# The Influence of Nuclear Power Plant Accident to Chinese Supervising

Nuclear and radiation safety center, MEP

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# NPP accident result

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## Chernobyl

Chernobyl Nuclear Power Plant Accident On April 26, 1986, a sudden surge of power during a reactor systems test destroyed Unit 4 of the nuclear power station at Chernobyl.

The accident and the fire that followed released massive amounts of radioactive material into the environment.

**Covered the damaged unit in a temporary concrete structure, called the “sarcophagus,” to limit further release of radioactive material.**


# NPP accident result



## Chernobyl

severe radiation effects **killed 28** of the site's 600 workers
Official closed off the area within 30 kilometers of the plant
**Evacuated about 115,000 people** from the heavily contaminated areas in 1986, and another 220,000 people in subsequent years.

**Is defined G-7**
**Mainly reason is mistaken operation continuously**

China was building the first NPP.

# NPP accident result

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**Fukushima NPP accident:**
**It happened on March 11 in 2011. a amounts of radioactive material released into the environment including sea.**
**Government asked that evacuation area is 20 kilometers.**
**A lot of radio waste need to dispose.**
**Is defined G-7**
**Mainly reason is seismic tsunami**

# NPP accident result

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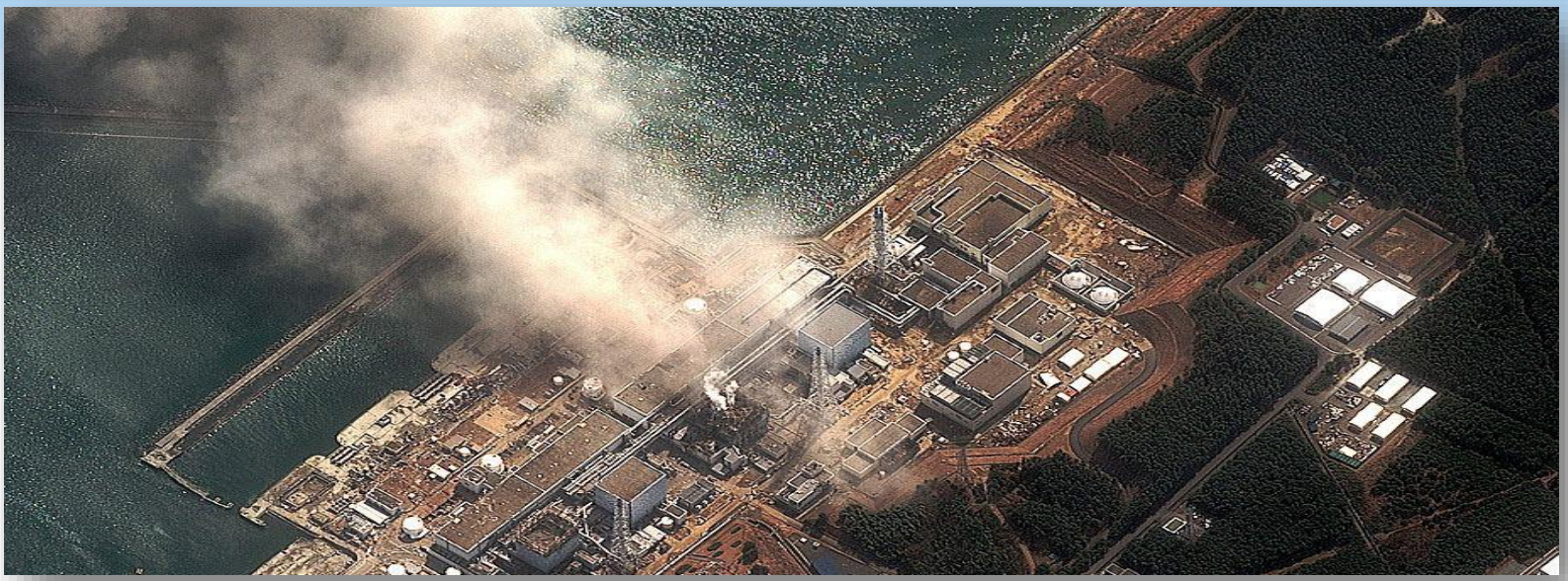


**Fukushima NPP accident:**

**had increased people's worries.**

**requirement :**

**mitigation strategies to respond to extreme natural events resulting in the loss of power at plants, ensuring reliable hardened containment vents, and enhancing spent fuel pool instrumentation**

# NPP energy



**Though NPP accidents had increased people's worries, it is concentrated, clean, safe and economical energy compared with other industries.**

**Dayawan NPP**

**French special Likasitan NPP**

# NPP energy



**First, nuclear energy is a high concentrated energy, especially suitable for lack of conventional energy sources and electricity - starved region, not limited by fuel for transport。As China's southeast and south region.**

**1kg U = 2700 tons of coal**

# NPP energy



**Meanwhile, nuclear power is clean energy and to protect the environment. Nuclear power generation unlike fossil fuel power plants that emit huge amounts of pollutants into the atmosphere.**

# NPP energy



## Comparison NPP with CPP

| PP | 1million kw NPP | 1million kw CPP |
|---|---|---|
| Fuel consume | Low enriched U 25t/y | 3 million ton |
| Fly ash | —— | 0.3 million ton |
| dusk | —— | 1600t |
| Spent fuel | 25t | —— |
| CO2 | —— | 6.75 million ton |
| SO2 | —— | $2.5*10^4$ t |
| NO&NO2 | —— | $1.5*10^4$t |

# NPP energy



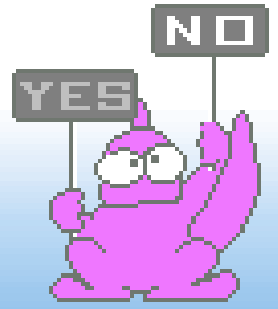
## Emission Comparison of different PP

| PP | Coal | gas | oil | NPP |
|---|---|---|---|---|
| Capacity, KW | 100 | 100 | 100 | 100 |
| Electric power, billion | 5.5 | 5.5 | 5.5 | 6.5 |
| Fuel, $*10^4$t | 300～360 | 77 | 104 | 0.0024 |
| CO2, $*10^4$t | 588 | 248 | 290 | 0 |
| SO2, $*10^4$t | 4.8 | 0.2 | 0 | 0 |
| Dusk, $*10^4$t | 0.9 | 0 | 0 | 0 |
| Ash, $*10^4$t | 45 | 0 | 0 | 0 |

# NPP energy



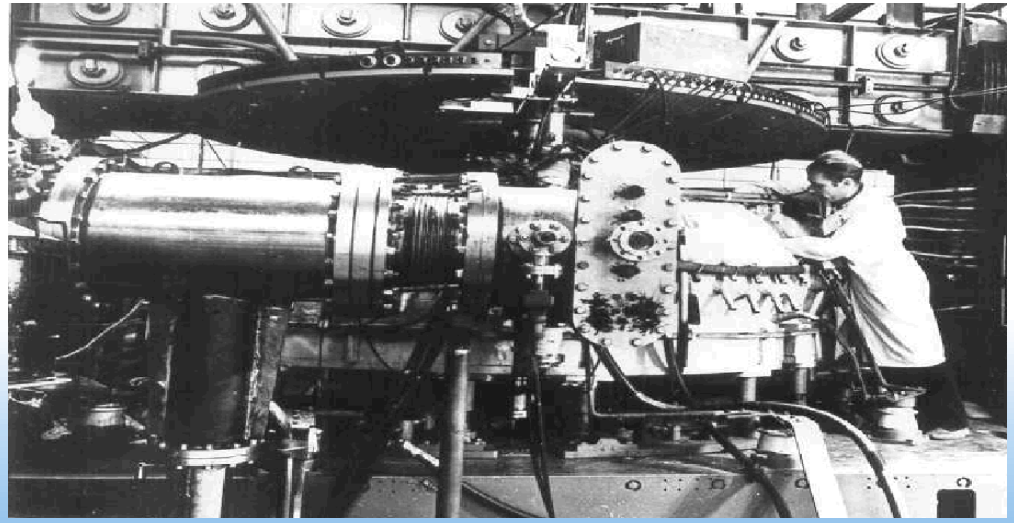
**And after decades of development and improvement of nuclear energy, nuclear power plant has become one of the security sector. Since first nuclear power station is built, more than 400 nuclear power plants in operation around the world, but they are basically safe operation in more than 30 years。**



# NPP energy



**The consequences of the Chernobyl nuclear accident was very serious, but the accident was caused by human factors. The direct cause of the accident was due to mishandling during a test.**

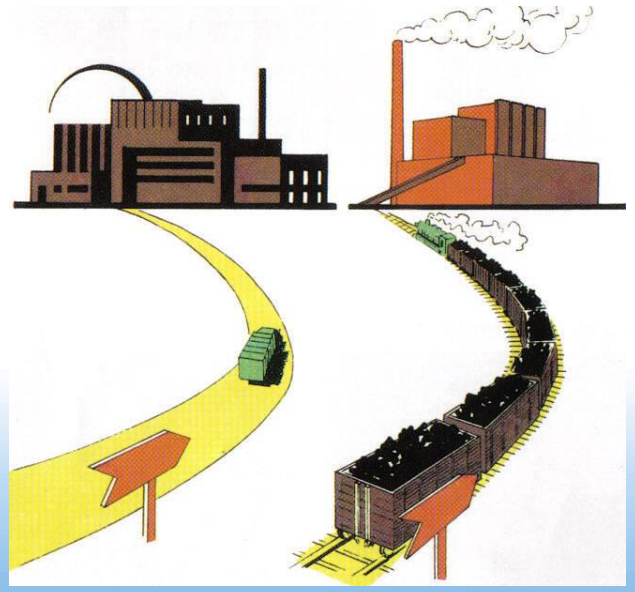


# NPP energy



Nuclear energy is the economical energy. Because the fuel cost and the transportation cost is low. As the technology is constantly improving and enhancing，nuclear power plant will also continue to lower costs.

And nuclear power generation cost less affected by international economic situation



# NPP energy



**It's like, Every coin has two sides.**

**As the one hand : The development and use of nuclear energy will bring great benefits to ecological resources, environmental protection, social life and economic development.**

**on the other hand : There are also a potential threat to human security.**

# Chinese Supervising situation



## ◆Position of nuclear safety

**President Xi jinping first proposed the overall national security concept, and established national security system in the Central National Security Council in April 2014.**

# Chinese Supervising situation

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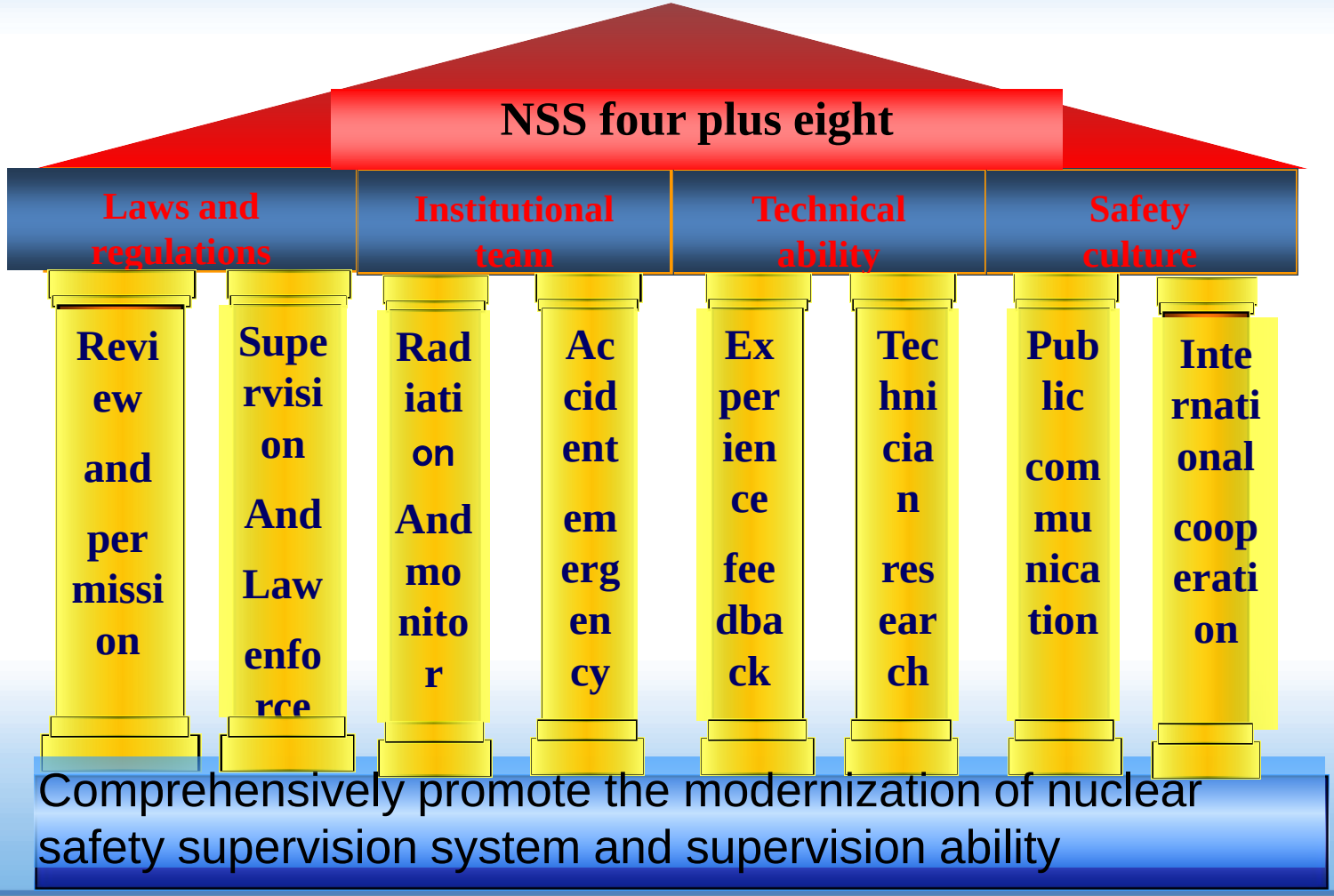

# Chinese Supervising situation

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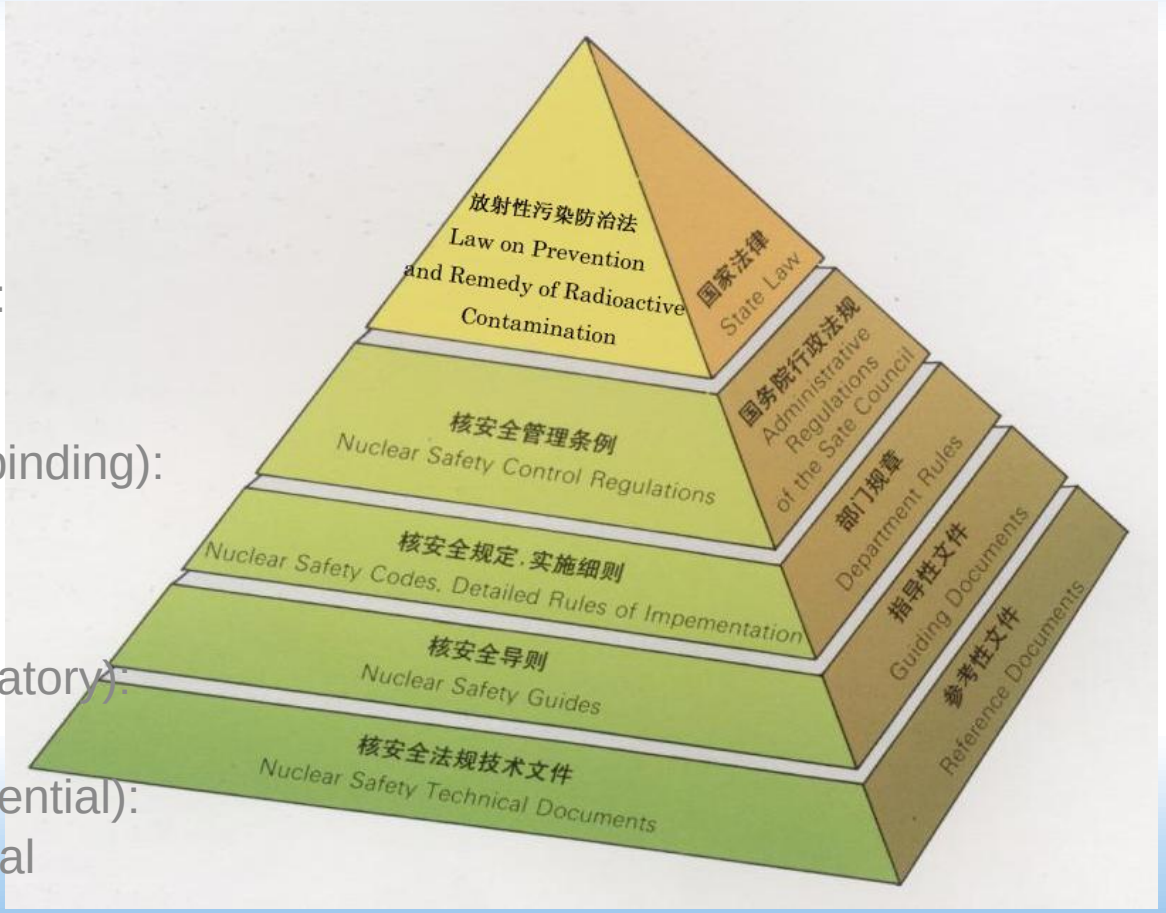
## Structure of Chinese nuclear safety legal framework

**Five-level framework:**

- Laws (legal binding):
  - Law on Prevention and Remedy Radioactive Contamination
- Regulations (legal binding):
  - Nuclear Safety Control Regulations
- Departmental Rules (legal binding):
  - Nuclear Safety Codes Detailed Rules of Implementation
- Safety Guides (recommendatory):
  - Nuclear Safety Guides
- Technical Documents (referential):
  - Nuclear Safety Technical Documents



# Chinese Supervising situation



## Regulations:

- civil nuclear facilities safety supervision and control
- nuclear source surveillance regulations
- NPP nuclear accident emergency management regulations
- safety and protection regulations on radioactive isotopes and radiation equipment
- Regulations of civil nuclear safety equipment supervision and Management
- Regulation of transportation safety management of radioactive materials
- Regulation on radioactive waste safety management

# Chinese Supervising situation



- MEP（NNSA）department rules（27items）

✓ Measures of the licensing of nuclear and radiation safety, methods of nuclear safety equipment, the management of the transport of radioactive materials, the basic standards for the safety of ionizing radiation protection and radiation sources

✓ Design of NPP safety regulations, safety operation regulations, quality assurance, safety regulations, siting selection

- Nuclear safety guides(89 items)：We are adopting international Atomic Energy Agency safety standards, and a series of technical laws and regulations have been formulated.

# Chinese Supervising situation

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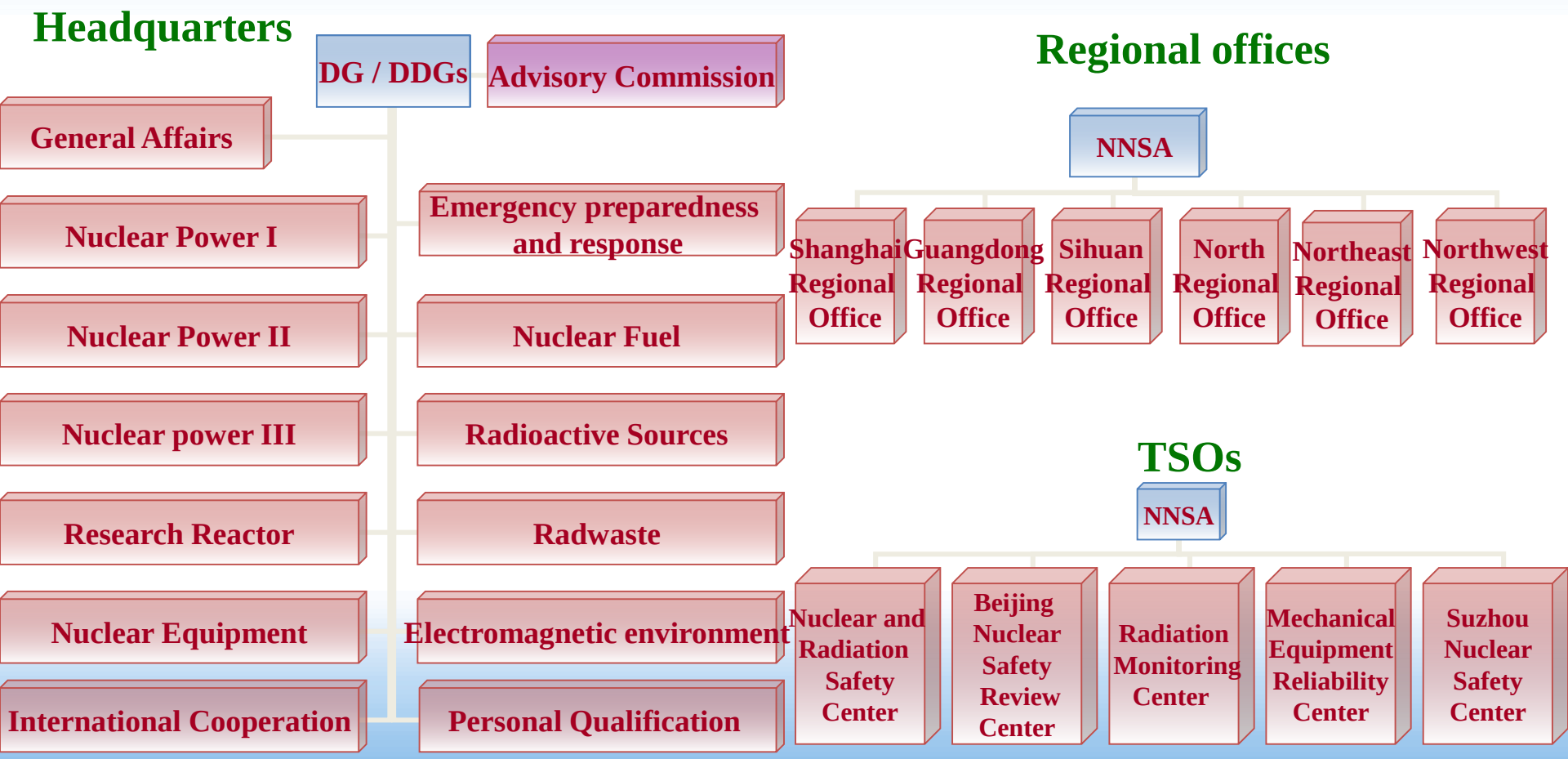
## Organization of the Regulatory Body



# Chinese Supervising situation



- **NNSA Headquarters**
  - 14 divisions and 80 staff in the headquarters
  - Annual project budget more than 90,000,000 RMB
- **Advisory commission**
  - more than 100 senior experts (including academicians)
  - 5 professional groups:
    1) nuclear reactor and system,
    2) fuel recycle, radwaste and sitting,
    3) radiation and emergency response,
    4) I&C and mechanical equipment
    5) Nuclear safety regulations and standards

# Chinese Supervising situation



- **Regional offices**
  - 6 regional offices and totally 331 staff.
  - performing inspection to nuclear installations and radioactive sources in the areas.
  - special function for North Regional Office: performing safety review and inspection on nuclear equipment related activities.
- **TSOs**
  - 5 main TSOs providing technical support to NNSA in safety review and inspection
  - NSC is the most important TSO to NNSA (600)

# Chinese Supervising situation

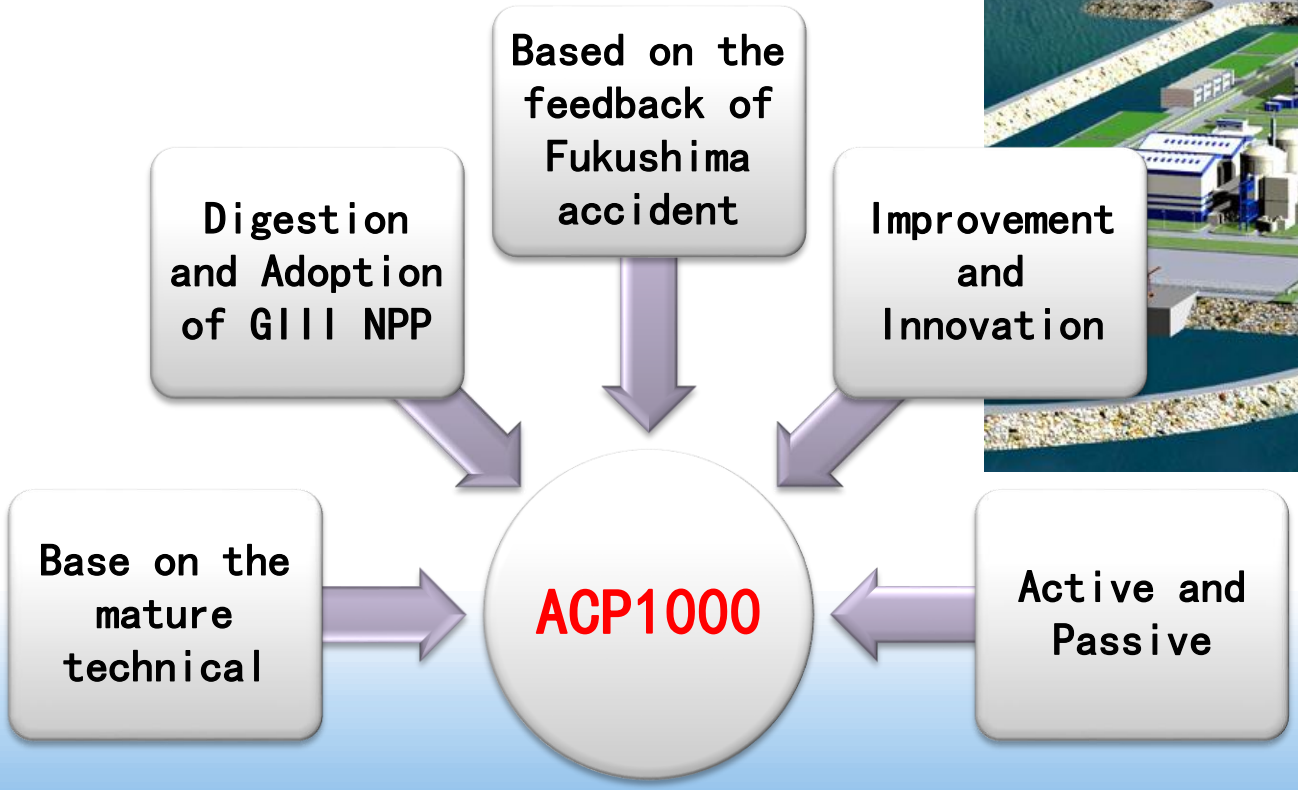
## Status of NPPs in China

- 30 units in operation now
- 24 units obtained Construction Permit (CP) with installed
  - ↳ 4 × AP1000 (G3)
  - ↳ 2 × EPR (G3)
  - ↳ 22×M310 (G2+)
- Followed by other projects

# Chinese Supervising situation



## Later NPP:AP1000 or above AP1000



# Chinese Supervising situation

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## ACP1000 Technical Features

**Safety features**

3rd generation PWR
In compliance with latest safety codes and standards

3 technical features
177 fuel assemblies, single-unit layout, double-shell containment

ACP1000

3 active + passive systems
Secondary heat removal,
Containment heat removal,
reactor cavity injection and cooling

3 enhanced protection capabilities against
Seismic
commercial aircraft crash
Plant emergency

CDF and LERF well satisfy requirements of latest national code (HAF102) as well as Generation III nuclear power plant utility requirements document (URD and EUR)

# Challenge and chance




Till April 2014

# Challenge and chance

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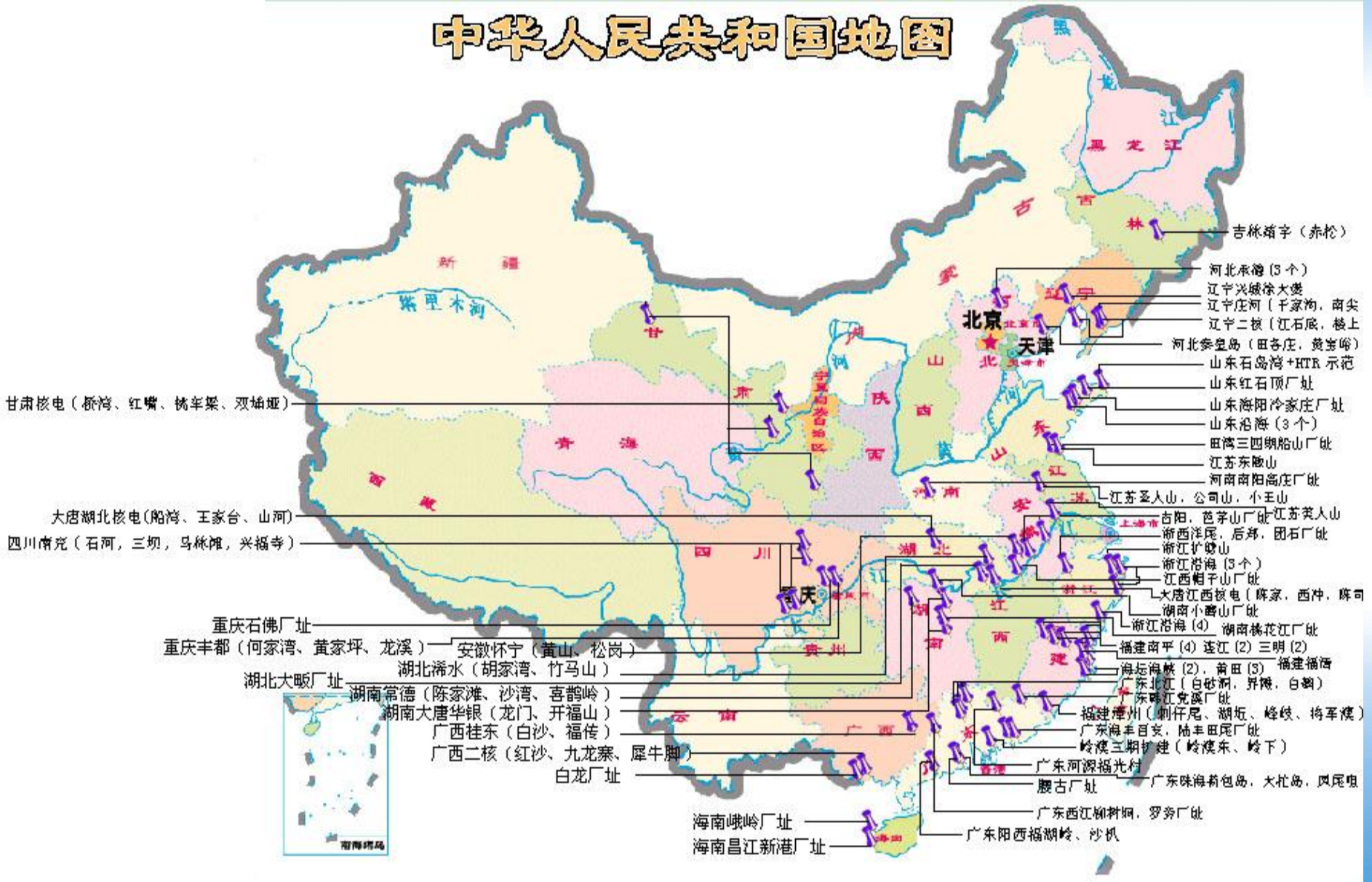

# Challenge and chance



## Challenge

- Lack of enterprise nuclear safety culture
- Regulatory tasks are still strenuous: import from many countries, a lot of technologies, a variety of rectors, multi class standards
- Regulatory system needs to be optimized: cross with other government departments
- Regulatory standards still need to be improved: the nuclear safety law has not yet been introduced, the technical standards need to be further improved
- Supervision needs to be strengthened: analysis and evaluation, self-checking calculation and experimental verification ability still need to be improved.

# Challenge and chance



## chance

- NPP capacity accounts for less than 2% to total electricity, far less level of world (17%).
- Government support
- Three NPP groups, each has itself design and research team
- Have Installation and management experience

# Thank you cooperation !