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Radiation Protection Performance Indicator System of CNNP

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Part 01

Factors to Consider When Establishing an Indicator System

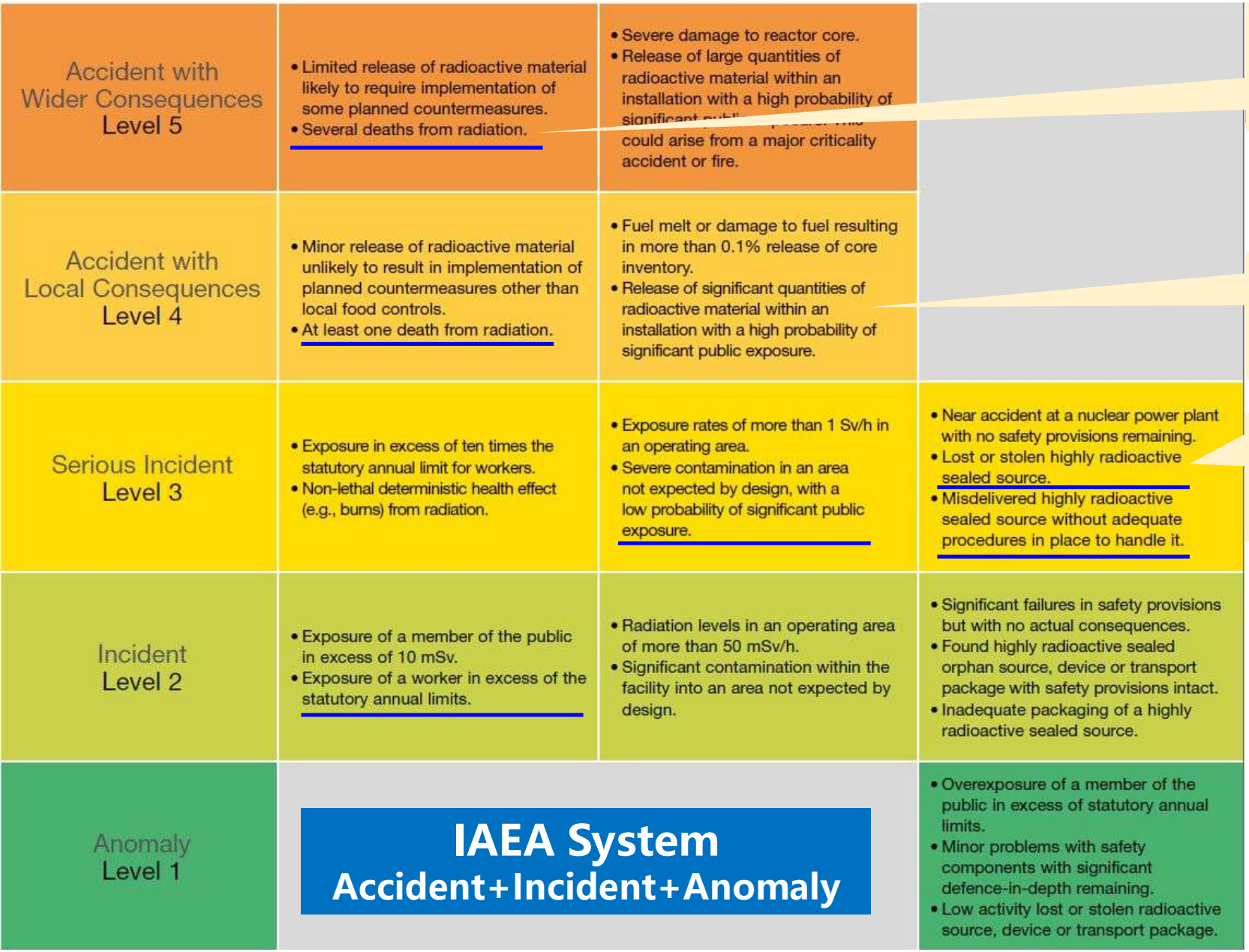
What is

[About Indicator]

1 Radiation Protection Indicator

2 RP Performance Indicator

3 RP Performance Indicator System


Accident with Wider Consequences Level 5
• Limited release of radioactive material likely to require implementation of some planned countermeasures.
• Several deaths from radiation.
• Severe damage to reactor core.
• Release of large quantities of radioactive material within an installation with a high probability of
could arise from a major criticality accident or fire.
Accident with Local Consequences Level 4
• Minor release of radioactive material unlikely to result in implementation of planned countermeasures other than local food controls.
• At least one death from radiation.
• Fuel melt or damage to fuel resulting in more than 0.1% release of core inventory.
• Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure.
Serious Incident Level 3
• Exposure in excess of ten times the statutory annual limit for workers.
• Non-lethal deterministic health effect (e.g., burns) from radiation.
• Exposure rates of more than 1 Sv/h in an operating area.
• Severe contamination in an area not expected by design, with a low probability of significant public exposure.
• Near accident at a nuclear power plant with no safety provisions remaining.
• Lost or stolen highly radioactive sealed source.
• Misdelivered highly radioactive sealed source without adequate procedures in place to handle it.
Incident Level 2
• Exposure of a member of the public in excess of 10 mSv.
• Exposure of a worker in excess of the statutory annual limits.
• Radiation levels in an operating area of more than 50 mSv/h.
• Significant contamination within the facility into an area not expected by design.
• Significant failures in safety provisions but with no actual consequences.
• Found highly radioactive sealed orphan source, device or transport package with safety provisions intact.
• Inadequate packaging of a highly radioactive sealed source.
Anomaly Level 1
IAEA System
Accident+Incident+Anomaly
• Overexposure of a member of the public in excess of statutory annual limits.
• Minor problems with safety components with significant defence-in-depth remaining.
• Low activity lost or stolen radioactive source, device or transport package.
Column 1 : Personnel Safety
Column 2: Boundary Control
Column 3: Defense in Depth and Source Safety
Major Accident Level 7
• Major release of radioactive material with widespread health and environmental effects requiring implementation of planned and extended countermeasures.
Serious Accident Level 6
• Significant release of radioactive material likely to require implementation of planned countermeasures.

Factors to Consider : Qualitative Classification

Accident	Incident	Anomly or Tool
• INES (IAEA/NEA) • Regulations of the State Council • NNSA ERP	• Group Company Focus • Other incidents not meeting the accident criteria	• Tracked by NNSA • WANO/ISOE • Deviation and Process Effectiveness

Factors to Consider : Weighting

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1 Level-1

Accident:
Radiation Accidents
Inccident:
Maximum Individual Dose
Internal contamination
Skin Contamination
Area Contamination
Radioactive Material Control
Unplanned R-Exposure
Other: CRE

External concerns

2 Level-2

Anomaly:
Skin Contamination
Area Contamination
Airborne Contamination
WBC Exceeding Record Levels
Dose Exceeds Work Permit
Defenses-in-Depth Flaws-for Source Safety
.....

Plant concerns

3 Level-3

Process Effectiveness:
Monitoring System Availability Rate
Number of C1/C2 Genuine Alarms
Number of EPD Alarms
Abnormal Radiation Levels-in RCA
Number of Radiation Hotspots
Number of False Alarms for-a Certain Device
.....

Department concerns

Part 02

RP Performance Indicator System of CNNP

System Framework

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Accident

Ordinary Radiation Accident or Higher
(Relatively serious
Major
Extraordinarily serious)

01

02

Incident (Personnel Safety)

Serious Unplanned Exposure
Ordinary Unplanned Exposure
Internal Contamination
Skin Contamination

(Area and material) Incident

Area Contamination
Radioactive Material Out of Control

03

04

Others

CRE
Maximum Individual Dose
Skin Contamination Anomaly

Definition

Definition of Radiation Protection Performance Indicators		
No.	**Name**	**Definition**
1	**Ordinary Radiation Accident or Higher**	Refer to unexpected abnormal exposure of personnel caused by loss, theft, or loss of control of radioactive sources; loss of control of radioactive isotopes and radiation-emitting devices; or failure of radiation protection management or technology. a) **Extraordinarily serious Radiation Accident** ※Loss, theft, or loss of control of **Class I or Class II** radioactive sources resulting in widespread severe radiation contamination; ※Loss of control of radioactive isotopes or radiation-emitting devices causing **acute death of three or more persons**; ※Failure of radiation protection management or technology causing acute death of three or more persons. d) **Ordinary Radiation Accident** ※Loss, theft, or loss of control of **Class IV or Class V** radioactive sources; ※Exposure of personnel exceeding the **annual dose limit** (GB18871-2002 Appendix B) due to loss of control of radioactive isotopes or radiation-emitting devices; ※Exposure of personnel exceeding the annual dose limit due to failure of radiation protection management or technology.

Definition

Definition of Radiation Protection Performance Indicators		
No.	**Name**	**Definition**
2	**Serious Unplanned Exposure Incident**	Any radiation exposure incident where an individual receives a single effective dose of 15 mSv or greater but less than 50 mSv due to unauthorized radiation work or human error or unexpected equipment malfunction. For skin dose: an individual of 150 mSv or greater but less than 500 mSv.
3	**Ordinary Unplanned Exposure Incident**	Any radiation exposure incident where an individual receives a single effective dose of 1 mSv or greater but less than 15mSv due to unauthorized radiation work or human error or unexpected equipment malfunction. For skin dose: an individual of 10 mSv or greater but less than 150 mSv.

Definition

Definition of Radiation Protection Performance Indicators		
No.	**Name**	**Definition**
4	**Incident of Radioactive Material Out of Control**	Incidents involving the uncontrolled removal of radioactive material (including radiation sources) from RCA.
5	**Internal Contamination Incident**	Incidents where the intake of non-tritium radionuclides in staff exceeds 1% of the ALI (Annual Limit of Intake)
6	**Area Contamination Incident**	Uncontrolled contamination of the workplace due to plant management or technical failure, including: a) Contamination levels exceeding 40 Bq/cm² within the RCA, with a contaminated area exceeding 1 m²; b) Contamination levels exceeding 4 Bq/cm² within the RCA, with a contaminated area exceeding 10 m²; c) Contamination levels exceeding 0.4 Bq/cm² outside the RCA.

Definition

Definition of Radiation Protection Performance Indicators		
No.	**Name**	**Definition**
7	**Skin Contamination Incident**	Incident where the skin equivalent dose of a worker due to radioactive contamination on their skin exceeded 1 mSv (0.2% of the skin equivalent dose limit).
8	**Skin Contamination Anomaly**	Worker’ s skin is contaminated, with the contamination level exceeding the control standard ($\beta < 0.4$ Bq/cm², $\alpha < 0.04$ Bq/cm²), and it has not reached the standard for a skin contamination incident.
9	**CRE**	The total dose of external and internal exposure received by all staff members (power plant employees, contractor employees, and personnel visiting the power plant for official business, etc.) within the given time period.
10	**Maximum Individual Dose**	The maximum effective dose that workers receive within a given period of time.

Part 03

Evaluation Method for Indicator Results

No.	Indicator	Minimum scope	Condition		Green light	Yellow light	Red light	Monthly weighting	Annual weighting
1	Radiation Accident	Unit	/		0	/	≥1	100	100
2	Ordinary Unplanned Exposure		/		0	/	≥1	100	50
3	Serious Unplanned Exposure		/		0	/	≥1	100	20
4	Radioactive Material Incident		/		0	1	≥2	20	20
5	Internal Contamination Incident		/		0	/	≥1	20	20
6	Area Contamination Incident		In Power		0	1	≥2	10	10
			Outage		0	1~2	≥3	10	10
7	Skin Contamination Incident		In Power		0	/	≥1	15	15
			Outage		0	1~2	≥3	15	15
8	Skin Contamination Anomaly		In Power		0	1	≥2	5	5
			Outage		≤6	7~9	≥10	5	5
9	CRE (man.mSv) (Take the annual criteria as an example)		No outage	PWR	≤72	72 < CRE < 120	≥120	30	30
				PHWR	≤130	130 < CRE < 175	≥175		
			Has full outage	CNP300/600/1000/ HPR1000	≤550	550 < CRE < 650	≥650		
				VVER/AP1000	≤480	480 < CRE < 600	≥600		
				PHWR	≤680	680 < CRE < 850	≥850		
			Has other kind of outage	CNP300/600/1000/ HPR1000	≤420	420 < CRE < 550	≥550		
				VVER/AP1000	≤360	360 < CRE < 500	≥500		
				PHWR	≤540	540 < CRE < 750	≥750		
10	Maximum Individual Dose	Plant	Cumulative maximum value this year		≤12	12<D<15	≥15	30	30

Periodic Report

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Monthly/Annual Performance Evaluation:

【Summary】

August 2025, 26 units of CNNP were in power operation, and 0 unit was undergoing outage.

A total of 26 operating units were evaluated this month, among which 25 units had green lights, 1 unit had a yellow light, and 0 unit had a red light.

No radiation accidents occurred at any power plant, and no unplanned exposure, internal contamination, skin contamination, area contamination, or out of control of radioactive material occurred.

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Thank you for your attention!

Let’s continue the conversation: **chenql@cnnp.com**