

# **KINS-IAEA Workshop on Safety Review and Assessment for Licensing NPPs,**

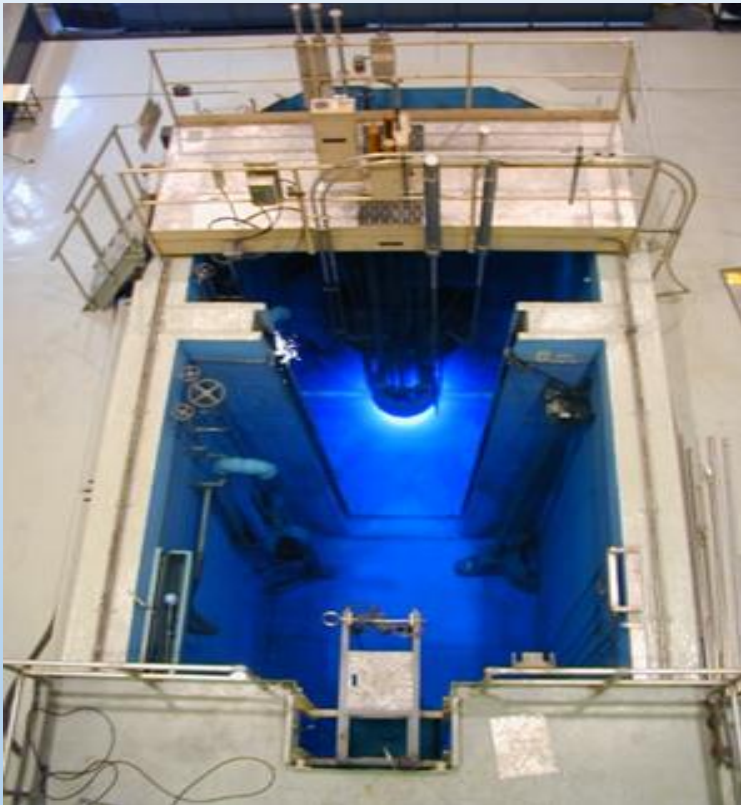
**Conducted by Korea Institute of Nuclear Safety (KINS)**

**Daejeon, Republic of Korea**

**27 ~ 31 May 2019**



# Safety Management at “Thai Research Reactor”



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OFFICE OF ATOMS FOR PEACE



# Safety Management at “Thai Research Reactor”

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- About Thailand Institute of Nuclear Technology (Public Organization) or TINT
- About Office of Atom for Peace
- Thai Research Reactor1/Modification1 (TRR-1/M1)
- Reactor Characteristics, Facility and Utilization
- Enhancement of Reactor Management
- Safety Management for TRR-1/M1
- Conclusions



# Safety Management at “Thai Research Reactor”

Thailand Institute of Nuclear Technology (Public Organization)

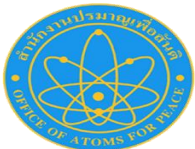
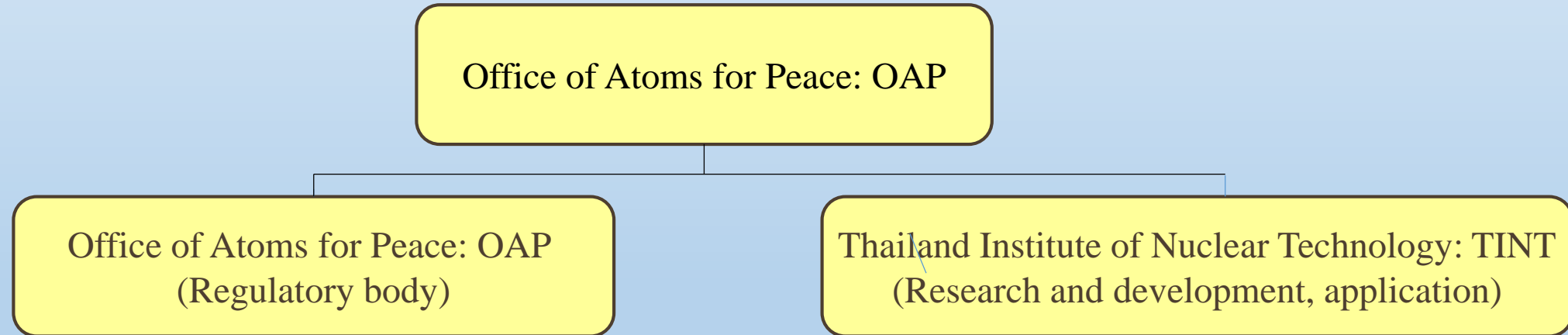
TINT



# Safety Management at “Thai Research Reactor”

## Thailand Institute of Nuclear Technology (Public Organization)

- Established in 2006
- Formally a part of Office of Atoms for Peace



# Safety Management at “Thai Research Reactor”

## Thailand Institute of Nuclear Technology (Public Organization)

### **Mission :**

- Carry out the research and development on nuclear science and technology for sustainable development of the country
- Transfer technology and provide consultancy services regarding the utilization of nuclear technology for socio-economic and environmental development
- Administer and operate the research reactor and other facilities, and provide nuclear technology and nuclear safety services to the public
- Promote a nuclear network and cooperate with organizations and research institutes, both domestic and international
- Disseminate and build up public acceptance on the utilization of nuclear science and technology for national



# Safety Management at “Thai Research Reactor”

**Thailand Institute of Nuclear Technology (Public Organization)**

## Organization

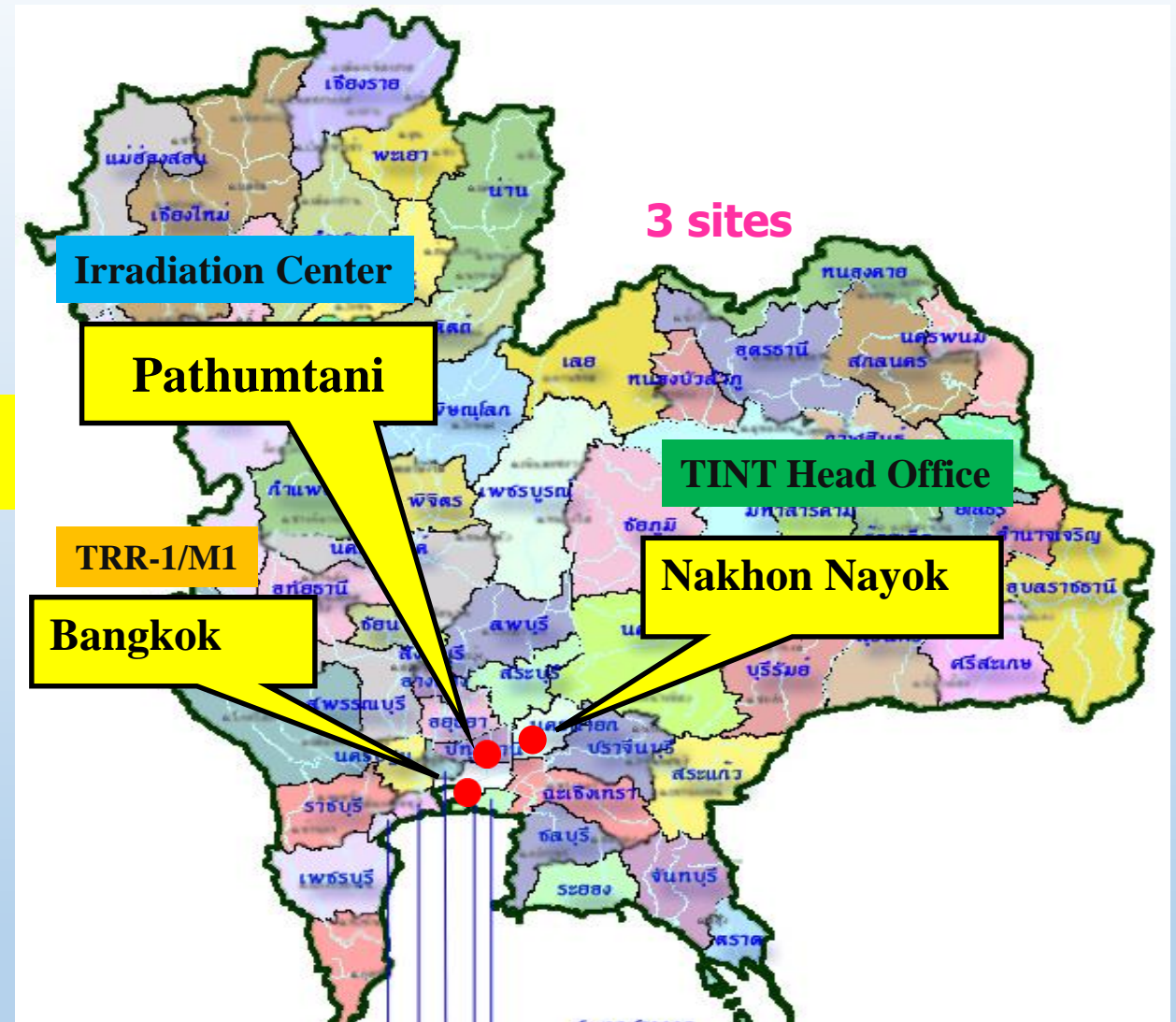
- Consists of 6 centers, 3 divisions, 4 units
- Approximately 230+ permanent staffs and 200+ temporary staffs
- 3 office sites – Headquarter (Nakhon Nayok), TRR-1/M1 (Bangkok), Irradiation Center (Pathumtani)
- Nuclear and radiation facilities: Research Reactor, Electron beam facility, Co-60 facility etc.





# Safety Management at “Thai Research Reactor”

Thailand Institute of Nuclear Technology (TINT)





# Safety Management at “Thai Research Reactor”

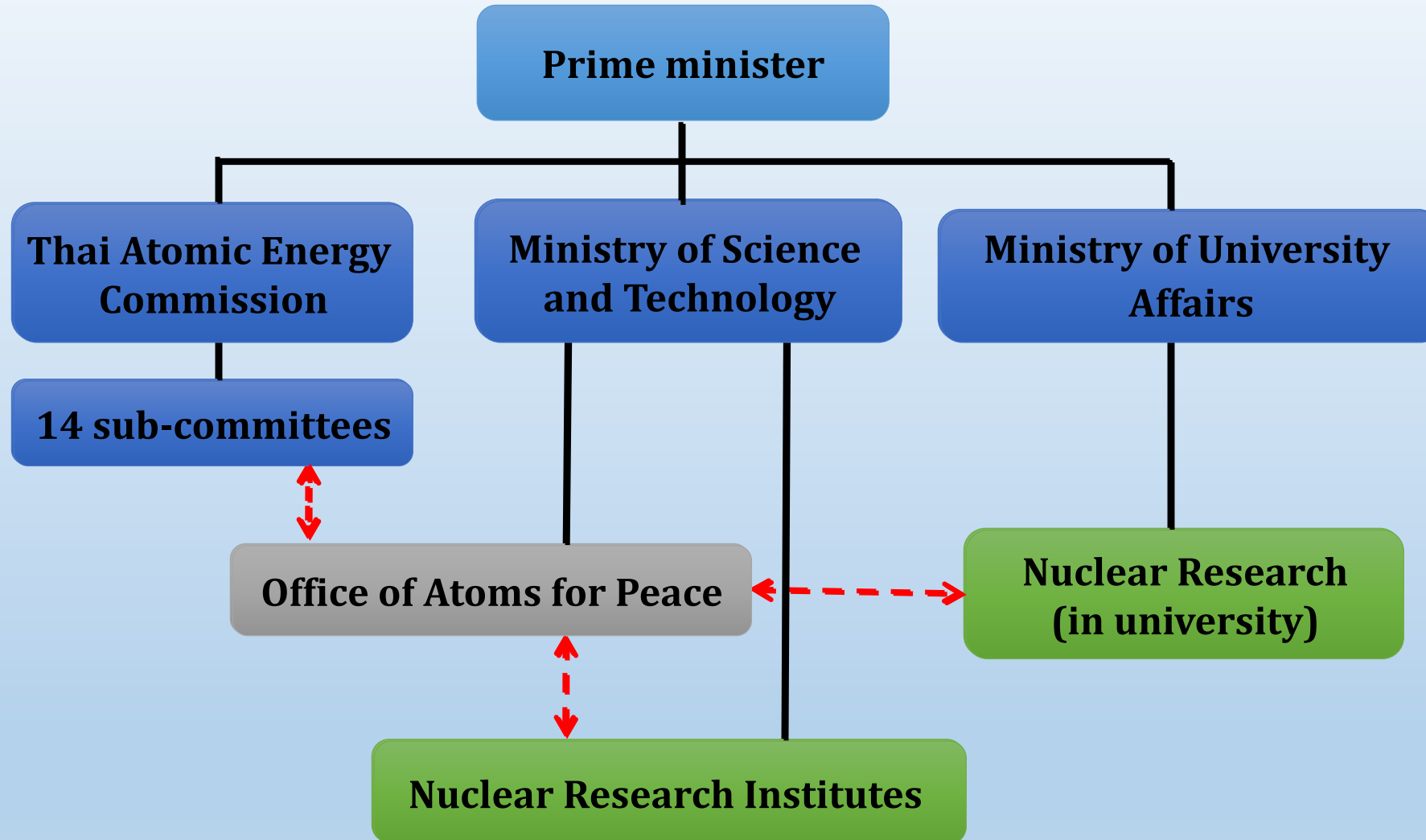
Office Of Atoms For PEACE

OAP

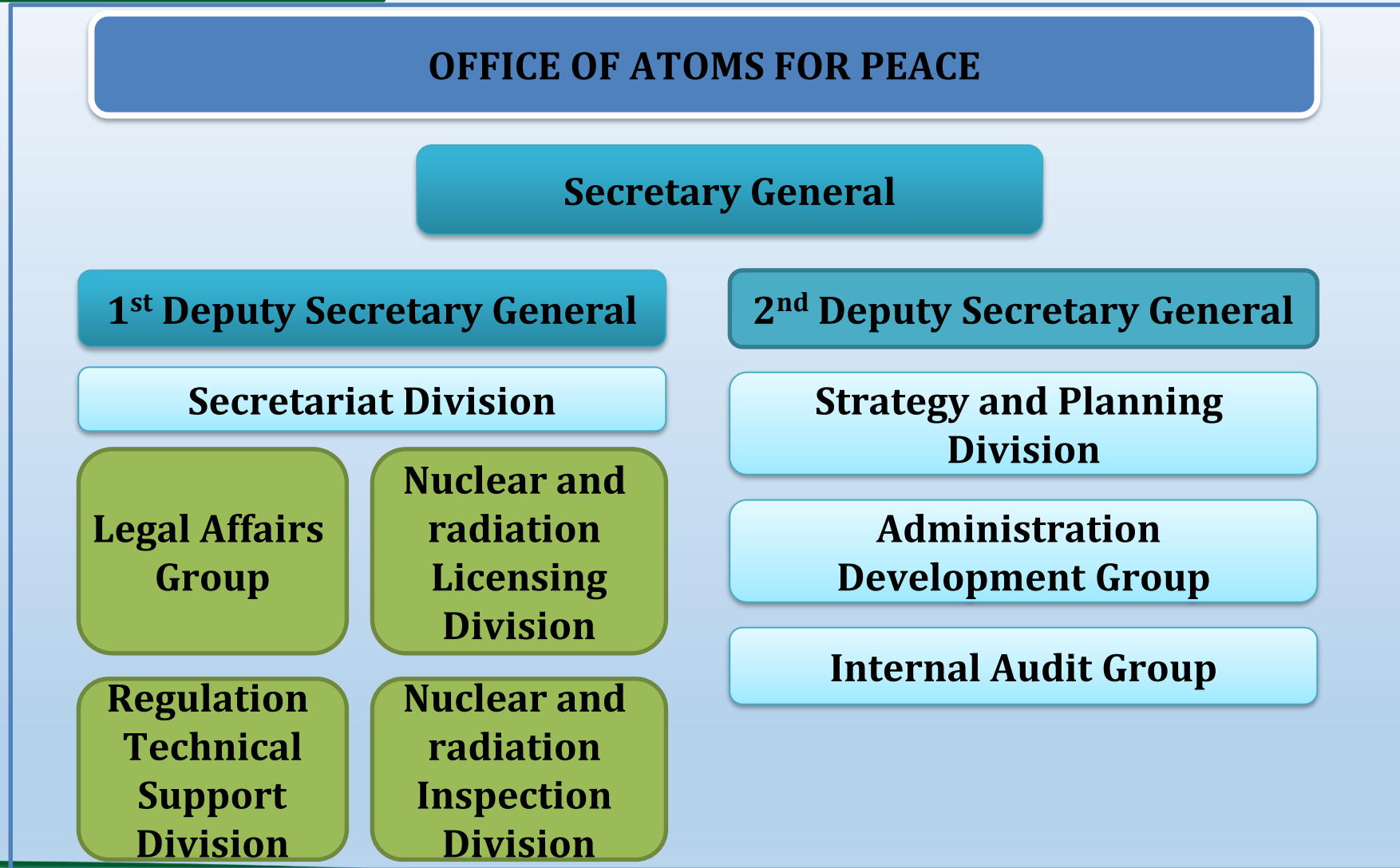


# Safety Management at “Thai Research Reactor”

## The organization of OAP



## **The organization of OAP**



## Safety Management at “Thai Research Reactor”

## History of Nuclear Law



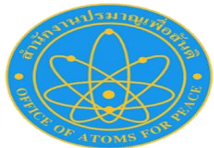
In 1965, Revised Act and Ministerial Regulation

In 2006, Establishing Nuclear Institute of Technology (TINT), to mainly focus on nuclear research conduction.

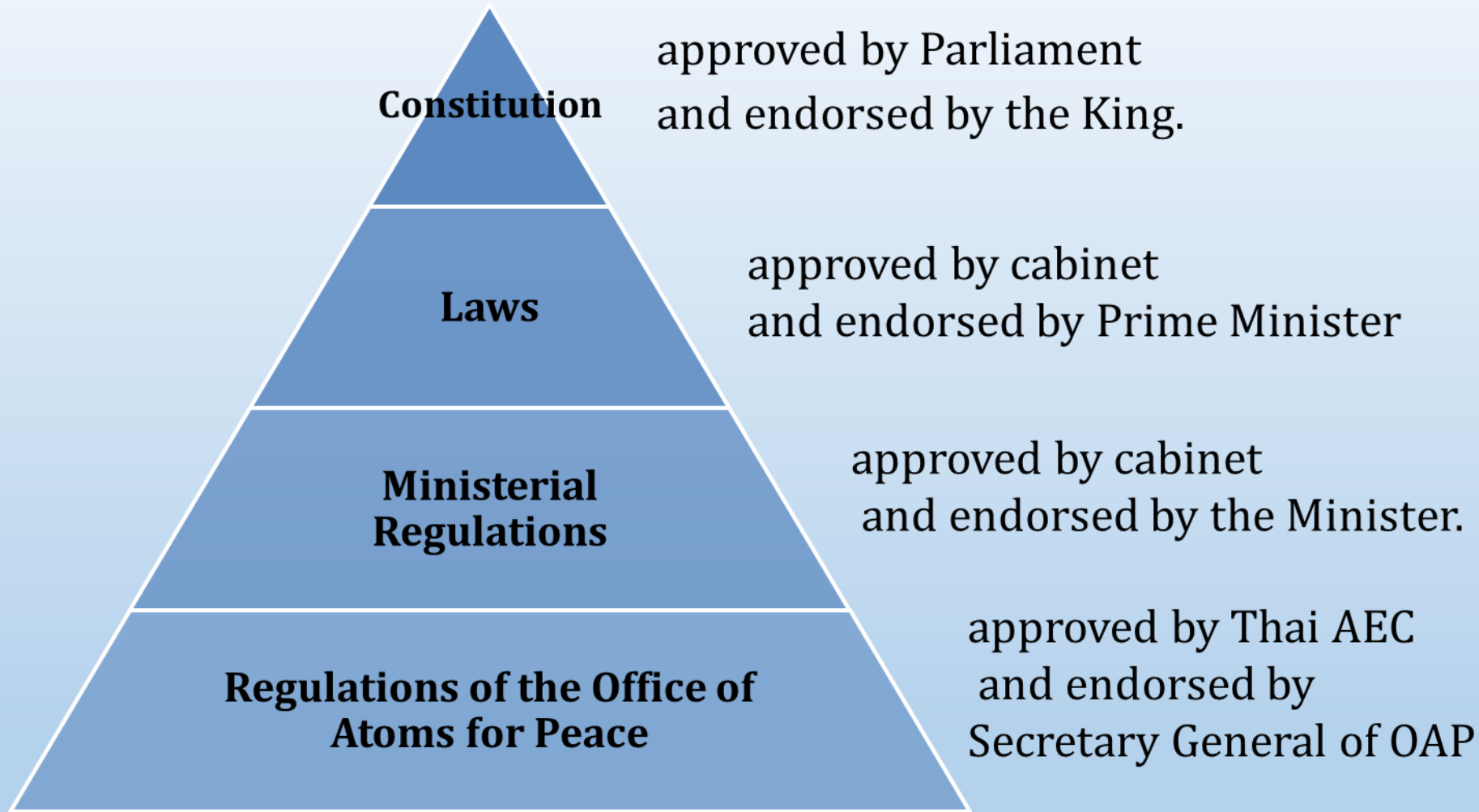
In 2016, Revised Act and Ministerial Regulation

In 2002, Reorganization Act, renamed the "Office of Atomic Energy for Peace" to "Office of Atoms for Peace"

In 1961, Atomic Energy for Peace Act and establishment of the Office of Atomic Energy for Peace, OAEP



## **Regulatory Hierarchy**



## **Basis for Nuclear Energy for Peace Act (Nuclear Law ), 2016**

- Based on IAEA Nuclear Law Handbooks and regulatory laws of Thailand and other countries
- Intended to comply with international instruments such as
  - Convention on Nuclear Safety
  - Joint Convention
  - Convention on Physical Protection of Nuclear Material (CPPNM) as amended
  - Comprehensive Nuclear Test-Ban Treaty (CTBT)
  - Safeguards agreement and Additional Protocol (AP)

## **Nuclear Facility Licenses**

<b>Licenses in the Act 1961 (issued by Atomic Energy Commission)</b>	<b>Licenses in the Act 2016 (issued by Secretary General of the Office of Atoms for Peace with the approval of the Nuclear Regulatory Committee)</b>
Licenses to produce, possess, or use atomic energy	Site License
	Construction License
	Commissioning License
	Operating License
	Decommissioning License



## **Penalties and Fines**

### **Penalties**

- To cover violations in this draft act
- To cover Convention on Physical Protection of Nuclear Material (CPPNM) as amended
- To cover Comprehensive Nuclear Test-Ban Treaty (CTBT)

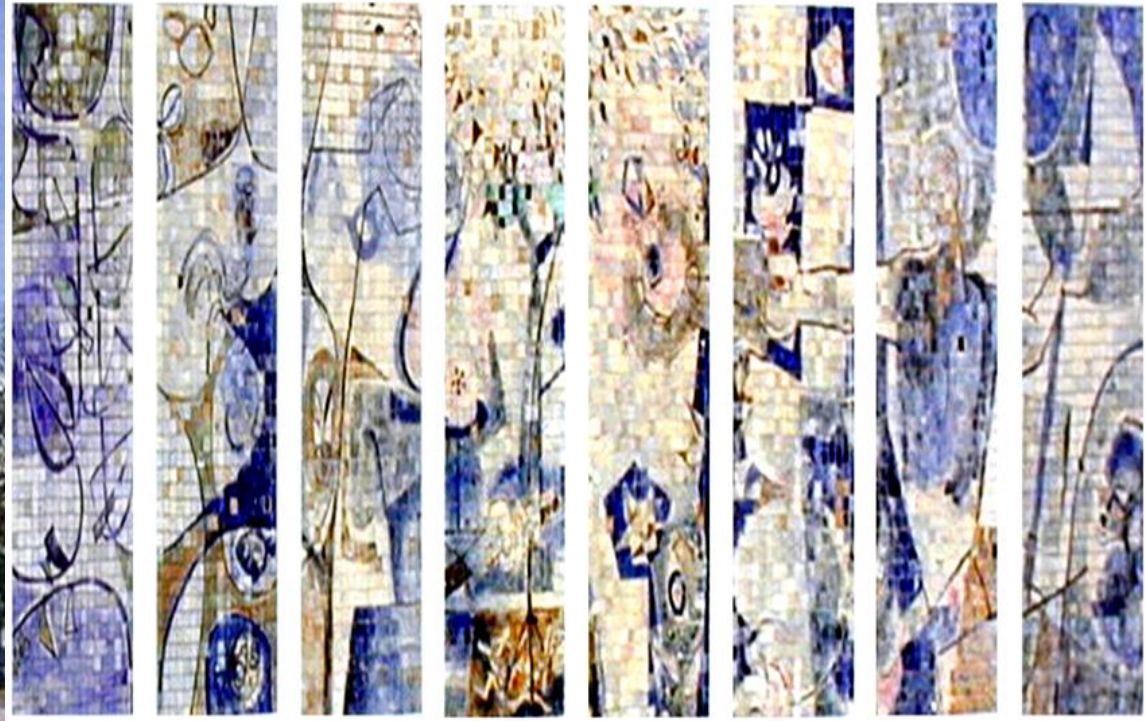
### **Fines**

Officers can punish violators by penalty fines in order to save time and cost for a court trial.

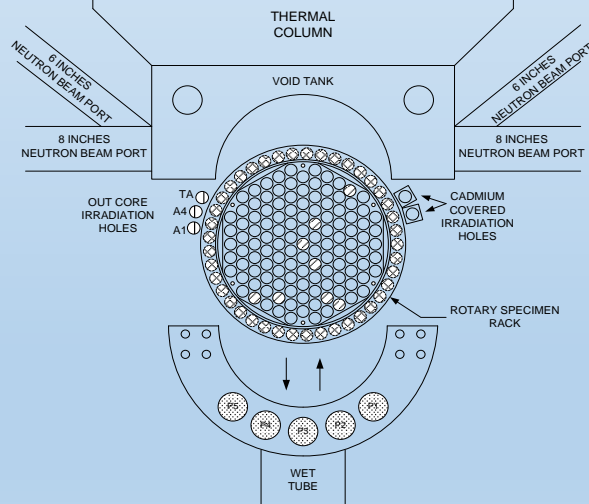
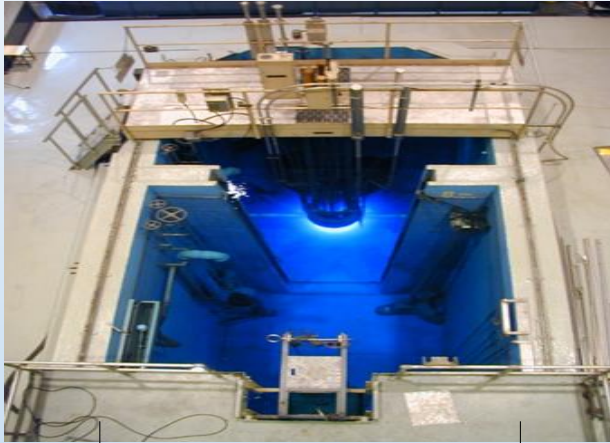
# Safety Management at “Thai Research Reactor”

## *Thai Research Reactor1/Modification1 (TRR-1/M1)*

*Since 1977*

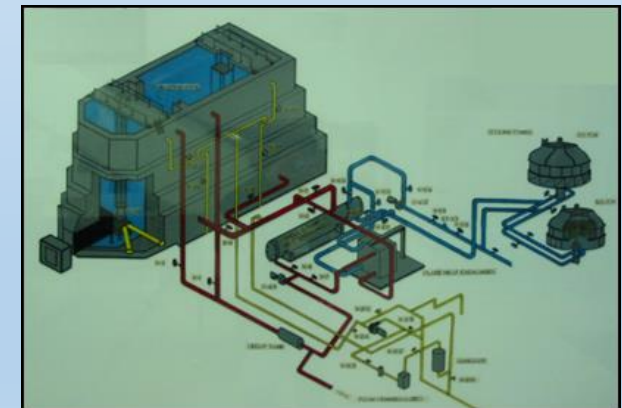


## Safety Management at “Thai Research Reactor”



## Reactor Characteristics

- **TRIGA MARK III : Fuel UZrH : 8.5 wt-% type and 20 wt-% type**
- **42 years of operation, Core Number 21, Operation 26 Hours / weeks by weeks**
- **Maximum Operating Power : 1.3 MW until now Total MWD = 2374 MWD**
- **Isotope Production (P-32 and Sm-153)**
- **Gem coloration in In Core Irradiation Tube, (Gem, Kunzite, Topaz) CT,C8, C12, F3, F12, F22, F29, G5,G33**
- **NAA by - G22, Pneumatic Transfer system, Rotary Specimen Rack, and out core Irradiation tube (about 20 Irradiation facility)**
- **Beam ports for radiography**





**TRR-1/M1 Facility**

**Facility:**

- ❖ TRR-1/M1 Instrumentation and Control Upgrade Project (I&CU project)
- ❖ Two-section pool with movable core
- ❖ Small holes in grid plate for temperature & axial flux measurement
- ❖ Irradiation positions: In-core and Out-core
- ❖ Large size irradiation facilities in Thermal Column
- ❖ 3 Neutron beam ports: Neutron radiography / PGNAA / Neutron Scattering

**Utilization of TRR-1/M1**

**Utilization:**

- ❖ Gems Irradiation (In-core irradiation)
- ❖ Radioisotope production (mainly Sm-153)
- ❖ Neutron Activation Analysis (commercial service)
- ❖ Researches (NAA/ Neutron radiography / Material irradiation, etc.)
- ❖ Training and Public Tour (on request)

# Safety Management at “Thai Research Reactor”

## Utilization of TRR-1/M1

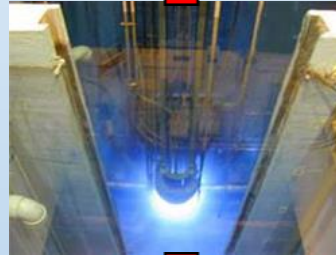
Gems  
Coloration



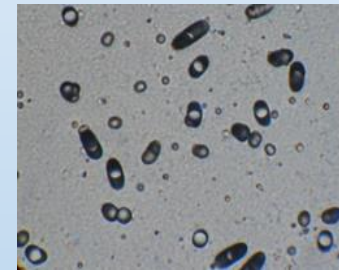
Isotope  
production



NPP Public Education



Neutron  
Activation  
Analysis



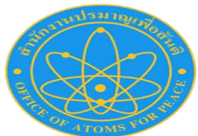
Research  
& Development



Neutron  
radiography

## **Enhancement of Reactor Management**

- Currently, QA program is quite well established ISO9001 certified.
- New standard :OHSAS 18001 “Occupational health and Safety Management Systems” to our operation system
- Introduction of IT based reactor management systems e.g.
  - Reactor Operation & Utilization (E-services)
  - Computerized Maintenance Management System (CMMS)
  - Fuel Management System (FMS)





## Safety Management at “Thai Research Reactor”

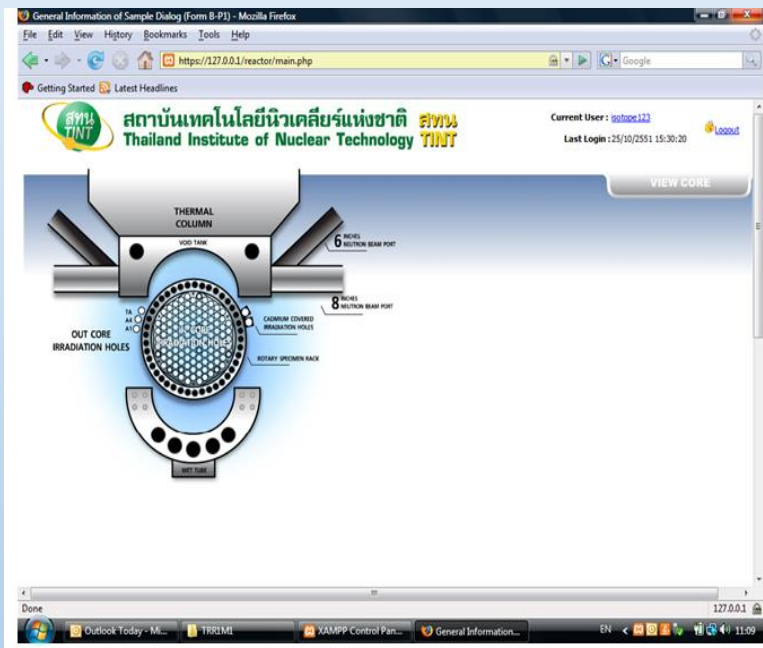
### OHSAS 18001 Occupational health and Safety Management Systems



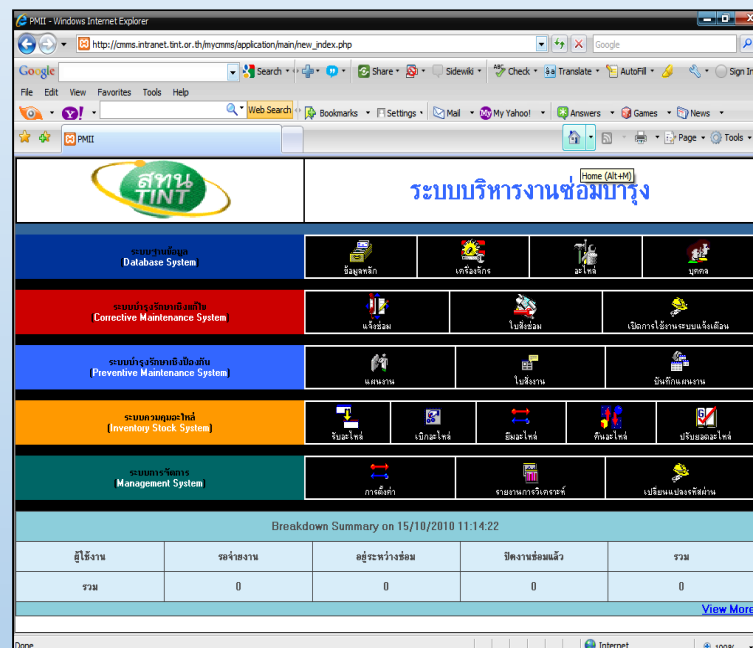
# Safety Management at “Thai Research Reactor”

## IT based reactor management systems

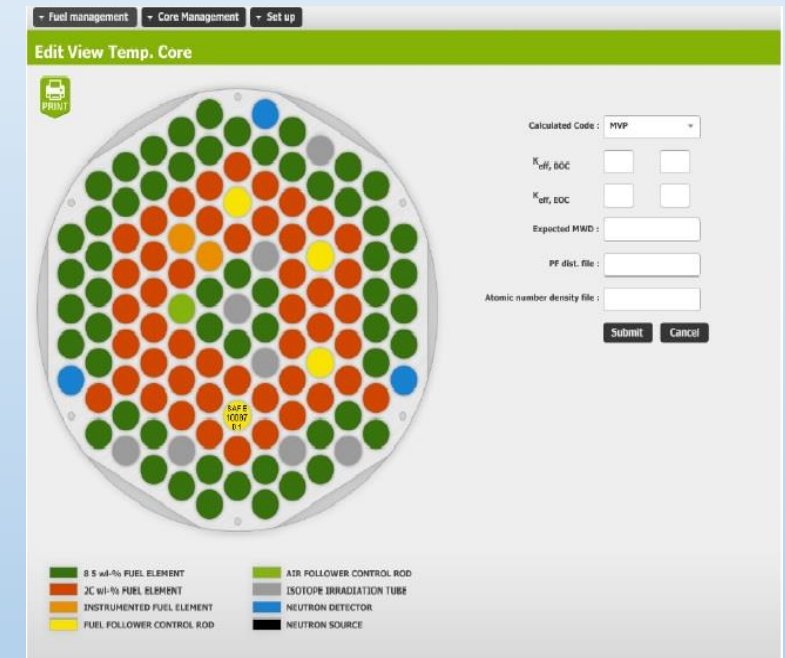
### E-services



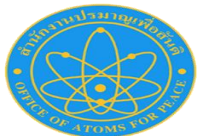
### CMMS



### FMS



# **SAFETY Management for TRR-1/M1**



## **Safety Management System for TRR-1/M1**

- ❖ **Management System**
- ❖ **Recent and Current Activities On Self-Assessment Related To Safety For TRR-1/M1**
- ❖ Resource Management
- ❖ Process Implementation
- ❖ Measurement, Assessment and Improvement

## **Transition To An Integrated Management System**

- ❖ Partially integrated in quality management, safety management and health management.
- ❖ Management systems for the safety, health, environmental, security, quality can examine via documentation control, records and assessments.
- ❖ Transition plan to develop the overall framework and processes for the integrated system.
- ❖ Reactor at present have a quality assurance program

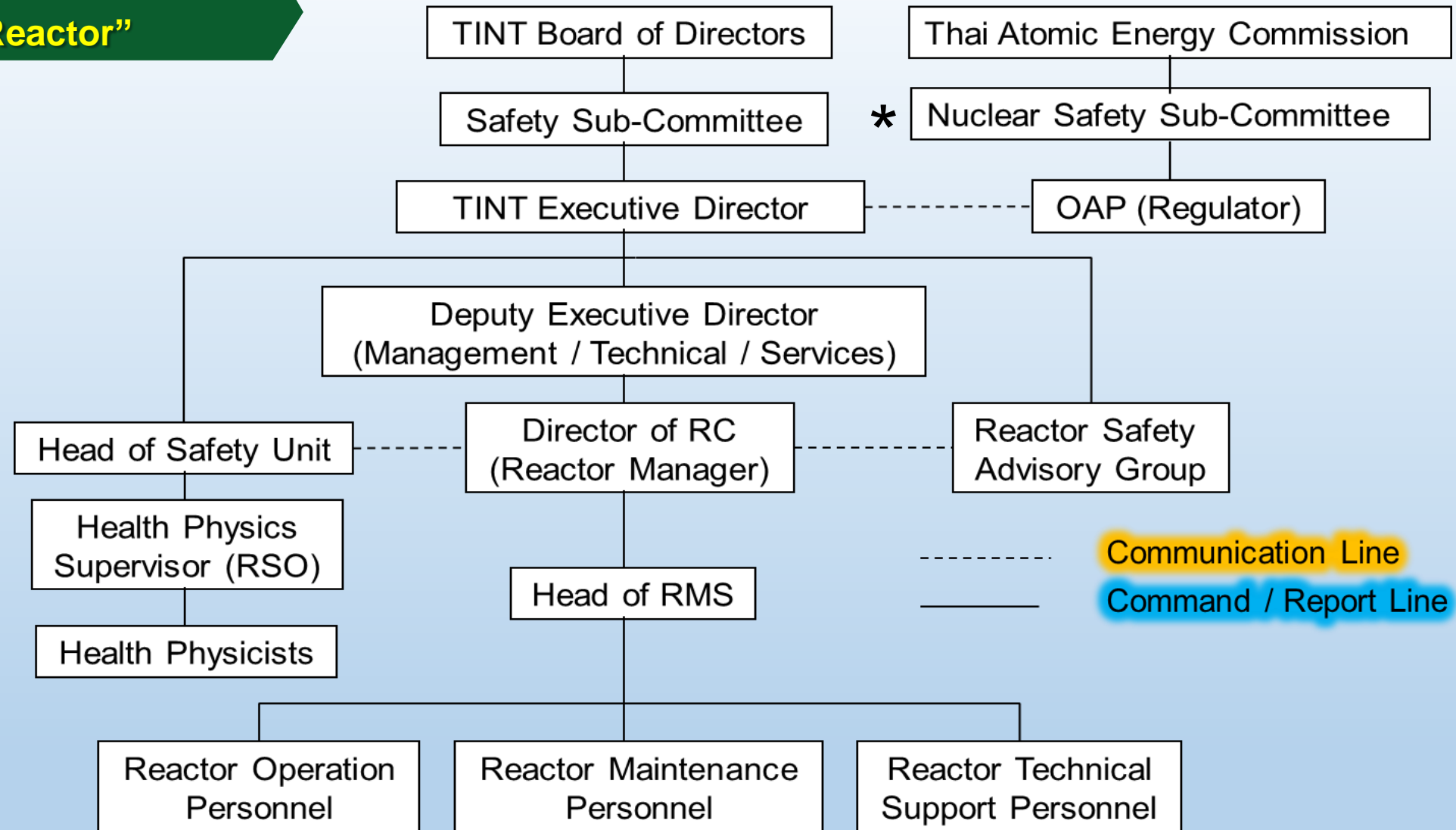
## **Management System**

- ❖ TINT established Quality Management System (QMS) for overall organization based on the Quality Management Standard : ISO9001, ISO14001 and OHSAS 18001.
- ❖ The Quality Assurance (QA) for routine operation and maintenance of TRR-1/M1 covered under the QMS of TINT
- ❖ Implementation plan was prepared by training, assigning and retraining
- ❖ The future plan to the integrated manage systems for environmental management, security management, quality management and business management.



# Safety Management at “Thai Research Reactor”

## Management Organizational Structure for TRR-1/M1 Safety



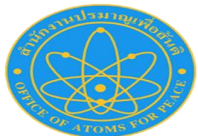


## **Thai Atomic Energy Commission (Thai AEC)**

The secretary of Thai AEC is the secretary director of Office of Atoms for Peace

The Main responsibilities of Thai AEC

- *Policy and Regulate the Thai nuclear power program such as NPPs, RRs, fuel cycle , fuel storage facilities and radiation activities.*



## **TINT Safety Sub-Committee**

A group of External Experts and Ex-Reactor Managers Empowered by Board of Directors  
to:

- ❖ *Scrutinizes 3S Policy and Plans for Board Approval*
- ❖ *Revises board regulations covering 3S*
- ❖ *Supervise 3S Operation/Activities*
- ❖ *Report to the Board of Directors*

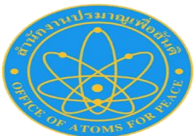
## **Recent and Current Activities On Self-Assessment Related To Safety For TRR-1/M1**

- ❖ ETReS Mission
- ❖ OHSAS18001
- ❖ FNCA Safety Management System: Self-assessment/peer review
- ❖ Periodic Safety Review
- ❖ Emergency Preparedness and Response Exercise

### ETReS ; Education & Training Review Service

- Self-assessment for the education and training system in the scope of nuclear safety.
- The self-assessment is conducted before the ETReS mission by IAEA experts.
- ETReS will address three key areas relative to the education and training in nuclear safety program of a Member State: basis and framework, competence and training, sustainability and improvement of the competence needed for nuclear safety.
- Thailand conducted the self-assessment of the education and training for nuclear safety and requested for the ETReS mission in 2015.

- OHSAS18001 is the Occupational Health and Safety Management Systems—Requirements
- The system helps promote a safe and healthy working environment.
- The Reactor Management Section conducted the self-assessment and improve the working environment on the following areas:
  - Identify and control health and safety risks
  - Reduce the potential for accidents
  - Aid legal compliance
  - Improve overall performance
- The Reactor Management Section is certified OHSAS18001 on Aug. 6, 2015



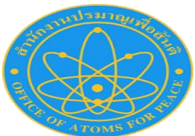
### FNCA Safety Management System (SMS) ; Self-assessment/ Peer Review

- This tool has been developed by the FNCA project on Safety Management System (SMS) for Nuclear Facilities based on nuclear industry safety guidance materials including IAEA GS-G-3.1 and the self-assessment / peer review tool used within the FNCA Nuclear Safety Culture project.
- The self-assessment covers 6 topics:
  - Management system
  - Management Responsibility
  - Resource Management
  - Implementation of Generic Process
  - Performance of Specific Process
  - Measurement, Assessment and Improvement

## Periodic Safety Review

- According to the **RASCAP**<sup>1</sup> meeting in Jakarta, Indonesia, in 2015, it is recommended that Member States should conduct the Periodic Safety Review (PSR).
- Thailand by the Reactor Management Section, Reactor Center, TINT, accepted to start preparing for the PSR.
- The PSR project is planned to be fully kicked off after the I&C upgrade project is finished, which is expected to be the end of the year 2016

<sup>1</sup>RASCAP: Regional Advisory Safety Committee for Research Reactors in Asia and the Pacific





## Emergency Preparedness and Response Exercise

- The exercise is conducted annually by the Reactor Management Section, Reactor Center.
- TRR-1/M1 emergency preparedness and response plan is reviewed and updated (if needed) annually after the exercise.
- The commentators of the exercise are invited from both internal and external organization, e.g., from TINT Radiation Safety Unit and from Office of Atoms for Peace, THAILAND.

## NUCLEAR POWER PROGRAM IN THAILAND

- Thailand first considered a nuclear power plant in 1966. The option to build a 600 MW BWR at Aow Pai, Chonburi Province was explored. However, after the discovery of natural gas in the Gulf of Thailand in 1978, the project was postponed indefinitely.
- In 2007, nuclear power was reintroduced again in the Thailand's Power Development Plan 2007-2021 (PDP 2007). The PDP2007 includes the nuclear power generation to supply 2,200 MW of electricity in 2020 and another 2,000 MW in 2021.



## PDP Before and After FUKUSHIMA Accident

### Before Fukushima Accident

Power Development Plan (PDP)	Nuclear Power Plant Description
PDP2007 (15 years: 2007-2021)	4 units of 1,000 MWe 2020 (2 units) and 2021 (2 units)
PDP2007 Revision 2 (15 years: 2007-2021)	2 units of 1,000 MWe 2020 and 2021
PDP 2010 Revision 1 (20 years: 2010-2030)	5 units of 1,000 MWe 2020-2021, 2024-2025, and 2028

## PDP Before and After FUKUSHIMA Accident

### After Fukushima Accident

Power Development Plan (PDP)		Nuclear Power Plant Description	
PDP2010 Revision 2	(20 years: 2010-2030)	4 units of 1,000 MWe	2023-2024 and 2027-2028
PDP2010 Revision 3	(20 years: 2010-2030)	2 units of 1,000 MWe	2026 and 2027
PDP 2015	(21 years: 2015-2036)	2 units of 1,000 MWe	2035 and 2036

## NUCLEAR POWER PROGRAM IN THAILAND

- Planned nuclear power plants

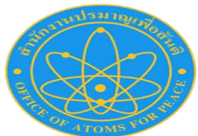
Station/Project name	Type	Capacity (MW)	Expected Construction Start Year	Expected Commercial Year
EGAT Nuclear Power Plant #1	LWR	1000	2029	2035
EGAT Nuclear Power Plant #2	LWR	1000	2030	2036

## MAIN REASONS TO POSTPONE NPP PROJECT

- Review Nuclear Safety Measures and Emergency Preparedness and Response Plan to include lessons learned from Fukushima Accident
- Prepare infrastructure to support NPP. Legislative Framework, Regulatory Framework, Stakeholder involvement etc.
- Promote public acceptance on nuclear power

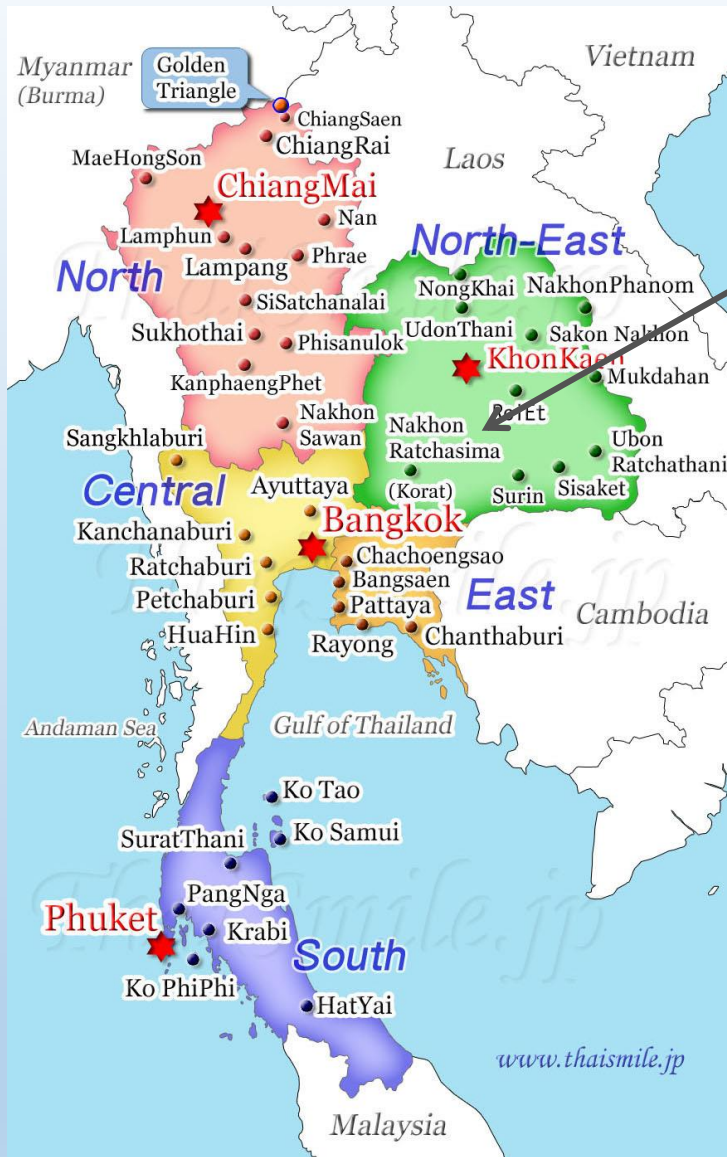


- Since 2011, the Reactor Management Section put a lot of efforts to revise the SAR for TRR-1/M1 to have the document up-to-date to the current reactor status.
- Most of the main recommendations from the follow-up INSARR mission in 2007 are satisfied by the updated SAR and ISO9001 certified.
- Started from 2014, the Reactor Management Section, the operator for TRR-1/M1, has been performed several self-assessments related to the safety of the reactor. For example, the self-assessment on the education and training system on nuclear safety, and the self-assessment for occupational health and safety management systems. The Reactor Management Section is now in the process of performing self-assessment on the safety management system which will be under peer review at the end of 2016.

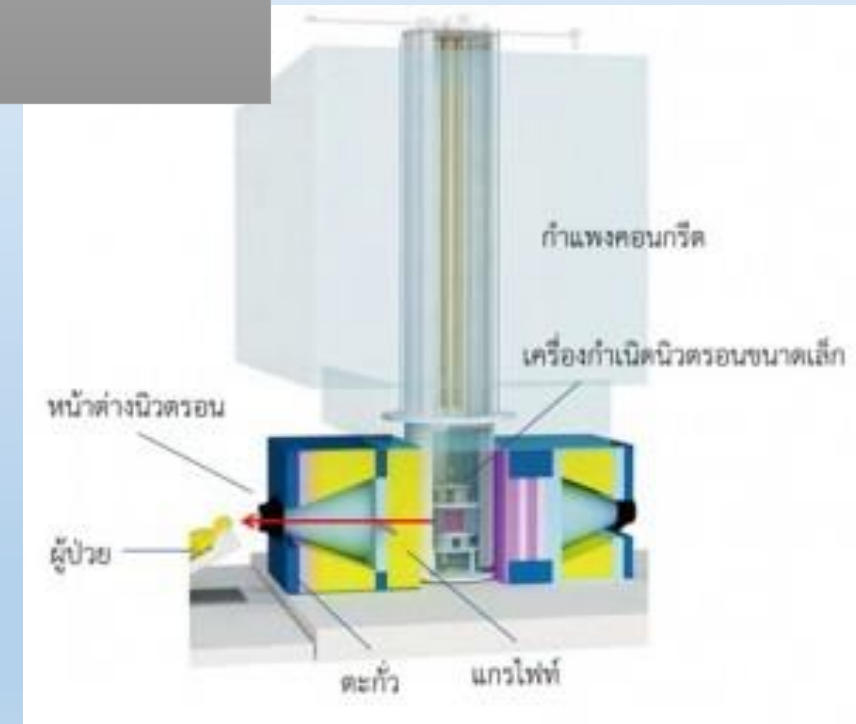


- In my opinion, the current challenge for the Reactor Management Section is how to convince both top management and operating staff to periodically perform self-assessment on various aspects related to the reactor safety. Also, how to efficiently evaluate the action plan implemented for each required tasks base on the self-assessment results.

# BNCT Research Reactor Project



- **Reactor Model:** Miniature Neutron Source Reactor, MNSR
- **Design :** China Institute Atomic Energy (CIAE)
- **Location:** Suranaree U. of Technology
- **Power:** 45 kW(th)
- **Utilization:** BNCT
- **Status :** Site licensing



THANK YOU