2008 AEC-NRC Bilateral Technical Meeting

Nuclear Reactor Regulatory Overview

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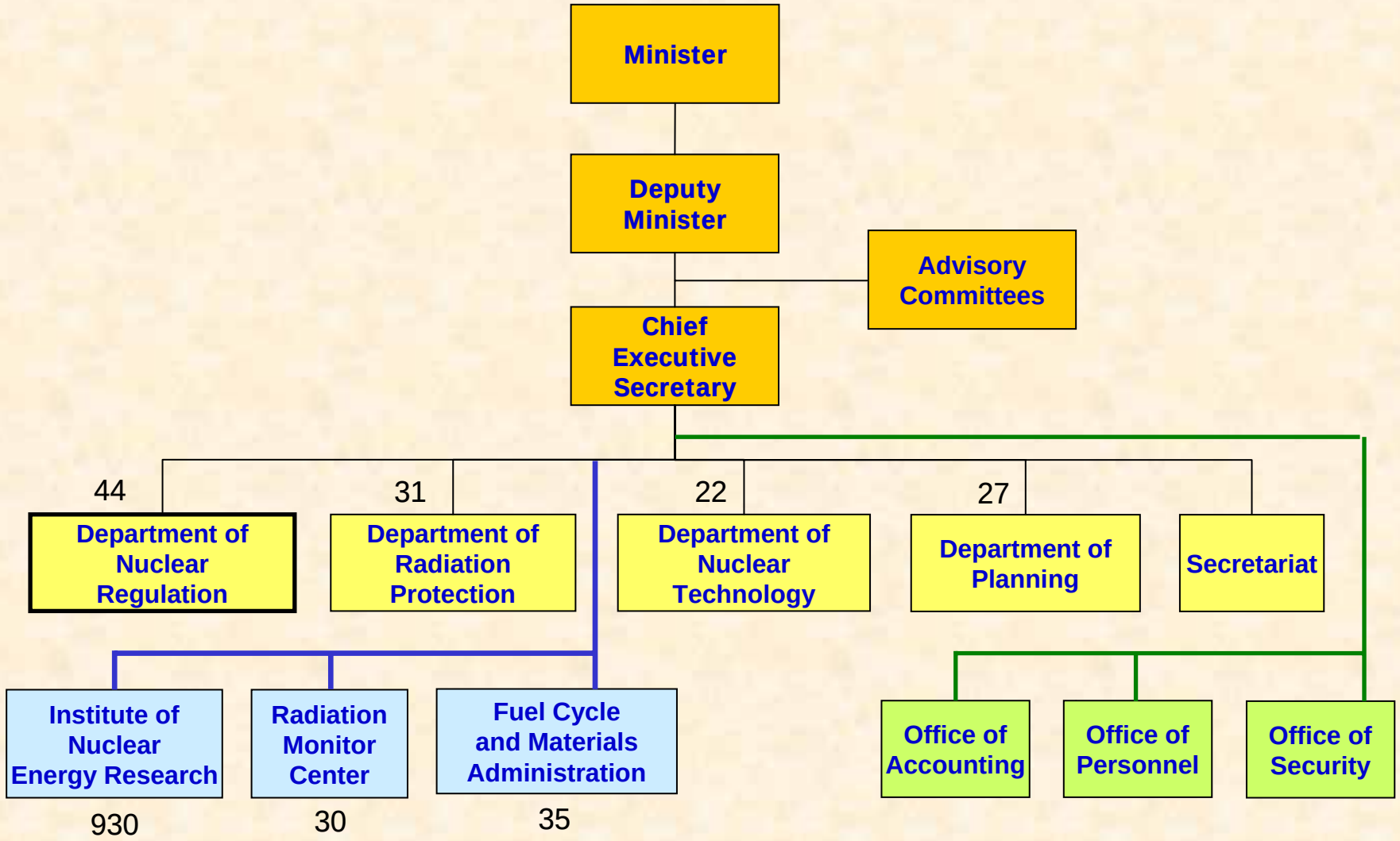
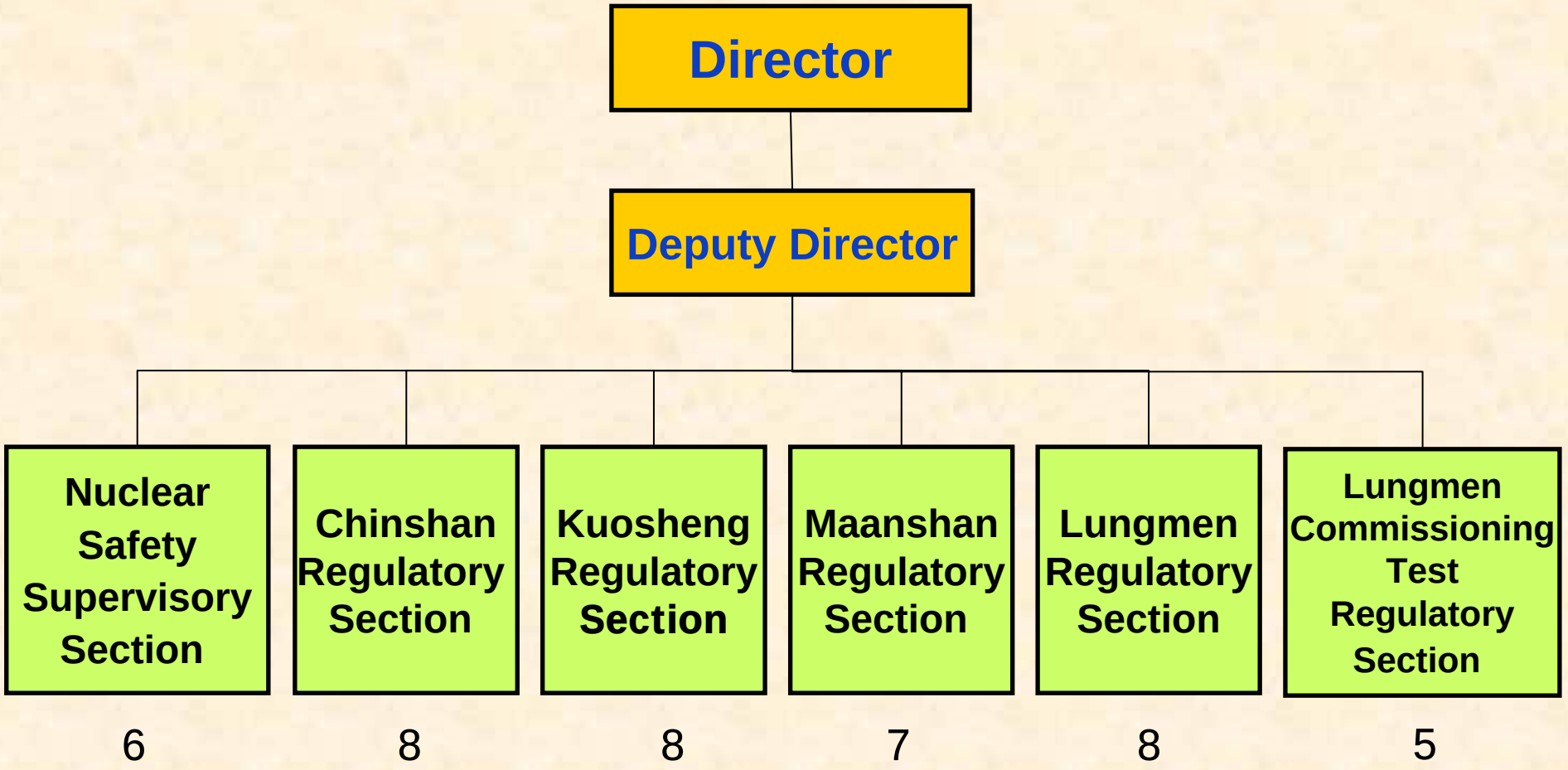
Outline

- Organization of Nuclear Safety Regulation
- Safety Performance of NPPs in Taiwan
- Recent Significant Events in Taiwan
- Major Regulatory Activities
- Important Upcoming Activities
- Concluding Remarks

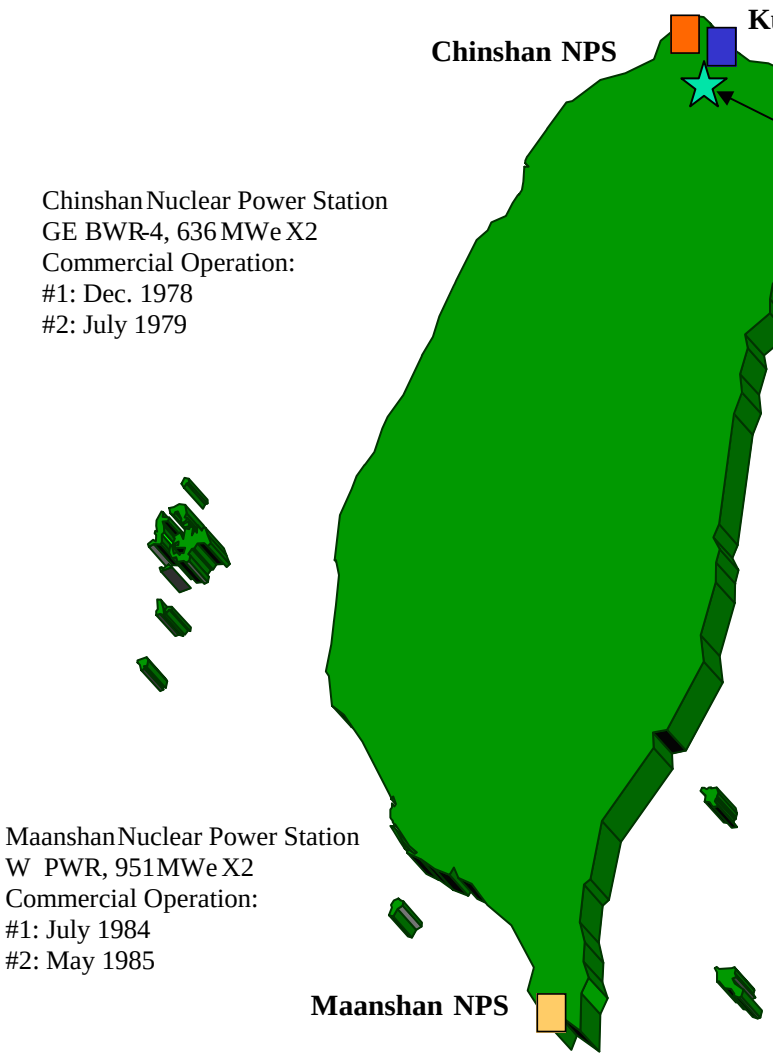
Organization Chart of AEC



Department of Nuclear Regulation



Locations and Design Features of NPPs in Taiwan



Chinshan Nuclear Power Station
GE BWR-4, 636 MWe X2
Commercial Operation:
#1: Dec. 1978
#2: July 1979

Kuosheng Nuclear Power Station
GE BWR-6, 985 MWe X2
Commercial Operation:
#1: Dec. 1981
#2: March 1983

Lungmen Nuclear Power Station
GE ABWR, 1350MWe X2
Commercial Operation Expected:
#1: 2009
#2: 2010

Maanshan Nuclear Power Station
W PWR, 951MWe X2
Commercial Operation:
#1: July 1984
#2: May 1985

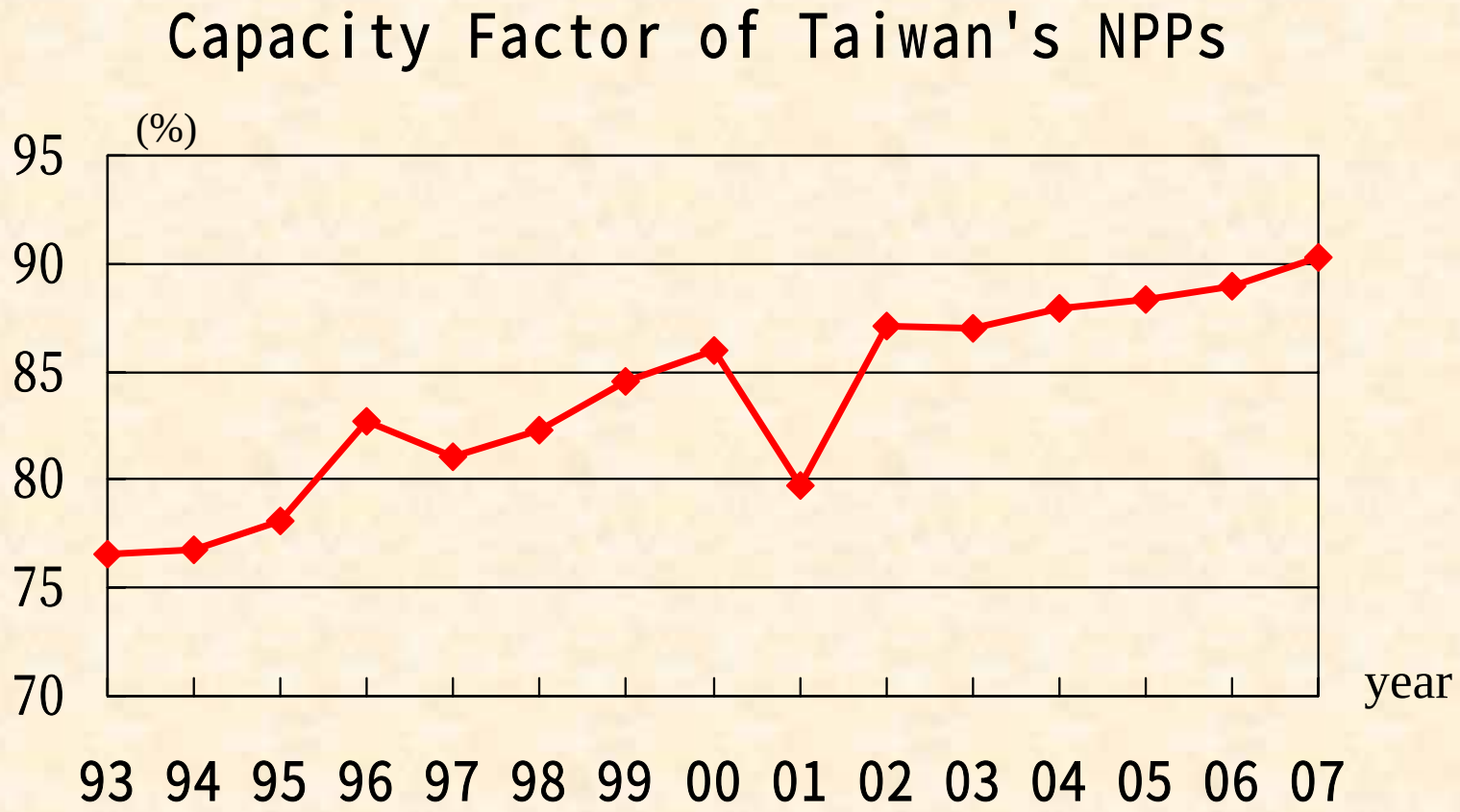
Safety Performance of NPPs in Taiwan

- The overall safety performance of nuclear power plants in Taiwan is continuously maintained at a high level of standards.
- The number of violation, automatic scram, and reportable event report (RER) are shown in Figures 1, 2, and 3.
- The performance indicators and the baseline inspection results show all green colors in the area of the reactor safety cornerstones.

1Q/2008 Summary of Reactor Safety Performance Indicators

指標	機組	核一廠		核二廠		核三廠	
		1	2	1	2	1	2
肇始事件	臨界7000小時非計劃性反應爐急停（自動或手動）	●	●	●	●	●	●
	非計劃性反應爐急停且喪失正常熱移除	●	●	●	●	●	●
	臨界7000小時非計劃性功率變動> 20%額定功率	●	●	●	●	●	●
救援系統	高壓冷卻水系統（HPCI / HPCS）不可用率	●	●	●	●	●	●
	反應爐爐心隔離冷卻水系統（RCIC）不可用率或輔助飼水系統（AFW）不可用率（核三廠）	●	●	●	●	●	●
	餘熱移除系統（RHR）不可用率	●	●	●	●	●	●
	緊要柴油機（EDG）不可用率	●	●	●	●	●	●
	安全系統功能失效	●	●	●	●	●	●
屏障完整	反應爐冷卻水系統比活度	●	●	●	●	●	●
	反應爐冷卻水系統洩漏率	●	●	●	●	●	●

註1： ●：無安全顧慮　○：低微安全顧慮　●：中度安全顧慮　●：顯著安全顧慮

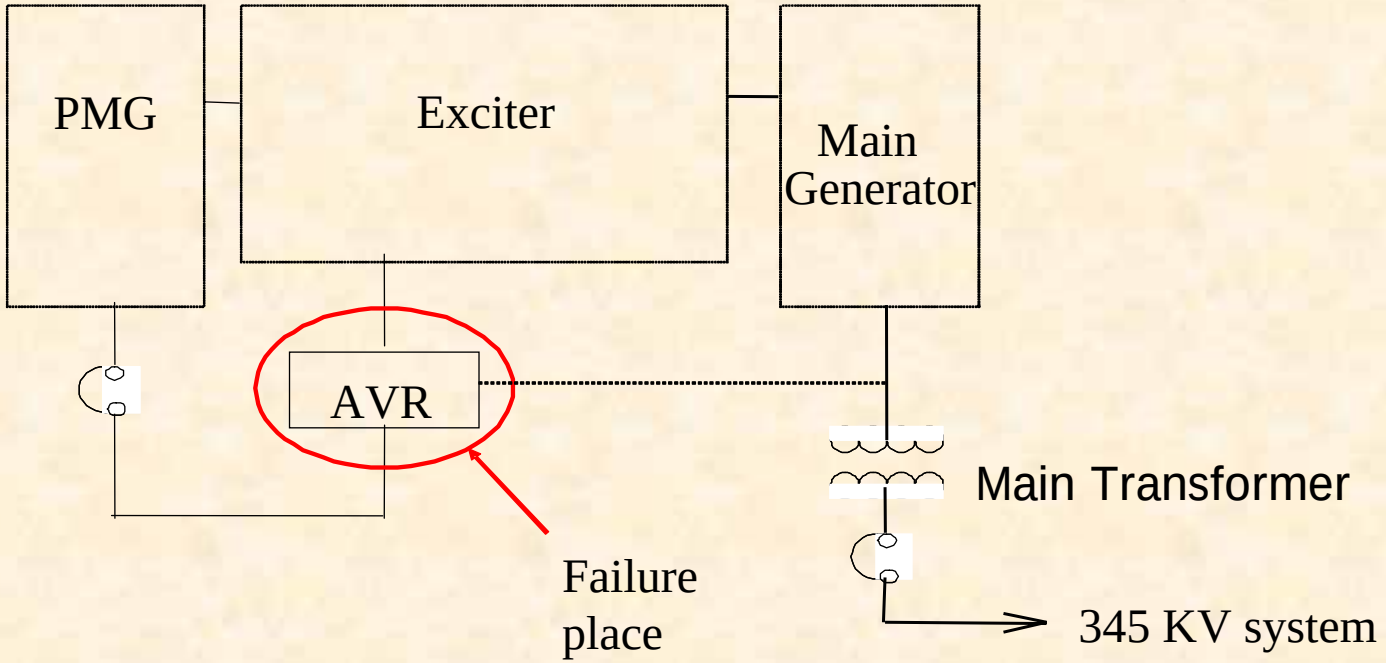

Capacity Factor of Taiwan's NPPs
(%)
95
90
85
80
75
70
year
93 94 95 96 97 98 99 00 01 02 03 04 05 06 07

Recent Significant Events in Taiwan

- KS #1 Reactor Scram Due To Main Turbine-Generator Trip on September 3, 2007
- KS #2 Reactor Scram Due To Main Turbine-Generator Trip on December 17, 2007
- KS #1 Reactor Scram Due to Main Turbine-Generator Trip on March 24, 2008

Event Description

- During these scrams, Reactor is almost at full power operation
- The main cause of these scrams is equipment failure (main-generator excitation control system—auto voltage regulator)



Exciter-Generator System Block Diagram

Discussion and lesson learned

- These scrams do not have safety significance.
- These AVR was just renewed from analog to digital design
  - Dec. 2005 (KS Unit 2)
  - Apr. 2006 (KS Unit 1)
- The failure AVR control circuit was sent back to the supplier (ABB), to conduct the detailed check and long time testing to find out the root cause of these failures.
- TPC should draw up the corrective actions as soon as possible, resolve the problem thoroughly.

Major Regulatory Activities in 2007-2008

1. Conduct Component Design Bases Inspection
2. Installation of Automatic Seismic Trip System
3. Transient Analysis Methodology Licensing Application
4. Power Uprate of Operating NPPs
5. Lungmen ABWR Construction Inspection
6. Preparation for the License Renewal Application of Operating NPPs

Conduct Component Design Bases Inspection

- This inspection (CDBI) was the first time to conduct at CS、KS and MS, In 2007. Inspection team members consist of the staff of Department of Nuclear Regulation and Institute of Nuclear Energy Research.
- Inspections were focused on system with high probabilistic risk analysis (PRA) rankings and high values for importance measures as follows:

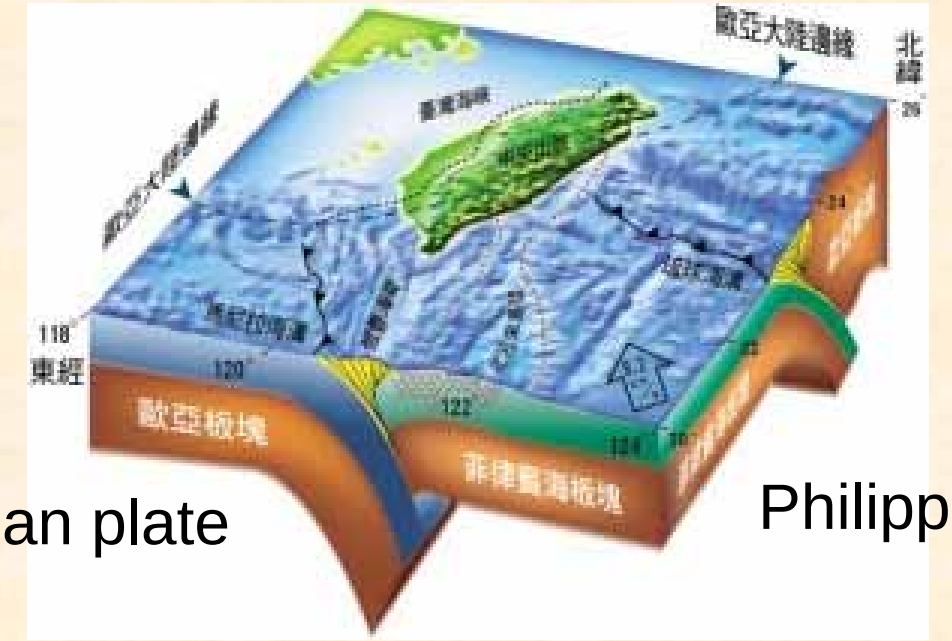
  CS:RCIC & CSCW System,

  KS:RHR、ECHW & NCHW System,

  MS:AFW & 125VDC System.
- The inspection will be routinely conducted biennially.

Installation of Automatic Seismic Trip System (ASTS)

- Taiwan is located at a complex juncture between the Eurasian plate and Philippine sea plate, where earthquakes occur frequently.



Eurasian plate

Philippine sea plate

Installation of Automatic Seismic Trip System (cont'd)

- The disastrous Chi-Chi earthquake (M=7.3) occurred on September 21, 1999 prompted AEC to request TPC to install the ASTS in its 6 existing nuclear units to further ensure the plant safety.
- ASTS is mandatory in Japan, which also encounters frequent earthquakes.
- Installations and tests have been completed in November 2007. ASTS have been put in service since then.

Transient Analysis Methodology Licensing Applications

- Transient Analysis has always been performed for Taipower by the fuel vendors.
- In order to develop their own safety analysis capability, TPC submits a series topical reports of TITRAM (TPC/INER Transient Analysis Methods) for licensing review.
- Totally 20 reports, 11 have been approved and have been implemented in the MUR applications.

Power Uprate of Operating NPPs

- Taipower has launched a power uprate project for its three nuclear power plants. The power uprate considered is the Measurement Uncertainty Recapture (MUR) type.
- According to the current schedule, all the units will implement power uprate from the beginning of the cycle after a refueling outage except Maanshan Unit 2 which may involve power uprate in mid-cycle.

Lungmen ABWR Construction Inspection

- The total accumulated progress of Lungmen project approach 78.38% (March 2008)
- In addition to the routine inspection activities, AEC also conducts some task forces on special area including:
  - ➢Reactor internal installation
  - ➢FSAR review
  - ➢Flushing
  - ➢RPV hydrostatic test
  - ➢Reactor Operator examination

Bird-view of Lungmen Plant

Preparation for the License Renewal Applications of Operating NPPs

- 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 license of the 1st (Chinshan) NPP in Taiwan has been issued for over 29 years. So it is the appropriate time to raise License Renewal issues.

Preparation for the License Renewal Applications of Operating NPPs(cont'd)

- Since 2005, AEC has kept close technical exchange on license renewal experience with USNRC through:
  - Inviting two NRC experts to give a workshop on US license renewal regulatory experience
  - Sending AEC DNR staffs to visit NRC (due to budget constraint the longest stay up to now is three months)
- The detailed LR guidance will generally reference related U.S. Regulatory Guidance.

Preparation for the License Renewal Applications of Operating NPPs(cont'd)

- Taipower Integrated Plant Assessment (IPA) Planning
  - Apply sequentially to Chinshan, Kuosheng , and Maanshan
  - 3 Years for each NPP
    - To be completed in 2007 for Chinshan
    - To be completed in 2010 for Kuosheng
    - To be completed in 2013 for Maanshan
- AEC will organize a review team in the near future.

Important Upcoming Activities

- MUR Application for Maanshan NPP
- Chinshan Unit 1 10-year periodic safety assessment
- Chinshan License renewal application
- Continue TITRAM licensing application for CS, KS and MS
- Lungmen PCT/Pre-op/start-up Inspection, FSAR Review and Operator examination
- Continue Improvement of our regulation, inspection manuals, and procedures
- Upgrade of PRiSE (software tool for SDP) to include shutdown safety and exernal events

Concluding Remarks

- Continue our effort to be more openness, effective, efficient and transparent in regulatory activities
- Regulatory activities for operating nuclear plant safety will be focused on power uprate, reactor oversight, license renewal, pressure boundary integrity in the near future.
- Regulatory activities for Lungmen power plant will be focused on PCT, Pre-op test, FSAR review, operator examination in the near future.

Thank You for Your Attention

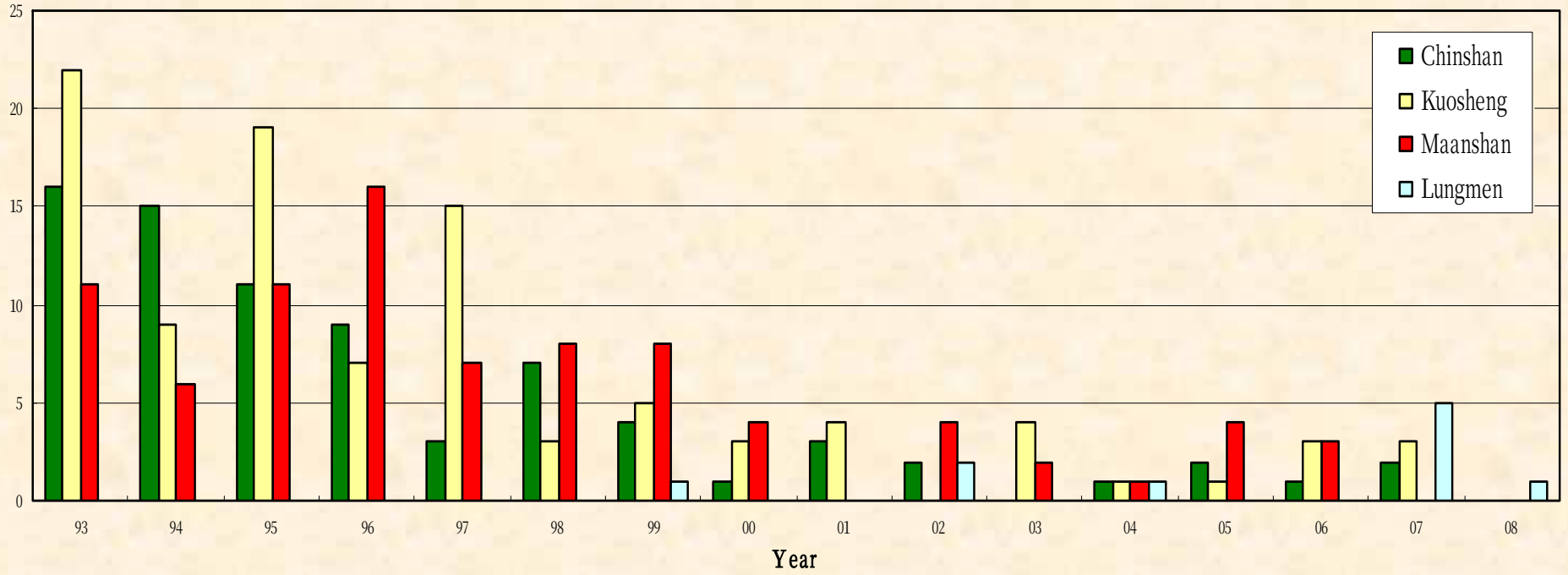


Figure 1 Number of Violations for Each Plant

(Data up to Feb 2008)

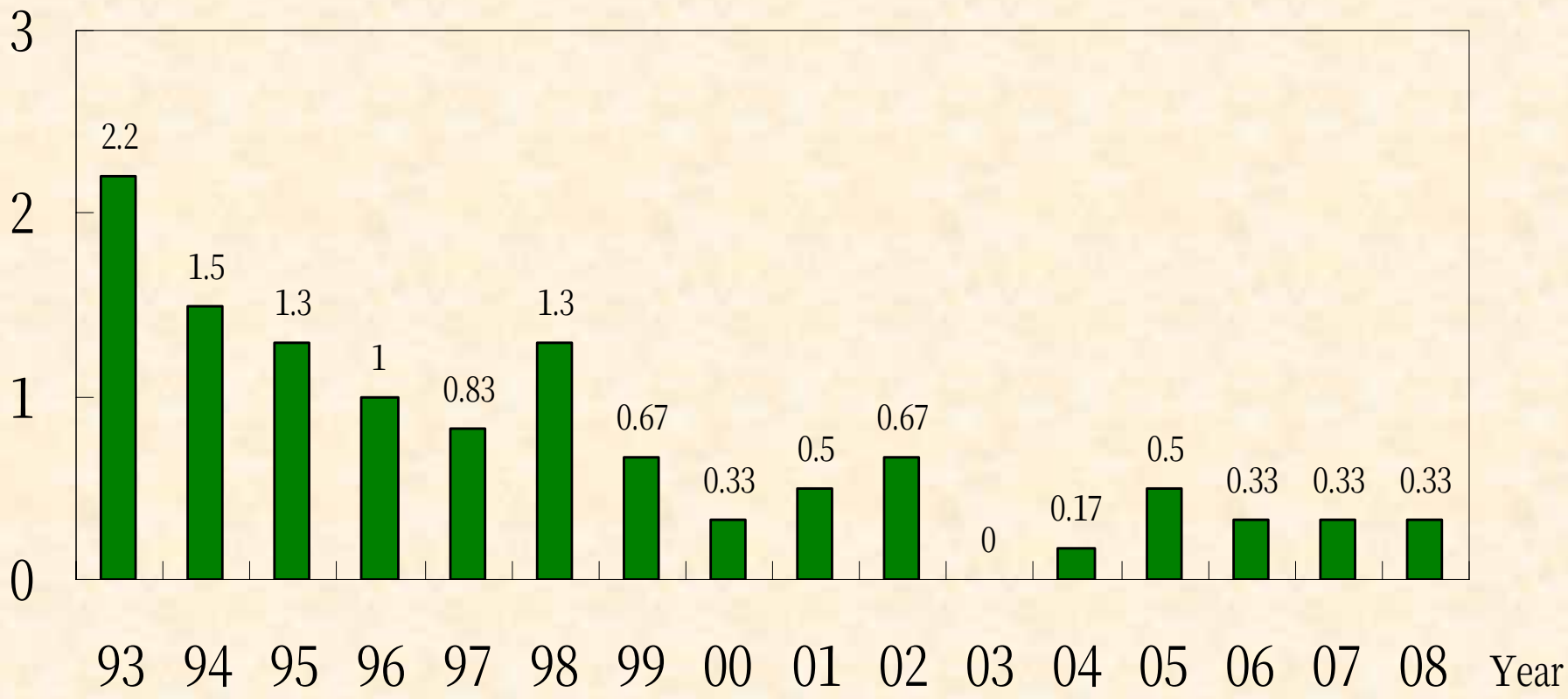


Figure 2 Average Number of Scram per Unit

（Data up to April 2008）

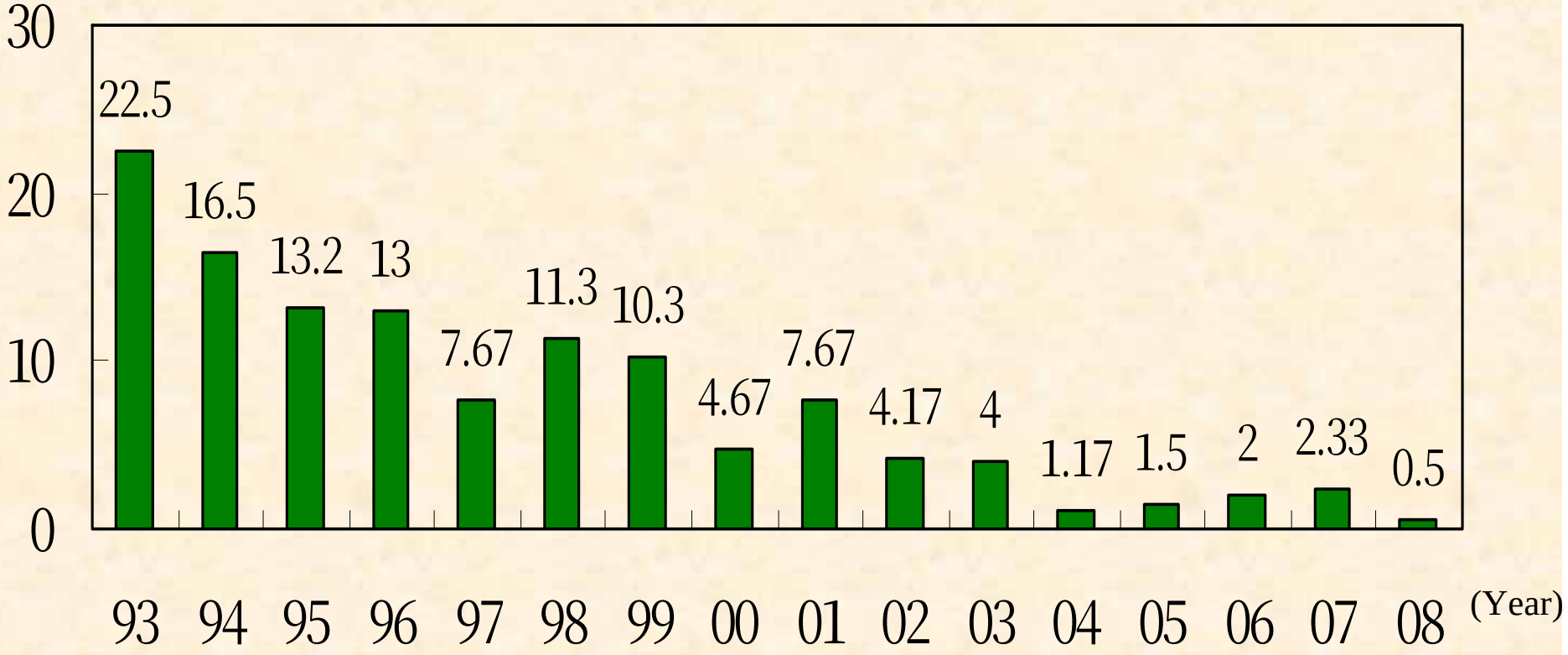


Figure 3 Average Number of RER per Unit

(Data up to Feb 2008)