Nuclear Reactor Regulatory Overview

Department of Nuclear Regulation

Atomic Energy Council

Outline

- Nuclear Power Plants Safety Performance
- Major Regulatory Activities
- Major Activities Under Planning
- Conclusion Remarks

Nuclear Power Plants Safety Performance

- 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) indicate a decreasing trend, although not stable in 2006, as shown in Figure 1, 2, and 3.
- Moreover, the performance indicators and the baseline inspection results show all green lights in the area of the reactor safety corner stone.

Major Regulatory Activities

Various regulatory measures have been taken to closely monitoring nuclear power plants safety performance. The major activities include:

- Lower the Age of License Operators
- Risk Informed Fire Protection Analysis
- Underground Cable Performance Monitoring
- Grid Stability
- BWR Control Rod Crack
- BWR Fuel Channel Bow
- Fuel Performance

Lower the Age of License Operators

- According to a survey, the average age of licensed operators in Taiwan is at least five years higher than that of their counterparts in the US, Among these personnel, approximately 10% are over 55.
- Moreover licensed operators over the age of 45 make up approximately 70% at Chinshan and Kuosheng. The problem of high average age of licensed operators will become more serious in ten years.
- AEC has requested Taipower to establish a licensed operator recruitment program to accelerate the lowering of the age.
- It is hoped that by lowering the licensed operators' age to below 55, the problem of high average age among licensed operators can be thoroughly solved.

Risk Informed Fire Protection Analysis

- A risk informed approach is adopted to resolve the Thermal-Lag fire barrier 3-hour rating issue for the redundant trains of cables and equipments.
- A RIFA (Risk Informed Fire Analysis) code is developed by INER for the analysis.
- The analysis of all the three plants have been completed, and the results showed that only a small portion of the cables should be re-routed and/or a fast action fire extinguish system should be added.

Underground Cable Performance Monitoring

- Lessons learned from NRC's Proposed Generic Communication on August 1, 2005, for "Inaccessible or Underground Cable Failures That Disable Accident Mitigation Systems", AEC conducted a special inspection for the cable's physical protection and functional capability at three plants.
- The inspection results showed that part of the cables were immersed in the water environment although the function of the cables still intact. Besides, part of the underground redundant cables exhibited insufficient physical separation.
- Corrective actions have been enforced which include periodic insulation measurement, periodic cable conduits inspection, and risk assessment of the cables.

Grid Stability

- The initiating event for the Maanshan unit 1 station blackout incident on March 18, 2001, is the grid instability.
- In addition to the stability improvement of the grid, how to minimize the influences and consequences of the grid instability to the reactor operation is another concern.
- The measures to be taken or under evaluation include communication protocol between grid operator and reactor operator (different department within Taipower) and risk assessment of the transmission system.

BWR Control Rod Crack

- Since the Japanese Tokai unit 2 control rod (D-120) cracking indications on the handle roller pinhole area were identified during its outage inspection in 1999, AEC has requested Taipower's BWR plants, Chinshan and Kuosheng, to inspect the control rod blades（originally D-Type） in the nearest routine outage. The inspection results showed the cracking indications were found in all four units.
- Several regulatory actions were enforced which include: reactor coolant boron concentration monitoring, control rod functional tests, control rod inspection and replacement program, and root cause identification.

BWR Fuel Channel Bow

- Operation experience from Susquehanna, Grand gulf, and LaSalle indicate that fuel channel will bow beyond expectation, which could impose safety concerns.
- Chinshan and Kuosheng fuel channel supplier are the same as the aforementioned plants. Therefore, Taipower has been asked to submit a channel bow monitoring program and operators familiarization training program regarding stuck rod(s) operation.
- Reload analysis for the safety limit MCPR using the updated data bank of the channel bow is also requested.

Fuel Performance

- During the recent operation, Kuosheng experiences 4 fuel failures, 1 (ATRIUM 10) for unit one and 3 consecutive cycles (2 ATRIUM 9B and 1 ATRIUM 10) for unit two.
- For Kuosheng unit two, 3 consecutive mid-cycle refueling were conducted to replace the failed rods.
- The root cause of unit one failed rod is debris induced failure, and the root cause of unit two failed rods is still waiting for hot cell inspection.
- In addition to the root cause investigation, the measures to detect the rod failure under high radiation background environment is also requested.

Major Activities Under Planning

In addition to the ongoing regulatory activities, AEC is also preparing the safety review for the foreseeing applications, including:

- Measurement Uncertainty Recapture Power Uprate
  （Tentative schedule: 2nd half of 2006）
- Lungmen FSAR （Tentative schedule: August 2007）
- Maintenance Rule （ Tentative schedule: January 2007）
- License Renewal （ Tentative schedule: 2008）

Conclusion Remarks

- The goal of the reactor regulation is not only to assure the safe operation but also to maintain the stable operation.
- The operational experience and the regulatory practices from the US provide valuable information to effectively regulate our reactor operation.

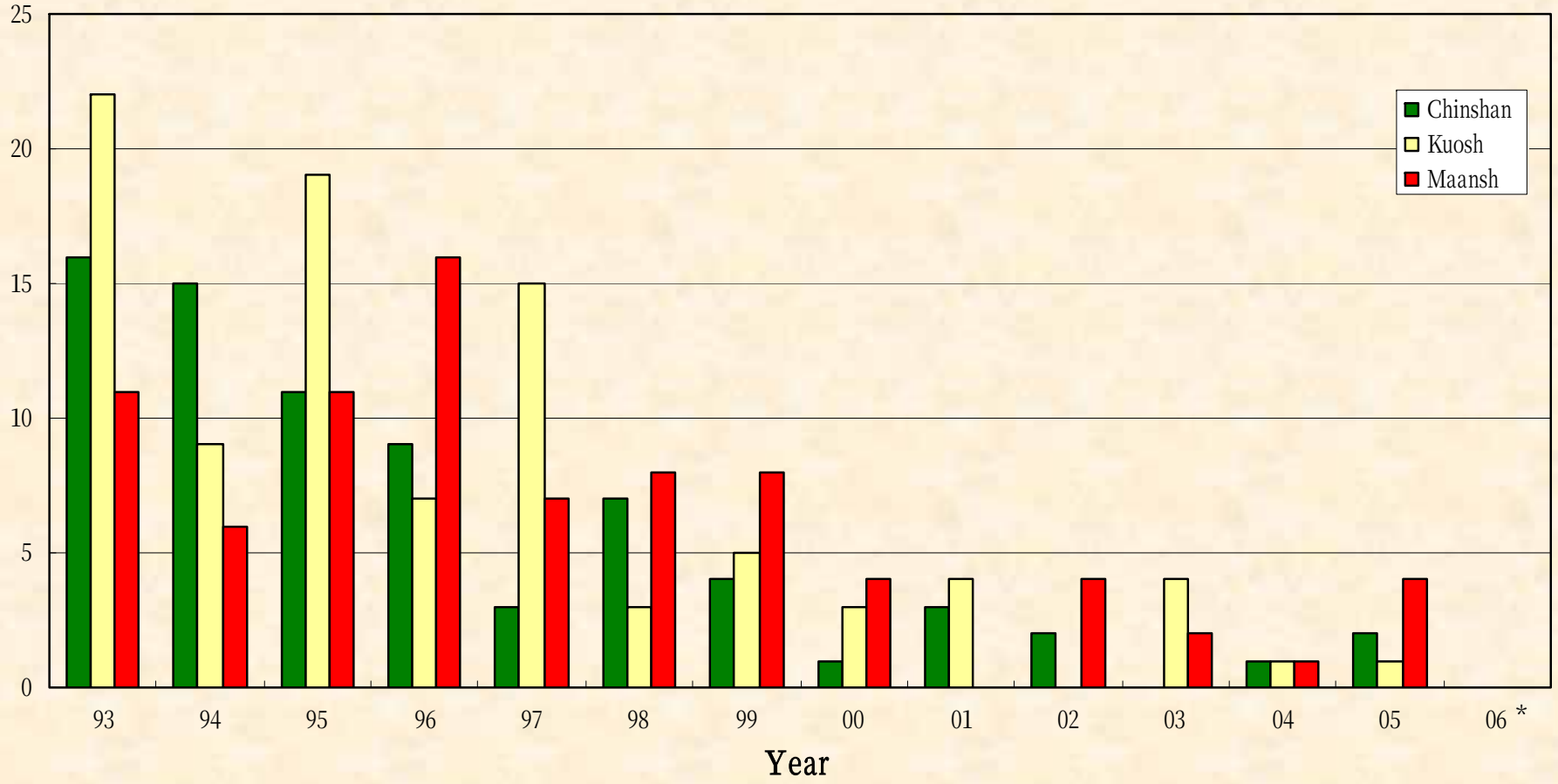

Figure 1 Average Number of Violations for Each Plant

(* : Data up to the end of March 2006)

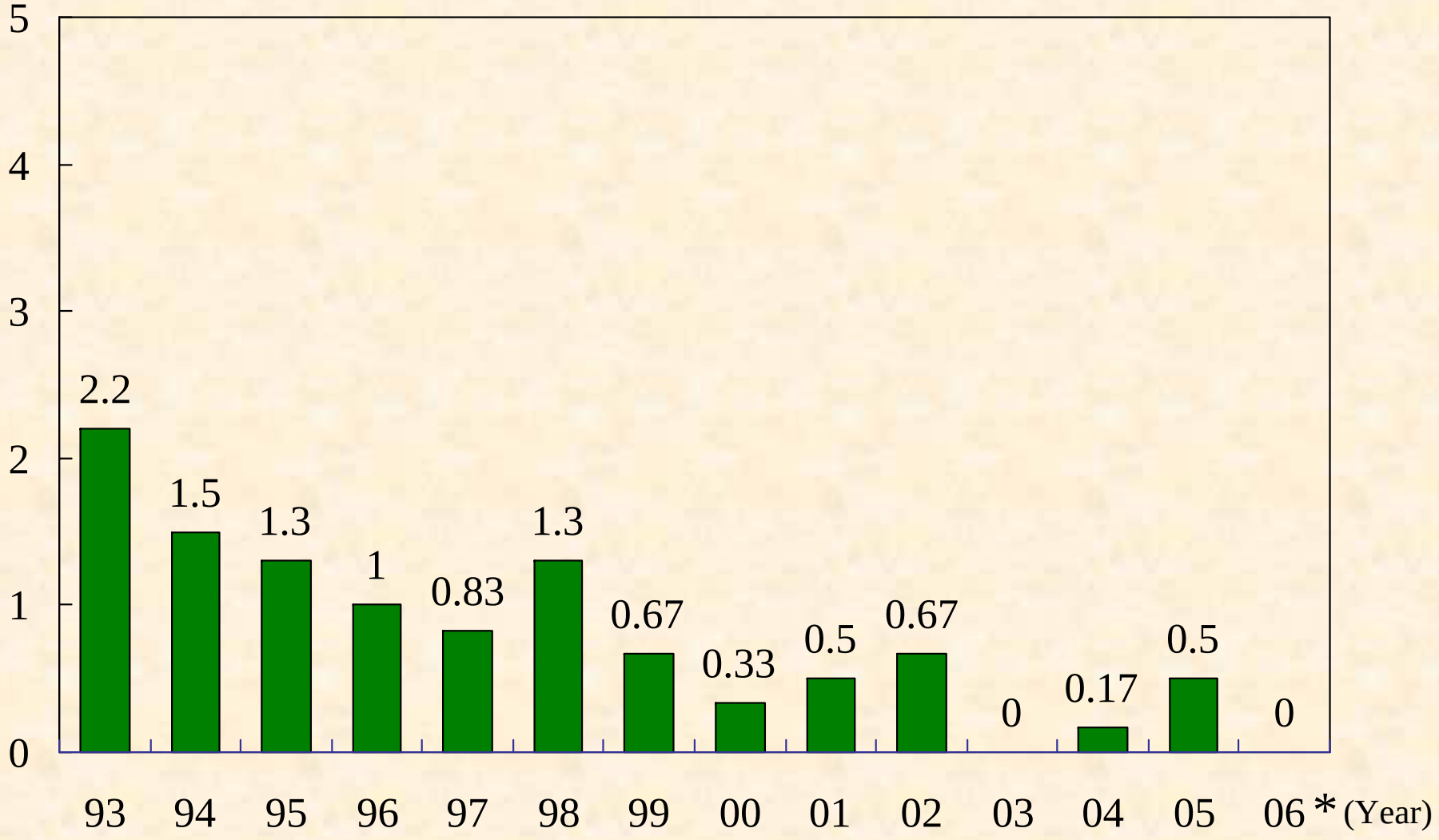

Figure 2 Average Number of Scram per Unit

(* : Data up to the end of March 2006)

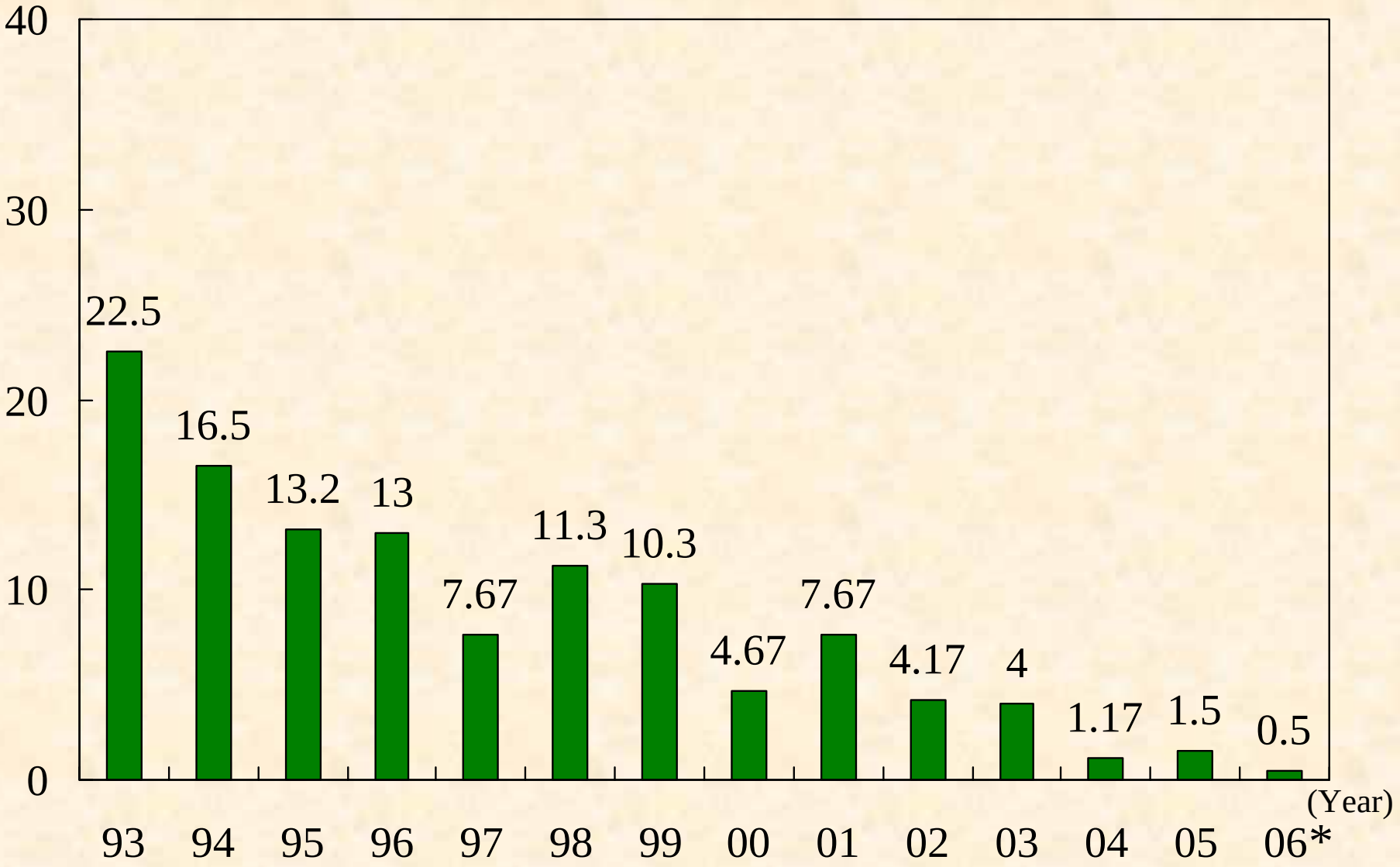

Figure 3 Average Number of RER per Unit

（* : Data up to the end of March 2006）