Centralized Monitoring and Management Practice of Occupational Exposure in CGN

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About CGN
History: A Path towards Innovative Development

1979: High starting point
Guangdong Province was chosen to be the site for building the Daya Bay NPP, which marks the starting point for China’s nuclear power sector. Innovative model: Relying on loans to finance the construction, repaying the loans by power sales, and operating a joint venture.

1994: Growing the nuclear sector through circular development
The Daya Bay NPP went into operation; the Ling’ao Phase I project was launched; According to international standards to achieve independence and develop tech and equipment by ourselves. In 1994, the China Guangdong Nuclear Power Group was founded.

2004: Nuclear power grew in scale; numerous clean energy were developed
We operated NPPs nationwide, including the Ling’ Ao Phase II, Hongyanhe, Ningde, Yangjiang, Taishan, Fangchenggang projects.

2011: Operating specialized segments by following the market rules; promoting technological innovation and joining the international market
Clean energy was developed, such as the wind, hydro and solar power.

2018: The Company is now operating 4+X specialized sectors; we have developed the HPR1000 and join the international market.
In 2013, the Company was renamed as the CGN Group.

In 2018, the Company is now operating 4+X specialized sectors; we have developed the HPR1000 and join the international market.
Nuclear Power Sector

- **Ningde Nuclear Power Base**
- **Daya Bay Nuclear Power Base**
- **Yangjiang Nuclear Power Base**
- **Hongyanhe Nuclear Power Base**
- **Fangchenggang Nuclear Power Base**
- **Taishan Nuclear Power Base**

**Capacity in Operation:**
- **56%** of mainland China’s total
- **41%** of mainland China’s total

**Nuclear Power O&M Services**
- Maintenance Service
- Training Service
- Spare Parts Management
- Production Preparedness

**Nuclear Power Engineering & Construction Services**
- Engineering Design
- Engineering Procurement
- Construction Management
- Testing & Commissioning
Regulatory Basis
Statutes

- Nuclear Safety Law
- Prevention and Control of Occupational Diseases
  ...

Regulations

- HAF103/HAD103... (National Nuclear Safety administration)
- Decree No. 55 of the Ministry of Health /Measures for Occupational Health Management of Radiation Workers
  ...

Standards

- Basic Standards for Protection against ionizing radiation ...
- Specification for individual Monitoring of Occupational internal/External exposure
  ...

Programs

- RP Programme
- Emergency Plan
- Monitoring &Management Produce
- Work instructions
  ...

- Programs
Dosimetry
External Dosimetry

- Whole-body thermoluminescence dosimeter (TLD)
  - BGN (beta/gamma/neutron) dosimeter with appropriate filtration

- Extremity thermoluminescence dosimeter (DXT-RAD)
  - Adjustable finger ring carrying TLD pellet

- Whole-body electronic personal dosimeters (EPD)
Internal Dosimetry

- Whole-body Counter
  - NaI & HPGe

- Urine/Faecal Analysis (under building)
- PAS (personal air sampler)/SAS (static air sampler)
Accredited Laboratory

- **CMA**: China Metrology Accreditation
  - RBT214-2017 (Competence assessment for Inspection body and laboratory mandatory approval)
  - General requirements for Inspection body and laboratory)
  - GB/T27025 (Base on ISO/IEC17025:2017)

- Qualification of Radiological Health Technical Service

- Located in 6 Nuclear Power Plant sites.
Information Systems
Information Systems

- Manage, process and store individual monitoring services data
- Dose limits control
- Share dose information
- Assist in statistical analysis of exposure records
- Personal records
- RCA pass share
- Continuous development and upgrade under requirements

PDUS
Dose Management System

RWP MS
Radiation Work Permit Management System

- Overall supervision of radiation risks
- Assign a separate number to each job
- Assist in making ALARA proposals

SDH private Line

Daya Bay
- KZC EPD
- TLD
- WBC

Ningde
- KZC EPD
- TLD
- WBC

Fangchenggang
- KZC EPD
- TLD
- WBC

Hongyanhe
- KZC EPD
- TLD
- WBC

Yangjiang
- KZC EPD
- TLD
- WBC

Taishan
- KZC EPD
- TLD
- WBC
Daily Dose Control
Daily dose control

- **Reference level**

- **Plant Control Target**
  - Do not exceed this value as far as possible

- **Intervention Level**
  - Close the access authorization for RCA of the worker intervened.

- **Investigation Level**
  - The daily and monthly cumulated dose should be investigated in time to confirm its authenticity.

- **Statistical methods**
  - Dose Value includes max (EPD&TLD), and internal exposure
  - Both in-plant and off-site exposure (contractor's declaration)
  - 365 Days rolling calculating
Monthly Report
### 异常事件汇总

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<tr>
<th>异常类型</th>
<th>大亚湾</th>
<th>宁德</th>
<th>红沿河</th>
<th>防城港</th>
<th>台山</th>
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说明:
In the early stage, for the small number of units, the fluctuation mainly comes from outage type and outage arrangement. With the increasing of the units number, the average dose in the past five years is about 0.4 man·Sv/unit.
The collective dose per unit and the collective dose per hour show an overall downward trend in past years.

The working hours per unit and the worker number per unit Fluctuate above and below the same value in past years.
From 2014, CGN Fleet start to using RWP system with significant increasing in number of used RWP by years.

By the end of 2018, most of the power plants have run RWP system, and the proportion of RWP dose to total dose is higher than 85%.
Individual Dose
From 2000 to 2018, there is a slight downward trend for the average individual dose for all workers. As the average worker number per unit is basically the same among years, the average individual dose is mainly affected by outage type and outage arrangement.
In past 5 years, the number of workers over 12mSv reduce by half, while the number of workers over 15mSv gradually reduce to 0.
Centralized Monitoring and Management of Occupational Exposure in CGN, including:

- External exposure & Internal exposure Monitoring
- Standardized Programme/Procedure/ instructions
- Real-time networked control CGN fleet dose data
- Periodic analysis and evaluation report

With the commissioning of the new units, the average unit dose of CGN has generally decreased year by year;

Centralized management helps control the individual dose limits, and the number of individual doses over 15mSv is controlled at a lower level.
Future Activities

• To Improve the capability of dosimetry (eye lens, biological sample, alpha nuclide monitoring)
• With new technologies such as wireless / intelligent monitoring to assist collective / individual dose control
• To enhance RWP system function of predicting and evaluating outage/task dose
Thank You!