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Environmental Radiation Monitoring in Korea

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Independence

Excellence

Transparency

Responsibility

국민에게 신뢰받는 안전 최우선의 KINS



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**FRAMEWORK OF ENVIRONMENTAL RADIATION
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I. Framework of Environmental Radiation Monitoring

Legal Basis for Environmental Radiation Monitoring(ERM)



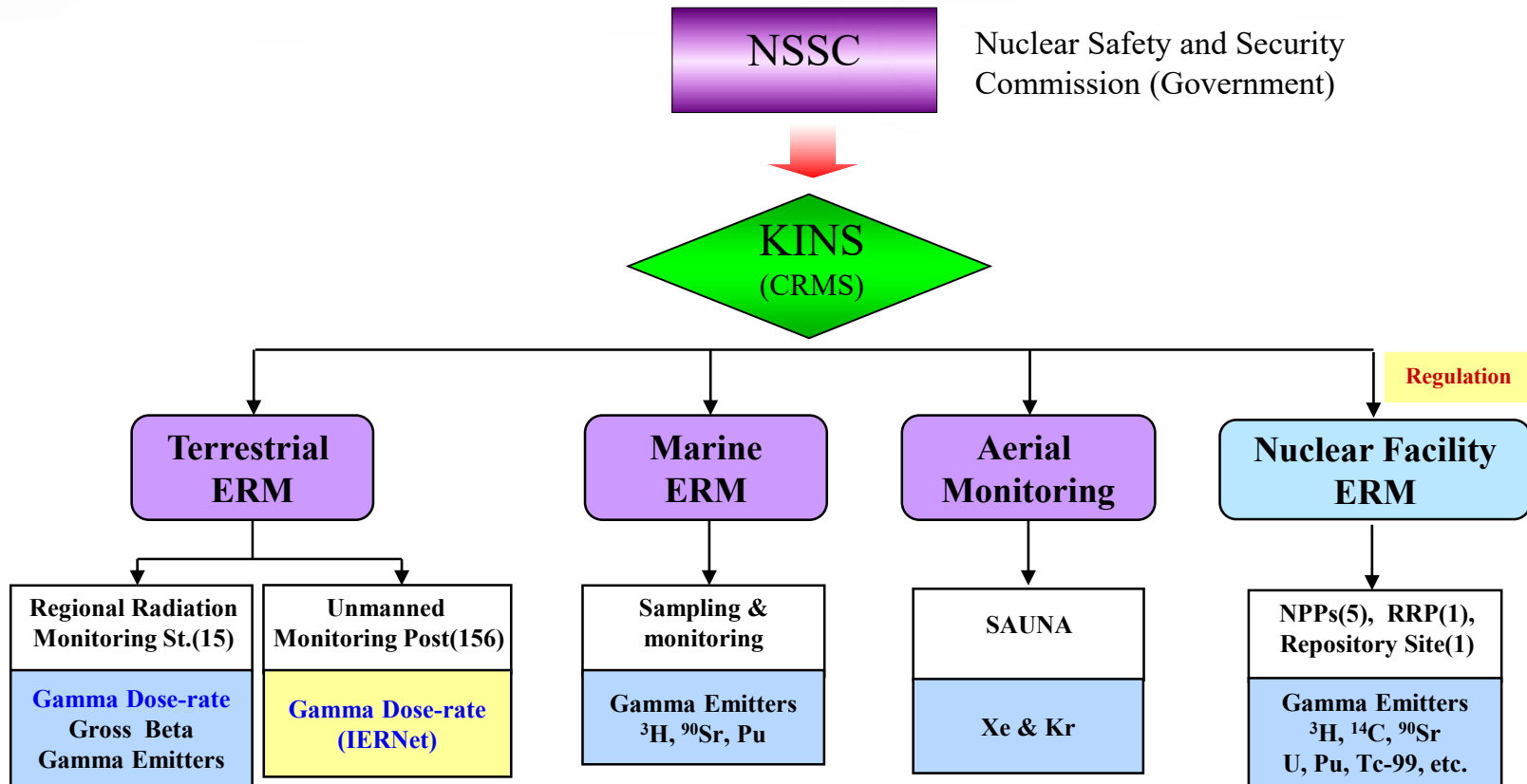
Hierarchy of Nuclear Safety Law



NSSC Notice 2017-17

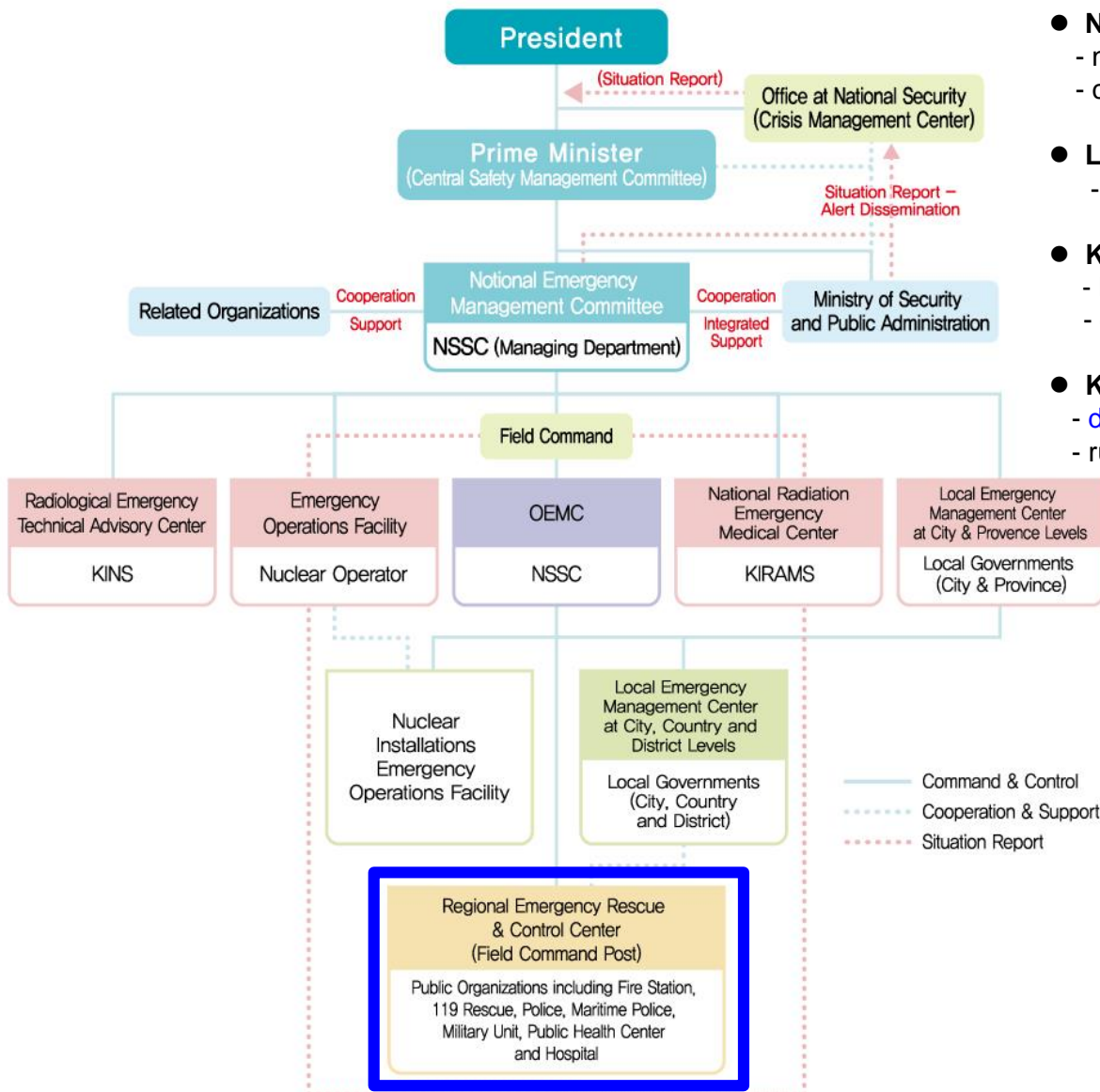
Regulation on Survey of Radiation
Environment & Assessment of
Radiological Impact on Environment in
Vicinity of Nuclear Power Utilization
Facilities:
Details of program and guidance

Environmental Radiation Monitoring Scheme in Korea



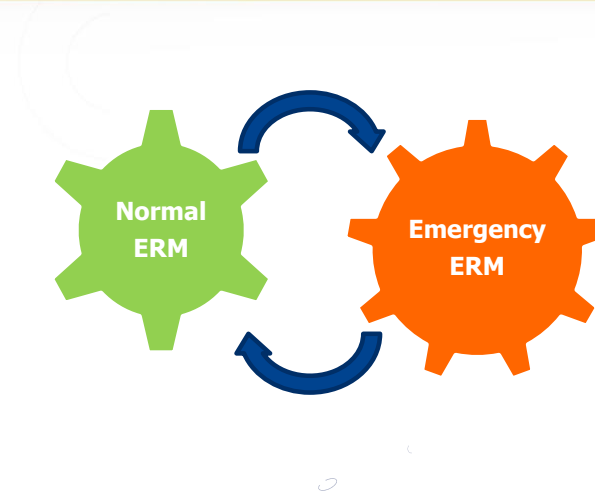
CRMS : Central Monitoring Station, NPP : Nuclear Power Plant, RRP : Research Reactor Plant
 RADA : Radioactive Airborne Dust Archive, ARM : Aerial Radiation Monitoring
 SAUNA : Swedish Automatic Unit for Noble gas Acquisition

National Radiological Emergency Management Scheme



- **Nuclear Safety and Security Commission (NSSC)**
 - national emergency management committee
 - chairperson of OEMC
- **Local Government**
 - local emergency management center
- **Korea Institute of Nuclear Safety (KINS)**
 - Radiological Emergency Technical Advisory Center
 - dispatch technical advisory team to OEMC
- **Korea Institute of Radiological and Medical Science**
 - dispatch technical advisory team to OEMC
 - run emergency technical advisory system

Emergency Response & Field Radiation Survey



Strengthened monitoring program in RRMS

Sampling Medium	Measurement / Analyses	Routine Schedule	Emergency Schedule
Ambient Dose Rate	Dose-rate(Continuous) from 128 locations	15 min.	5 min.
Airborne Particulate	Gross Beta by CAMS at 15 RMS	30 min./day	30 min./day
	Gamma Emitters	Once/week	Twice/week
Precipitation	Gross Beta	Each precipitation	Every precipitation
	Gamma Emitters	Monthly	Every precipitation
Fallout	Gamma Emitters	Monthly	Monthly
Drinking Water	Gamma Emitters	Monthly	Weekly
Seawater	Gamma Emitters	April, August	Monthly
Marine Products	Gamma Emitters	April, August	Monthly (fish, shellfish, seaweeds)

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II. Nationwide Environmental Radiation Monitoring(ERM)

Terrestrial ERM Program at Stations

Sample	Analysis Items	2017
Ambient gamma dose rate	Ambient gamma dose rate	C
	Cumulative dose(TLD)	Q
Airborne dust	Gross-beta	W
	Artificial beta(CAMS)	C
	Gamma RN (Particulate)	W(direct) M(ash)
	Gamma RN (Gaseous)	W(charcoal)
Fallout	Gamma RN	M
Precipitation	Gross-beta	Every precipitation
	Gamma RN	M
Tab water	Gamma RN	M
Soil	Gamma RN	B
Rice & cabbage		A
Indicator plant		A
* Foodstuffs	Gamma RN	-
Dose rate for emergency situation	Soil	A
	Dose rate	B(NaI(Tl))

C : continuously, A : annually, B : biannually, Q : quarterly, M : monthly, W : weekly, D : daily

Central and Regional Monitoring Stations

- ▶ Article 147 in “Enforcement Decree of the Nuclear Safety Act” ([Monitoring of Nationwide Environmental Radioactivity](#))
- ▶ Operation of regional environmental radioactivity monitoring station(RRMS)
 - Initiated since 1963
 - [CMS\(KINS\) + RRMS\(15\)](#): G-B in air, Gamma in terrestrial and consumable food samples
 - Unmanned MP(155): Ambient gamma dose rate
- ▶ Survey and assessment of maritime ER
- ▶ Operation of a nationwide automatic monitoring network for [environmental radiation](#)



Location of RRMS

Ambient Dose Rate Monitoring Network (IERNet – real time)



Government operation post: RRMS(15) + UMMP(155), IERNet display 270 data (as of Jan.'19) in total

IERNet Homepage

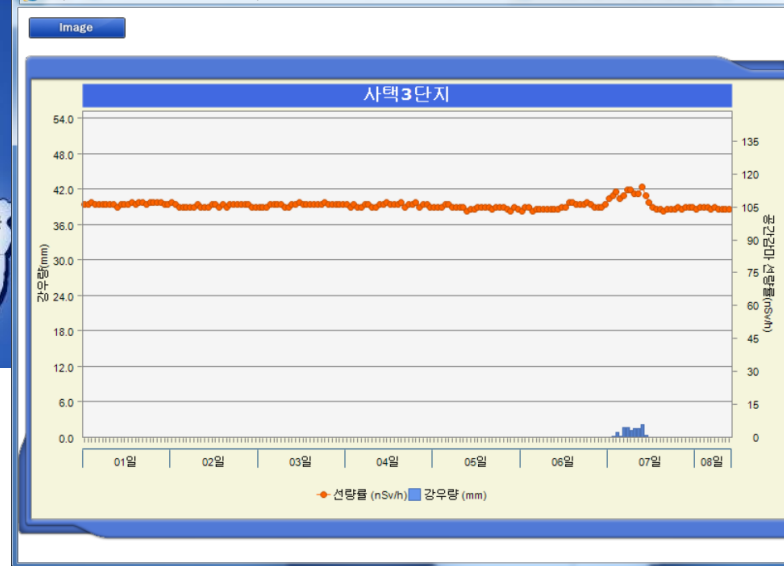


지역명	nSv/h	μR/h	상태
수원	157	16.1	정상
문산	170	17.5	정상
포천	134	13.8	정상
양주	132	13.6	정상
파주	118	12.1	정상
시흥	128	13.2	정상
화성	157	16.1	정상
안양	126	12.9	정상
과천	136	14	정상
구리	119	12.2	정상
의정부	165	17	정상
양평군	114	11.7	정상

지역 상세 지도 : 경기도

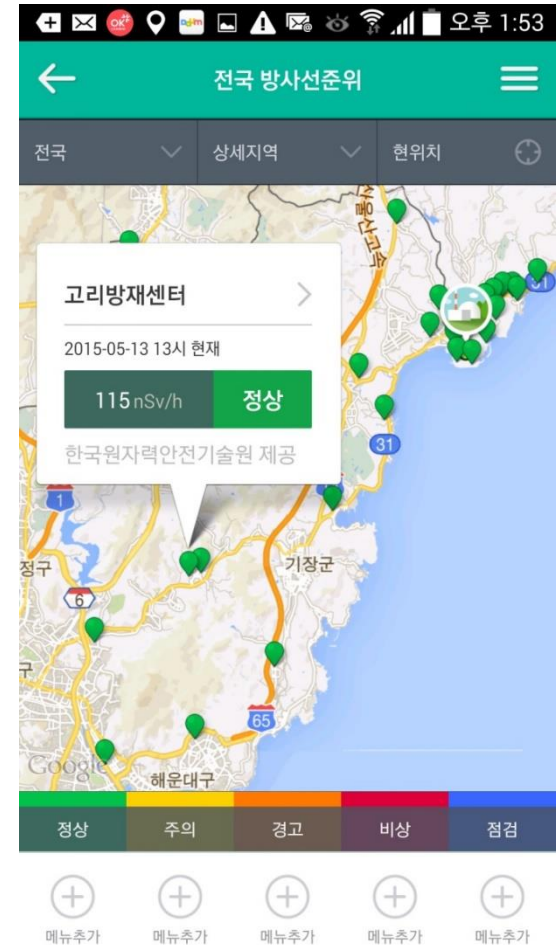
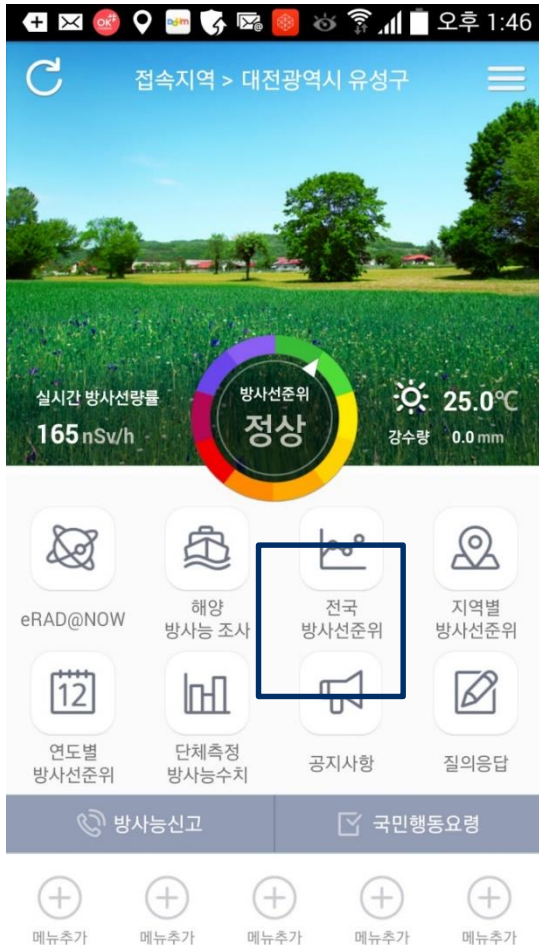


http://iernet.kins.re.kr/ifi/week_chart.asp



Open to Public by Smartphone

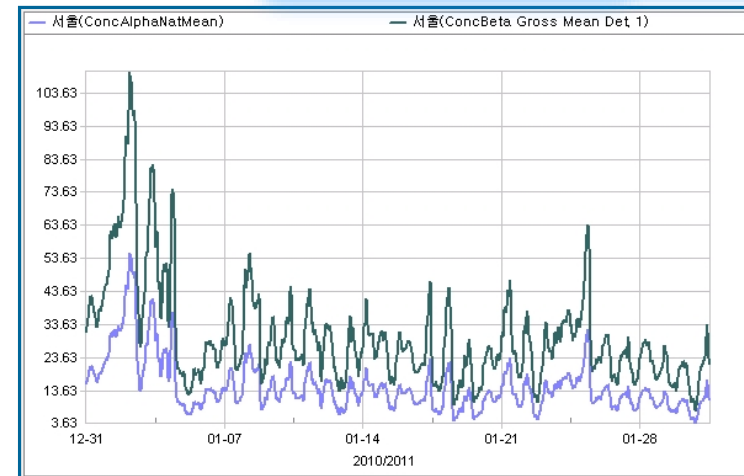
- ▶ Radiation monitoring data open to mobile phone application
- ▶ eRAD@NOW2



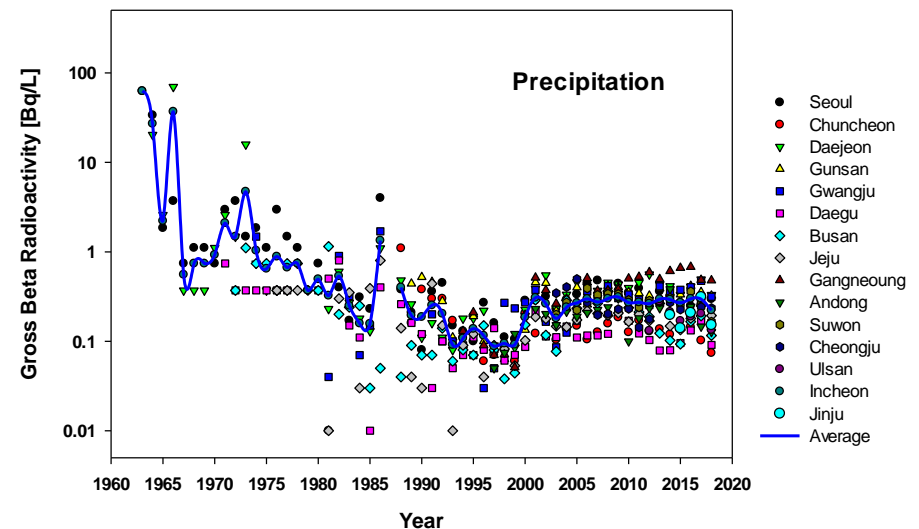
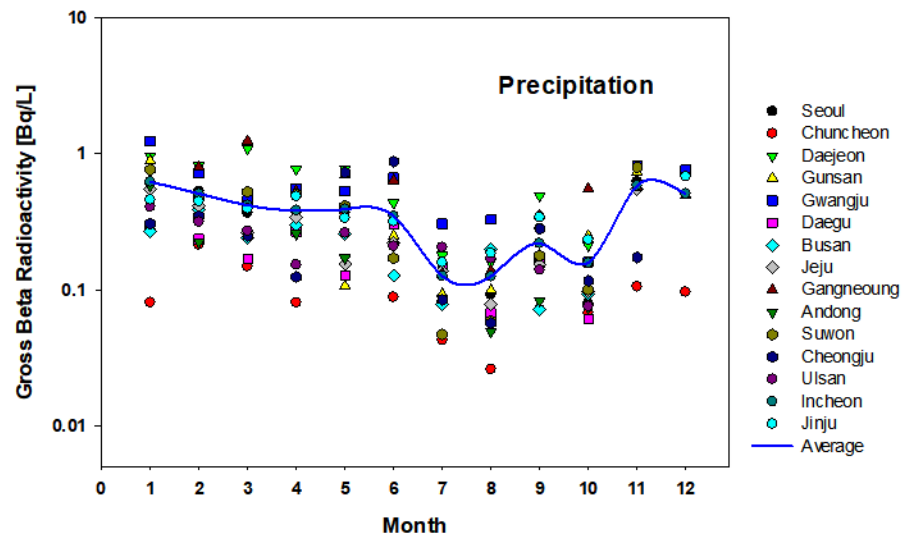
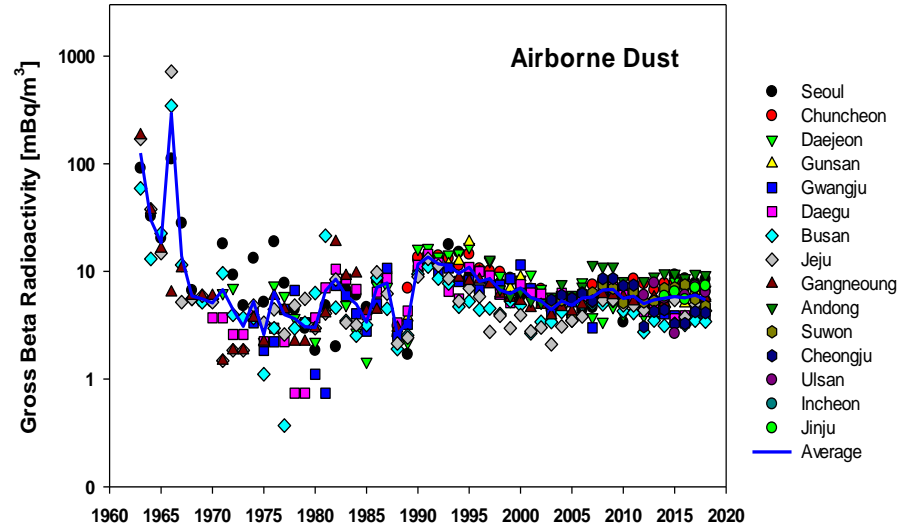
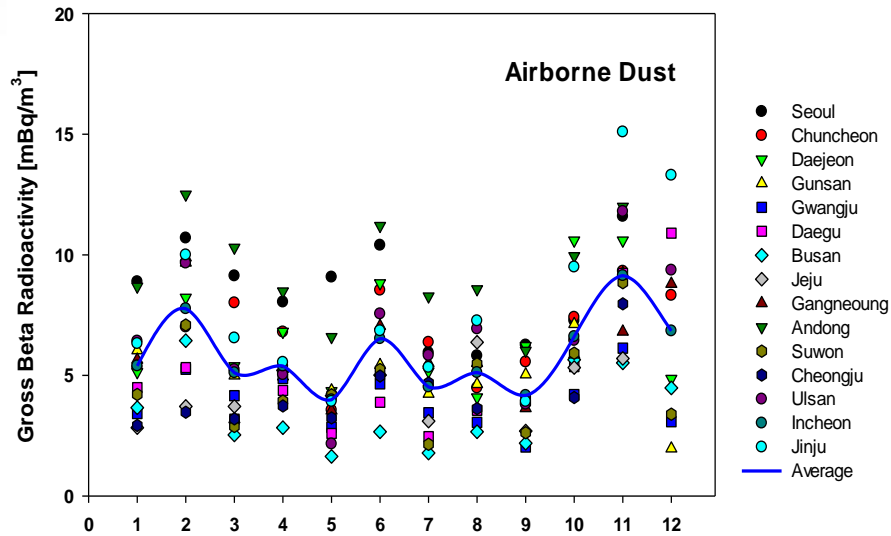
Continuous Airborne-dust Radioactivity Monitoring System(CAMSNet-near real time)

Manufacturer/Model	Speciation
Germany Thermo Electronic GmbH (FHT59S-2)	<ul style="list-style-type: none"> ✓ Measurement range: $0.1 \sim 10^6 \text{ Bq/m}^3$ ✓ Detector: ZnS coated plastic scintillation detector ✓ MDC: 0.3 Bq/m^3 ✓ Sampling period: 30 min

- ▶ 15 Regional Monitoring Stations
- ▶ 2 scintillation detector per each CAMS
- ▶ Measured α/β activity near real time [30 min] in airborne dust



Aerial Radioactivity Monitoring(Gross-Beta)

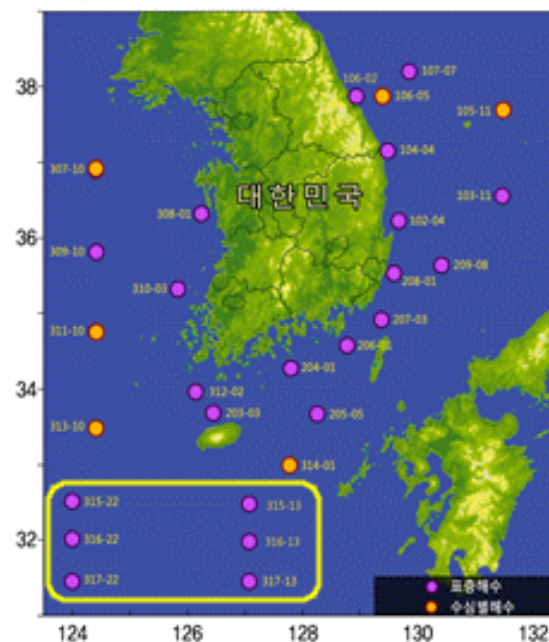


Marine Environmental Radioactivity Surveillance

- ▶ Expanding of the survey area and shortening of analysis frequency



<Seawater Survey Location (2010)>



<Seawater Survey Location (2017)>

Sample		Before ('11~)	After ('12~)	Note
Seawater	Location	22	28	⇒ East China Sea
	Frequency	2/y	4/y	Short frequency
Fishery	Location	7	80	Inshore ⇒ open sea
	Frequency	2/y	yearly	Short frequency

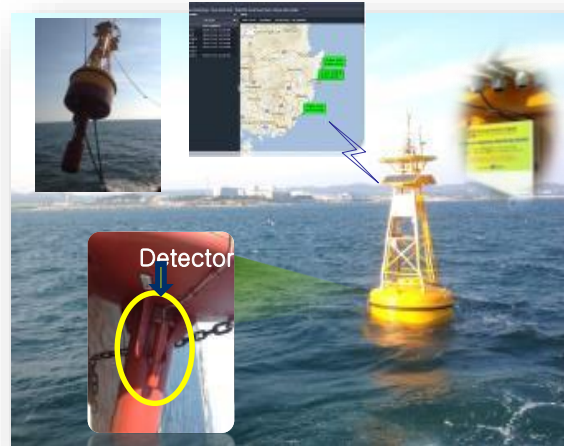
Seawater Radioactivity Monitoring Network

- ▶ For the real-time radioactivity monitoring in the ocean, 18 unmanned seawater radioactivity monitoring system are installed and run in the first half of 2018.

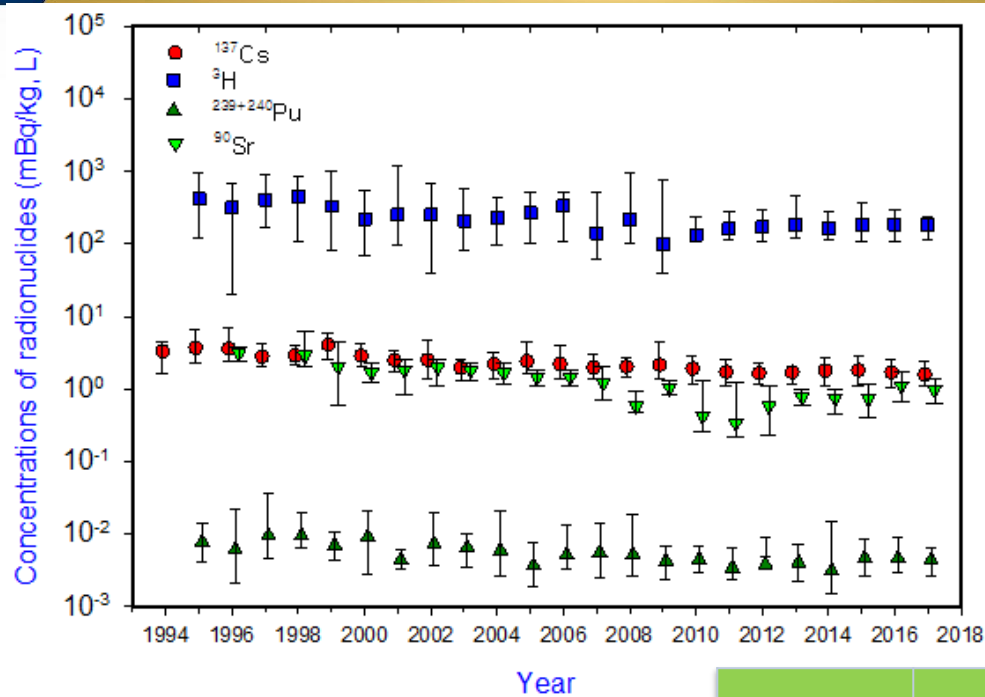
Location of SRMS



- ▶ Seawater radiation monitoring with a Buoy (left) and in the ferry boat plied in the East Sea (right)



Yearly Variation of RN in Seawater



RN	Unit	2017		Previous (2012~2017)
		Samples	Range	
^{137}Cs	mBq/kg	441	1.10~2.43	1.08~2.77
^3H	Bq/L	22	0.117~0.238	<0.107~0.458
^{90}Sr	mBq/kg	16	0.635~1.37	<0.239~1.77
$^{239+240}\text{Pu}$	$\mu\text{Bq/kg}$	22	2.67~6.34	1.48~14.6
$^{240}\text{Pu}/^{239}\text{Pu}^{\times}$	-	22	0.194~0.252	0.168~0.263

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III. Verification Surveillance around Nuclear Facilities

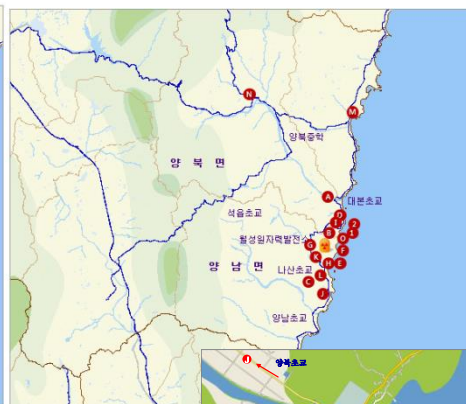
ERM Around Nuclear Facilities

▶ Art. 104(Environment preservation), Notice of NSSC (no. 2017-17)

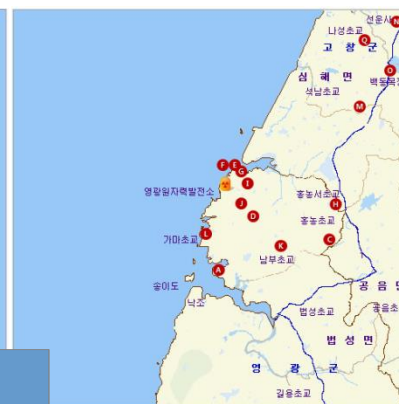
- **(Licensee)** Evaluation of **long-term accumulation pattern** of RN, **short-term variation** by RN, radiation **dose assessment** resulting from operation of facilities
- **(NSSC)** Verification of licensee monitoring activity and assessment of environmental impact
- **(Facilities)** 5 NPP sites, KORAD, Research reactor in Daejeon
- **(Analysis items)** Radiation & Radioactivity in the terrestrial and marine samples
- **(Targets)** Ambient and accumulated dose rate, gamma emitters, ^{90}Sr , ^3H , ^{14}C , Pu, U, ^{99}Tc , ^{129}I



Kori + Saeul



Wolsung
+KORAD



Hanbit



Hanul

Monitoring Program around NPP

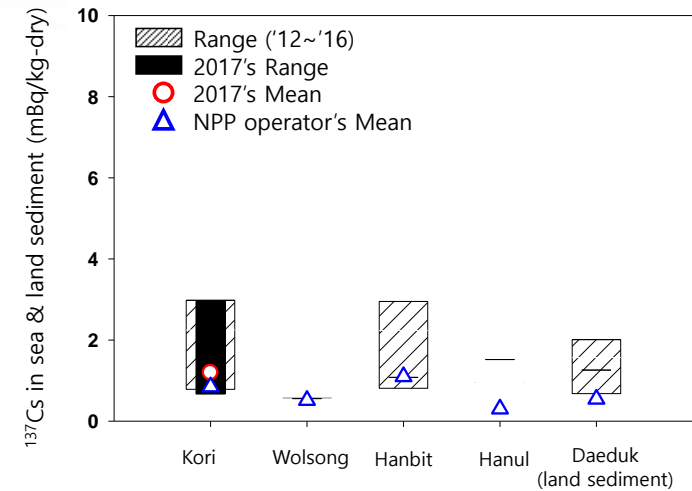
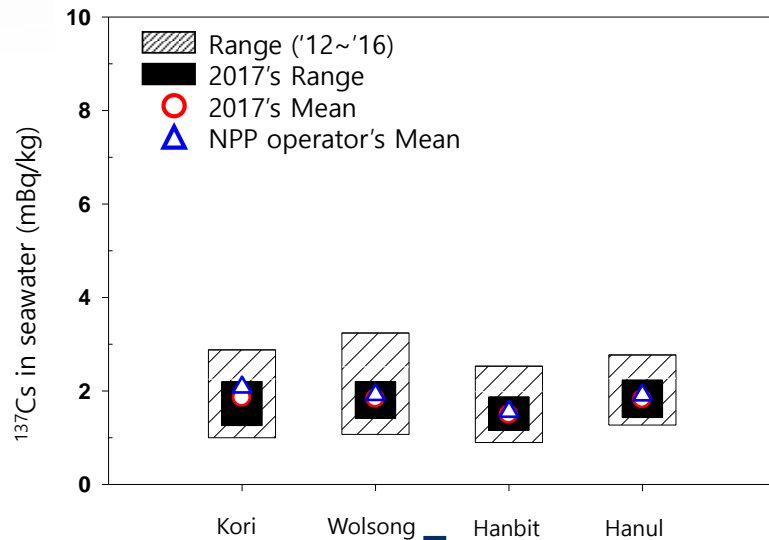
Environmental Sample			Analysis Items	Frequency	Sampling location
Radio activity	ES	Soil	Gamma RN	2/y	부지 당 5개 지점
			^{90}Sr , $^{239+240}\text{Pu}$,	1/y	부지 당 2개 지점
			$^{240}\text{Pu}/^{239}\text{Pu}$ ratio	1/y	대덕부지 3개 지점
			U		
		Sea sediment	Gamma RN	2/y	부지 당 2~6개 지점
		River sediment	^{90}Sr , $^{239+240}\text{Pu}$,	1/y	부지 당 2~6개 지점
			$^{240}\text{Pu}/^{239}\text{Pu}$, U	1/y	대덕부지 2개 지점
		Air	^3H , ^{14}C	monthly	월성원전주변 2개 지점 3개 원전주변 1개 지점
		Pine needle	^3H , ^{14}C	Monthly	월성원전주변 2개 지점
	Water	Seawater	Gamma RN, ^3H ,	quarterly	취.배수구 3~8개 지점
			^{90}Sr , $^{239+240}\text{Pu}$,	2/y	(대덕제외)
			$^{240}\text{Pu}/^{239}\text{Pu}$ ratio		
		Underwater	Gamma RN, ^3H	2/y	부지 당 2개 지점
		Surfacewater	Gamma RN	Quarterly	대덕 1개 지점
		Precipitation	Gamma RN,	Monthly	대덕 2개 지점
	Foodstuff	Milk	^3H		각 원전 기상관측소 (월성은 거리별 6개 지점)
			Gamma RN	Quarterly	각 원전 부지당 1개 목장
			Gamma RN	Monthly	대덕 1개 목장
		Cabbage	^{90}Sr	2/y	부지 당 1개 목장 (한울제외*)
			^3H , ^{14}C	Monthly	월성 원전주변 1개 목장
	Marine Sample	Rice	Gamma RN	1/y	부지 당 2개 지점
		Fishery	Gamma RN	2/y	부지당 2~3개 지점 (대덕제외)
		Seaweed	Gamma RN	2/y	부지당 2~3개 지점 (대덕제외)

ERM Program

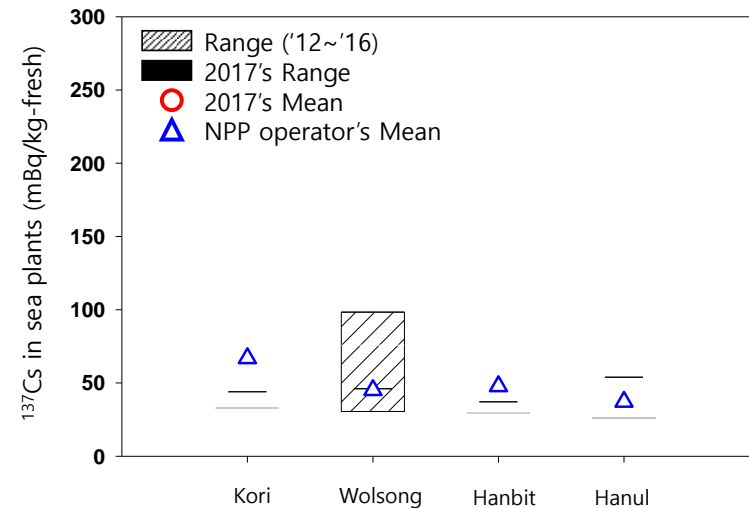
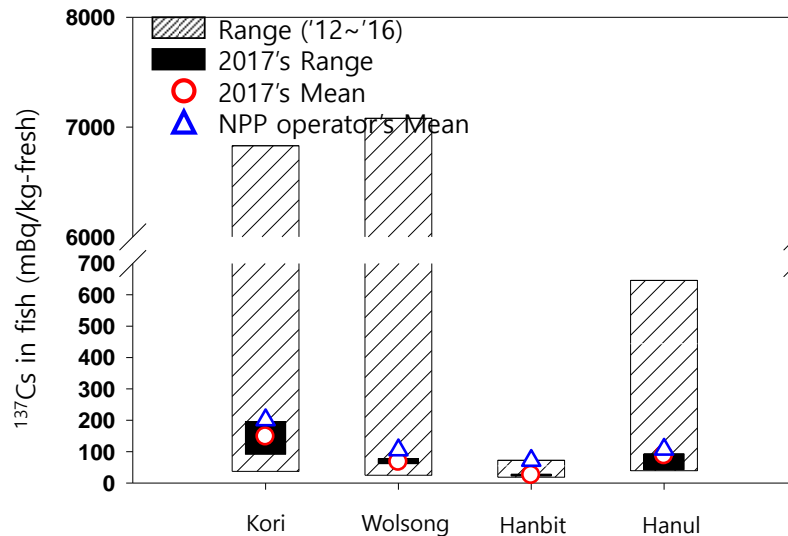
(around Radioactive Waste Disposal Facility)

Sample name			Analysis items	Frequency	Sampling location
Radio activity	ES	Soil	Gamma RN ⁹⁰ Sr, Pu isotopes U isotopes	2/y 1/y 1/y	BongGil Bridge(NE, 1.6km)
		Sea sediment	Gamma RN ⁹⁰ Sr, Pu U	2/y 1/y 1/y	BongGil-Re Beach(NE, 1.5km)
		Air	³ H, ¹⁴ C	monthly	YangBook Ele. School(NNW, 7.0km)
		Pine needle	³ H, ¹⁴ C	Monthly	
	Water	Seawater	Gamma RN , ³ H, ⁹⁰ Sr, Pu 동위원소	Quarterly 2/y	BongGil-Re Beach (ENE, 1.3km)
		Underwater	Gamma RN , ³ H, ⁹⁰ Sr, Pu U, ⁹⁹ Tc	2/y	NPP Main Gate (E, 0.8km) BongGil-Re(NE, 1.3km) SangBong(E, 0.6km)
		Precipitation	³ H	monthly	Meteorology Tower (SSW, 0.2km) YangBook Ele. School (NNW, 7.0km)

^{137}Cs Results in the Marine Samples

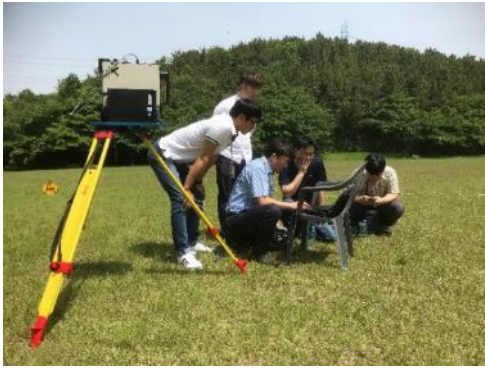


Transfer and concentration



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IV. Field Surveillance against Emergency Situation



'19 Intensive Exercise on Environmental Survey

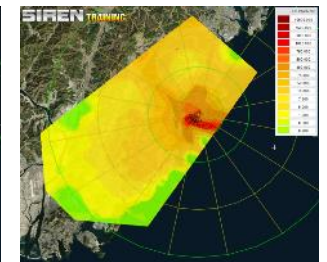


- 29-31 May 2019, Uljin OEMC & Hanul NPP Site
- NSSC, KINS, KAERI, KHNP, MND(JCS)
- Exercise : In-Situ HPGe gamma spectrometry

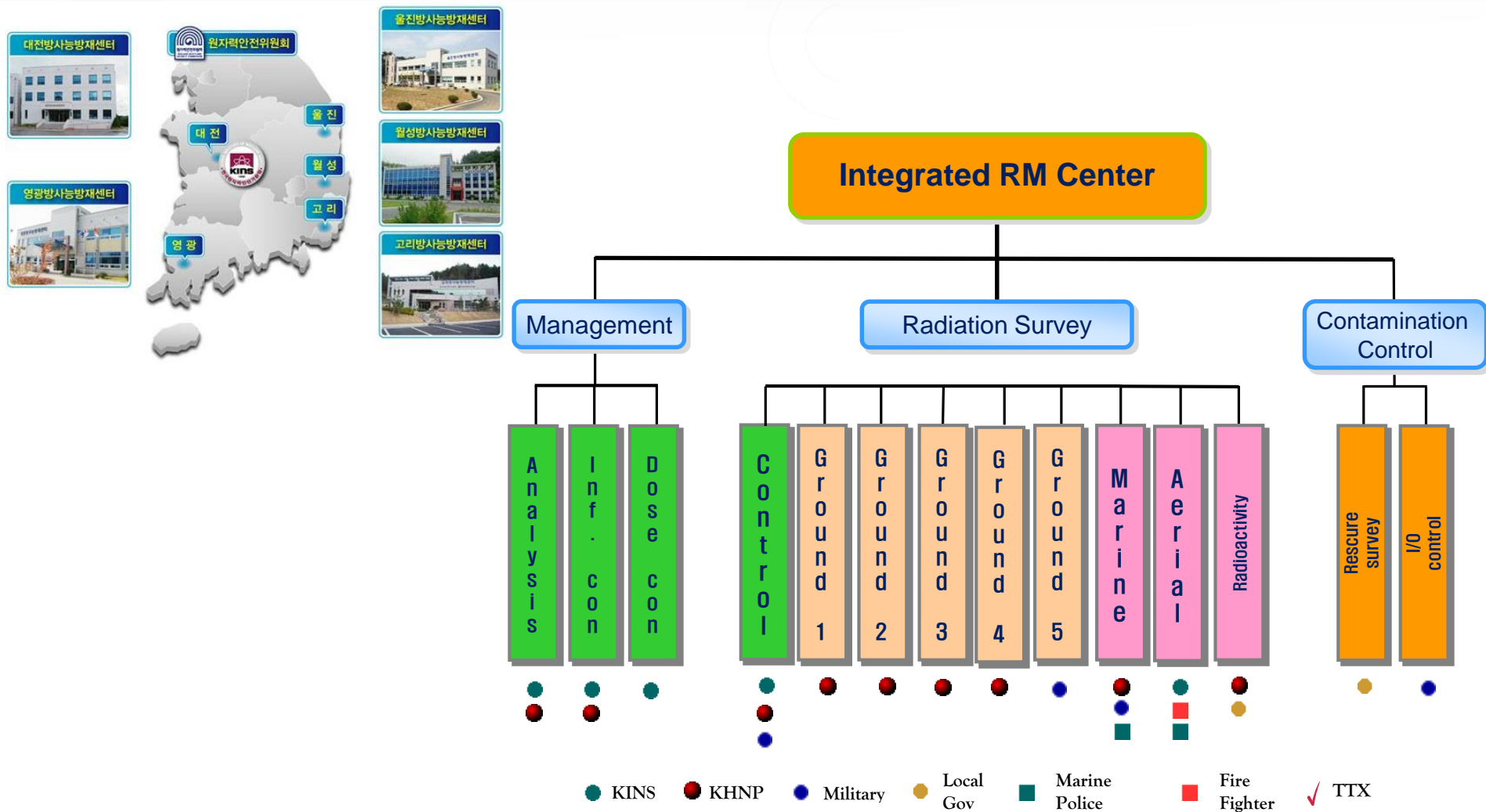


KINS is a Cornerstone for a Safe Korea

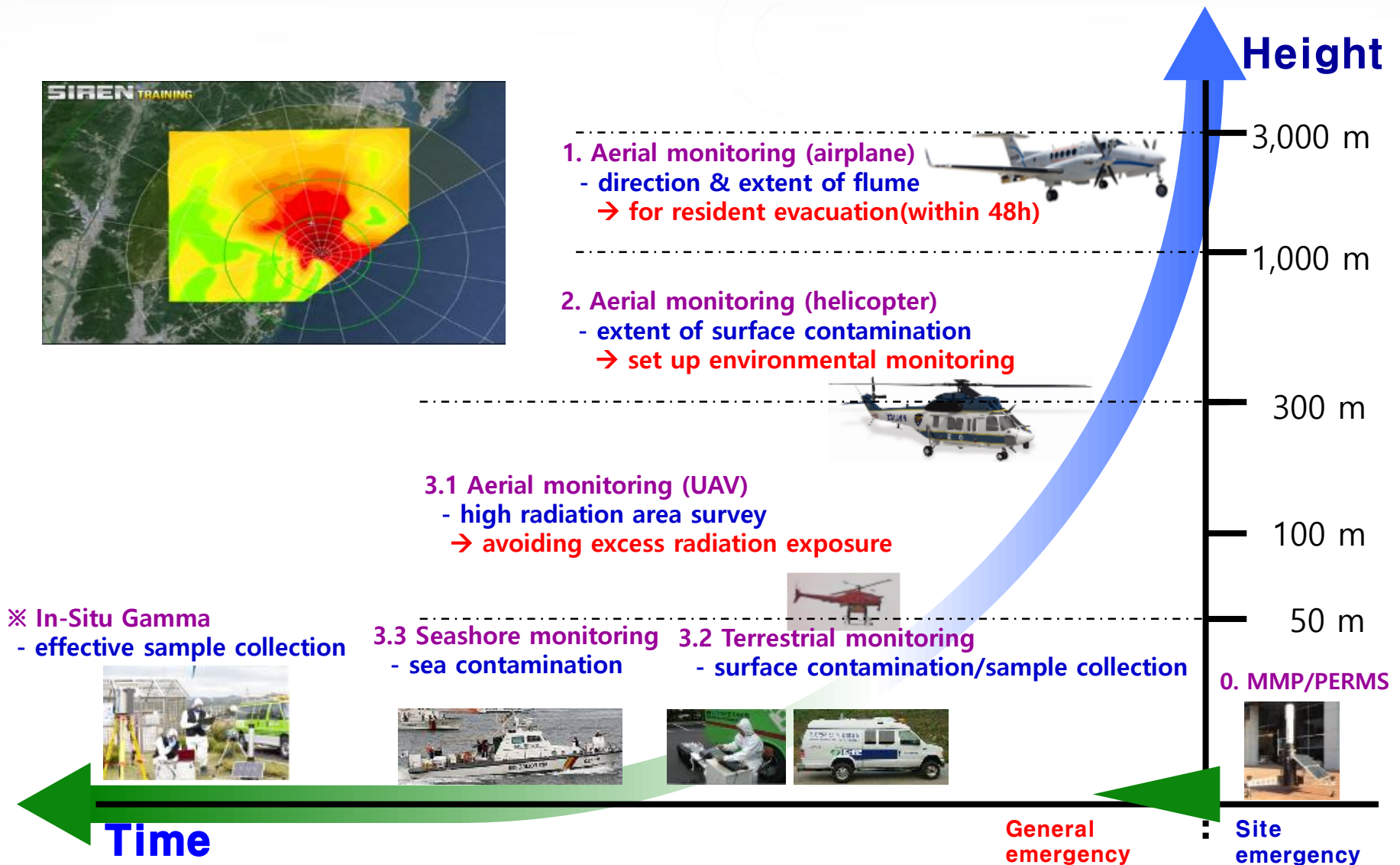
'19 Emergency Environmental Monitoring Exercise 1 Unified, 1 Jointed, 1 Intensive



Joint Radiation Monitoring Center at OEMC



Environmental Monitoring Scheme in Emergency



Emergency Field Radiation Survey (Joint RM Center)



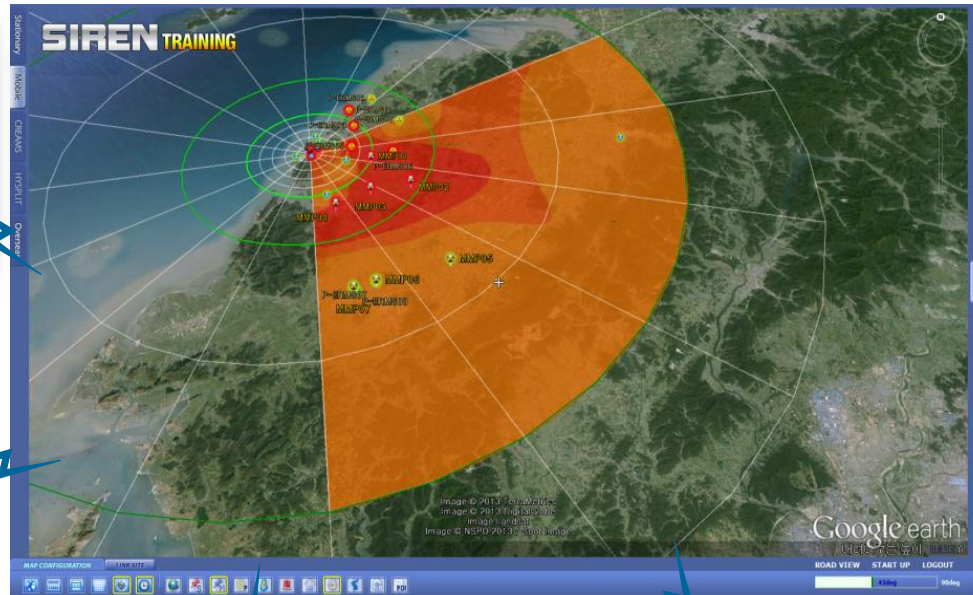
Car-borne survey



Aerial survey



Deployment of MMP

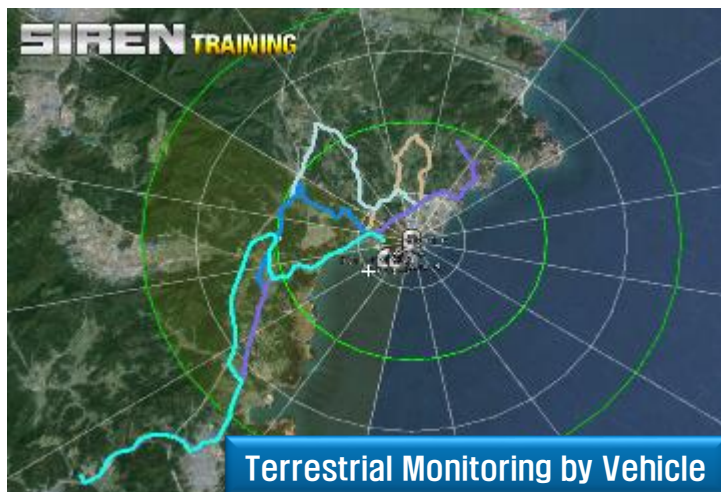


In-situ gamma measurement

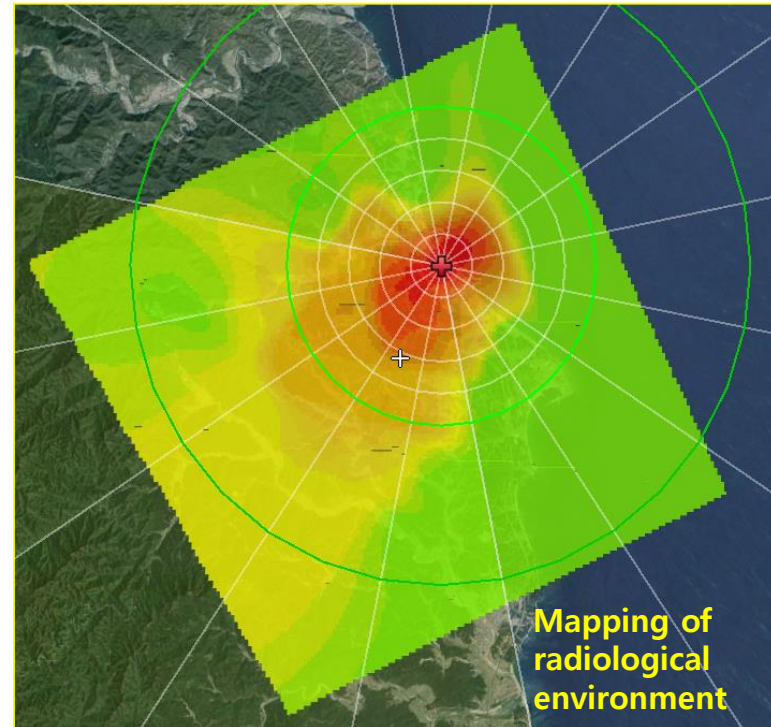
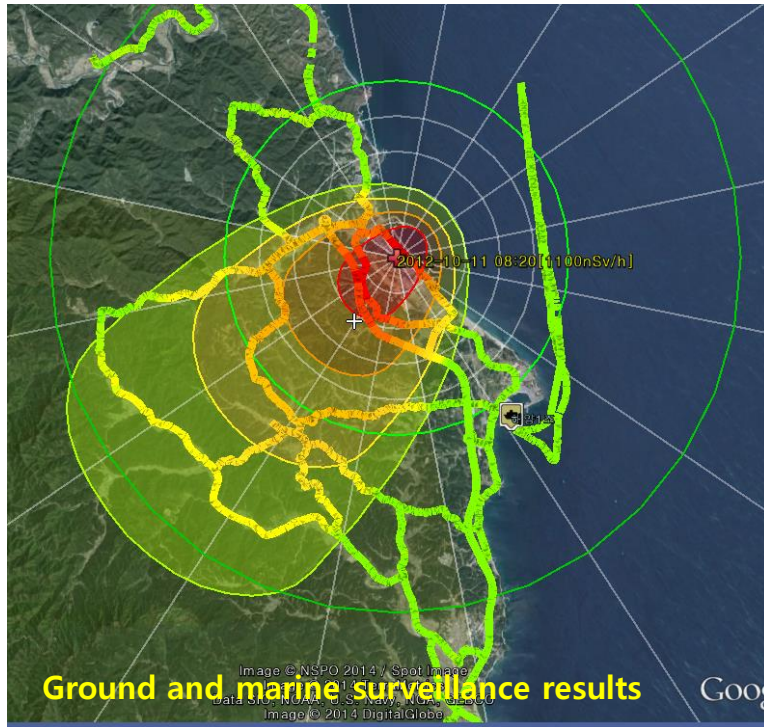


Environment sample collection

Jointed Radiation Monitoring Center



System for identifying Radiation in Environments Nationwide(SIREN)



- ▶ System for Identifying Radiation in Environments Nationwide
- ▶ Collection and evaluation of fixed and field monitoring results ➡ Mapping
- ▶ Report to decision maker

Thank you very much

KINS

