Introduction of Major Activities in NSTC of INER

Presented to Honorable Guesses

USNRC Director of NRR, Mr. J. Dyer

Deputy Director of RES, Mr. J. Wiggins

Institute of Nuclear Energy Research (INER)
February, 2006

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1. Mission and Organization of INER
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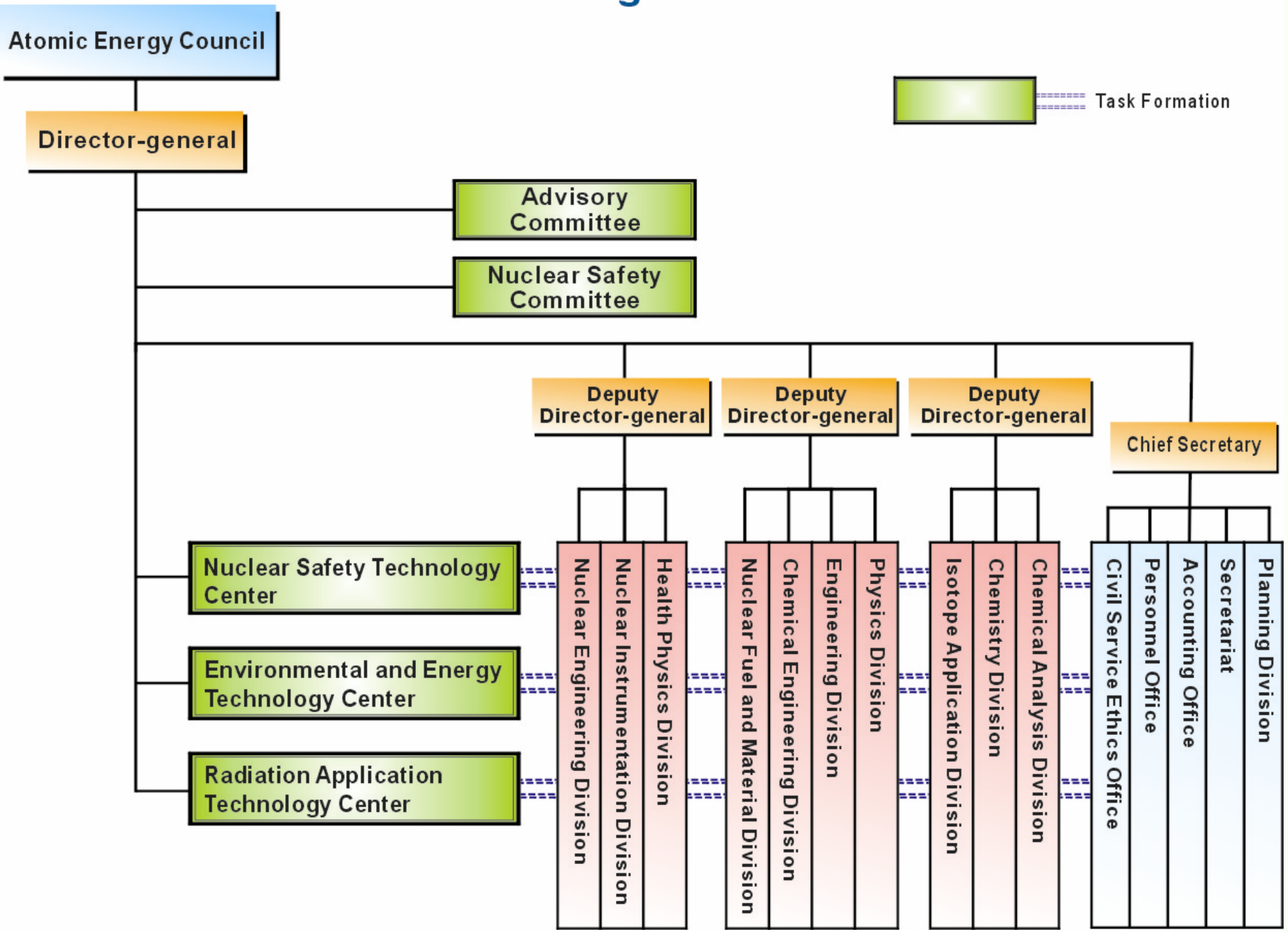
3. Closing Remarks

1. Mission and Organization of INER

Mission：

- To develop domestic nuclear technologies to support nuclear safety regulation and to enhance operational efficiency for nuclear power in Taiwan
- To develop nuclear facilities decommission, and radioactive waste management technologies
- To develop radiopharmaceutical and radiation applications technologies
- To develop technologies on new and renewable energy

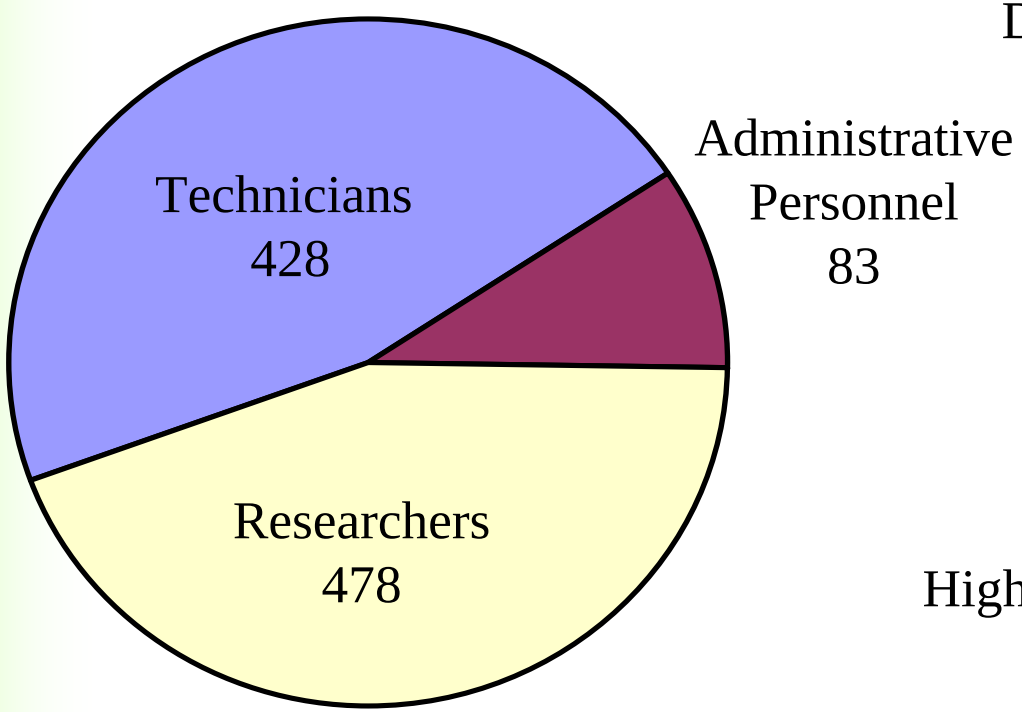
INER'S Organization Chart



INER's Staffs

(Feb. , 2006)

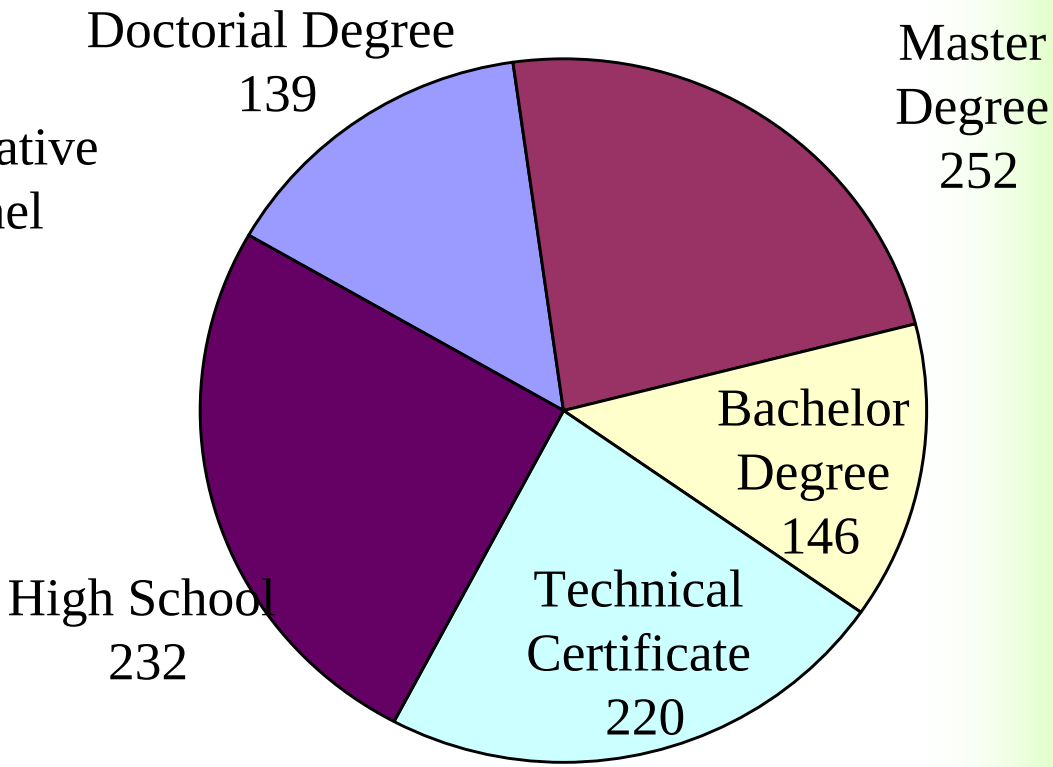
Total Staffs 989



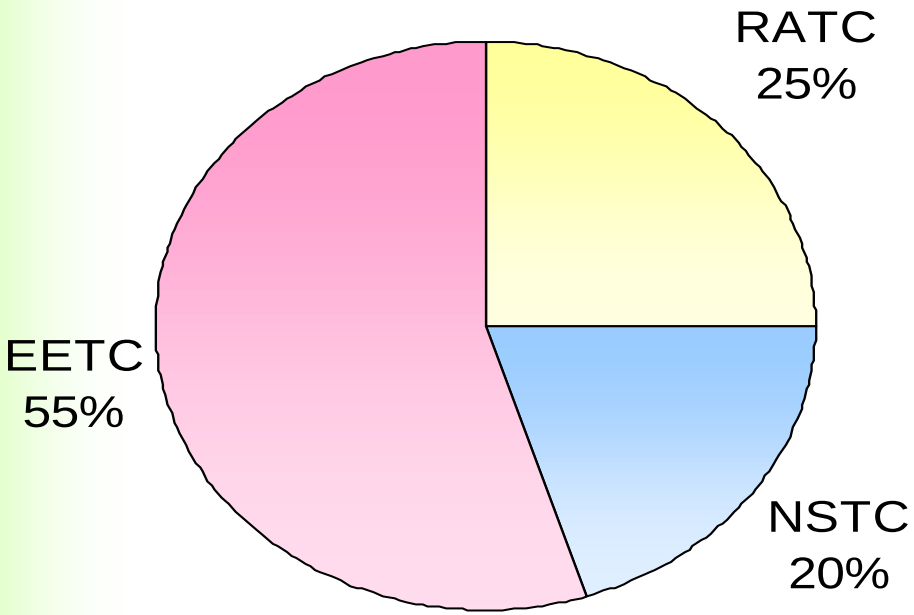
258 by contract

Education

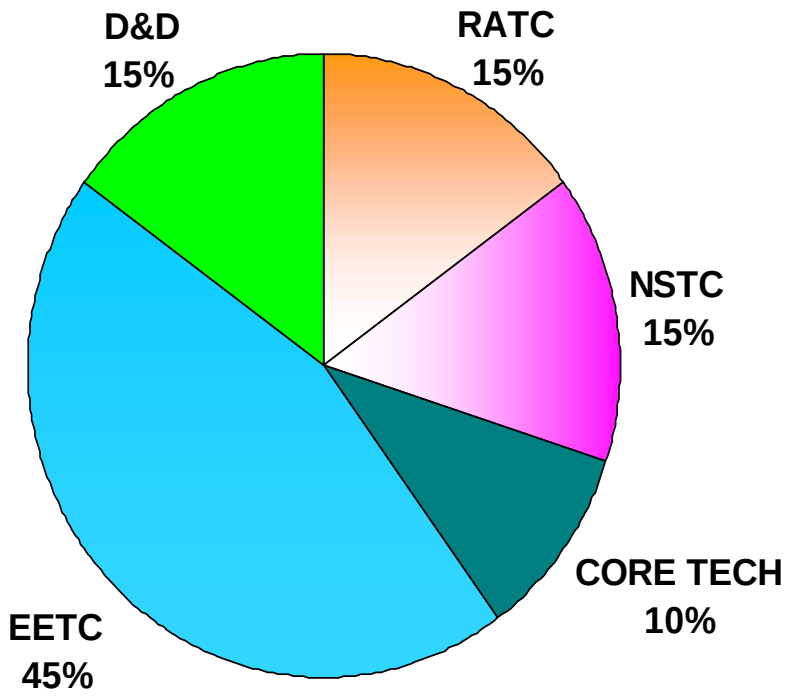
Researchers and Technicians (989)



R&D Budget of 2005



Planning Budget Share in Future

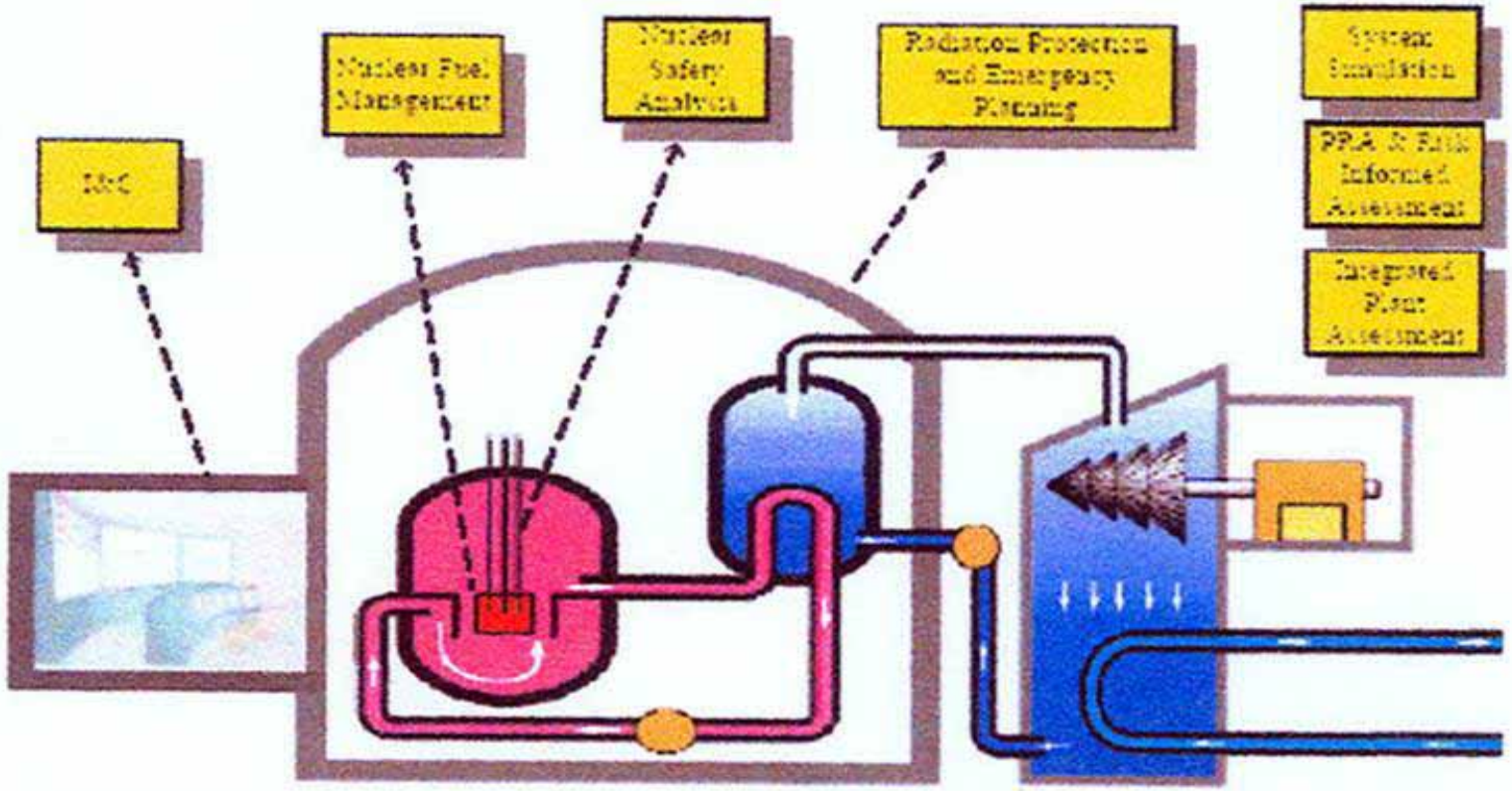


U$ 25M(funded by Gov.)

U$ 20M(TPC &Domestic Comp.)

(1) Nuclear Safety Research Area in NSTC

Main Technologies of Nuclear Safety Center

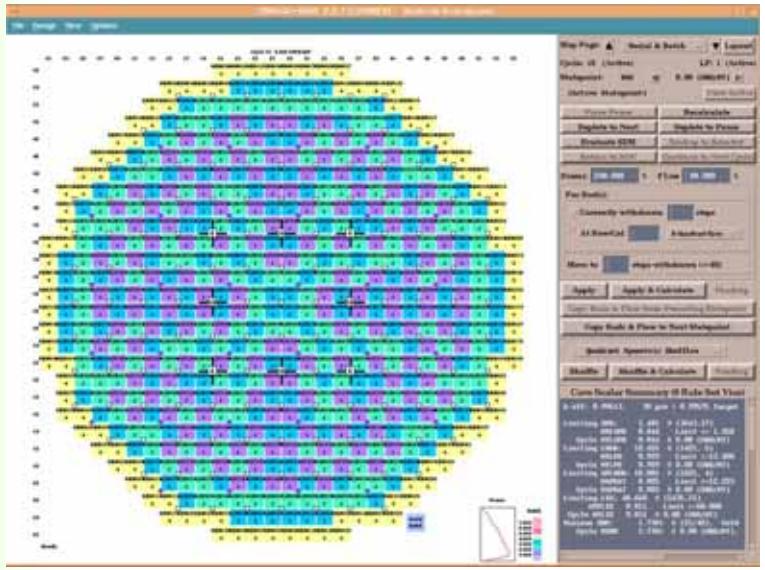


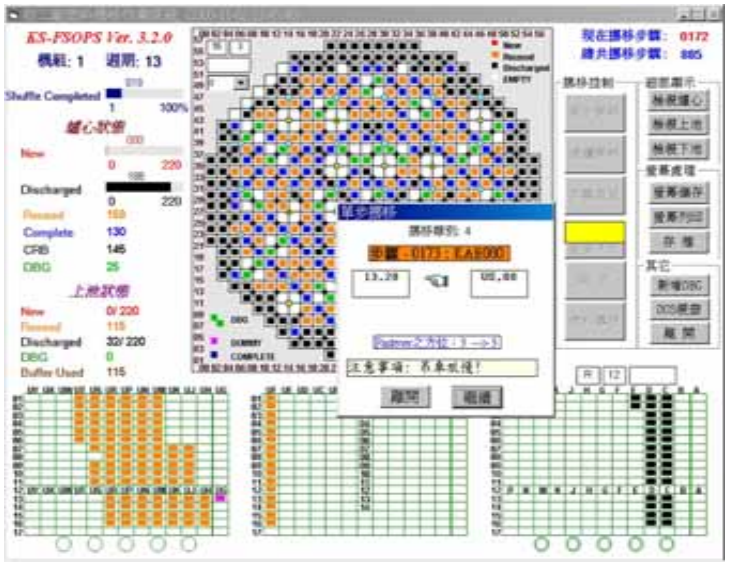
To support the safe operation of Taiwan's 6 nuclear power units

Core Technologies in NSTC

1. **Core Management and Design**
2. **Transient Simulations and Accident Analyses**
3. **Nuclear Fuel and Material Testing and Evaluation**
4. **Nuclear Reactor Water Chemistry Evaluation**
5. **Components Aging Evaluation**
6. **Nondestructive Testing**
7. **Concrete Structure Safety and Performance Analyses**
8. **Plant Risk Assessment**
9. **Plant Thermal Efficiency Analyses and Diagnoses**
10. **Nuclear Power Plant Design Review**
11. **Nuclear Power Plant Instrumentation and Control**
12. **Radiation Standard Measurement and Evaluation**
13. **Nuclear Accident Emergency Responses Analysis**
14. **Radiation Dose Measurement and Radiation Safety Analyses**

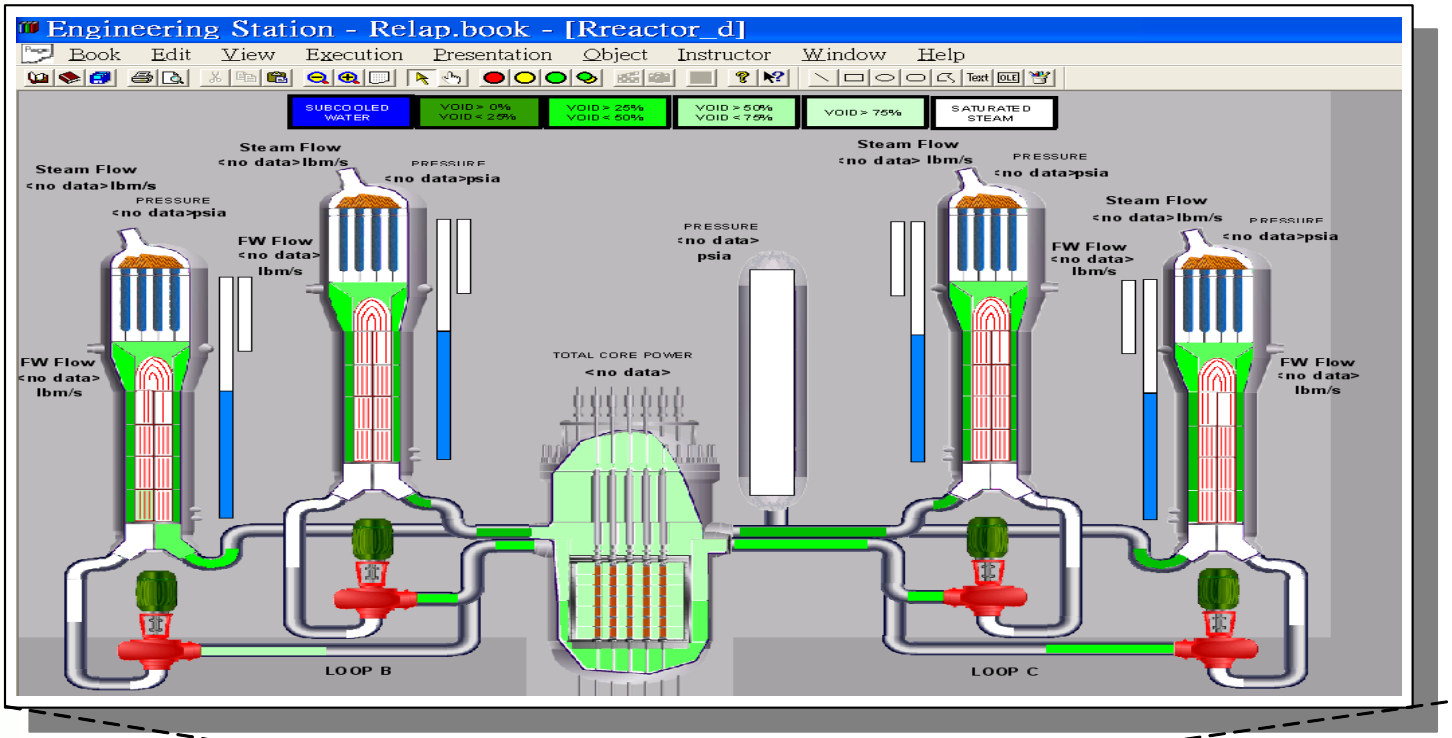
In-core Fuel Management Techniques





- Core Follow Benchmark & Core Design Evaluation
- Core Loading Pattern Design
- Core Management Application Software
- Criticality Safety Analysis
- Accident Analysis
- Fuel Bid Evaluation

Display Screen



Relap5-3DK

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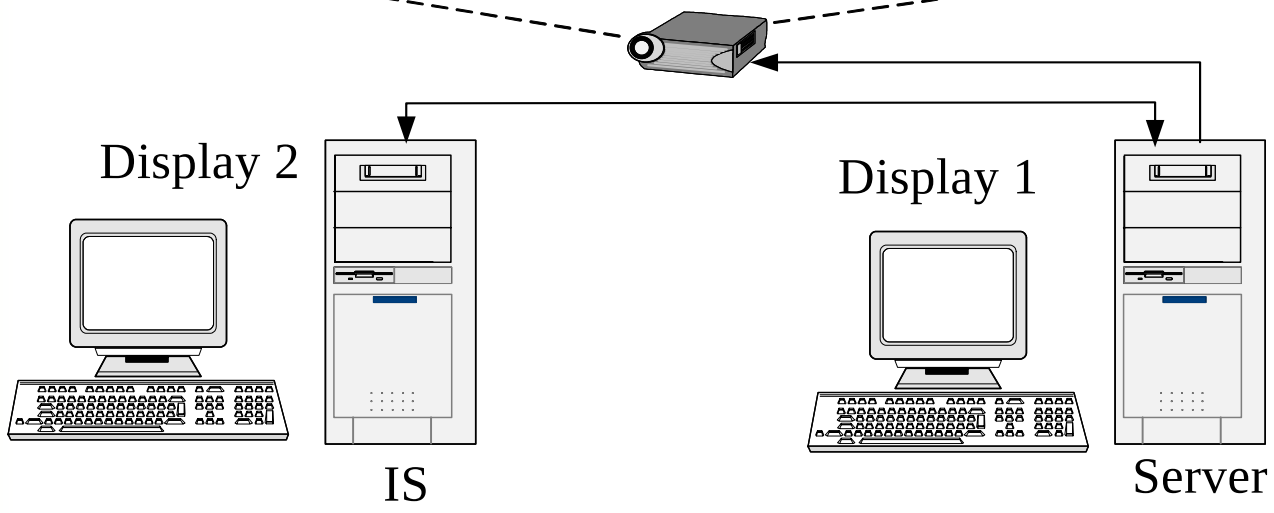
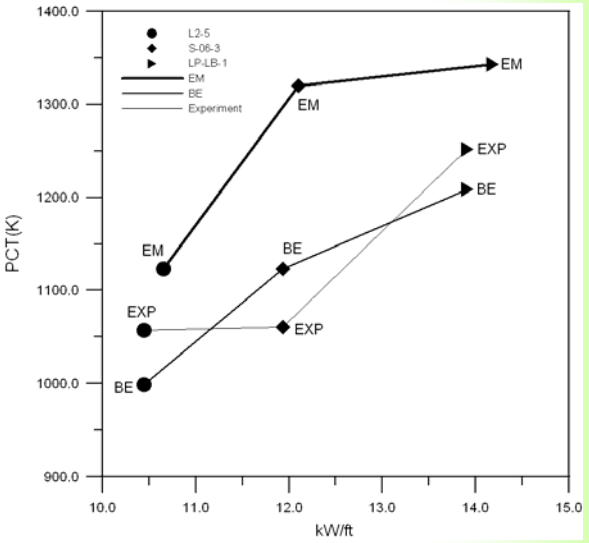
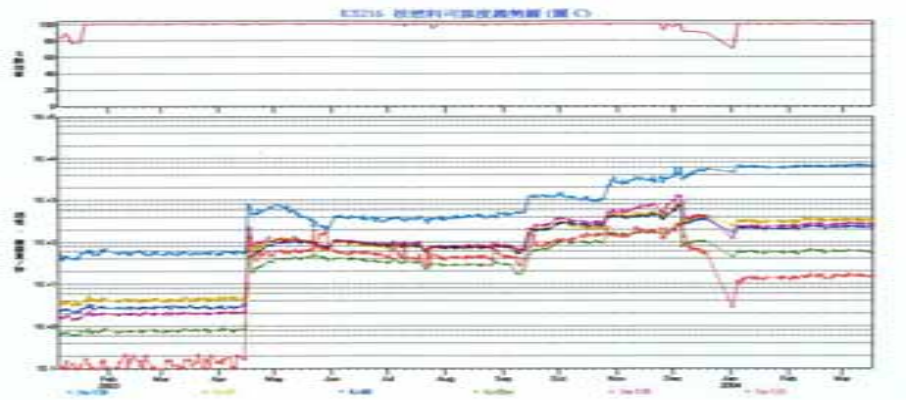


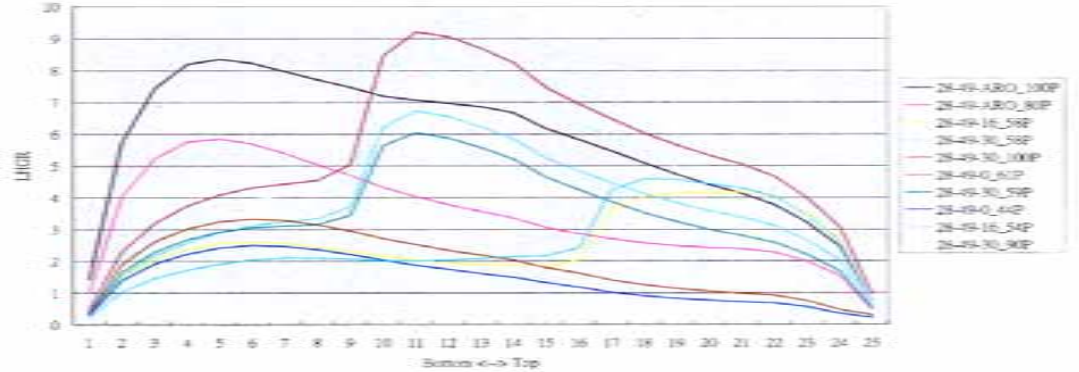


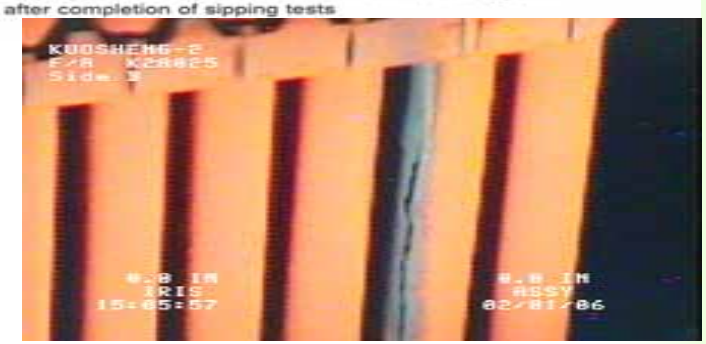
Hardware Configuration of Engineering Simulator

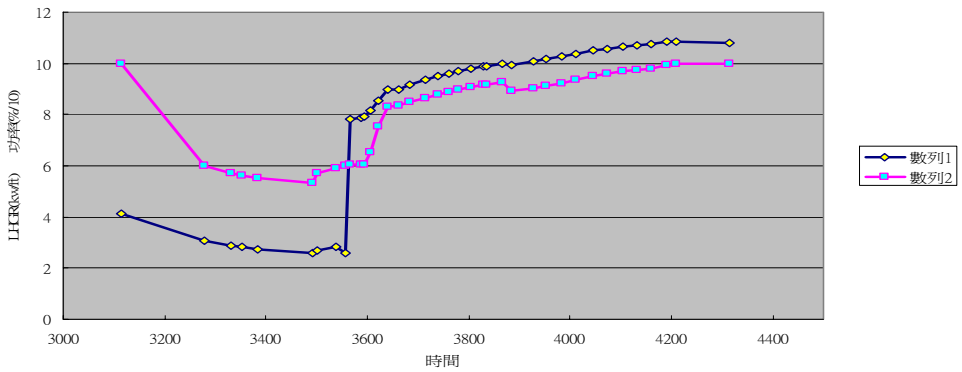
Fuel Inspection and Root Cause Analysis

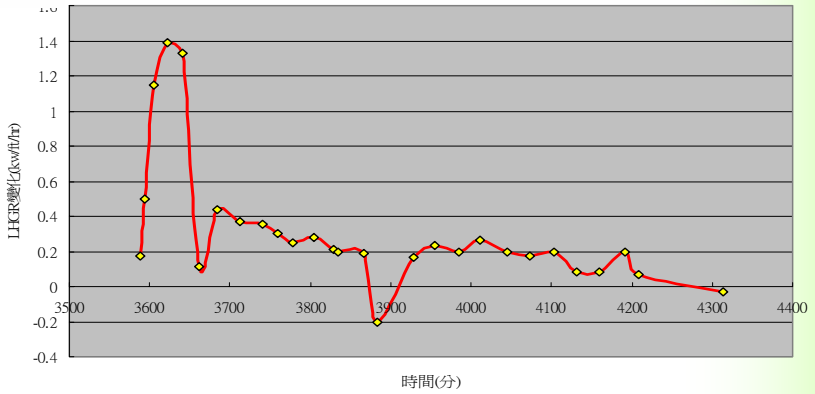


Sipping hood being disconnected from refueling platform mast after completion of sipping tests

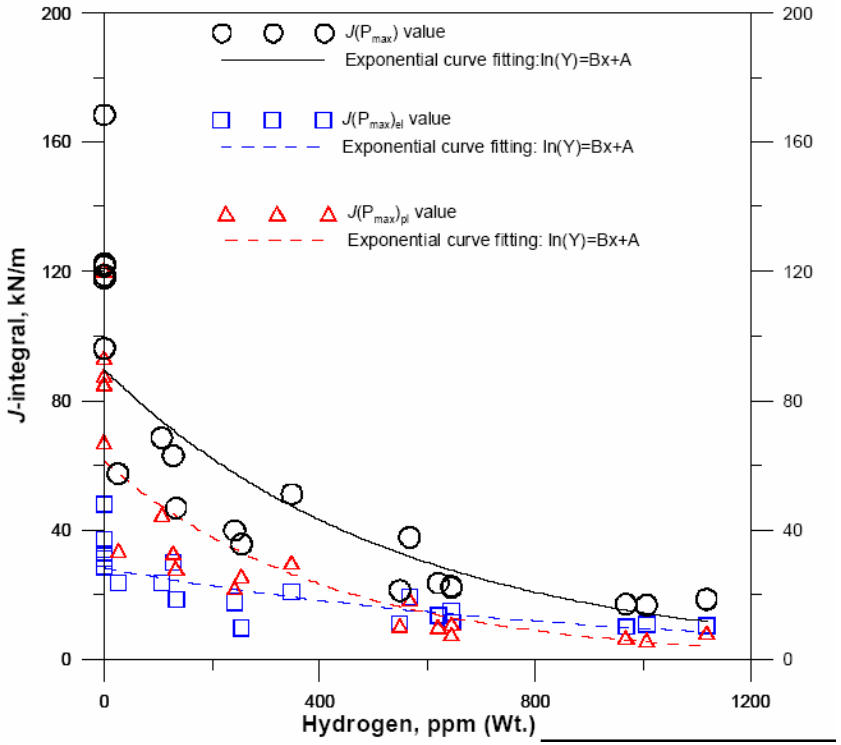


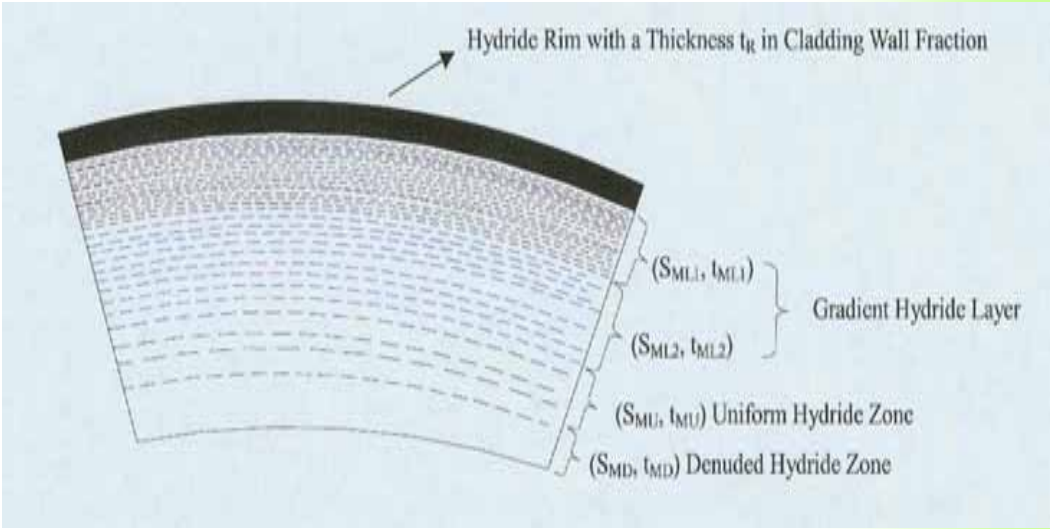


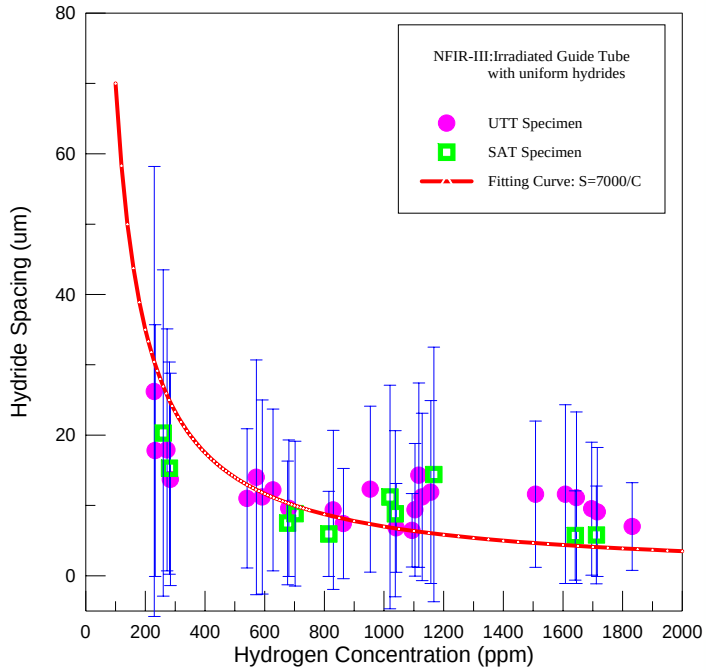




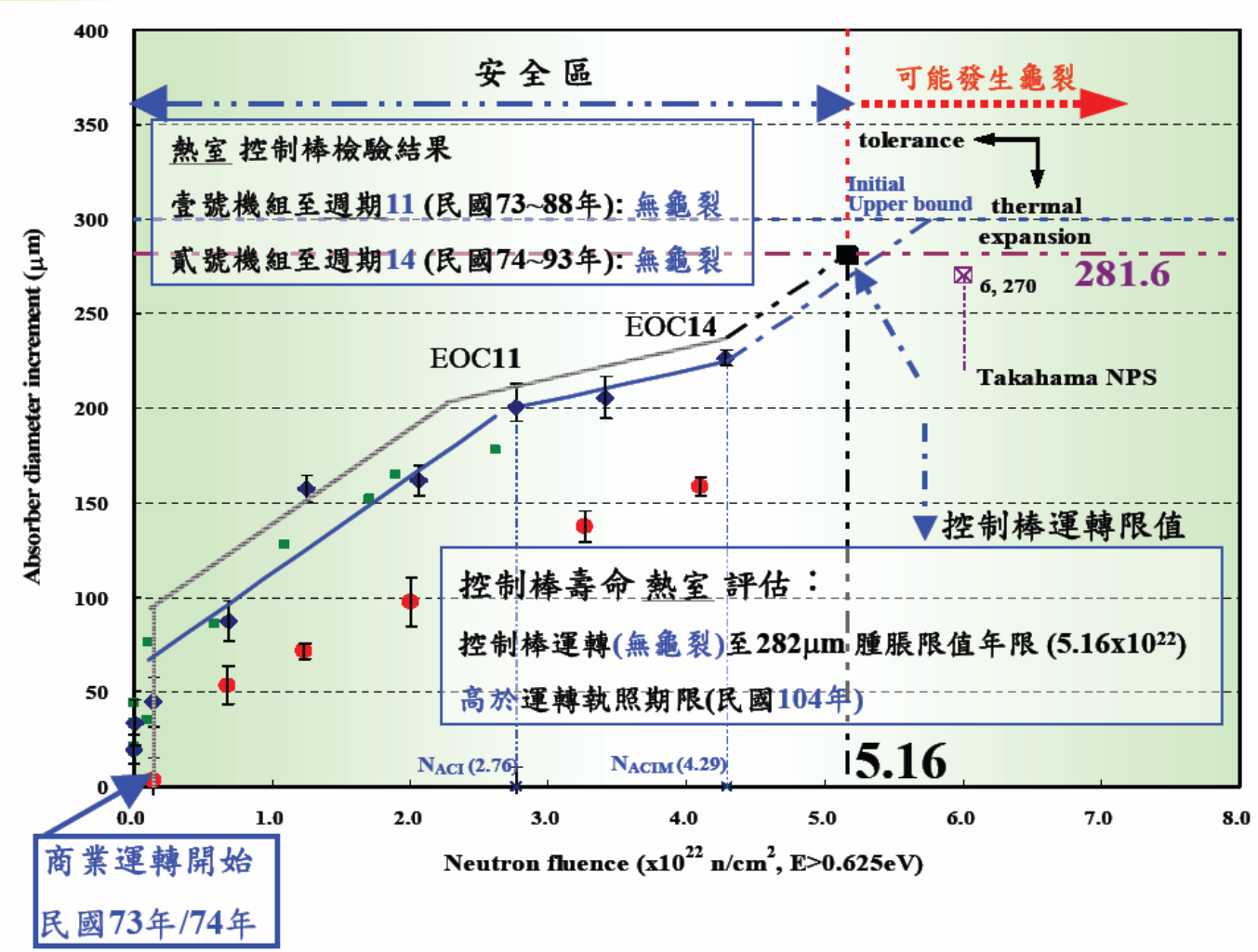
Hydride Effect on Zircaloy Cladding







Hot Cell Examination and Life Evaluation for Maanshan NP Control Rod

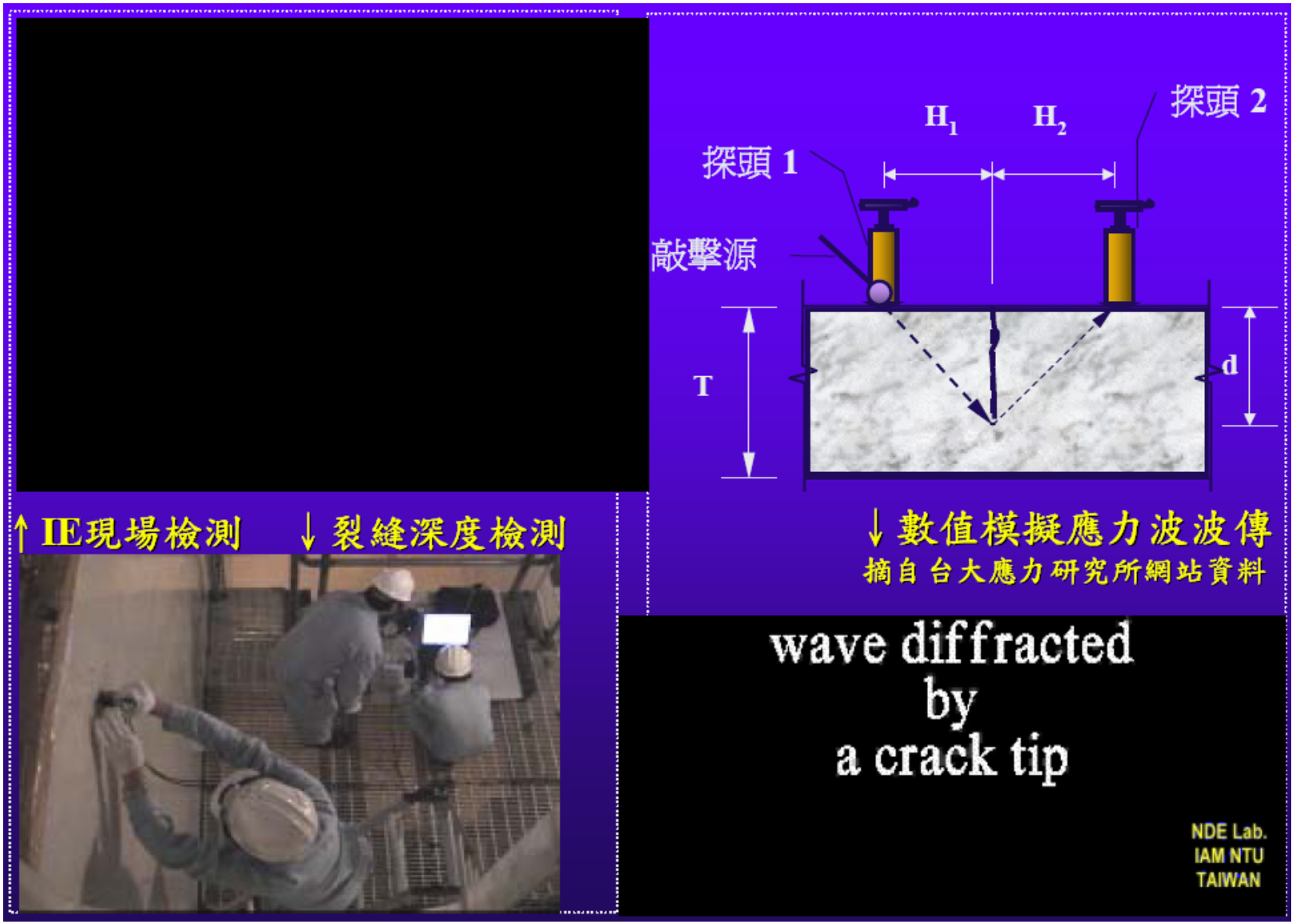


Benefits :

- Assure the Safety of Maanshan NP Control Rod
- Reduce Control Rod Replacement Frequency
- Reduce the Radwaste of Control Rod

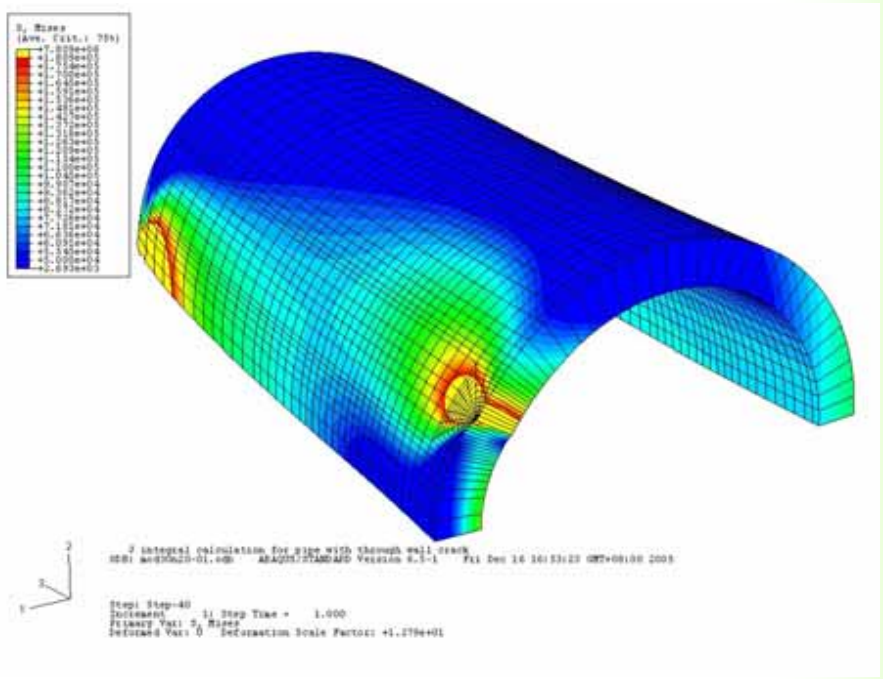
Lungmen NPP Project Pedestal Weld UT Inspection

NDT Tech. For Concrete Strucure

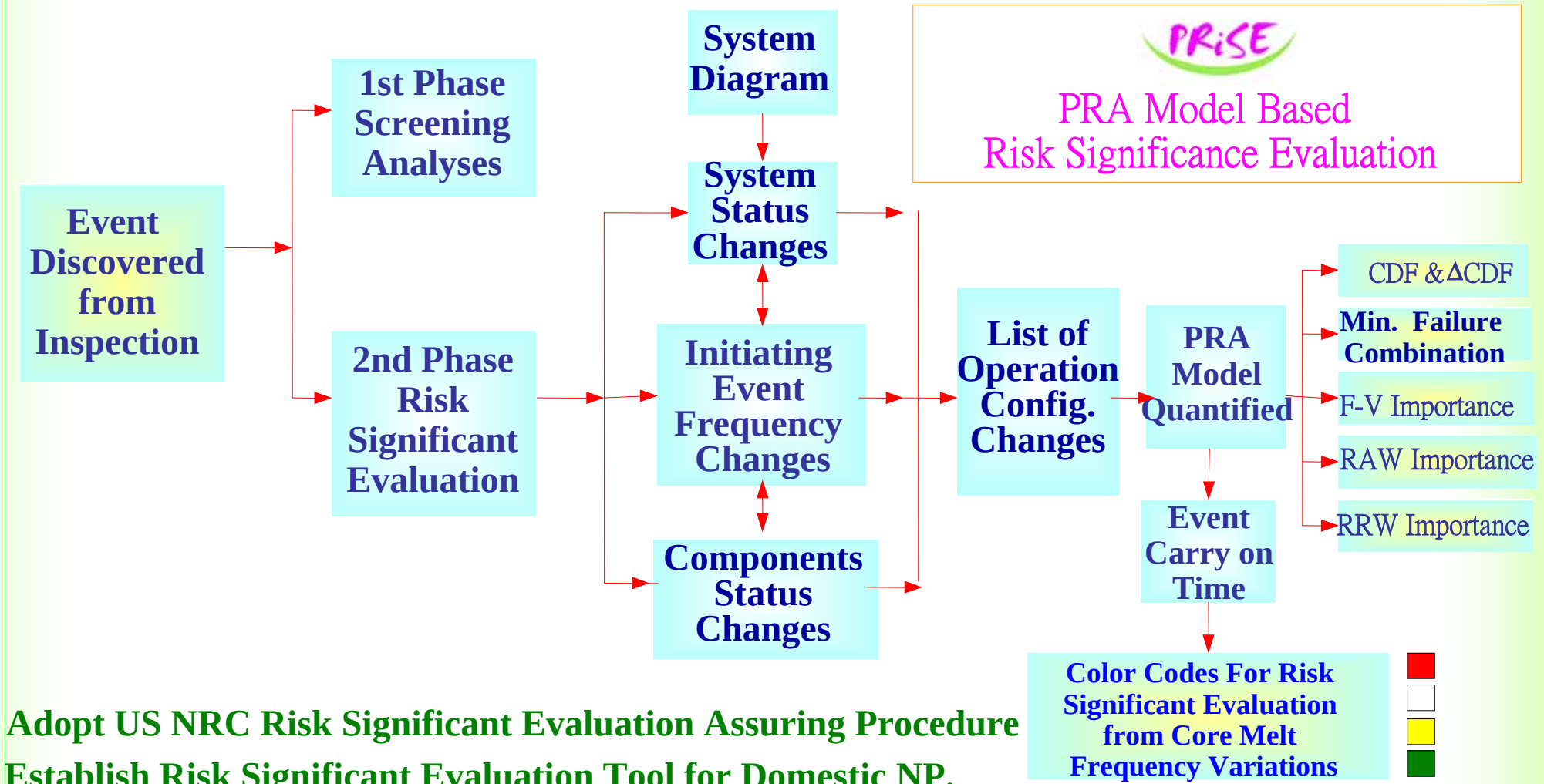


Expertises on Engineering Mechanics

- Major expertises on engineering mechanics include
  - Nuclear piping
  - Reactor vessel internals
  - Steam generator
  - BOP heat exchangers
- Main projects
  - Elasto-plastic fracture evaluation for cracked pipes of nuclear plant
  - Maintenance on BWR reactor and internals
  - Performance and retubing analysis for feedwater heaters of nuclear power plants



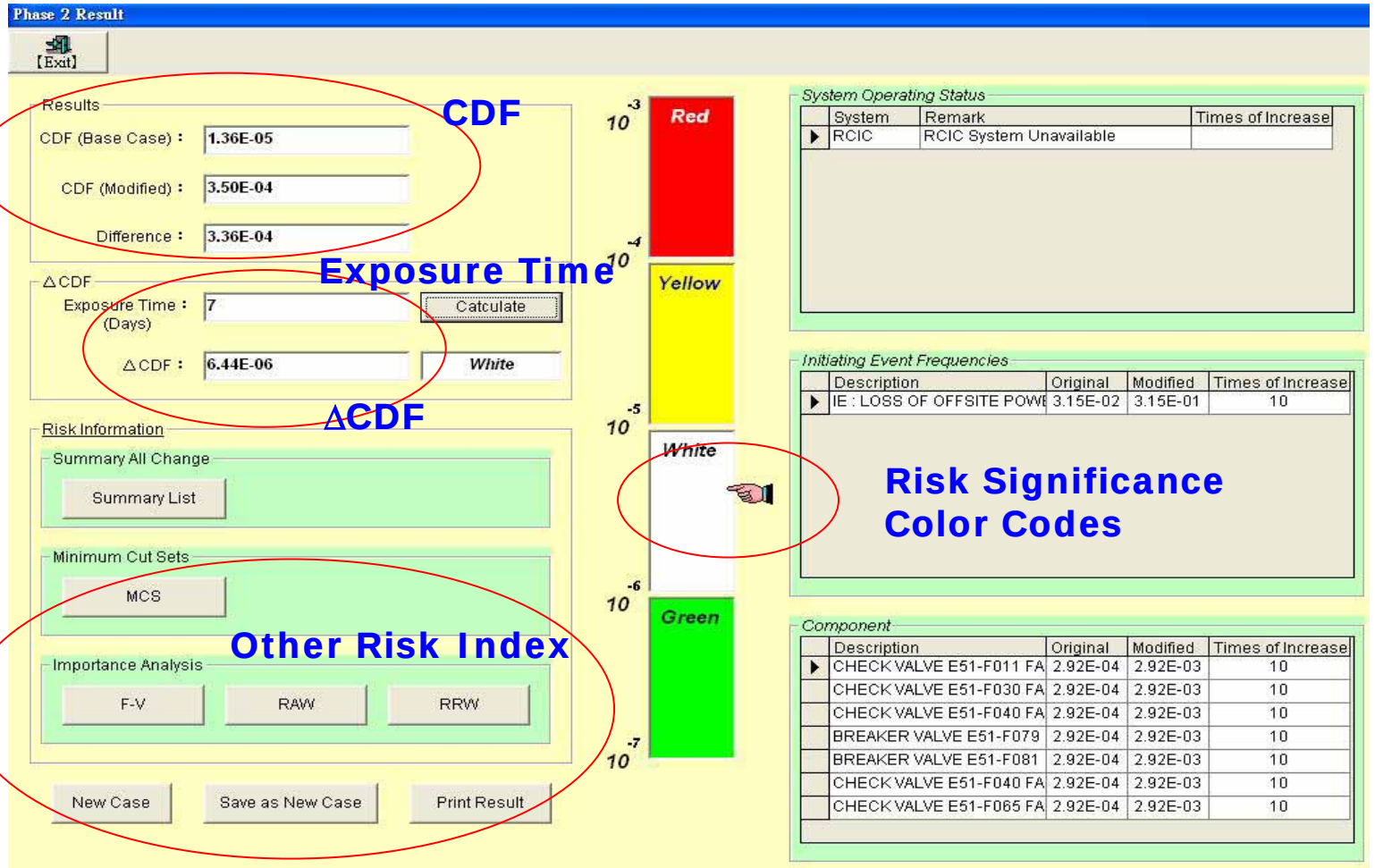
PRA Model Based Risk Significance Evaluation



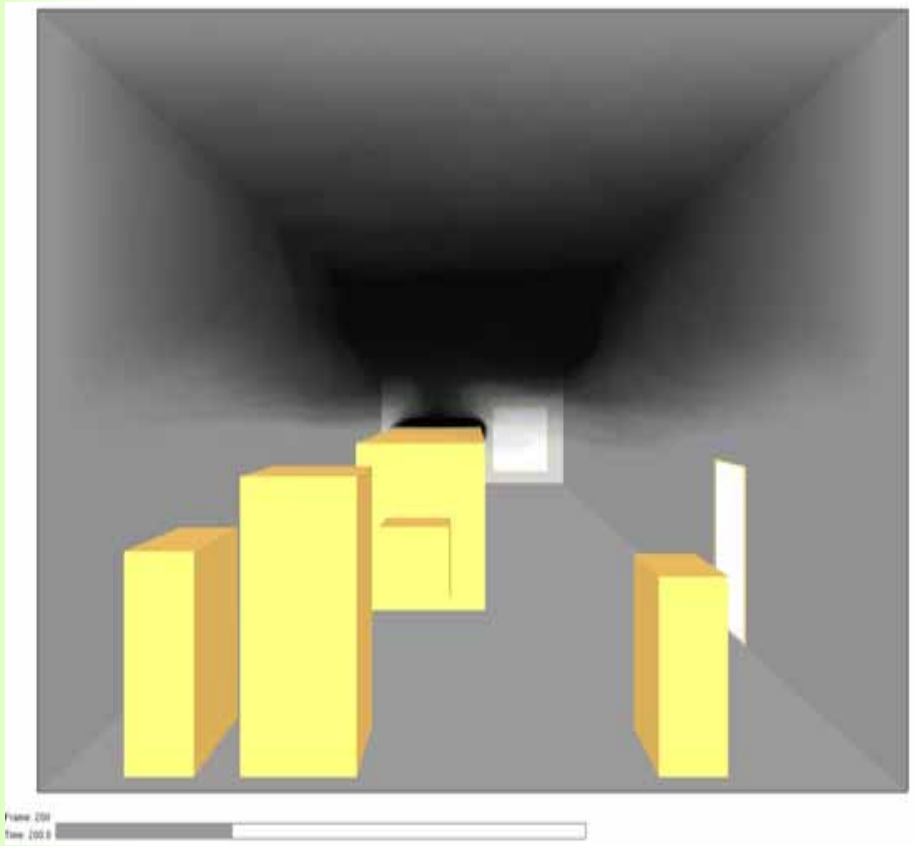
Adopt US NRC Risk Significant Evaluation Assuring Procedure

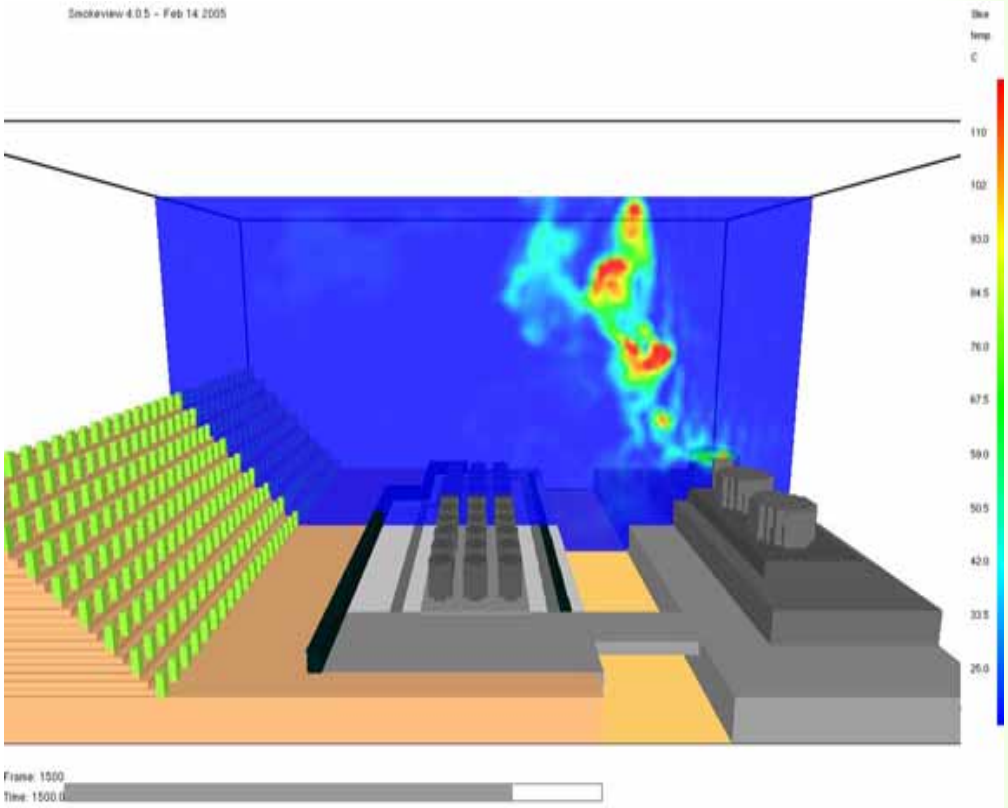
Establish Risk Significant Evaluation Tool for Domestic NP.

Risk evaluation and management



Smoke distribution and Fire Simulation of NPP and ISFSI Site





THERMAL EFFICIENCY MONITORING SYSTEM FOR KUOSHENG NUCLEAR POWER PLANT

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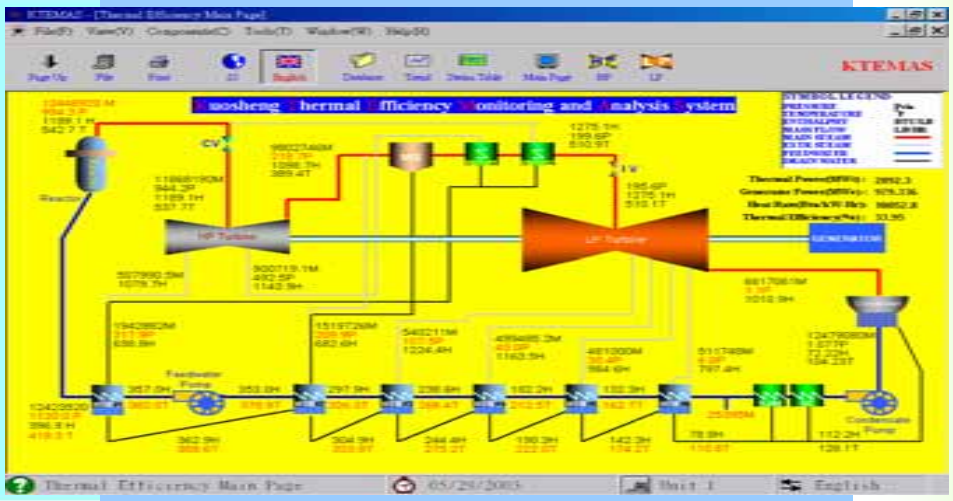
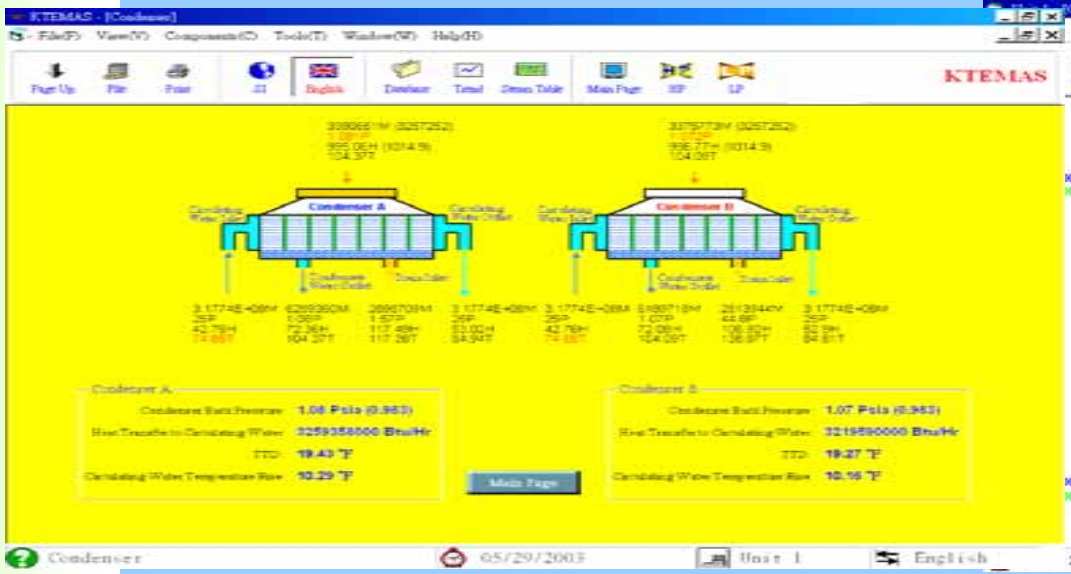




Condenser Performance Monitoring

Data Display and Trending

Digital Instrumentation and Control System

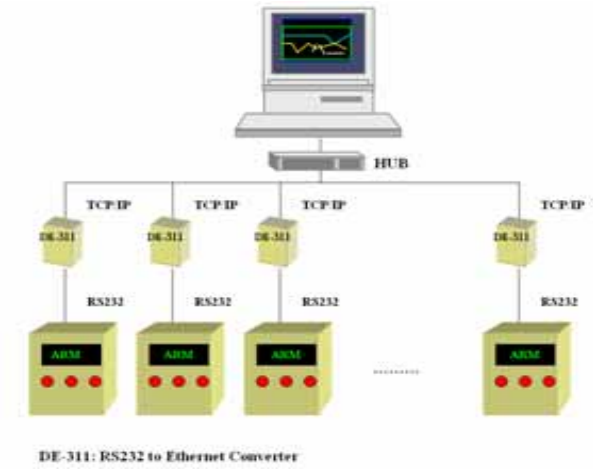
- Software Verification and Validation
- Software Safety Analysis
- Human Factors Engineering (HFE)
- Design and Simulation of Digital Control System
- I&C System Safety and Security Assessment
- Applications:
  - Licensing Review Support to AEC
  - TPC Lungmen Project - DCIS System
  - I&C Retrofit Project of TPC Nuclear Power Plants
  - OECD COMPSIS (OECD Exchange of Operating Experience concerning Computer-based Systems Important to Safety Project)

HFE Design Review

Test Bed of Digital I&C System

Integrated Control and Monitoring System of Nuclear Radwaste Facility

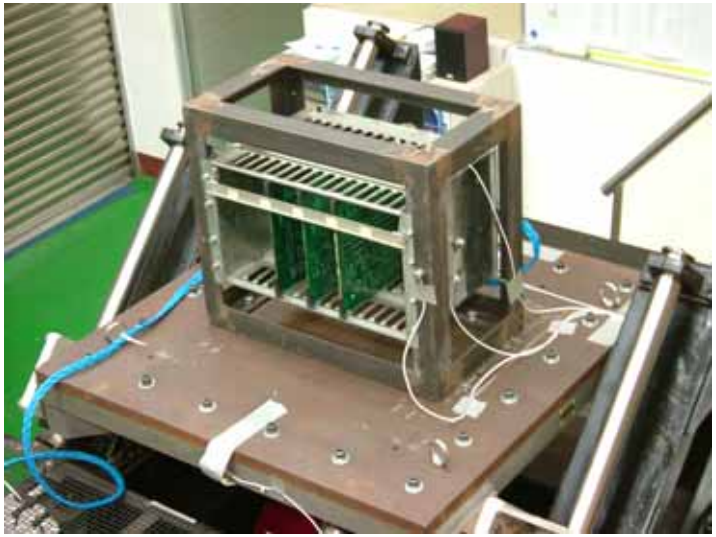
- **Visualized inventory status;**
- **Scheme for the reallocation of radwaste drums;**
- **TCP/IP-based software to exchange information;**
- **OPC-based software to integrate various PLC-based equipment;**
- **Efficient, reliable redundant database;**
- **Multi-port, real-time data acquisition system;**
- **INER designed area radiation monitoring system**



Radiation Monitoring System

Computerized Inventory Control System

Seismic Shake Table and Services for Nuclear and Non-Nuclear Components



- **Nuclear Safety Component Dedication and Qualification**
  - **EPRI NP5652: Commercial Grade Item Dedication (CGID)**
  - **IEEE Std. 323: Environmental Qualification**
  - **IEEE Std. 344: Seismic Qualification**
  - **USNRC 10CFR50 App. B: Quality Requirements**

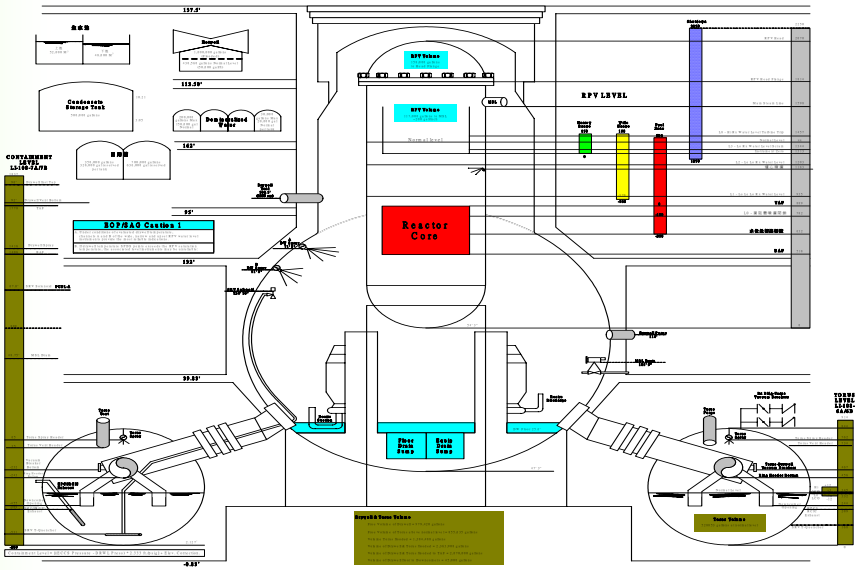
4.16 KV Breaker Dedication

Seismic Switch Dedication

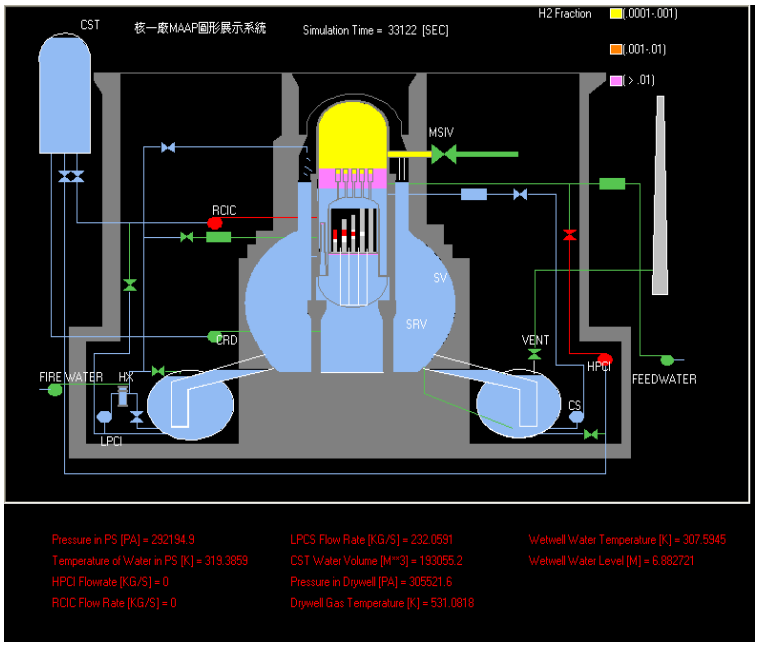
Decision Assistance Diagram for ChinShan NP Accident Management

- **The Severe Accident Management Guideline (SAMG) of Three NPPs Were Developed**
- **The SAMGs Were Applied in Emergency Response Exercise**

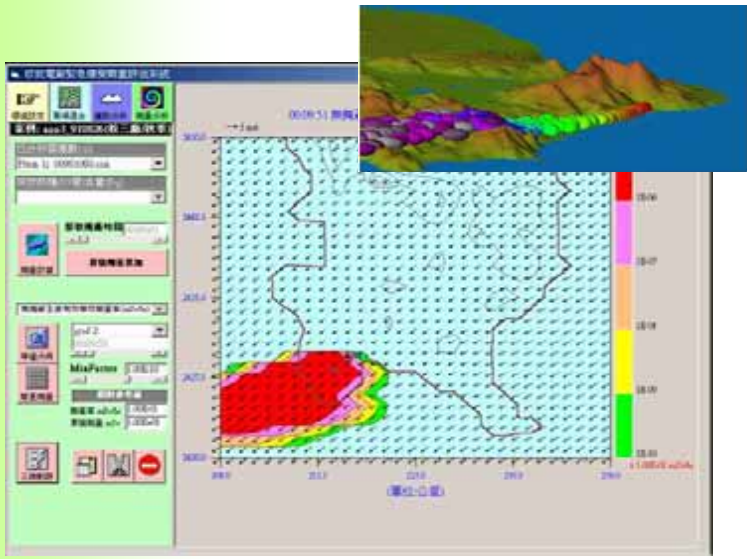
SAMG Aid of Chinshan NPP

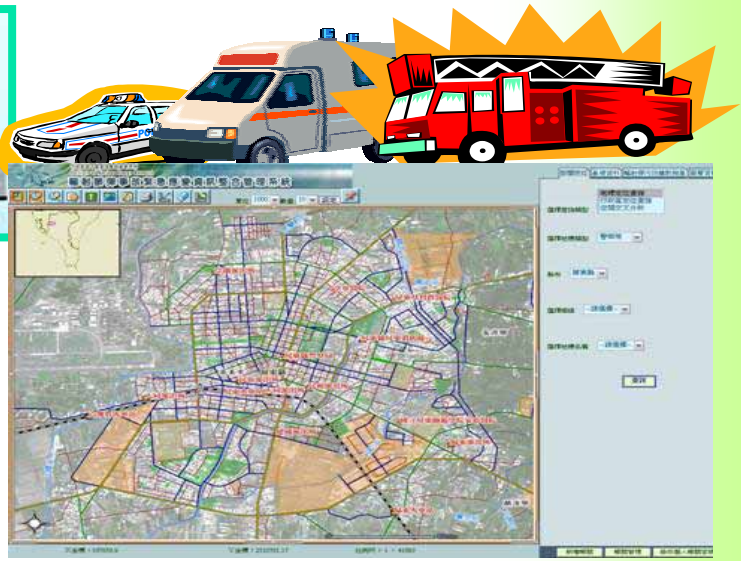


MAAP4 Graphical Display System



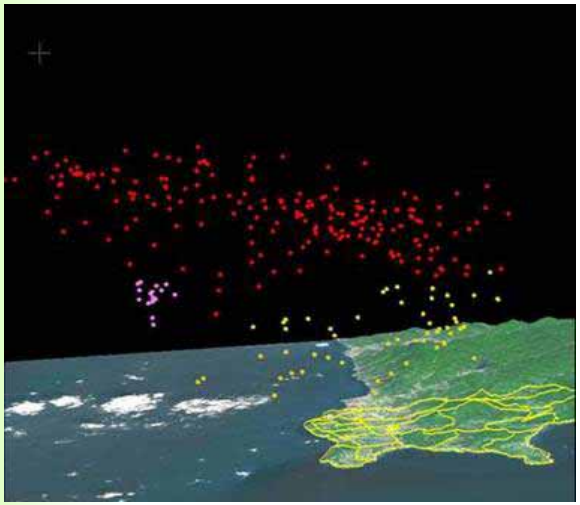
Emergency Response
(nuclear accident & dirty bomb)





Environmental radiation survey and monitor

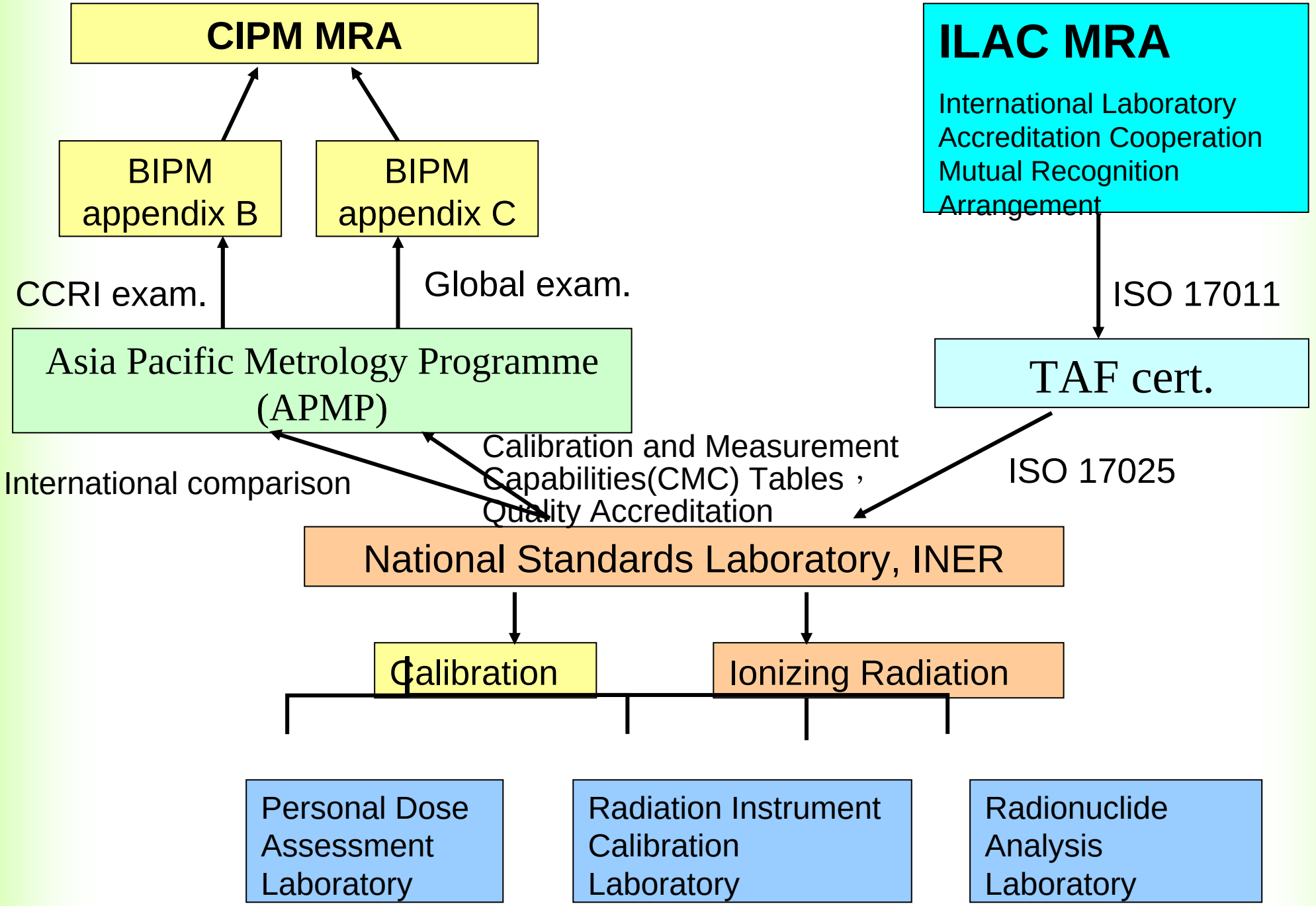
MIS (Management Information System)



Dose assessment

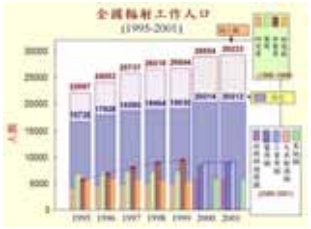
Demonstration for dirty bomb in 2004

Radiation Standard



Radiation Safety

Environmental measurement and detection center



National Program

NPP & RDD response

AEC

Medical machine and radiation source inspection

Incident management

Professional Management, inspection and Control

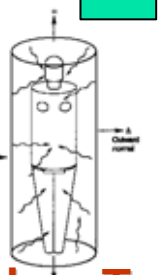
Emergency

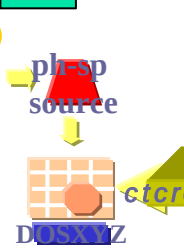
Environmental monitoring

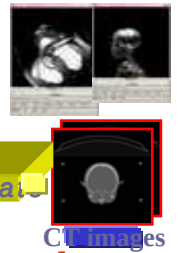
Radiation control

Dosimetry

Safety

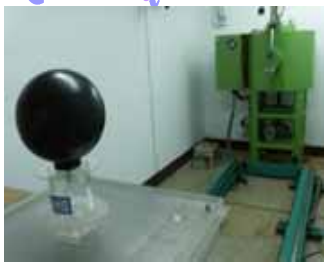




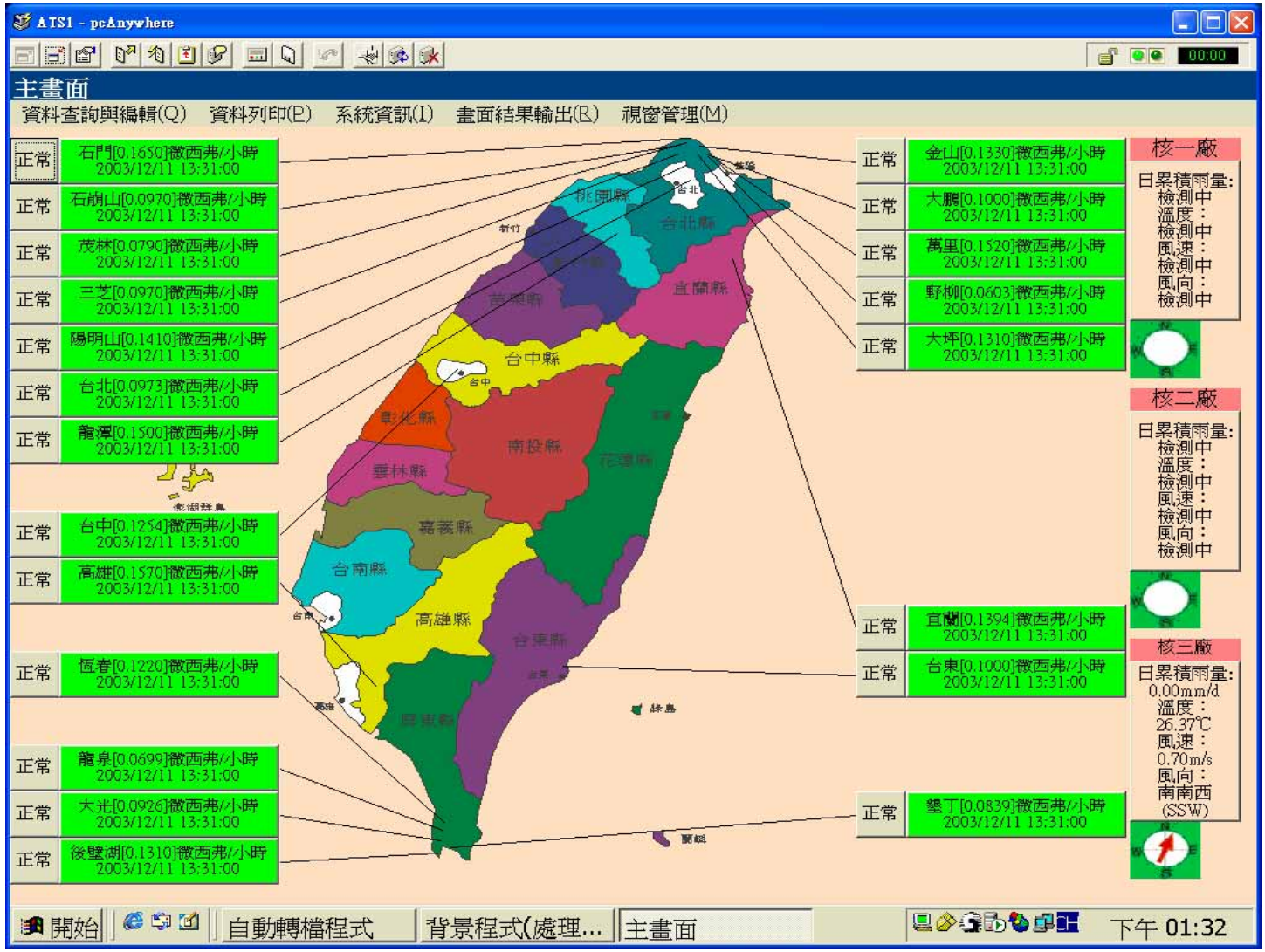


Professional Knowledge, Technology and Research

Service & Quality



The Environmental Radiation Monitoring Network System of Taiwan Radiation Monitoring Center



CLEARANCE

AEC → **Regulations on Clearance Level for Radioactive Waste Management** — Dec. 29, 2004

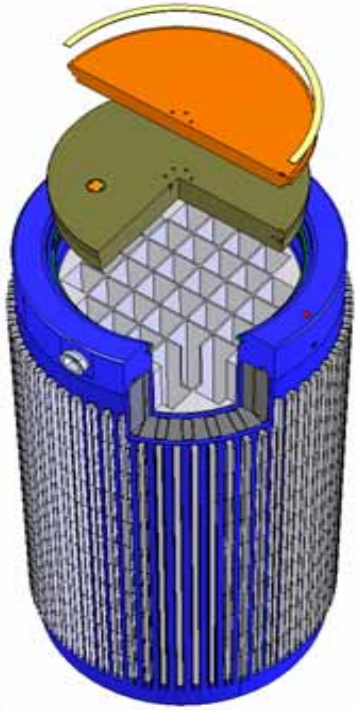
INER → **Decommissioning Technology**
Decontamination Technology
Clearance planning
Radioactivity Survey and Measurement
Sampling and Radioactivity Analysis
Environmental Monitoring
Radiation Dose assessment
Instrument Calibration
Data-base Knowledge Management
Radioactive Waste Management

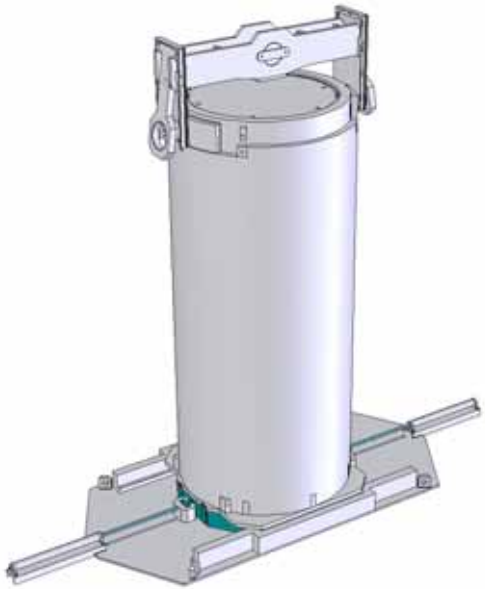
NPP Facility → **Release** ← Radiated operation area



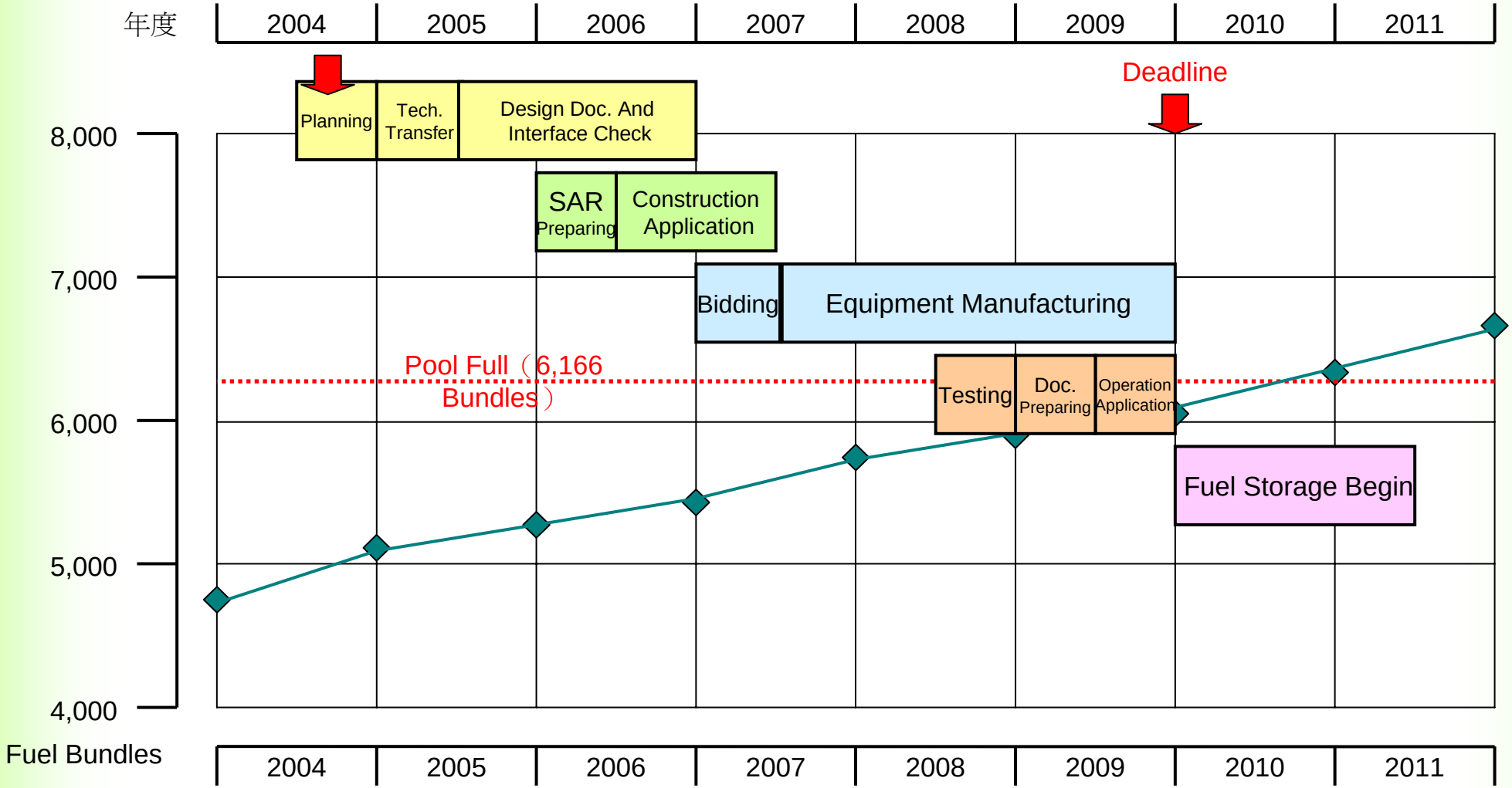

Spent Fuel Management

- ISFSI interim dry storage technology





Timetable of Kuosheng NP Spent Fuel Interim Storage



INER's Main Facilities for Radwaste Management

- Radwaste Treatment Plant
- Radwaste Storage Facilities
- Contaminated Metal Melting and Casting Plant
- Plasma Melter Plant
- Radwaste Solidification and Volume Reduction Laboratory

TRR Reactor Shielding Block Removal

Initiation of TRR Reactor Shielding Block Removal 2003.11.5

Clean-up the Spent-Fuel Pool

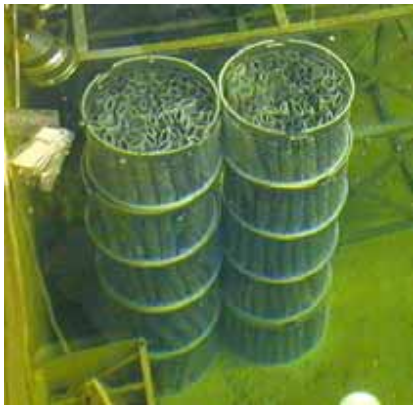
TRR Wet Storage Tank Removal

TRR Shielding Block Removal Accomplished on 2004.4.20

Dismantled Concrete Block Preparing for Storage

Aluminum Tube Inside the Spent Fuel Pool

Handling Equipment for Aluminum Tube



Aluminum Tube Cutting and Packaging

Equipements for TRR Fuel Stabilization and the Oxidized product

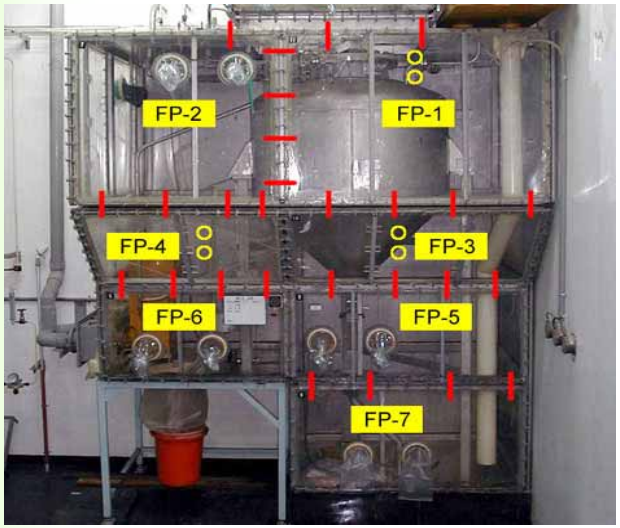
U Powder Collection and Sedimentation Tank

Mo-99 Facility at Bldg. 14 started dismantling on 2003.6.20

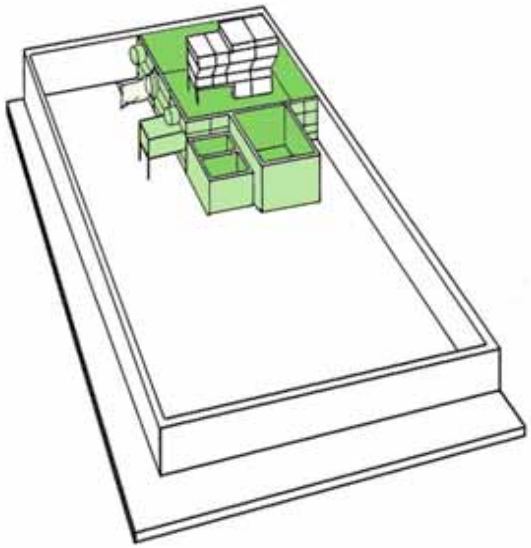
Equipments Outside Hot Cell being Dismantled

Staffs Preparing to Enter Hot Cell

Equipments Inside Hot Cell Dismantled



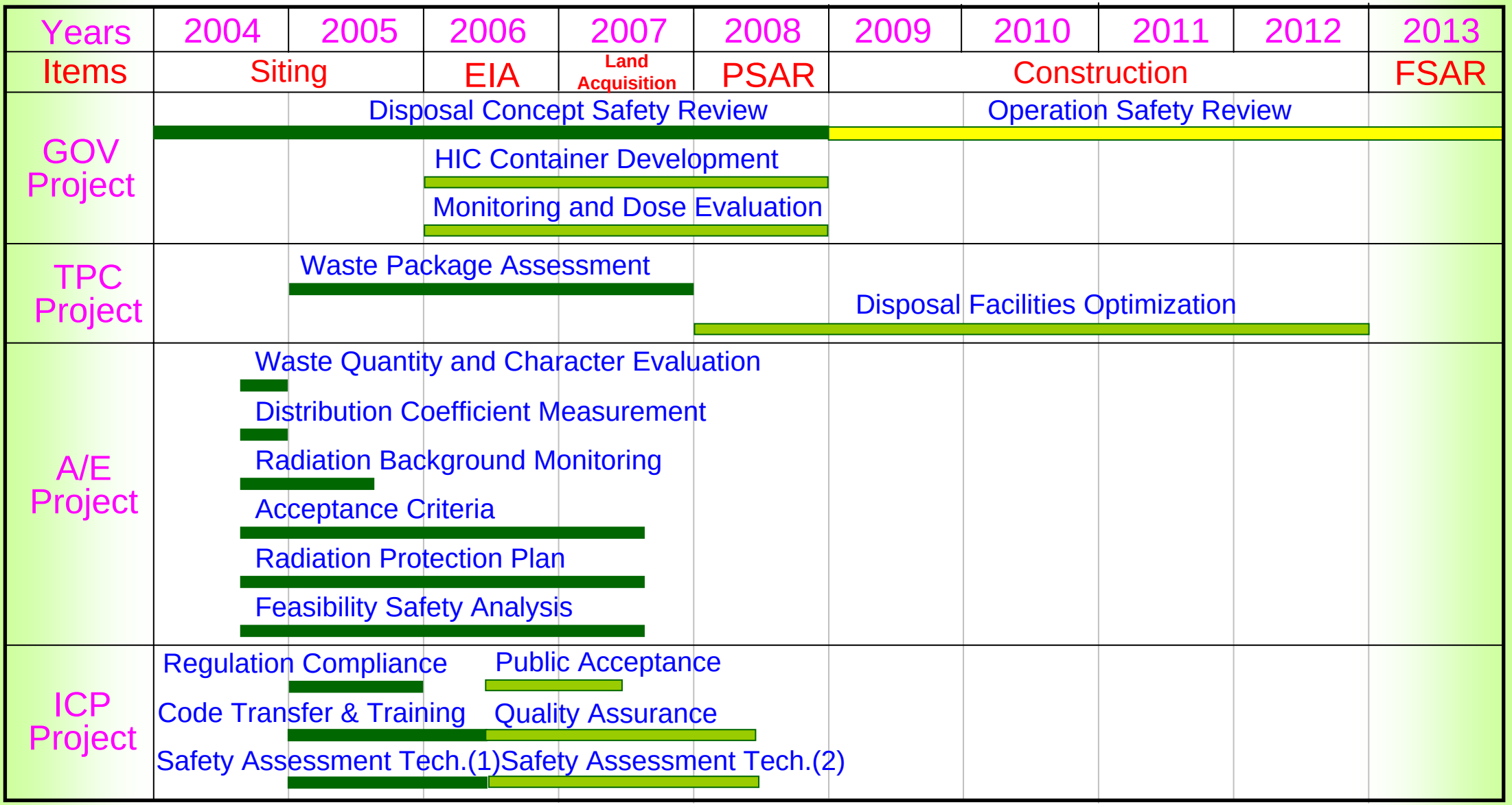
Planning to Dismantle Unit 21 Glove Box at Bldg. 016



A Design of PC Tent

Personnel Training

Timetable Of Low-Level Waste Disposal R&D



■ Plasma Melter

※ Handling Low Level Solid Waste，
Volume Reduction Efficiency 1/5～1/2，
Reducing Storage Pressure and Reduce
Final Disposal Costs。

The Press Conference for Cooperation Between INER and China Shipbuilding Corp. in Taiwan

＊Expect to Complete Test and Operational License Application in 2004

＊Torch Life >500 Hr in 2006

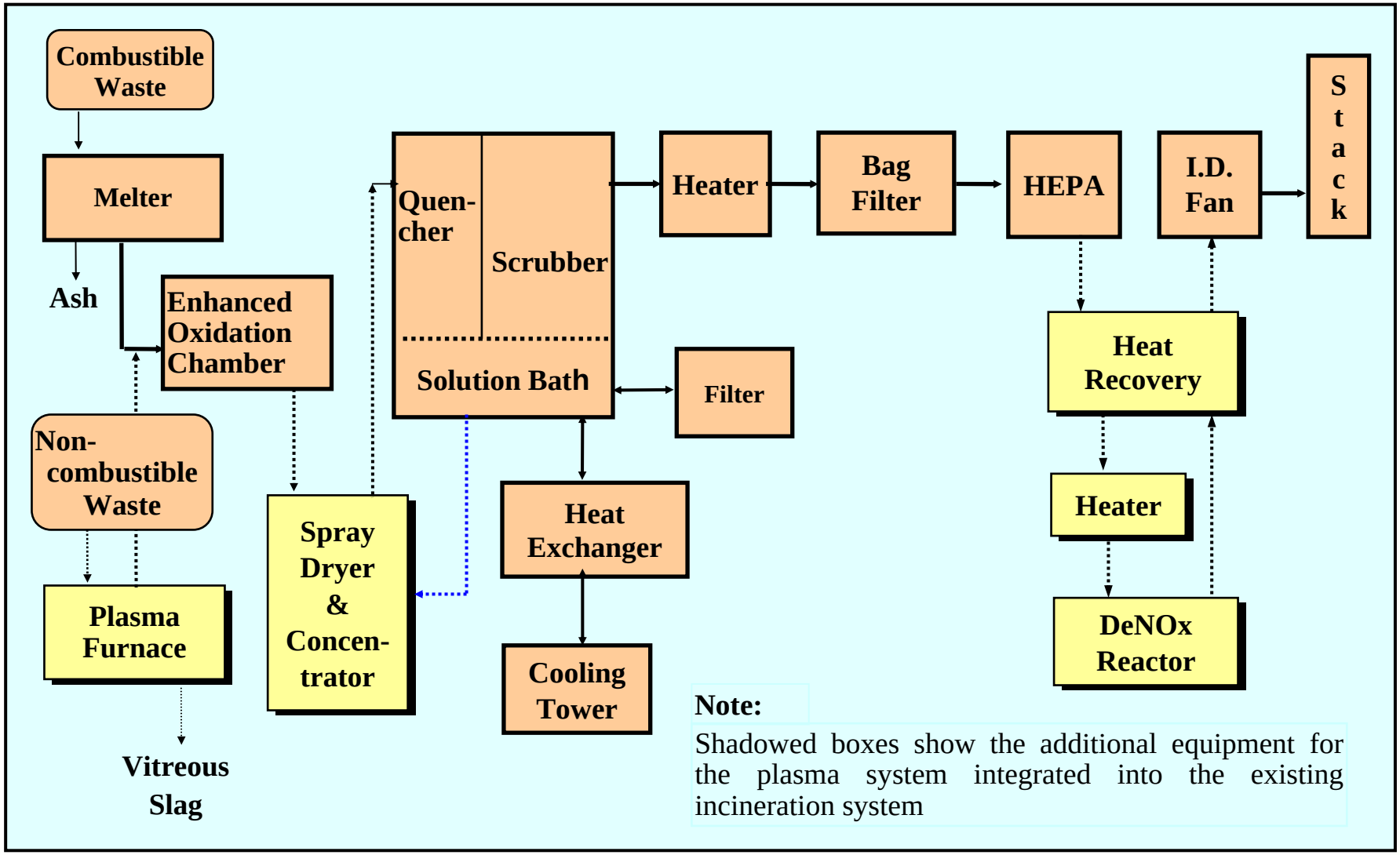
INER's Plasma Melter

INER-PF250R LLW plasma Melter

INER-100NT Plasma Torch

INER-1200T Plasma Torch

Schematic diagram of LLW plasma melting process



Photos of Municipal Solid Waste Fly Ash and Vitreous Slag

MSW Fly Ash

Vitreous Slag

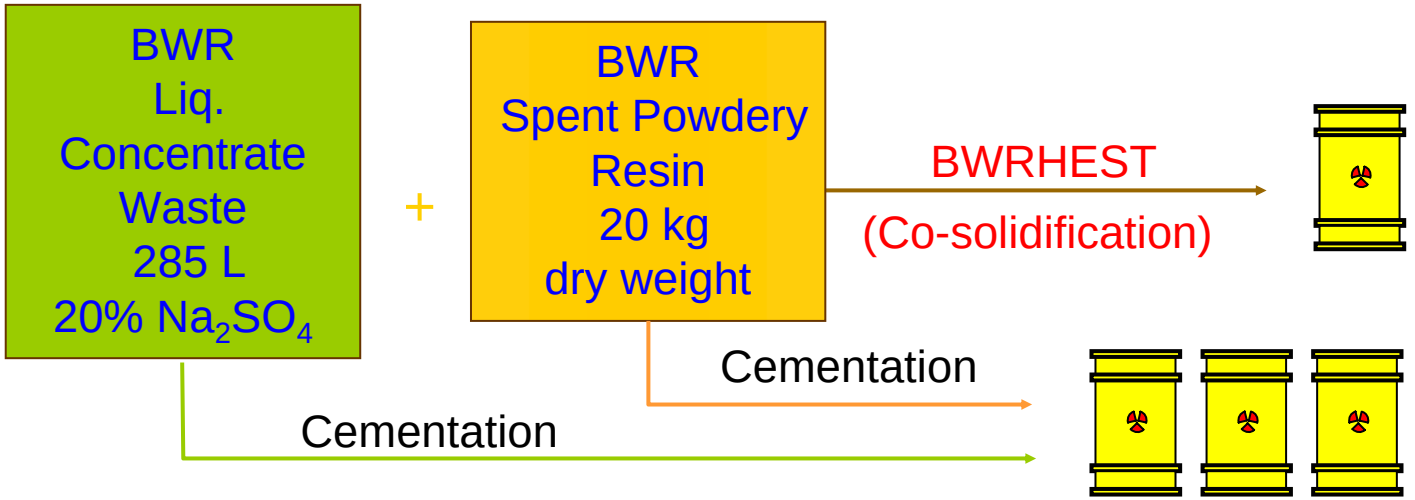
WOHEST Cooperation Project between INEEL and INER

- WOHEST：
  - A combination of the Wet Oxidation Technology (WOT) and the High Efficiency Solidification Technology.
  - The total solution for volume reduction and solidification of liquid wastes & spent ion exchange (IER) resins from PWRs and BWRs.
- Objective of cooperation：

  To promote INER's WOHEST technology for the treatment of radioactive spent ion exchange resin (IER) in US market.

BWRHEST

- BWRHEST
  - Accomplish “solidify wastes with wastes” by co-solidification of BWR wastes resulting in high volume reduction



Comparison of solidified-waste volume by BWRHEST and cementation

Closing Remarks

- Close Cooperation with American Organization

  USNRC : CAMP, COOPRA, CSARP, BINP

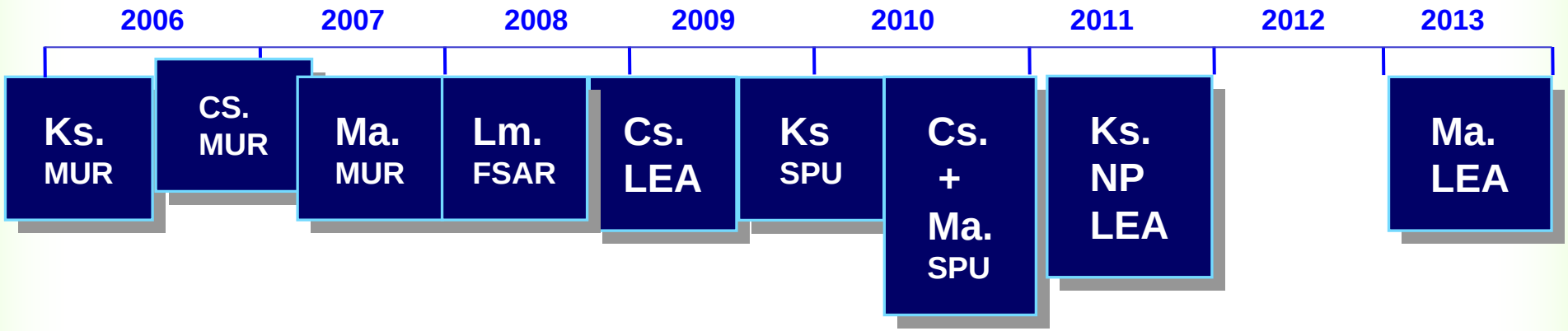
  Nation Lab. : SNL, BNL ,INL, ORNL,ANL

  Vendor : GE, W, FANP-Richland, NAC

  Other Organization : EPRI, NIST

Closing Remarks

Forecast of Taiwan's Nuclear Power Plants Activities



Evaluation of the Synergistic Effects of LR, PUR and Short Outage

Thank you for your Attention