

Radiation Protection Management in Shandong Haiyang Nuclear Power Plant

Liu Pengzhen
SDNPC
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1. Radiation Zoning Management

- RCA was established based on design, in which specific protection measures and safety provisions are or could be required for controlling normal exposures or preventing the spread of contamination during normal working conditions, and preventing or limiting the extent of potential exposures. The access control area is set up for zoning management.

Zones	Dose Rate D (mSv/h)	Actual Dose Rate D (mSv/h)	Management Requirements
Green Zone	$0.0025 < D \leq 0.01$	$0.0001 < D \leq 0.007$	Staff can stay without time limit.
Yellow Zone	$0.01 < D \leq 1$		Staff can stay with time limit.
Orange Zone	$1 < D \leq 10$	$0.0001 < D \leq 0.248$ (except reactor building)	Lock management; Strict restrictions on entry and length of stay.
Red Zone	$D > 10$		Lock management; Strict restrictions on entry and length of stay. The radiation protection personnel conduct site supervision.

2. Radiation Work Management

■ Radiation Work Permit

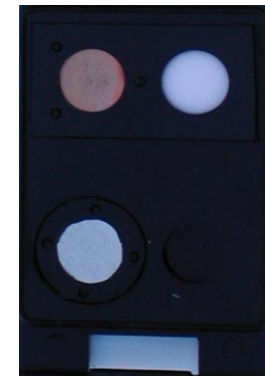
- All radiation work at the NPP require radiation work permits (RWP).

■ Radiation Work Permit Grading

- The radiation work permit (RWP) is classified into 3 grades based on the radiation risk.(grade one,grade 2 and grade 3 according to risk from high to low.)
- Radiation work is supervised by the radiation protection personnel, including external radiation level (Gamma dose rate), internal radiation level (air pollution)and surface contamination level, etc.

3. Individual Dose Monitor and Dose Limit System

	Internal exposure	External exposure
Monitoring methods	The whole-body counter (WBC)	Cumulative dosimeter (TLD) Direct-reading electronic dosimeter (EPD)



3. Individual Dose Monitor and Dose Limit System

The individual dose limit should comply with GB18871, in which it is 20mSv. The annual management target value for individual dose is 13mSv in our station.

Reference Level	External exposure		Internal exposure
Measurement type	EPD	TLD	WBC
Recording level	1 μ Sv	Greater than the background value	MDA (minimum detection limit)
Investigation level	1mSv (one day)	4mSv (two months)	0.5mSv
Warning level	8mSv (one year) 6mSv (single overhaul)	N/A	N/A
Intervention level	10mSv (one year)	N/A	1.5mSv

3. Individual Dose Monitor and Dose Limit System

■ Records and Archives of Individual Dose Monitor:

- ❑ The records of individual dose should be included in the individual dose file annually.
- ❑ The individual dose file for a staff member should be kept until he/she is 75 years old , or 30 years after leaving his/her radiation job.
- ❑ The dose received in emergency intervention or accident should be specially indicated in the individual dose file so as to distinguish it from normal occupational exposure, and it should be accompanied with an investigation report.

4. Surface Contamination and Protection

■ **Surface Contamination:** object or body are contaminated with radioactive dust or liquid.

■ **Protective Measures against Surface Contamination**

- Choose materials that is easily to be decontaminated.
- Prevent equipment and appliances from being contaminated
- Establish the contamination isolation zone
- Take decontamination measures
- Standardize individual behaviors
- Use personal protective equipment correctly

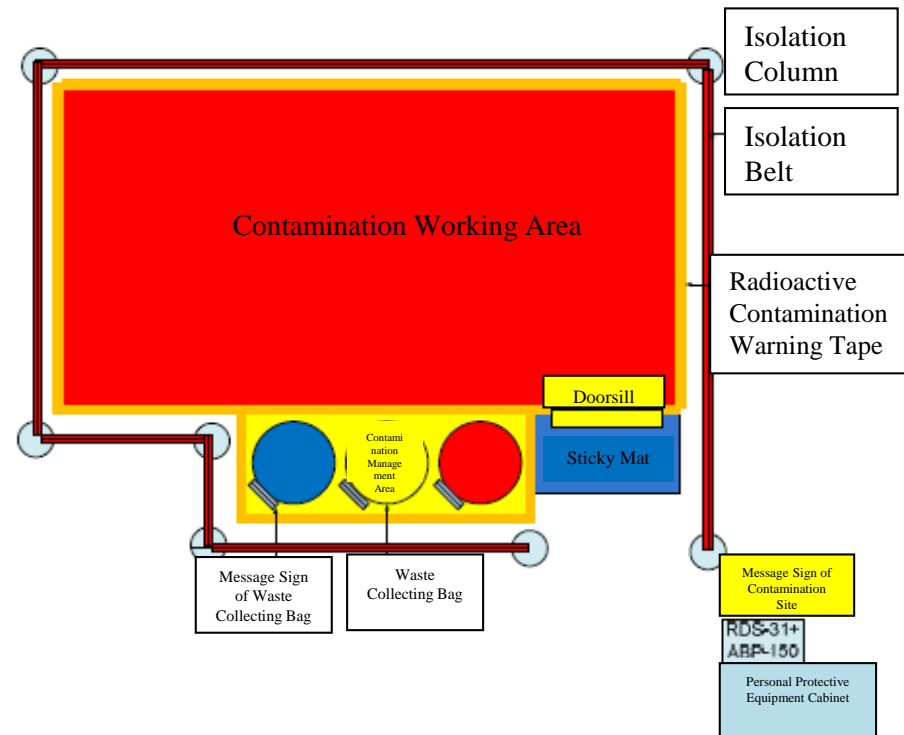
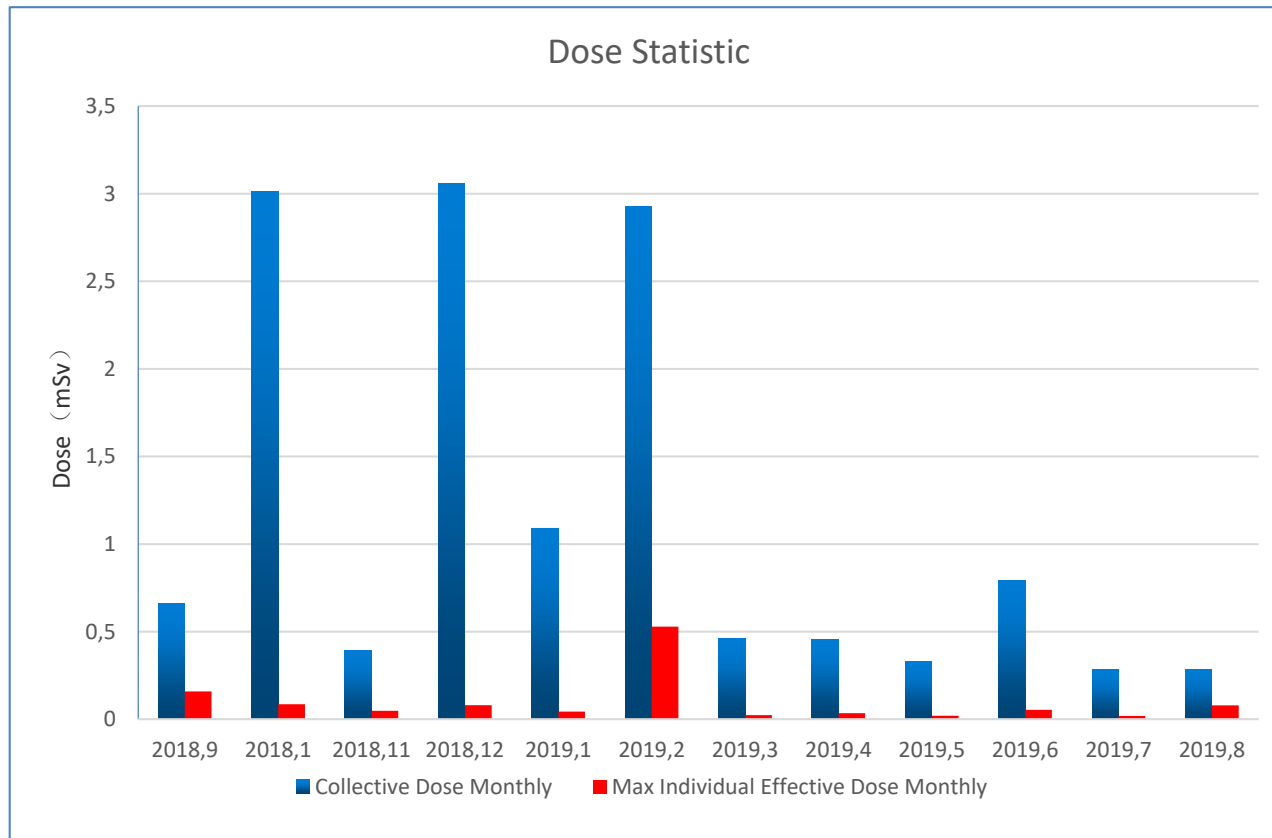


Figure 1. Schematic layout of standard site

5. Performance Indicators in Radiation Protection

S.N.	Category	Index Items
1	Dose control	Collective Dose (person. mSV)
2		Max. individual effective dose (mSv)
3		Unplanned radiation events
4	Contamination control	Body surface contamination event
5		Internal contamination event
6		Ground surface contamination event due to human factors
7	Material control	Radioactive material out of control event

5. Performance Indicators in Radiation Protection



6. Optimization in Radiation Protection Management

■ ALARA Committee

In 2014, Haiyang NPP established the ALARA Committee, which takes full responsibility for overall arrangement and promotion of optimization management work in radiation protection.

■ ALARA Work Plan

ALARA Work Plan is issued every year to guide annual radiation protection optimization. From November 2014 to March 2019, we have held 9 ALARA meetings in total.

■ ALARA Team

As for works with high radiation risks, an ALARA team, which is composed of the preparation engineer, the leader in charge and RP personnel, would be organized to carry out the following works: call for a meeting for risk analysis and work preparation, in which the ALARA objectives, protection requirements and emergency measures would be discussed. Everything above is to ensure that radiation risk is under control.

7. Works with High Radiation Risk

- **Work in the reactor building in the power operation condition.**
- **Work in the primary side of steam generator: open and close manhole , in-service inspection, etc.**
- **Reactor related work: open and close the cover of pressure vessel , handle nuclear fuel, etc.**
- **Replace the radioactive filter core (WLS/CVS/SFS) .**
- **Overhaul valves, pumps and other equipments in radioactive systems.**
- **Work related to entering the radioactive container.**

THANK YOU !