

# Experience on JRTR Licensing

2014. 10. 30

Yongse KWON, Hyunwoo LEE,  
Minho CHOI



Korea Atomic Energy  
Research Institute



# Part I

## Introduction to JRTR

# Project Overview

Project Name	Jordan Research and Training Reactor (JRTR) Project
Owner	Jordan Atomic Energy Commission (JAEC)
Contractor	Consortium of KAERI and Daewoo E&C
Contract Type	Turnkey EPC* Contract
Project Period	Aug. 1, 2010 to First half of 2016**
Site	Campus of JUST† (Ramtha, Jordan)
Scope of Supply	<ul style="list-style-type: none"><li>▪ Design and Construction of JRTR (Reactor, Reactor building, Service building including RI production facility, Aux. buildings, and Training Center)</li><li>▪ Education and Training of Jordanian Staff</li></ul>

\* EPC: Engineering, Procurement and Construction

\*\* Period extension under discussion with JAEC

† Jordan University of Science and Technology

# Project Progress

- 2009. 1 Request for Proposal
- 2009. 5 Submission of Technical Proposal
- 2009. 12 Preferred Bidder Announced
- 2010. 3 Contract Concluded
- 2010. 8 Project Launched
- 2011. 7 Application for Construction Permit
- 2013. 8 Issuance of Construction Permit
- 2014. 12 Application for Operating License
- 2015. 11 Issuance of Operating License  
& Initial Fuel Loading
- 2016. 6 Handover

# Specification of JRTR

Reactor Type	Open-Tank-in-Pool
Thermal Power (MW)	5 (upgradable up to 10)
Max. Thermal Neutron Flux (n/cm <sup>2</sup> ·s)	1.5X10 <sup>14</sup> in the core (Central Trap) 0.4X10 <sup>14</sup> in the reflector region
Fuel Type & Material	Plate type; 19.75% enriched, U <sub>3</sub> Si <sub>2</sub> in Al matrix
Fuel Loading	18 fuel assemblies, 7.0 kg of U <sup>235</sup> (Equilibrium cycle)
Coolant/Moderator Cooling Method	H <sub>2</sub> O Downward, forced convection flow
Reflector	Be and D <sub>2</sub> O
Utilization	<p>Multipurpose</p> <ul style="list-style-type: none"> <li>- neutron beam application (n. science, n. radiography, etc.)</li> <li>- neutron irradiation service (RI production, NAA, NTD, etc.)</li> </ul> <p>by utilizing</p> <ul style="list-style-type: none"> <li>- 4 beam ports (including 1 port reserved for cold neutron)</li> <li>- 1 thermal column</li> <li>- more than 22 vertical holes (including replaceable in-core holes)</li> </ul>

# Jordan Center for Nuclear Research




# Part II

## Regulatory Framework of Jordan

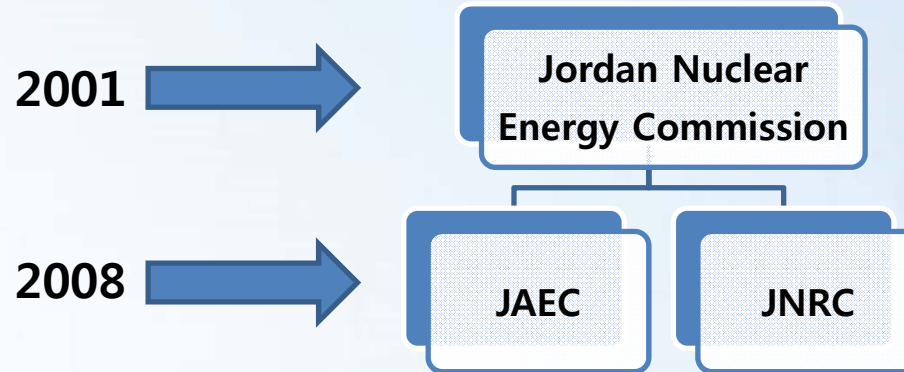
# Background



- In 2006, Jordan launched a study to consider the nuclear power option, which resulted in a Roadmap for establishing a nuclear power program.
  - In 2007, King Abdulla II announced that Jordan would launch a nuclear power program.
  - The motivations for the program are to increase energy security, reduced dependence on fuel imports, and reduced reliance on fossil fuels while meeting growing energy demand.
- 



# Establishment of JNRC



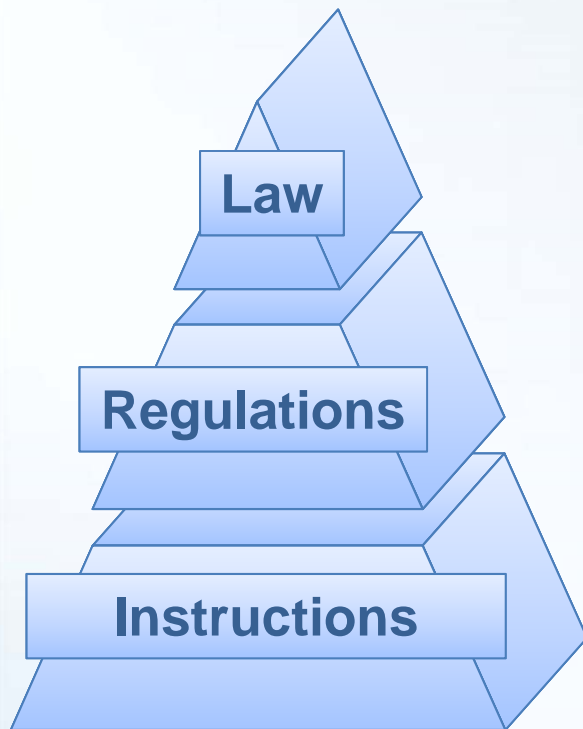
- JNRC is an independent Regulatory Body, to achieve...

- Regulating and monitoring the use of nuclear energy and ionizing radiation;
- Protecting the environment and human health and property from the hazards of radiation and related pollution;
- Ensuring the availability of conditions and requirements of general safety, radiation protection, and nuclear safety and security.

# Independence of JNRC

- JNRC is an independent and empowered Regulatory Body, reporting directly to the Prime Minister.
- JNRC independently conducts:
  - Legislation,
  - Assessment: analyzing compliance activities with current legislation,
  - Control: checking conditions fulfillment,
  - Enforcement: penalty in case of non-compliance.
- ❖ **The Jordan's regulatory bodies including JNRC merge into the EMRC in April 2014, to strengthen Jordan's radiation and nuclear regulatory infrastructure by providing more resources and influence.**

# LEGAL FRAMEWORK IN JORDAN



- JNRC establishes regulations
- For further clarifications, guidelines / instructions are drafted
- Taking into consideration national and international laws.
- Codes and standards to be established



# Part III

## Experience on CP Licensing


# Background



- KAERI and DAEWOO E&C consortium signed a contract March 30, 2010 with Jordan to build the Middle Eastern country's first nuclear research reactor by 2015

# Cooperation between KINS and JNRC



- March 27, 2010, Amman
    - Agree to get regulation support in package
    - JNRC hope to make direct agreement with KINS
  - May 22, 2010, Amman
    - Conclusion of MOU between KINS and JNRC to cooperate on regulation
  - May 4, 2011, ANNuR 2<sup>nd</sup> Periodic Meeting
    - Conclusion of Special Agreement between KINS and JNRC to support regulation on the construction and operation of JRTR
- 

# Cooperation between KINS and JNRC

## ● Responsibility of JNRC and KINS

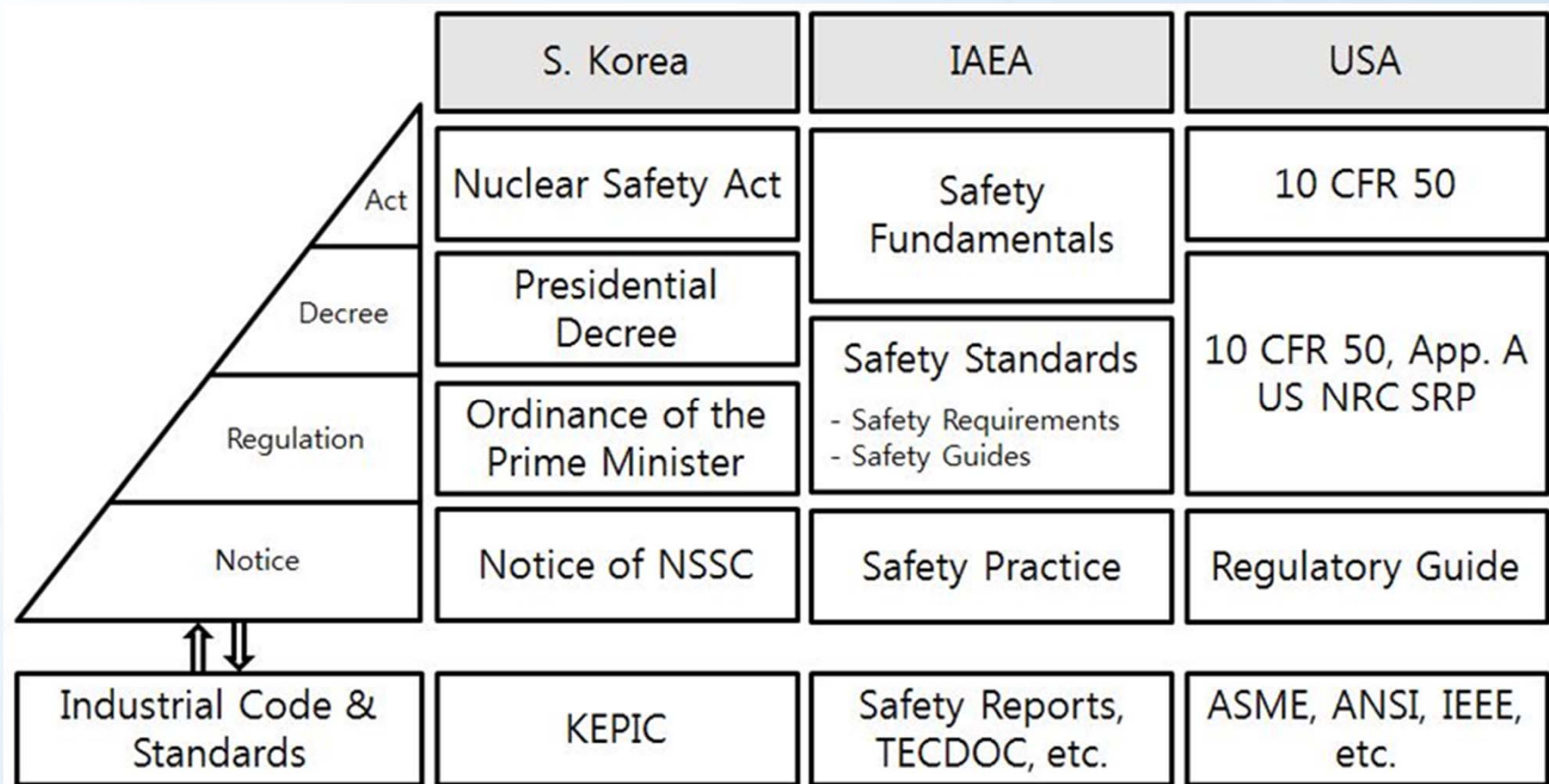
“JNRC and KINS shall conduct the review or inspect on JRTR jointly.”

- KINS shall provide technical support to JNRC for
  - Review of Site
  - Review of Construction Permission
  - Review of Operation License
  - QA Inspection
  - Pre-operational inspection
- KINS shall train JNRC's regulatory staff.



# Applied Regulations

- Legal regulation systems of Korea, IAEA, and USA



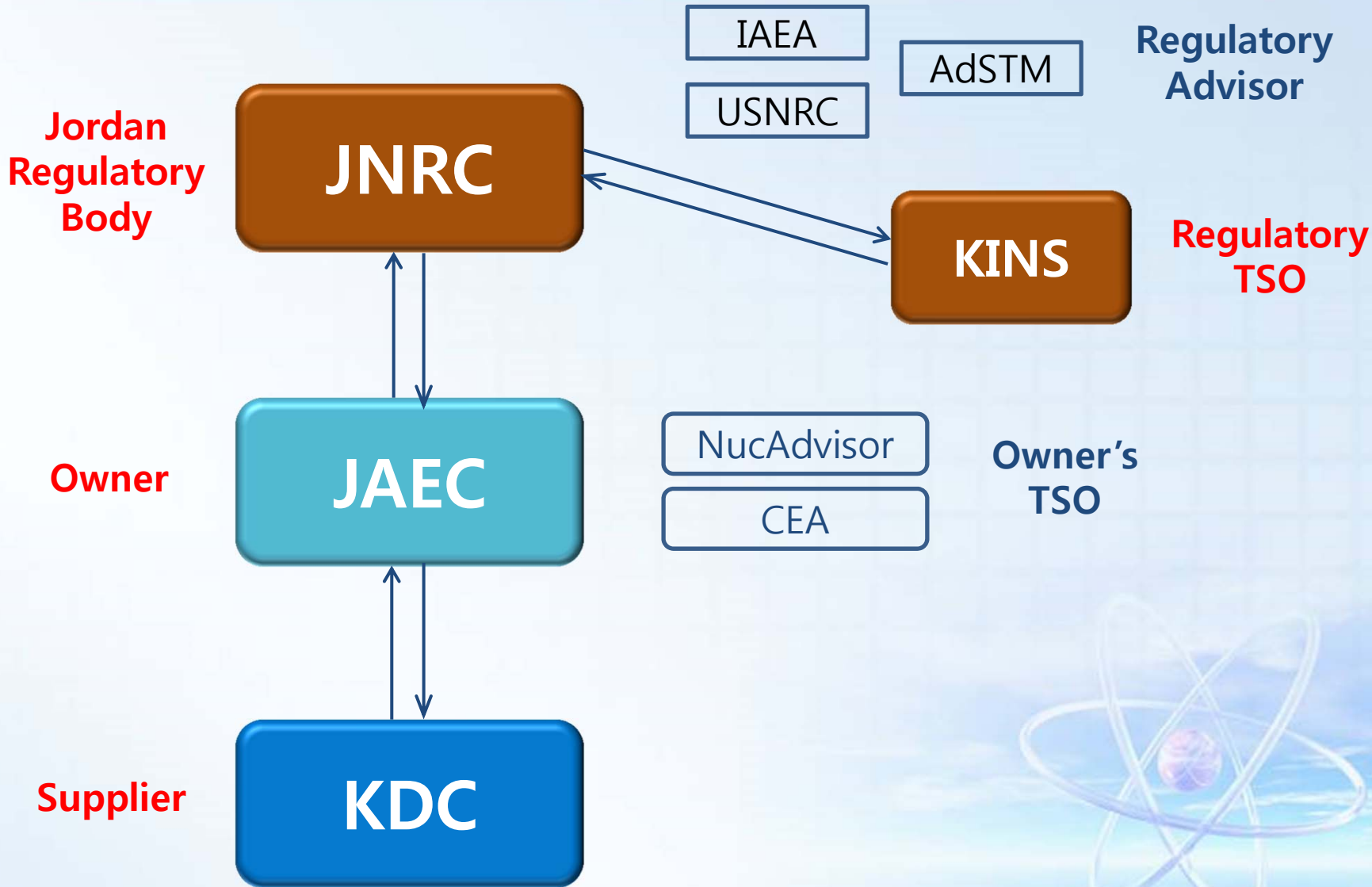


# Applied Regulations

- JNRC, KINS and KDC Consortium agree to apply...
  - Korean Regulation and Guidelines
  - The IAEA Safety Requirement, NS-R-3, NS-R-4
  - The IAEA Safety Standard, SSG-20
  - Industrial Codes & Standards(KEPIC, ASME, IEEE, ASTM etc.)



# CP Review Procedure



# Special Issue : Safety Classification

- IAEA RR Safety Section reviewed JRTR PSAR and recommended that some **NNS system** should be classified “**Safety-related System**”.
- There are some mis-understandings about safety class definition between IAEA and US(Korea) classifications.



# Special Issue : Safety Classification

## ● Correspondence of JRTR Classification to IAEA and US Classifications

IAEA general concept (for instance, in NS-R-4)	Items important to safety		Items not important to safety
	Safety system	Safety-related items	
	⇕	⇕	⇕
JRTR	Safety Class 3 (Quality Class Q)	NNS Class with specified functions (Quality Class T/Q)	NNS Class (Quality Class S)
	⇕	⇕	⇕
ANSI 51.1	Safety Class 1, 2 and 3 (ASME NQA-1)	NNS Class with specified functions (selected requirements from ASME NQA-1)	Other NNS Class items

# Special Issue : Safety Classification

- No SC-1 and SC-2 in JRTR
  - JRTR has no components within the scope of ASME Boiler and Pressure Vessel Code, Section III.
  - The JRTR is an open-tank-in-pool type reactor so that there is no overpressure concern.
- The classification of JRTR SSCs follows not only Korean or US regulation but also the concept of IAEA.
- JRTR NNS item with Quality Class T or Q is the 'item important to safety,' and particularly the 'safety-related item' in the IAEA's glossary.

# Part IV

## Conclusions

# Conclusions

- Good model of international cooperation on nuclear regulations
- Good lesson to those countries that plan to introduce a nuclear program
- Understandings on the differences and resemblances between the US and European regulatory philosophies are needed.
- The licensing process, applicable regulatory standards and guidelines shall be clearly stated in written form under the contract conditions.

# Thank You



Korea Atomic Energy  
Research Institute

