

ERP-Based Radiation safety, Environment and Emergency Preparedness Management Information system for NPP



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Korea Hydro-Nuclear Power Company

Contents



Company Overview

Overview of KHNP ERP

Overview of REM

Radiation Management

Radioactive Waste Management

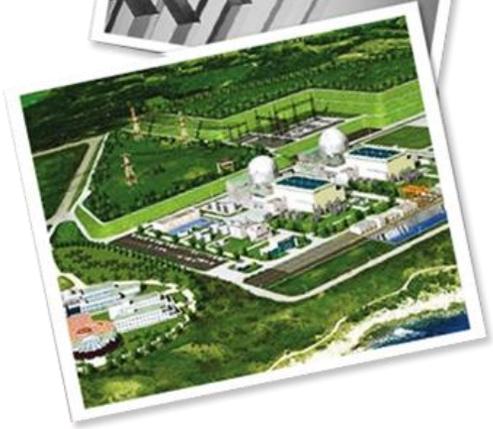
Environment Management

Emergency Preparedness Management

Expectations

Foundation Background of KHNP

- **In accordance with reorganizing plan of utility industry under government's order, April 4th, 2001, KEPCO(Korea Electric Power Corporation) divided power generating business area into 6 subsidiaries.**
- **The purpose of reorganizing utility industry is to maximize the effectiveness and stably provide cheap and highly efficient electric power through competitions among power generation companies.**
- **KHNP is one of KEPCO's subsidiaries and consists of nuclear, hydro and Pumped water power plants.**



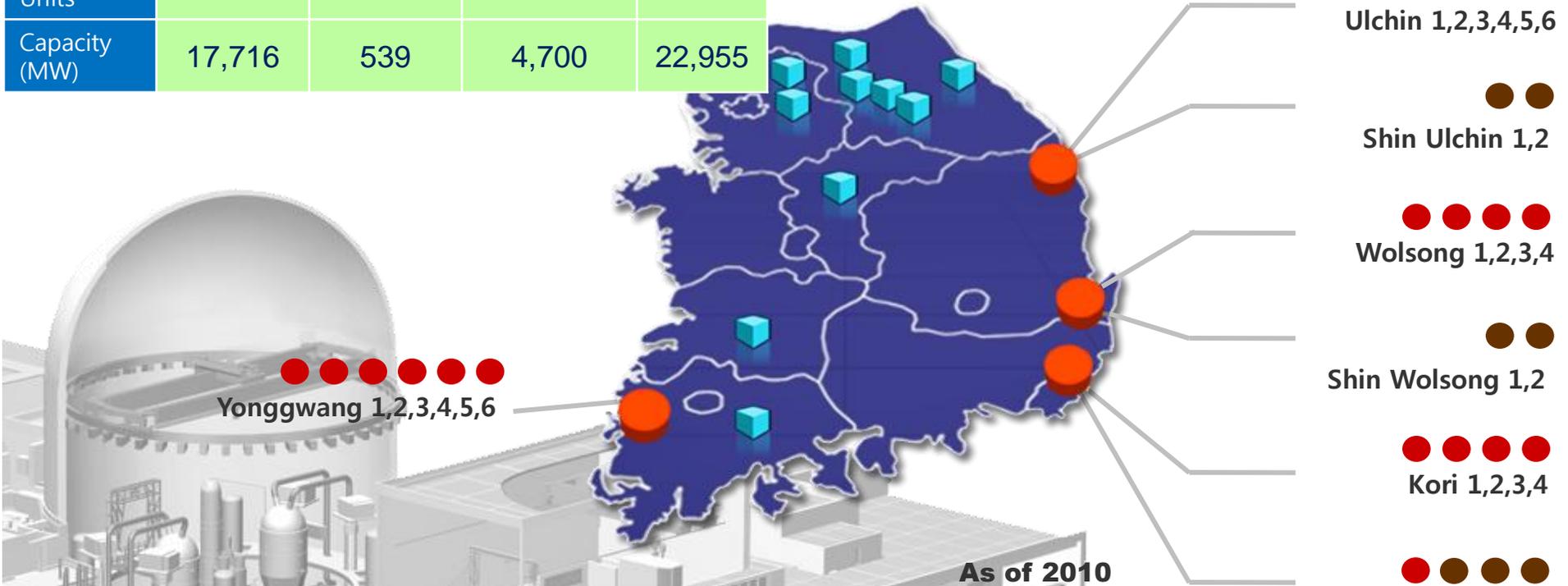
Company Overview

Major Status

31%

Div.	NPP	Hydro	Pumped	Total
Operating Units	21	27	16	64
Capacity (MW)	17,716	539	4,700	22,955

- In operation
- Under construction
- Hydro Power



- Ulchin 1,2,3,4,5,6
- Shin Ulchin 1,2
- Wolsong 1,2,3,4
- Shin Wolsong 1,2
- Kori 1,2,3,4
- ●●●● Shin Kori 1,2,3,4

Div.	Performance	Div.	Performance
Capacity Factor	91.2%	Unplanned S/D	0.1case/Unit
Rate of Operation	89.5%	Collective Dose	0.79man-Sv/reactor

■ What is ERP?

ERP system ultimately intensifies the competitiveness of a company by efficiently managing all the resources such as human and physical resources required for corporate activities.



- ❑ **Popular as a strong tool for business process innovation**
- ❑ **Simultaneously deal with all transactions in a corporate regarding with Sales, manufacturing, purchase, inventory, finance, personnel, and etc**
- ❑ **Solve troubles resulted from rapidly changing management status, and development of information technology**

DREAMS : Digital Real time Enterprise Asset Management System

ERP Project Progress

2001. 04 : Separation from KEPCO

2001. 12 : Launch ERP Project

2003. 02 : ERP System Open

2009. 02 : Diagnosis for ERP upgrade & ISP

2010. 02 : ERP Upgrade(R/3 → ECC6.1)

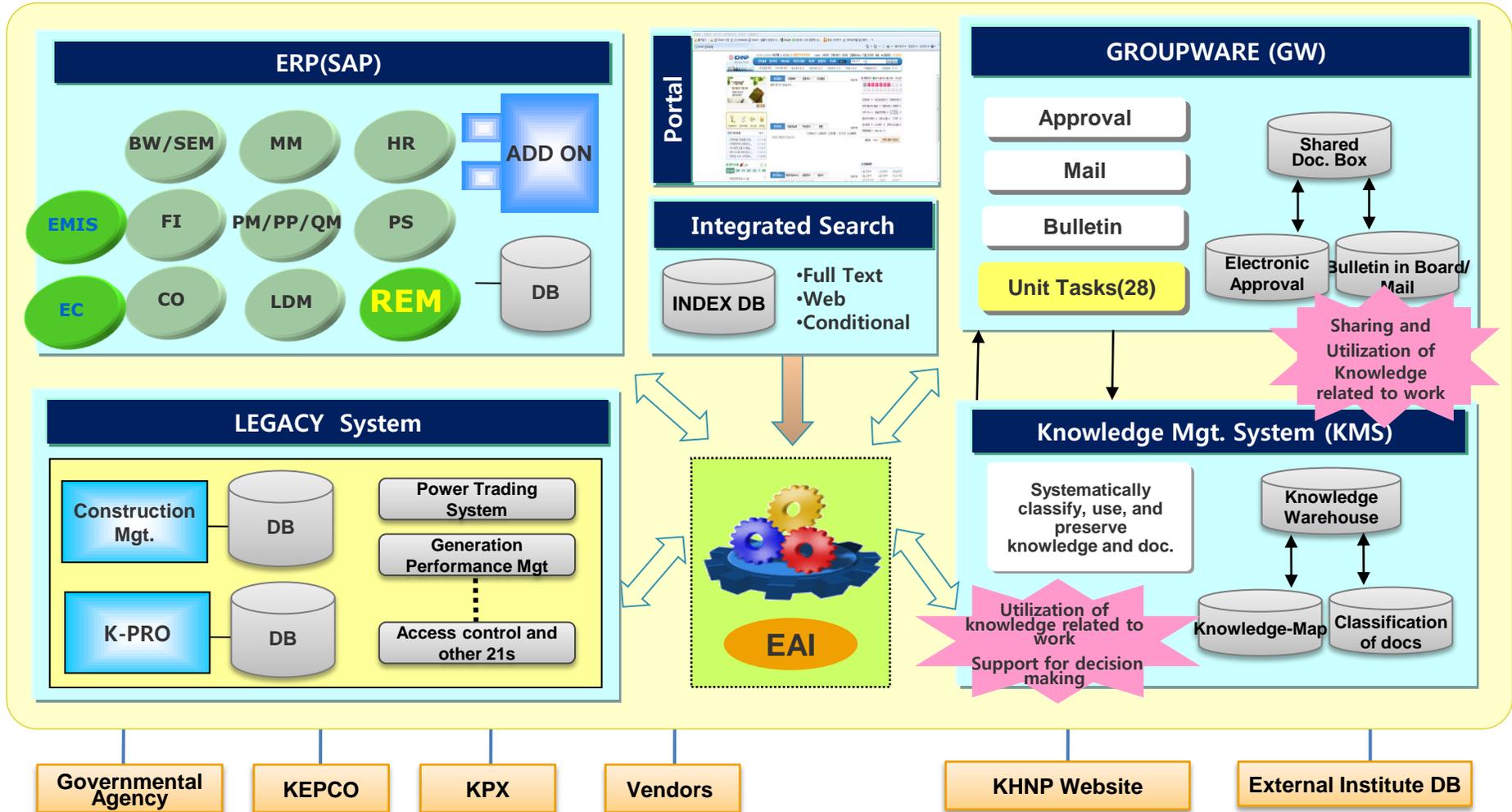
World Best Nuclear Power Plant



KHNP ERP Architecture

REM : Radiation & Environment Management

- RAM : Radiation Management
- RWM : Radioactive Waste Management
- EPM : Environment & emergency Preparedness Management



REM Process Composition

Headquarter Monitoring	BI	Group Ware	REM Portal			
	Integrated Portal					
RAM Radiation Safety	Radiation Worker History	Dispatch Transfer	Visitor	Access Qualification (WBC, Medical Exam., RP Training)		Related Sys.
	RWP	Dose Limitation Dose Objectives	Radiation/Radioactivity Measurement	Radiation Document		
	Access Control	HP Shift Journal	Procedure	Cyber RP Training		
	Radioactive Material Transportation	Radioactive Isotope	O/H Radiation Work history	Cyber ALARA center		
RWM Radioactive Waste	Solid Radioactive Waste	Liquid/gaseous Radioactive Waste Release Permit		Liquid/gaseous Radioactive Waste Release Results(Data)		
	Self disposal Waste	Solid Radioactive Waste Data Input/workflow		Solid Radioactive Waste Disposal Request		
EPM Environment	Environment conservation	Public complaint	Industrial Waste	Environment Real Time Info.	Environmental Radioactivity	
	Personnel health	disaster Safety	Green House Gas Emission	Chemical material	Environment Account	
EPM Emergency Preparedness	Emerg. Response Organization And Duty	EP Training	Exercise Evaluation	EP Document		
	ERO Member	EP E-Learning		Radiological Emergency Response Action System		

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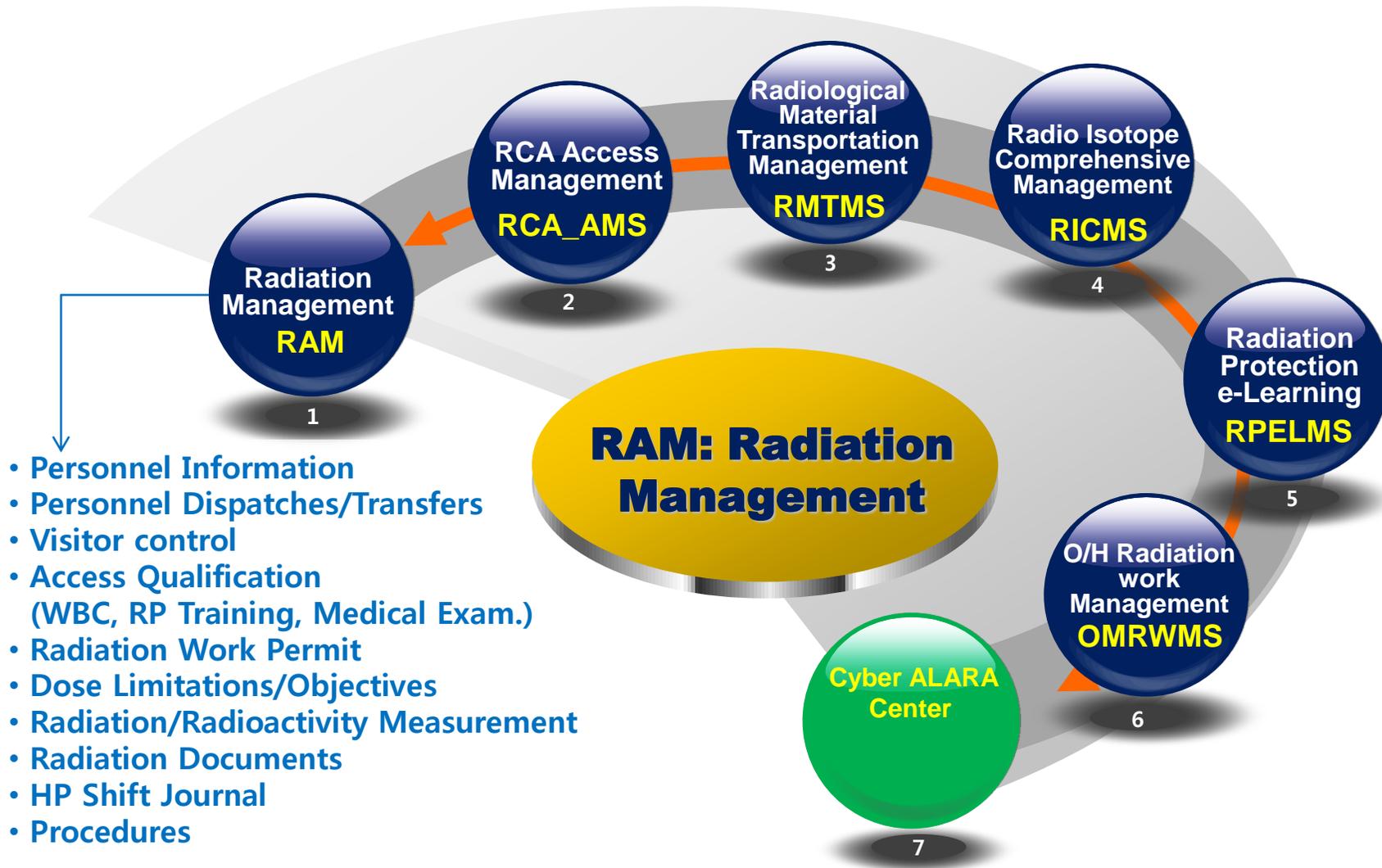
Radioactive Waste Management

Environment Management

Emergency Preparedness Management

Expectations

Radiation Management



Radiation Worker's exposure history Mgt change



Hard copy

1st Generation

- **Mgt lvl : Plant**
- **Data Inconsistency
Due to manual
Processing**
- **Insufficient
Transparency of Data
management**



MV

2nd Generation

- **Plant**
- **Early version of
computer capability**
- **Insufficient
Transparency of
Data management**



NRS

3rd Generation

- **Plant**
- **Data missing and
duplication in case of
employee's movement**
- **Insufficient
Transparency of Data
management**



ERP(RAM)

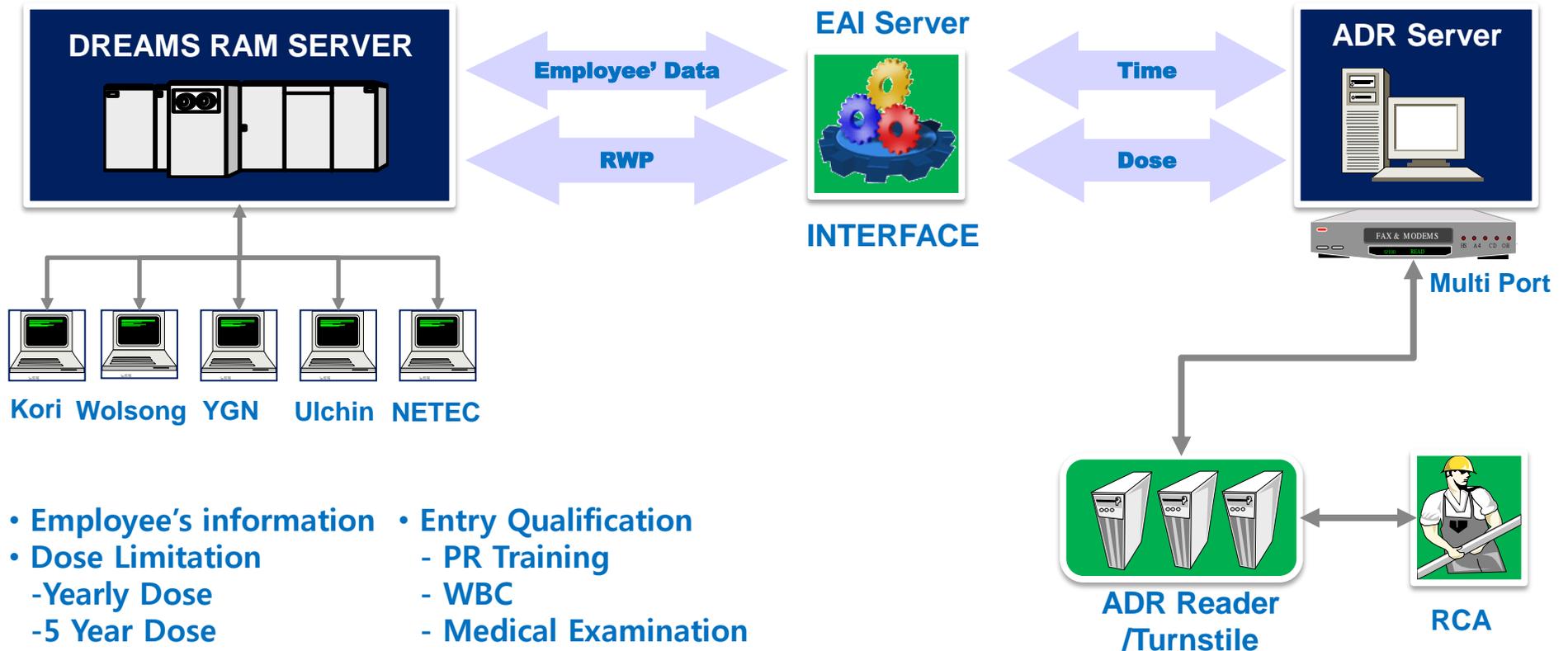
4th Generation

- **Companywide**
- **Reinforcement of
companywide
integration**
- **Data consistency**
- **Improvement of Data
Transparency**

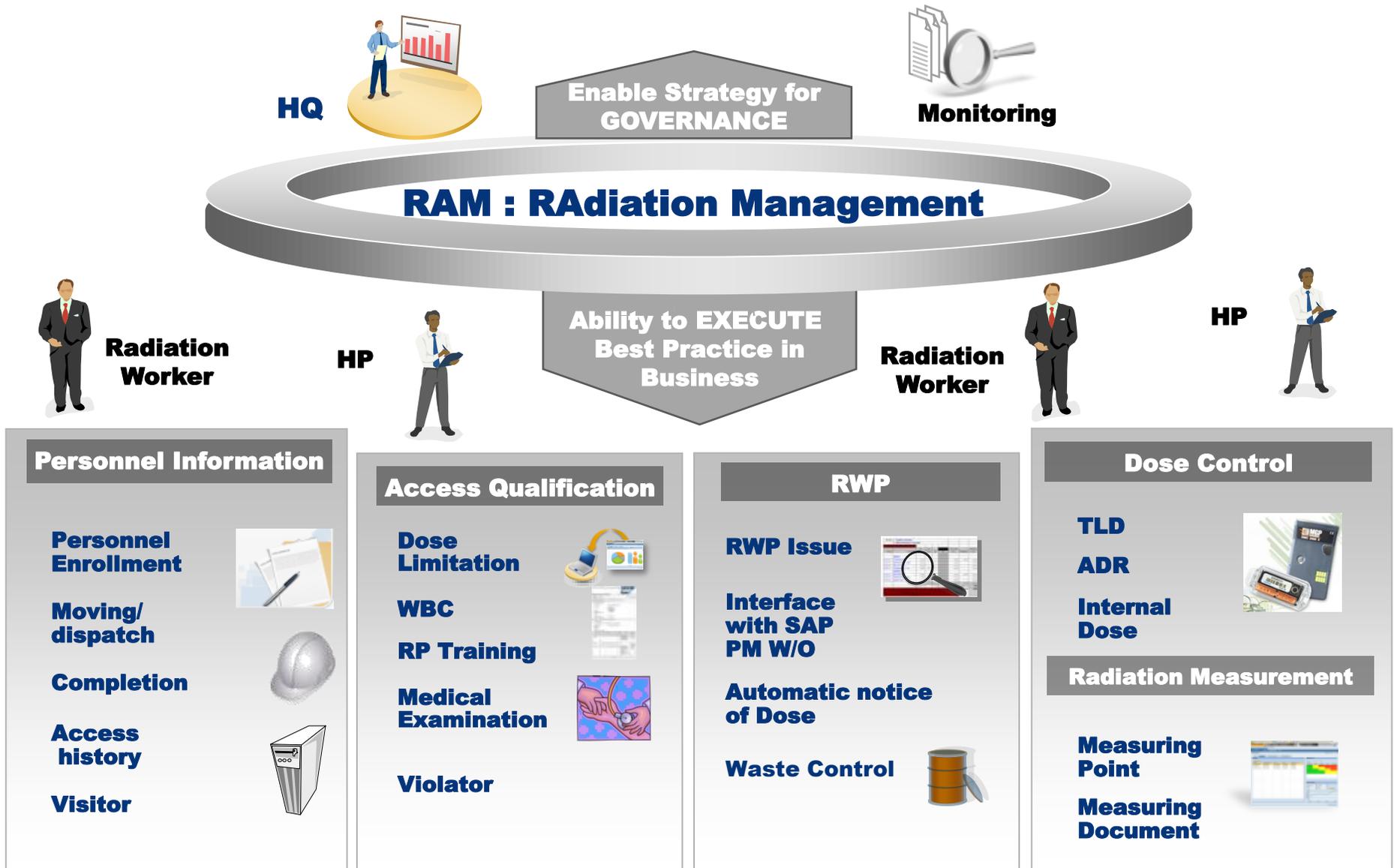
Network composition of RAM

- Registration of employee/Access Qualification
- Approval of Radiation Work Permit

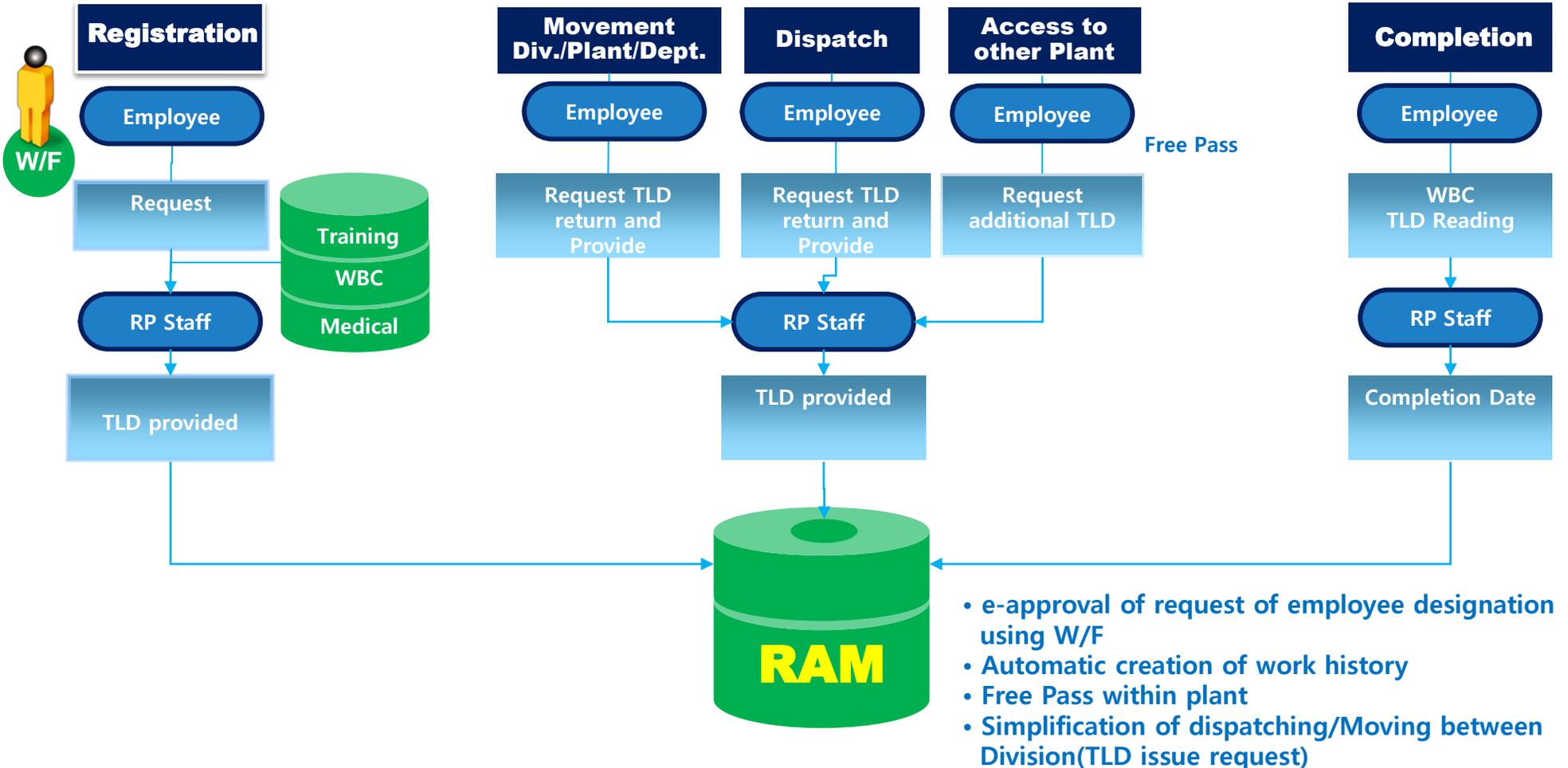
- Entry and Work in RCA



Major Process of RAM

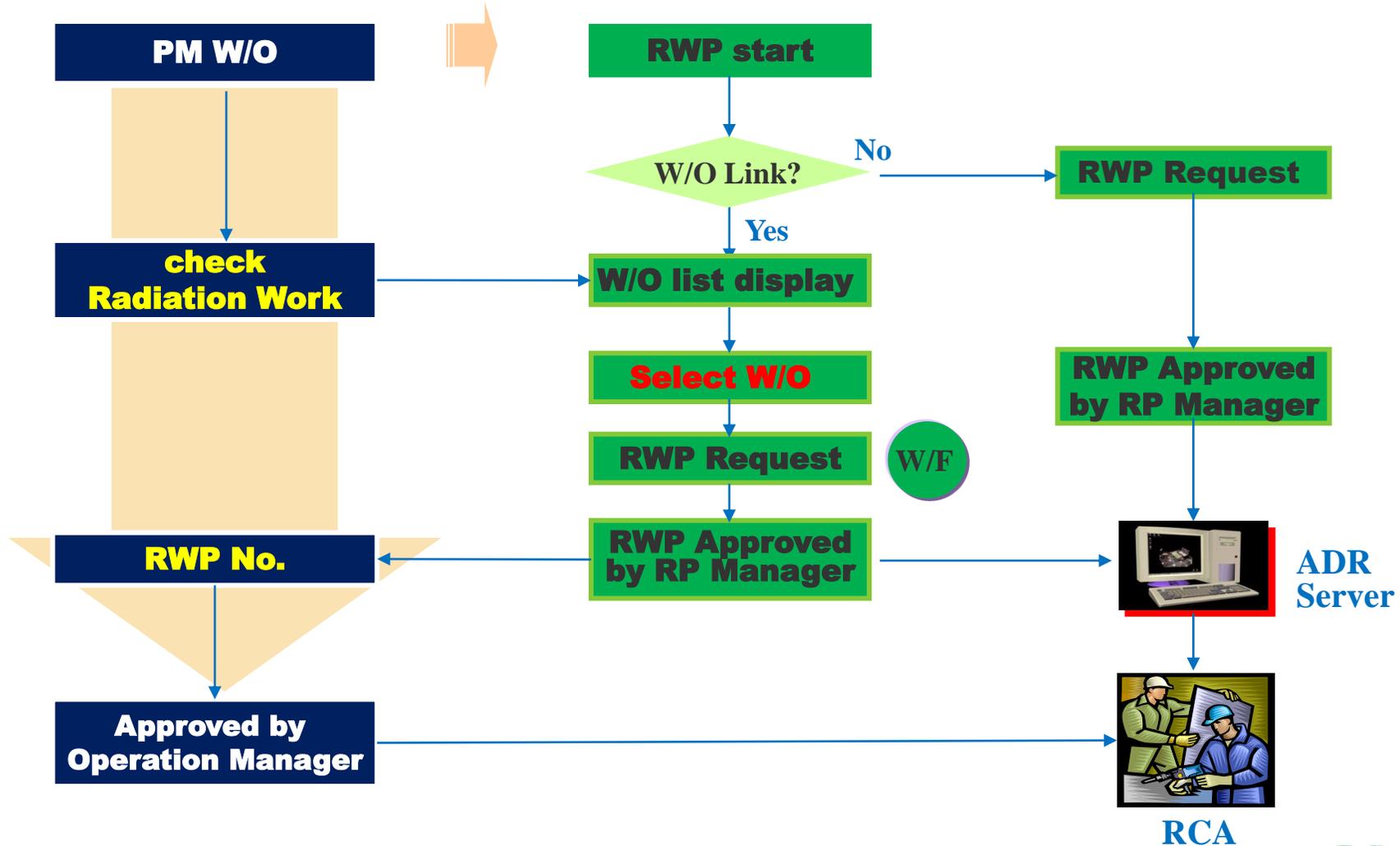


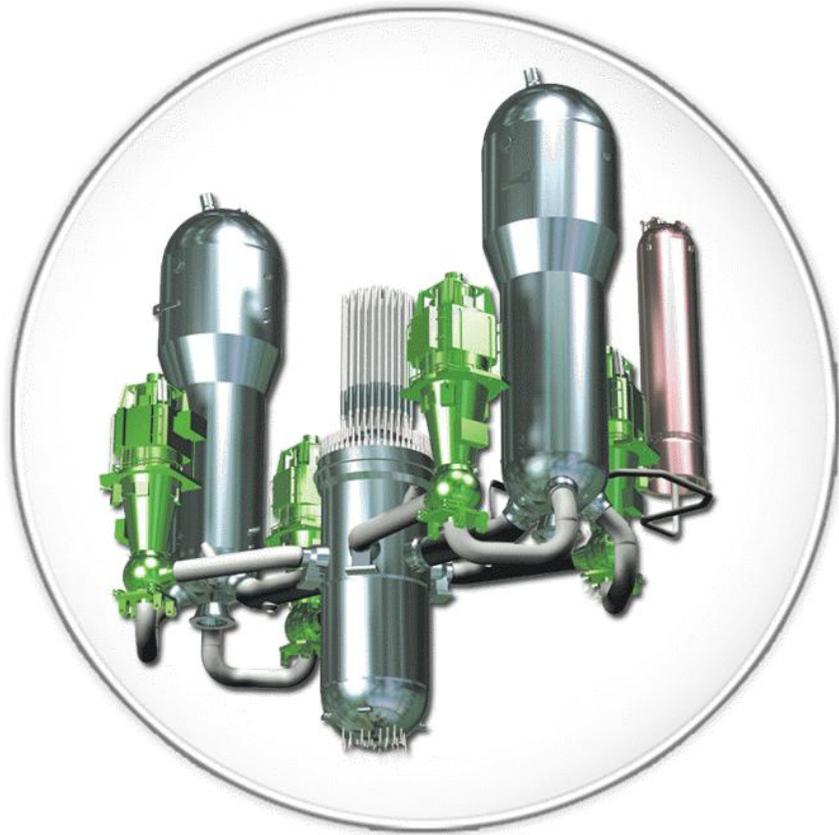
Employee Work History Process



Radiation Work Permit

- Reduction of required time before preparation
- with interfacing RWP and W/O
- Companywide code integration

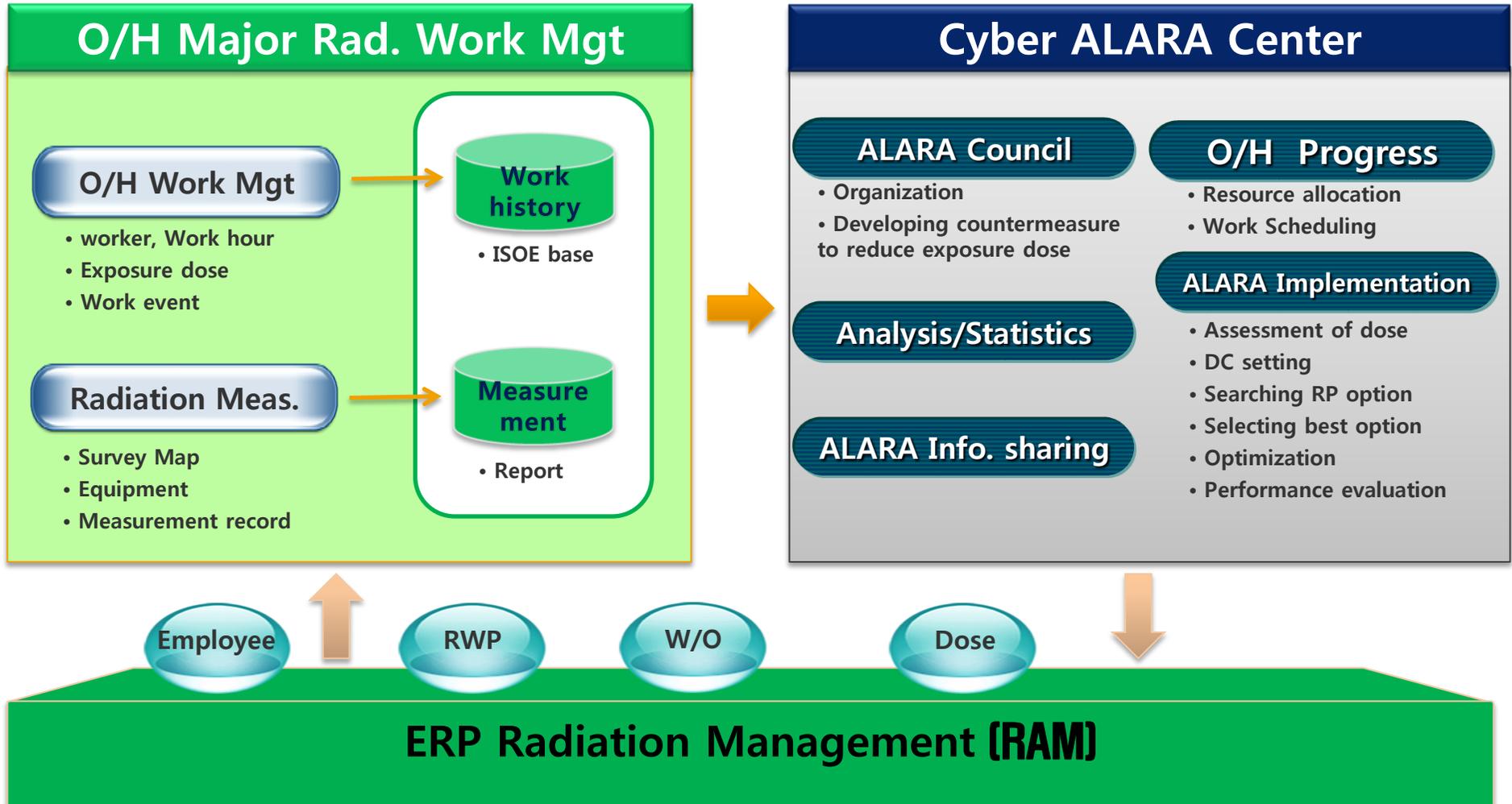




O/H Major Radiation Work Management System

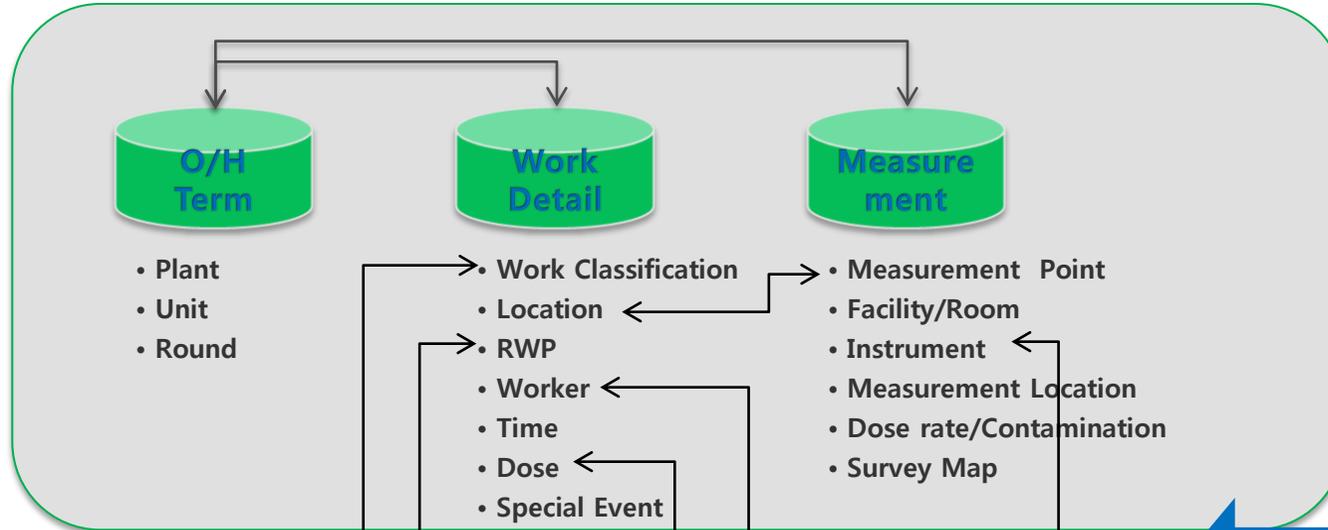
System Overview

- Repair/Maintenance work info. Management in radiation controlled area
- Radiation work infor. Management focused on ALARA analysis

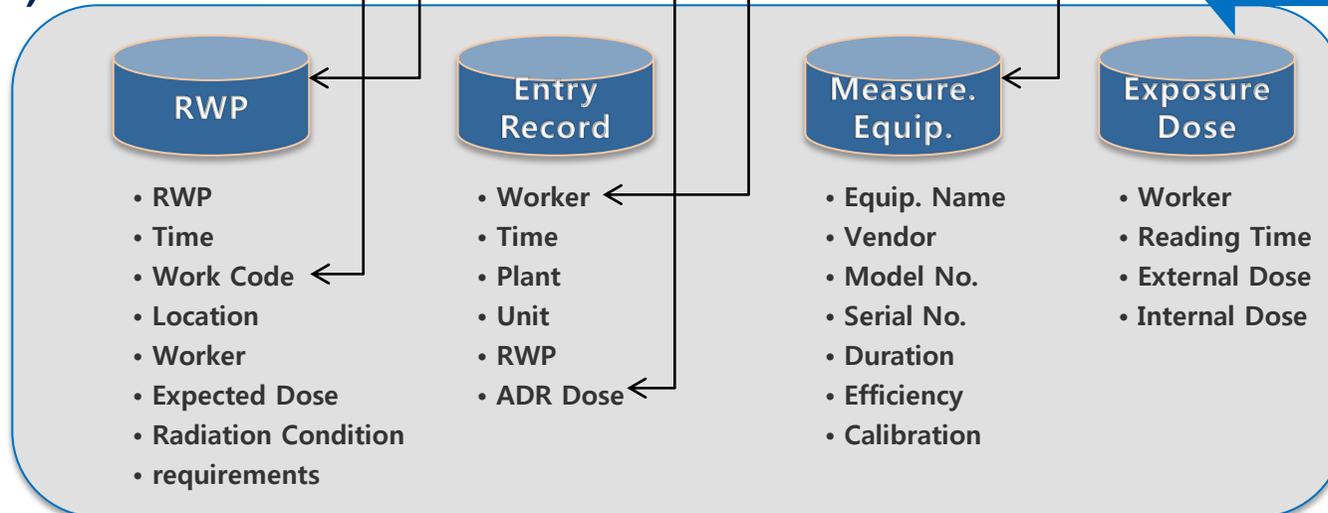


DB Composition and Relations

O/H Major Work Management



SAP(ERP) RAM



Analysis

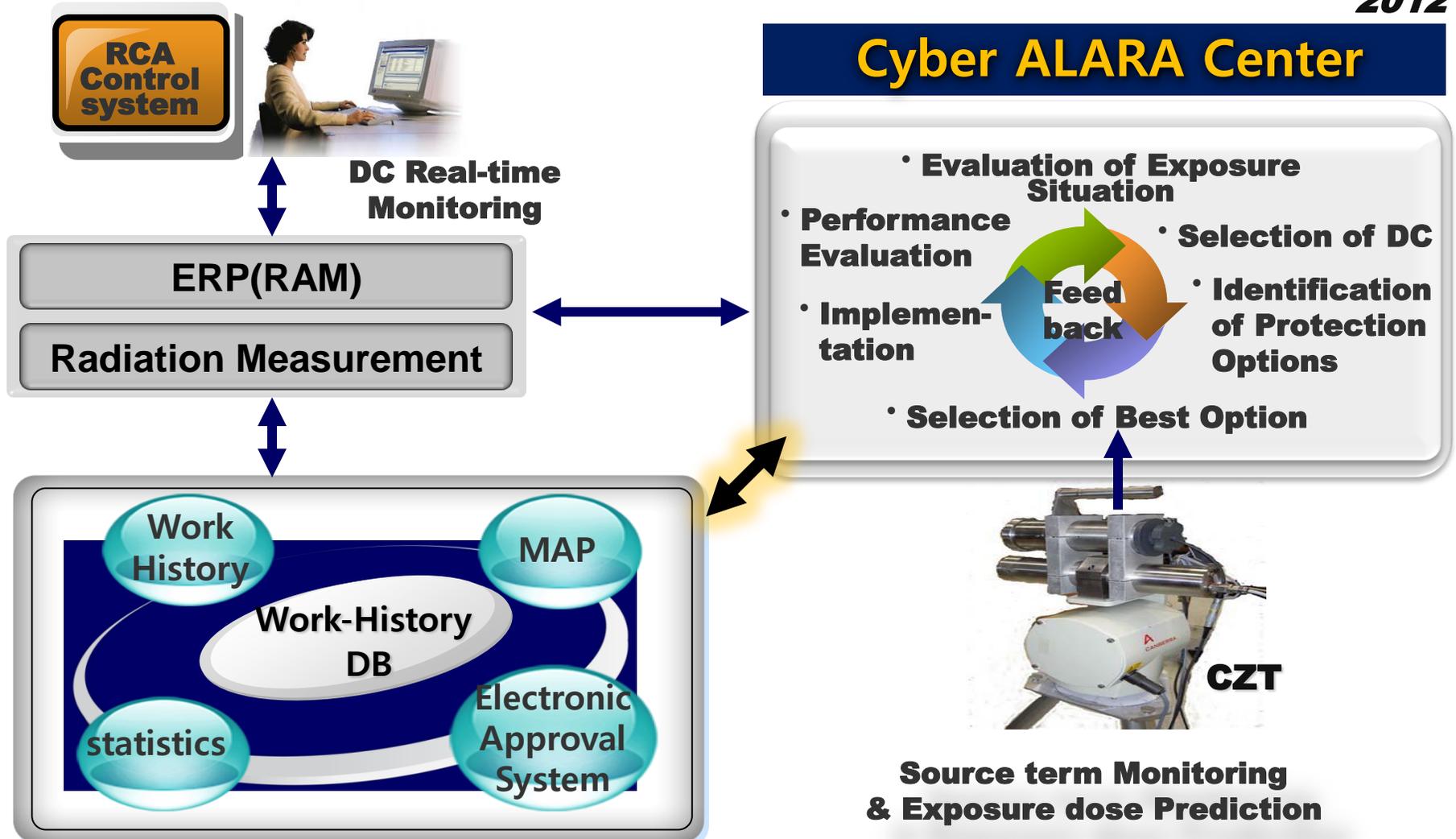
ALARA Center

Cyber ALARA Center



2012

Cyber ALARA Center

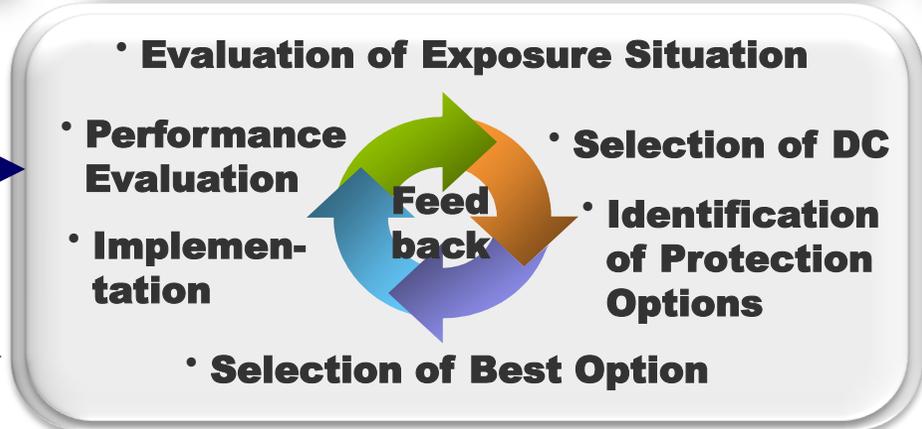


Cyber ALARA Center

Exposure dose prediction

- ① Source term Monitoring
- ② Exposure dose prediction

ALARA PROCESS Electronic Approval System



Real-time Monitoring/Statistic

- ALARA Performance
- Real-time monitoring

- Statistic Process

History

- ① Plant by Plant History
- ② Other Plant History
- ③ Domestic & Foreign Good-Practice
- ④ ALARA Core Item

ALARA Benchmarking Study on Each Work



- ① ALARA Workshop
- ② ISOE International Good-Practice
- ③ Operation Experience(OE)
- ④ Other Main Examples

Domestic & Foreign Good-Practice

- ① CZT Monitoring
- ② Shut-Down Chemistry
- ③ Zinc Injection
- ④ Cyber Plant
- ⑤ Tele-Monitoring
- ⑥ Dose Constraint
- ⑦ Cost-Benefit Analysis
- ⑧ Robotics
- ⑨ Domestic & Foreign ALARA Statistics

ALARA Core Item

ALARA Implementation Process

- No, of exposure, Personal dose in min./max, distribution, Potential exposure



- Basic level of optimization
DC (Dose Constraint)

- Diverse Experience/DB required

- Social Value: Ethics, generation
- Non-radiation harm : mental shock
- Economics : Cost, Uncertainty

- Qualitative /Quantitative judgement
- Supporting instrument for decision making
- pecuniary parameter of dose

**“Cost-Benefit Analysis based of KHNP
unique method of Does-pecuniary Value”**

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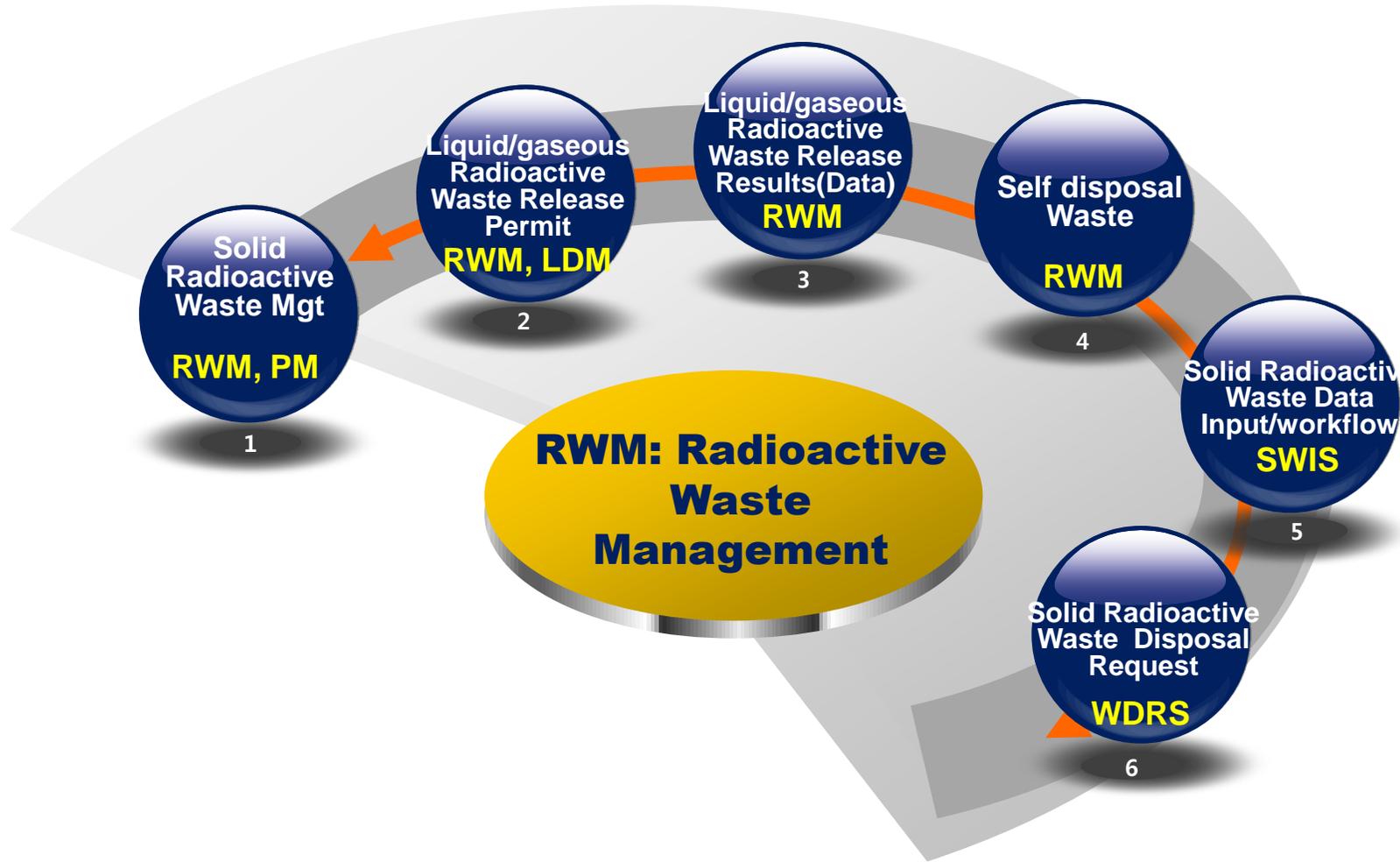
Radioactive Waste Management

Environment Management

Emergency Preparedness Management

Expectations

Radioactive Waste Management



Solid Radioactive Waste Drum Infor.

- Tracking of Radioactive Waste Drum Life Cycle
- Drum Master
- Storage
- Drum nuclide information

Creation

- Serial No.
- Contents
- Date
- Dose rate
- PCP No.
- Release No.

Storing

- Location
- Date
- Nuclide
- Radioactivity
- Class
- Shipping information

Disposal

- Location
- Date
- Dose rate

Drum Master

설비	2000122	설비범주	M	페드럼_압축전
설비내역	고체폐기물드럼;잡고체			
상태	INST	0001	내부도	
효력발생일	2002.06.10	효력만료일	9999.12.31	

일반데이터	WMC_01	페드럼생성_적재장소
클래스		
오브젝트유형		
권한그룹		
중량		크기/치수
재고번호	U1-2002-001/B	시작일

유지보수사이트	9900	방사선 폐기물관리
위치		
품	A-01-01	
플랜트섹션		
작업장		
관리등급		
정렬필드		

Class & Characteristic

일반	조직	구조	폐기물 정보
----	----	----	--------

분류	2002.06.10
드럼생성일	형검류
폐기물종류	신발류
	가연성
가연성 구분	0,0010 mSv/hr
표면 방사 선량율_상(생성시)	
표면 방사 선량율_중(생성시)	
표면 방사 선량율_하(생성시)	
1m방사선량율_상_생성시	0,0001 mSv/hr
1m방사선량율_중_생성시	0,0800 mCi
1m방사선량율_하_생성시	0,0816 mCi
감마핵종 방사능량_Mn-54	0,0428 mCi
감마핵종 방사능량_Co-58	0,0182 mCi
감마핵종 방사능량_Mn-60	0,2027 mCi
감마핵종 방사능량_Zr-95	0,2328 mCi
감마핵종 방사능량_Ag-110m	
감마핵종 방사능량_Cs-134	
감마핵종 방사능량_Cs-137	
감마핵종 방사능량_Ce-144	0,0010 mCi

Functional Location

기능위치변경: 구조리스트

기능위치 내역

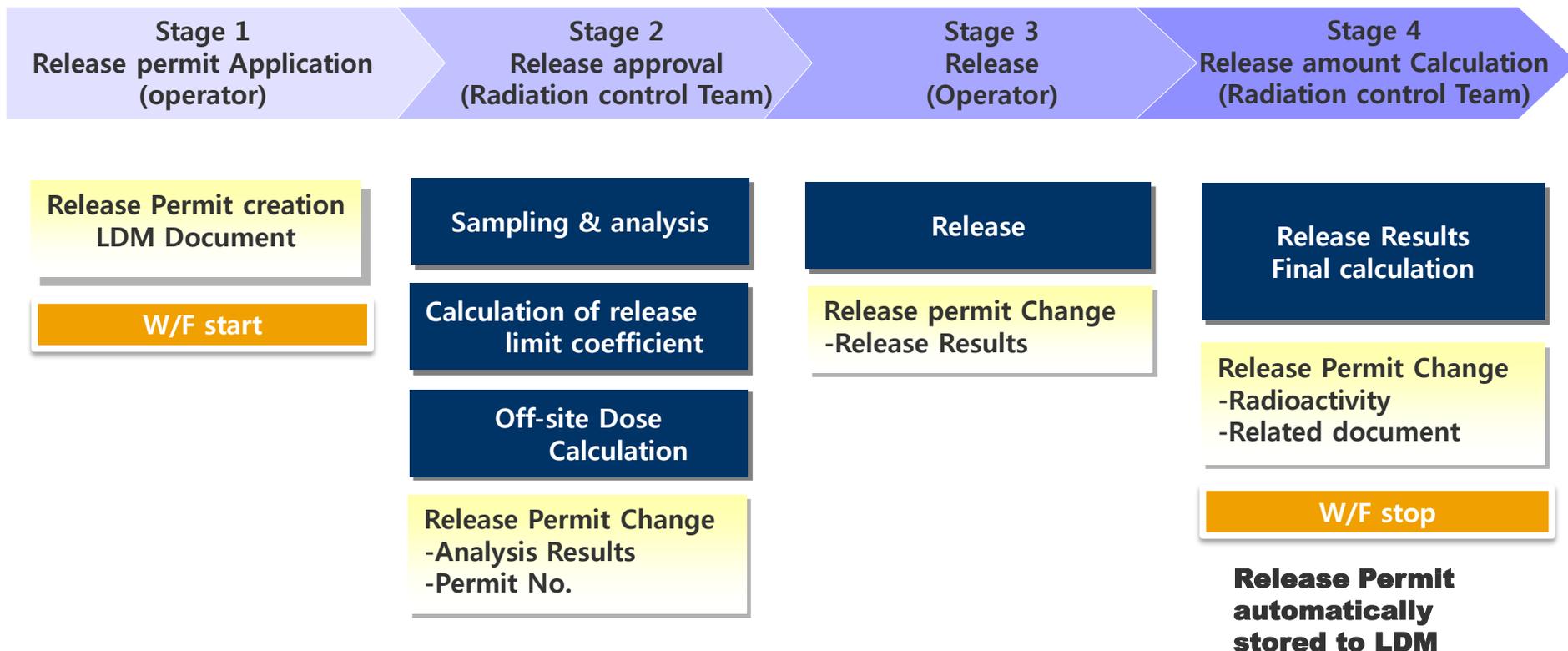
WM	KHNP 폐기물 관리조직	효력발생일	02.06.12
WM-111	KHNP 폐기물 관리조직		
WM-21	고리원자력(분)		
WM-22	영광원자력(분)		
WM-23	월성원자력(분)		
WM-24	울진원자력(분)		
WM-241	울진1발전소[폐기물]		
WM-241-4100	울진1발전소 적재창고[폐기물]		
2000122	고체폐기물드럼;잡고체		
WM-242	울진2발전소[폐기물]		
WM-249	울진 문무공통[WM]		

PM

Radioactive Waste Disposal Process



Liquid/Gaseous Radioactive Waste Release Permit



Liquid/Gaseous Radioactive Waste Release Results

Companywide integrated management

- Report creation in shorter time
- Various statistical analysis

Sample collection and analysis

Release Type	items	Term
A	Gamma	Prior to
	H-3	Prior to
Gas Tank	Gamma	Prior to
Continuous Release	Gamma	monthly
	H-3	monthly
Condenser	Gamma	Weekly
All Case	Iodine	Weekly
	Particle	Weekly
	Alpha	Monthly
	Sr-89/90	Quarterly
	Noble Gas	Continuous

Automatic Cal.

Report on result

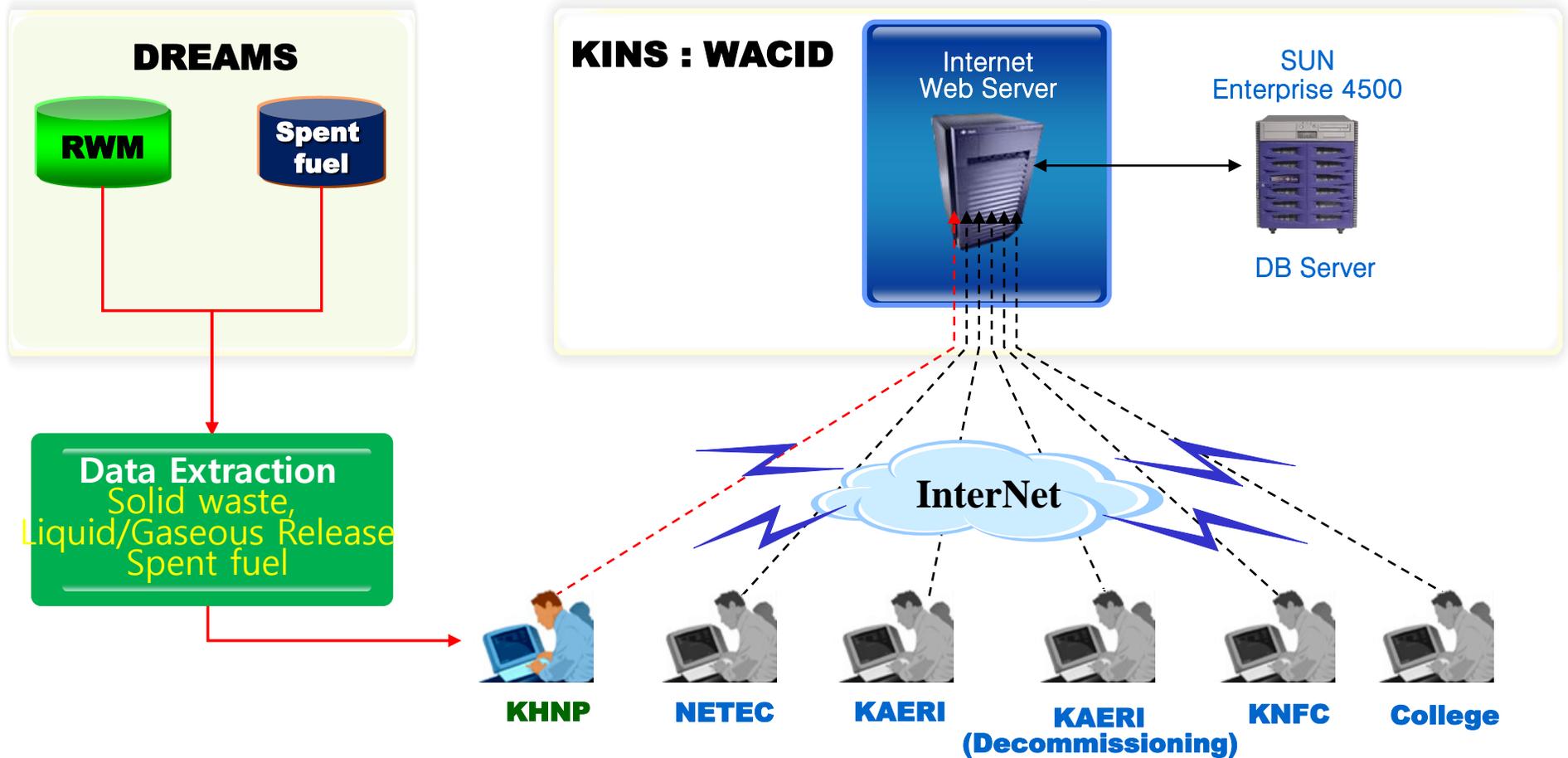
Statistics and Inquiry

ODC

Providing report

■ Link to National IT network

※ WACID : Waste Comprehensive Information Database



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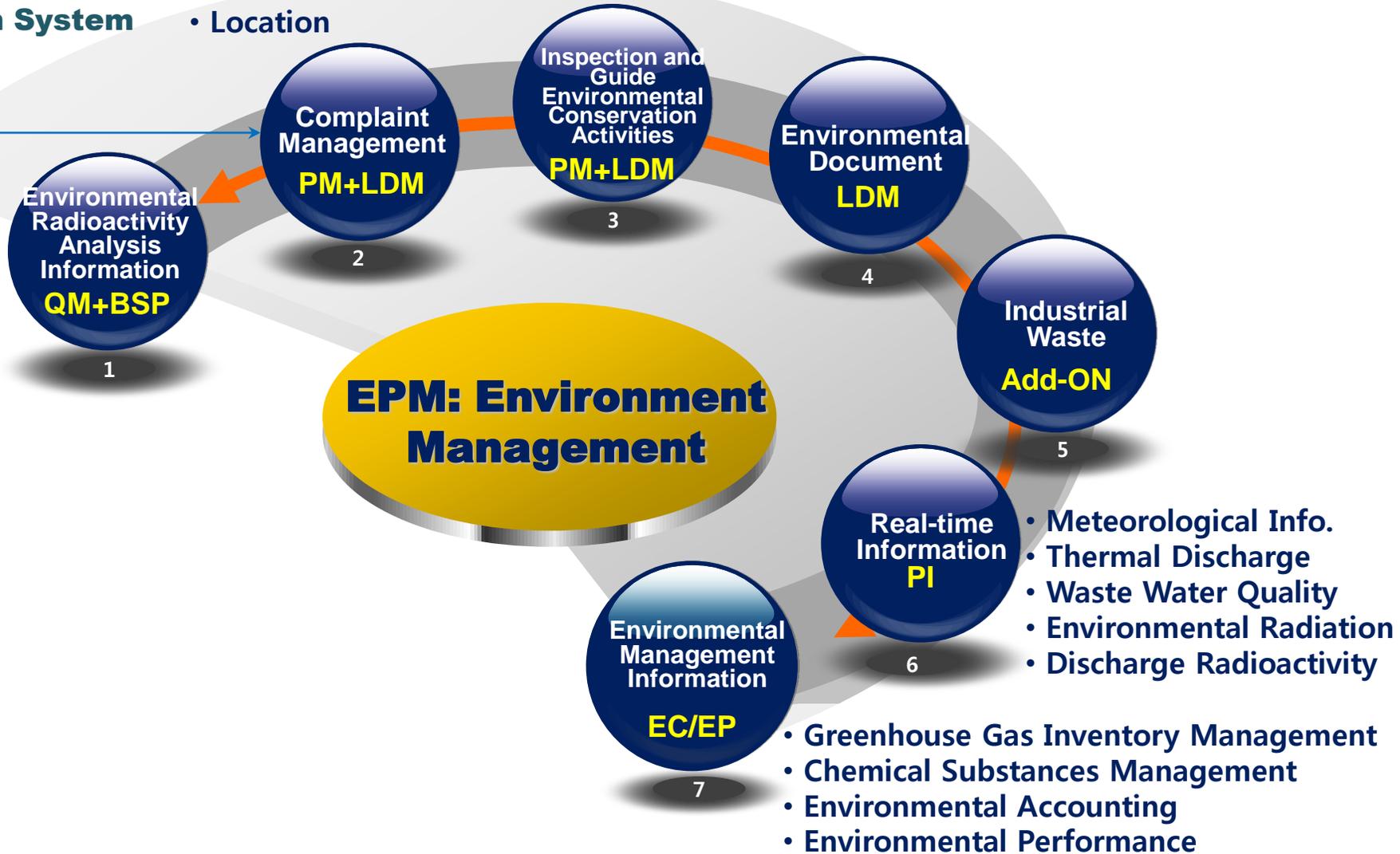
Emergency Preparedness Management

Expectations

Environment

Local Community Management Information System

- General
- Construction
- Location
- Thermal Discharge
- Environment



Chemical Material Management

Comply with Environmental Regulations

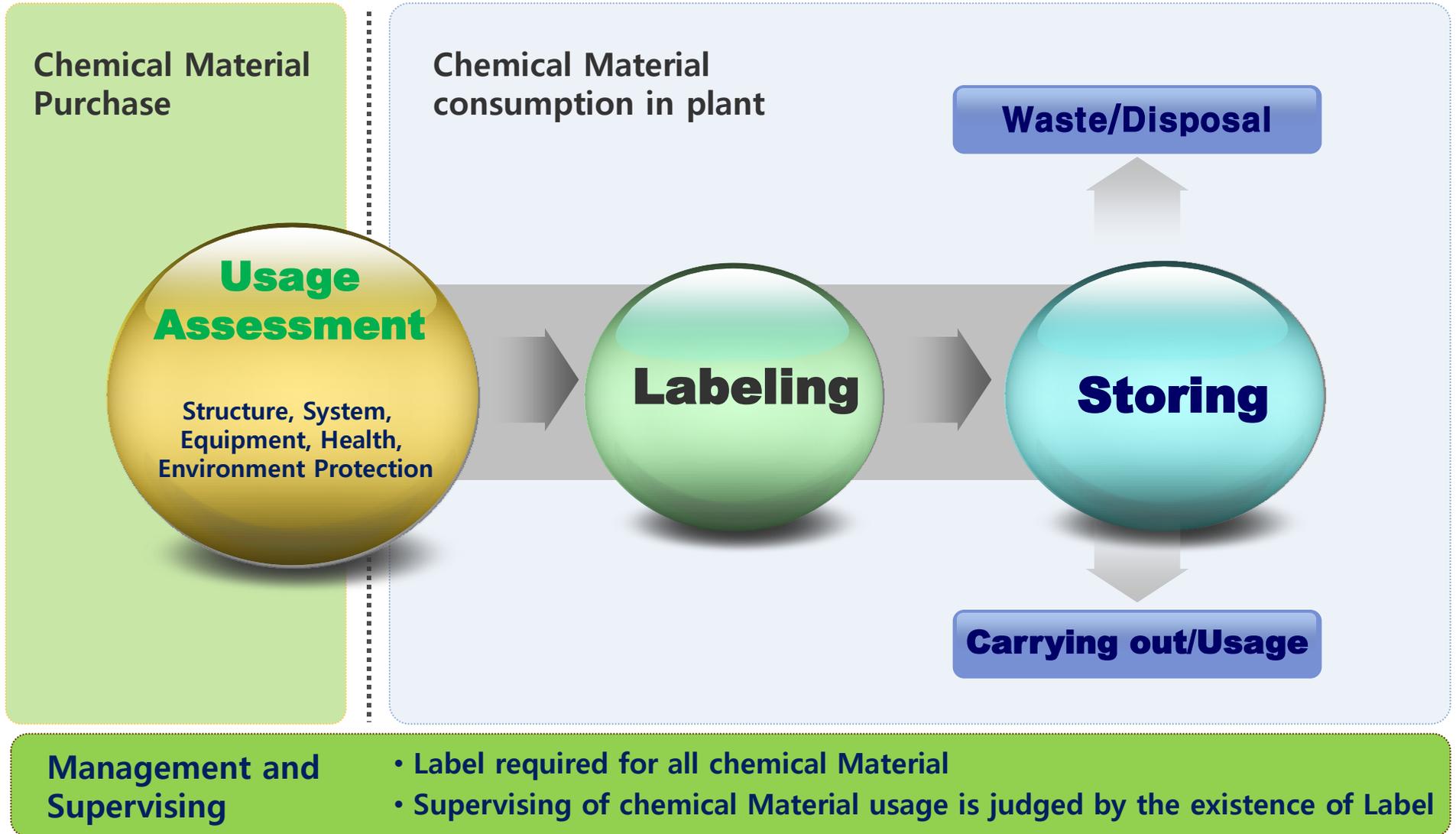
- Chemical Substances Distribution Management
- Chemical Substances Emission and Transfer Management
- Toxic Substances usage Management
- Statistics and Report Management



System / Work Safety

- Chemical Substances Management Guideline/Procedure Standard
- Establish Chemical Substances Use/Authorization/Assessment Standard
- Hazard Assessment of Plant Facilities/System
- Labeling etc.

Chemical Material Management



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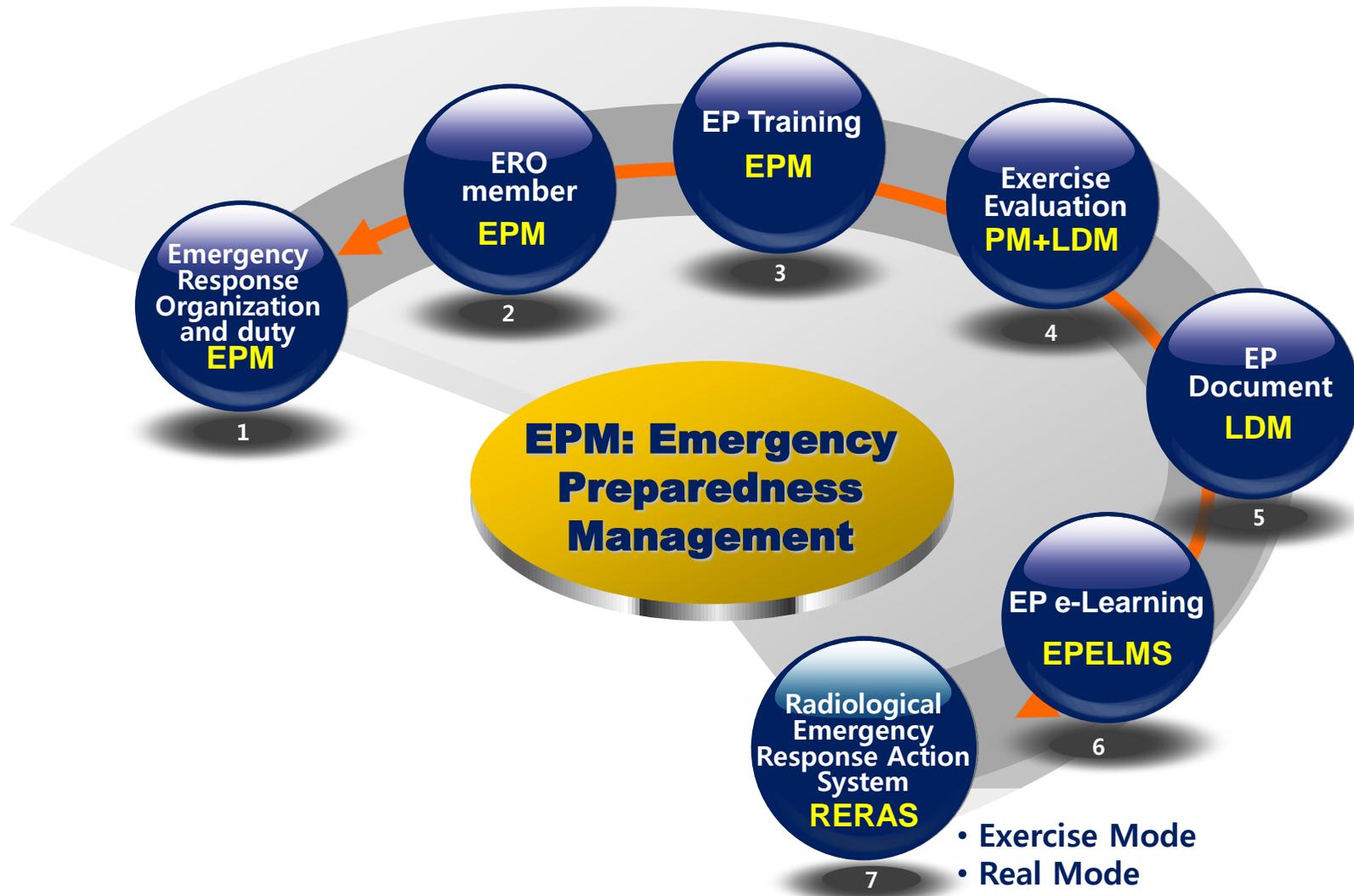
Radioactive Waste Management

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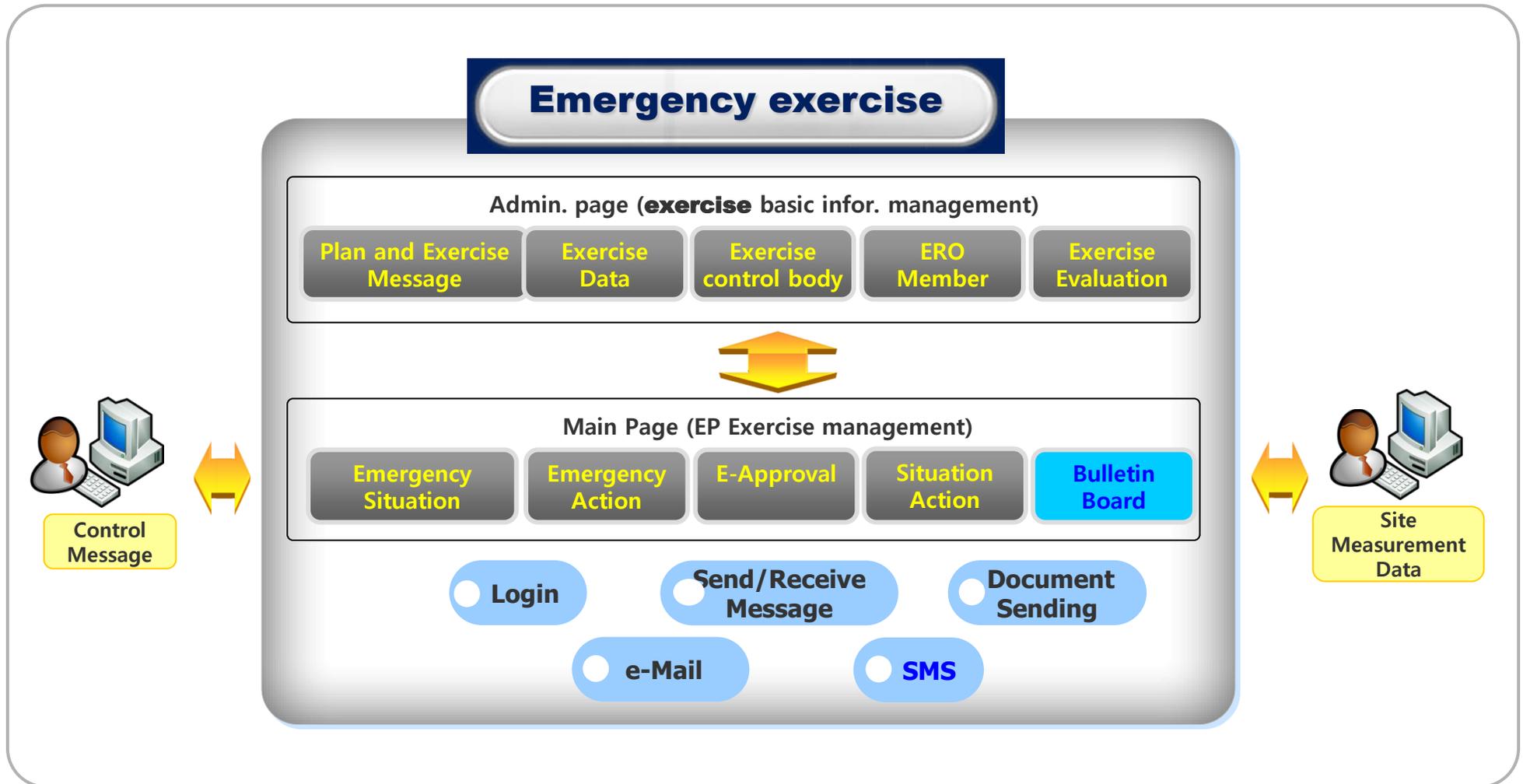
Emergency Preparedness Management

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Emergency Preparedness

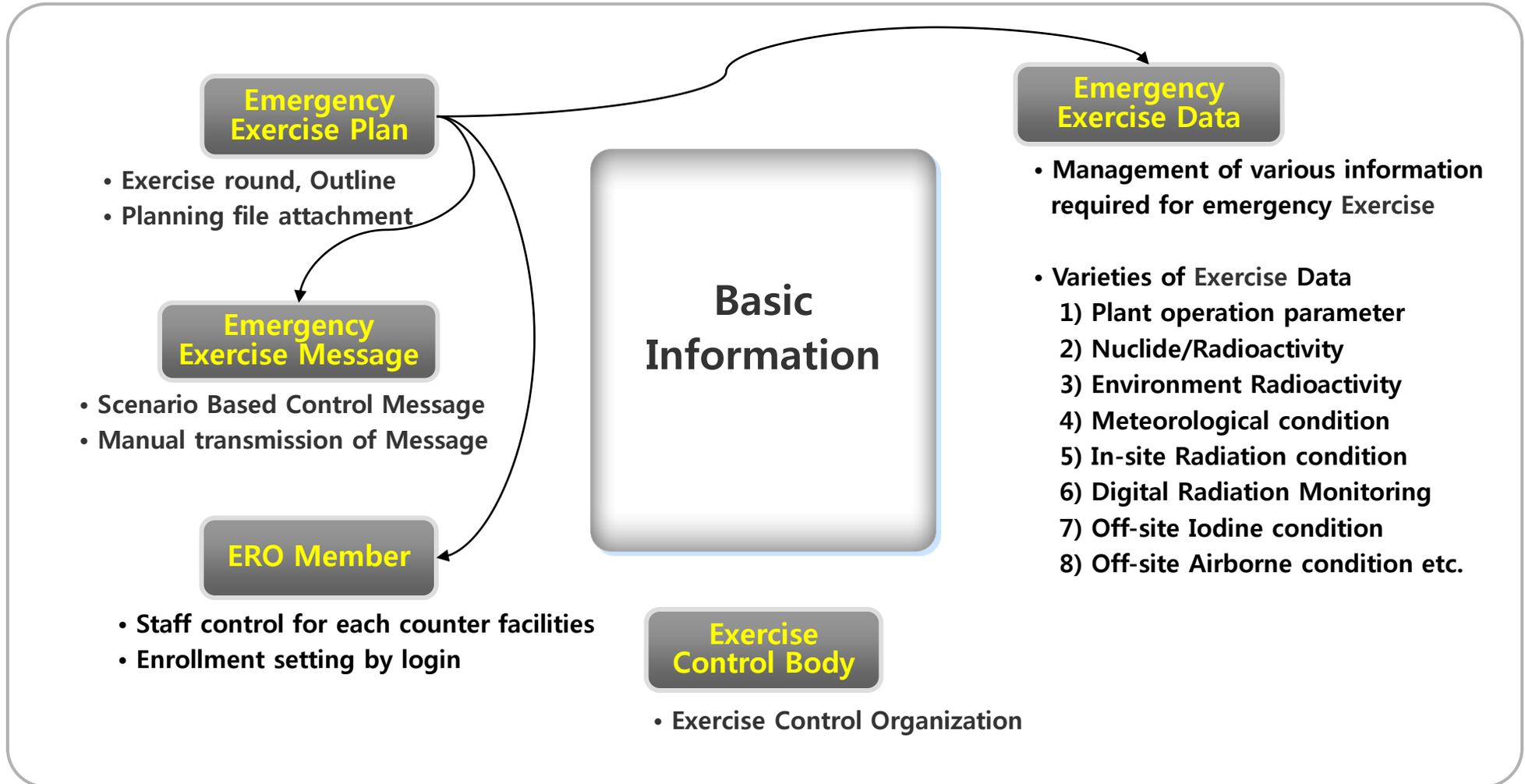


System Composition



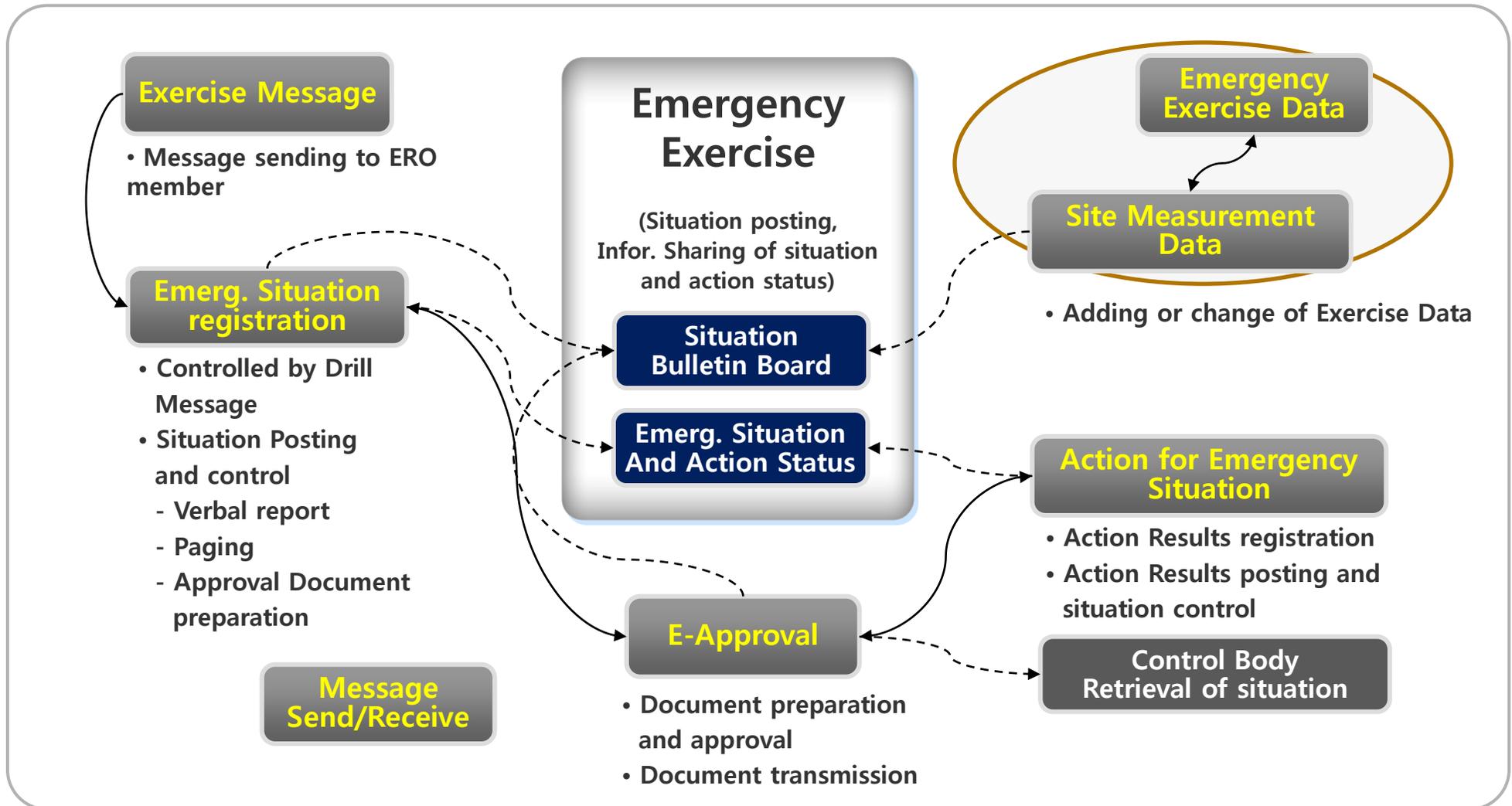
Radiological Emergency Response Action System

Work Function Diagram – Basic Information

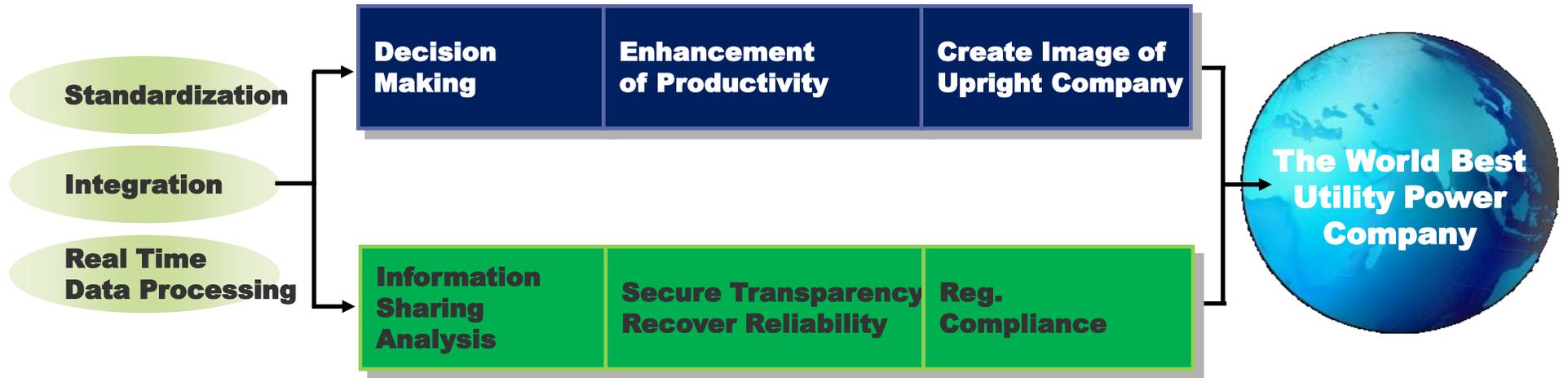


Radiological Emergency Response Action System

Work Function Diagram – Emergency Exercise



Expectations



『**Optimization of Radiation management**』

Thank you for your attention !