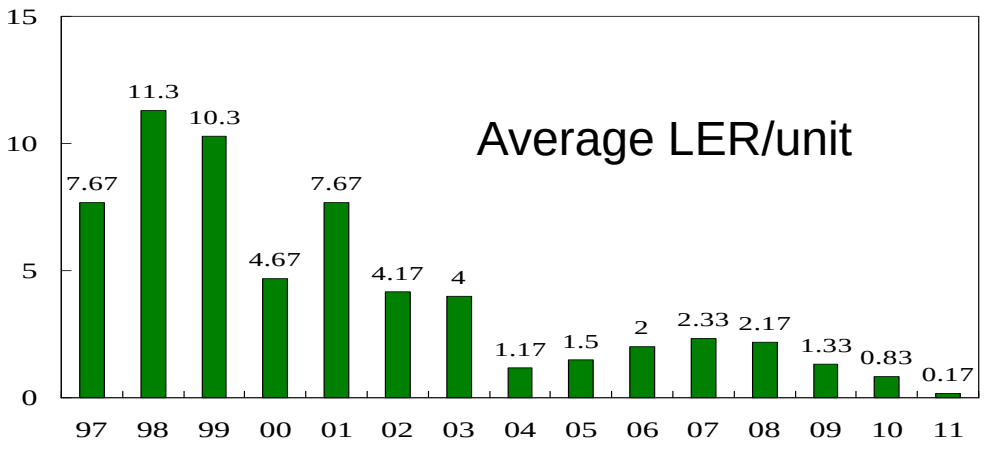
Transparency and Openness of AEC regulation (1/2)

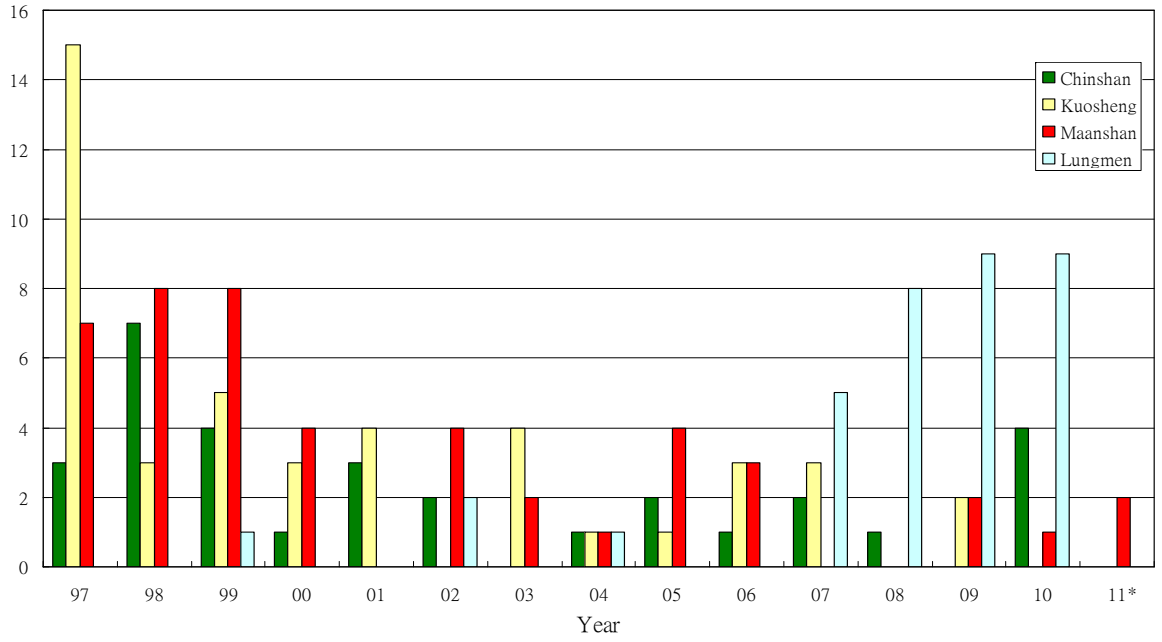
- Information provided on AEC website
  - On-line operating status of NPPs and Radiation monitoring of Taiwan
  - Monthly report of regulatory activities and safety performances of NPPs
  - ROP inspection reports and indicators
  - Lungmen plant progress and inspection findings
  - Meeting minutes of safety advisory committees

Transparency and Openness of AEC regulation (2/2)

- Regulatory conferences for operating NPPs and Lungmen plant
- Operator license statistics
- Civil penalty, Violation, and Notification for corrective action of NPPs
- LERs and inspection reports
- Clarification for news media report







Number of Violation for Each Plant（* : Data up to the end of Mar. 2011）

Taiwan Benefits from the Transparency and Openness of NRC regulation **(1/2)**

- On January 27, 2011 Fort Calhoun identified unsealed conduit penetrations of the Intake Structure. Flooding through the penetrations could have impacted the ability of all the station raw water pumps to perform their design accident mitigation functions.
- This event was reported to NRC and was posted on NRC website.
- AEC got this information and asked Maanshan Nuclear Power Station if any similar condition existed.
- After walkdown of the Intake Structure of the Nuclear Service Cooling Water system, Maanshan NPS also identified two unsealed pipe penetrations. In the event of tsunami, flooding through the penetrations could defeat all the Nuclear Service Cooling Water pumps to perform their design functions in consideration of the worst condition.
- The penetrations have been re-sealed on February 14, 2011.

Taiwan Benefits from the Transparency and Openness of NRC regulation **(2/2)**

- During a outage in September, 2010, North Anna Power Station discovery of microtherm insulation in containment which could impact the new containment sump strainers installed to address NRC GSI-191 requirements.
- This event was reported to NRC and was posted on NRC website.
- Maanshan NPS have a sump strainer improvement plan to address GSI-191 issue. During that time, unit 1 had performed walkdown activities to provide strainer technical specifications for designing new containment sump strainers and the walkdown of unit 2 still on planning.
- After reviewing of the North Anna event and related plant drawings , Maanshan NPS determined that some uncontrolled plant drawings of insulation were absent in debris generation calculation.
- Maanshan NPS performed additional walkdown during the outage of unit 2 to address this issue. Similarly, microtherm insulations were found on the top of the pressurizer.
- Maanshan NPS will also performed additional walkdown during the outage of unit 1 in April this year.

Concluding Remarks

- Promote safe operation of NPPs is the top priority for nuclear community worldwide
- The growing need for public awareness of safety urges AEC to be more open and efficient through openness and transparency
- AEC and NRC could be mutually beneficial through continuous cooperation and technical information exchange

Thank You for Your Attention