KINS-IAEA Workshop on Radiation Safety and Emergency Response in the Medical or Industrial Use of Radiation, 10 ~ 14 June 2019, KINS, Korea

## Introduction of RASIS and RADLOT

The system for the safety and security system of radioactive materials and radiation sources in Korea



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## Legislative & Regulatory Framework



Detailed security measures : security plan, detect, delay, response, protection of sensitive information, check of trustworthiness, training, import & export guidance, etc.



## NSSC Notice on Security of Rad. Sources





## Safety and Security of Rad. Sources

#### In Korea, radiation sources are managed by

- regulation processes of permits, notifications, registrations, approvals, inspections, and enforcements on
  - production/distribution or sale/usage/transport/disposal/transfer and acquisition
- licensee's legal periodic report on
  - o source status additionally including purchase/acquisition
- related organizations' tasks such as export/import declaration, consigneddisposal etc.
- and location monitoring for radiation sources

## Information is integrated and analyzed by two systems RASIS & RADLOT



## RASIS

#### System Development (1998~2001)

- Development of RASIS (1998)
- Safety Management System for Licensees and Related Institutions

#### System Stabilization and Operation (2002~2016)

- Continuous System Upgrades and Improvements
- Development of On-line Application

#### System Advancement (2016~2018)

- Enhancement of Functions for Monitoring and Controlling of Rad. Sources
- Enhancement of Performance by H/W Upgrades
- Simplification of the System Configuration with Portal System Development



### Structure of RASIS(<u>RA</u>diation <u>Safety</u> Information <u>System</u>)

- Cradle-to-Grave Control System for Rad. Sources





## **RASIS : Process of Flow**





## **RASIS: Regulatory Information System**

- Operated since 1999
- User : Regulator (NSSC/KINS)
- Features





### **Statistics**

	2015	2016	2017	2018
System Users	4,121	4,464	5,030	5,327
On-line Application	8,890	11,322	12,676	11,585
every year, 10~20% increased				

	Usage		Sale	Salo	Mobile-use	Production		total	
Type of business	notification	permit	+usage permit	permit	(NDT)	permit	sum	notification	permit
Medical	13	137	0	0	0	12	195	13	182
Industrial	5,552	582	44	226	55	104	6,563	5,552	1,011
Research	270	58	2	0	0	3	333	270	63
Educational	133	163	0	0	0	2	298	133	165
Public	759	57	0	0	0	1	817	759	58
Military	76	32	0	0	0	0	108	76	32
Sum	6,803	1,062	46	226	55	122	8,314	6,803	1,511



## Source Management Process on RASIS





## **RASIS: Source Tracking System**

#### Source tracking process





## RASIS: Source Tracking System (Example)

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	2	Co-60	RS-Type-Co60	1234-07-05	보유	(주)휴비스-전주공장		20050824	2.2	구매위탁			
	3	Co-60	RS-Type-Co60	1236-07-05	보유	(주)휴비스-전주공장		20050824	6.9	구매위탁			
	4	Co-60	RS-Type-Co60	1235-07-05	보유	(주)휴비스-전주공장		20050824	1.3	구매위탁			
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## Before advancement of RASIS





### After advancement of RASIS





## Installation & Operation of RADLOT

#### Background

- a small radiation source missing event which occurred in a city near Seoul in March 2003
- needed big announce which said that the radiation source was very harmful...
- → necessities of a system to track locations of radiation sources

#### Objectives

- to prevent missing events of radiation sources
- to recover missed sources as soon as possible

#### Proceedings

- Development during 2004~2005
- Pilot operation during Busan APEC held in Busan city, November 2005
- Official launch in March 2006 with 1,001 mobile terminals and 4 servers
- Some upgrades on mobile terminals after then



## Installation & Operation of RADLOT

#### RADLOT is the RADiation source LOcation Tracking system that

- supports real-time monitoring of irradiators of industrial radiography
  - it shows location information and route of mobile terminal attached on the portable irradiator
- uses Global Positioning System(GPS) and Code Division Multiple Access (CDMA) network
  - o it collects data periodically and when an operator send a order,
- is composed with mobile terminals, a central control system and a commercial telecommunication network

#### RADLOT is able to

- check locations and routes of portable/mobile radiation source used for industrial radiography
- monitor the radiation level where it attached, and enhance the management of radiation source















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### **Dedicated Location Tracking Mobile Terminals**



It communicates central control center with CDMA communication function and it's location data is made by GPS-One method. It have RF Module and IO controller which inform mobile data terminal availability and location in an emergency.

 CPU : ATMEL MEGA128M (9 x 9(mm))
 Case : 71 x 83 x 30(mm)
 Battery : lithium polymer 5600mA(size:50 x 35 x 17(mm))

#### START-II

Having G-M dosimeter in addition to location tracking function of START-I, START-II can show dose rate around radiation worker with irradiator by LCD screen of terminal.

CPU + RF module : 24 x 386(mm)
 Case : 20 x 72 x 100(mm)
 LCD : 40.5 x 30(mm)
 rechargeable battery (two AA size)



START-II

• •

#### START-88e

Upgraded type from START-I for 880 projector. It has energy compensated G-M detector and GPS function in addition to CDMA. Detachable battery box.

 CPU : ultra low power MPU (5.1 x 6.6(mm))
 Case : 16 x 70 x 160(mm)
 Battery : lithium-ion polymer 5200mAh (size:59 x 74 x 10(mm))



#### START-88s/88sa

Recently upgraded type of START-88e. A kind of W-CDMA terminal with energy compensated G-M detector. Easily and stably attachable under the handle. Rechargeable without detaching the terminal.

CPU : ultra low power MCU (5.1 x 6.6(mm))
 Case : 160.5 x 61 x 25(mm)
 Battery : lithium-ion polymer up to 6000mAh



Minimized terminal type)

As main cause of START-I's breakage is shock arising from collision of irradiator with other substance, START-I-SS is improved minimal START-I in order to reduce shock.

• CPU : ultra low power MPU (5.1 x 6.6(mm)) • Case : 65 x 44 x 30(mm) • Batten : Lithium polymor 5100m (circu 50

Battery : lithium polymer 5100mA(size:50 x 35 x 17(mm))



START- I - IH

(Built-in handgrip type)

Same type of START-I-SS(Minimized terminal type), improved bulit-in handle type reducing the performance degradation caused by impact

CPU : ultra low power MPU (5.1 x 6.6(mm))
 Case : built-in handgrip
 Battery : lithium polymer 5100mA(size:50 x 35 x 17(mm))

• A Pilot Project to Establish Radioactive Sources Location Tracking System in Viet Nam

- KINS has developed Radioactive Sources Location Tracking System which allows real-time tracking of mobile radioactive sources based on GPS satellite signals and mobile telecommunication networks
- KINS has been sharing benefit of this technology with the international community
- Trilateral cooperation between ROK, Viet Nam and the IAEA was first discussed during 2012 and 2014 Nuclear Security Summit
- ROK launched a pilot project, RADLOT-V, jointly with Viet Nam and the IAEA in 2015 and finished in 2017





**Development of Mobile-Terminal Unit (MTU)** 

#### **Establishment of Central Control System (CCS)**



#### Filed Tests

- The 1<sup>st</sup> field test in Viet Nam
  - > Using local Viet Nam USIMs, the data transaction between MTU and DB server of the CCS was tested and successively verified
- The 2<sup>nd</sup> and 3<sup>rd</sup> field tests in Viet Nam





#### Nuclear Conference & Training for System Users

- IAEA Nuclear Conference (5-9 Dec. 2016)
  - Introduction of key achievements of project : Photo Essay (IAEA), Exhibition Booth (KINS)
- Training for System Users (17 Jan. 2017)
  - VARANS & 10 Licensees from 5 Companies in Viet Nam participated in the training
  - After training, the shipment and installation of the system had been completed and the beta test was launched officially on 13 Feb. 2017 (2 months)







#### Key Achievements

- Developed system manuals (translated in Vietnamese) which was used as training materials for system users
- Shipment and Installation of the System
  - The physical firewall was installed in addition to the security S/W to protect the server
- Beta Test for 2 months
  - > Delivered Final Products (30 MTUs plus 2+5 extra MTUs, 60 Battery Packs, etc.)
  - Deployed to the licensees (Some of them are located in Southern Viet Nam)
  - > Meeting between VARANS & Vendor for the beta test review (10-12 May 2017)
  - > Feedbacks received and reflected in the system
- Technical support from Korea side was provided for 1 year after the official closeout of the project and it was done by remote access



### Conclusion

#### **\*** KOREA has developed radiation safety and security control systems

- has done its efforts to adopt international standards on legal system and regulatory structure
- has developed and used IT based systems for safety and security control of radiation sources

## RASIS/RADLOT have been operated to enhance safety and security control for sealed sources

- For effective RASIS operation, upgrade has been continued;
  - o to enhance performance and monitoring functions
- For effective RADLOT operation, upgrade has been continued;
  - o to enhance performance of mobile terminals and its programs
  - o to overcome other limitations
  - RADLOT-V project which was carried out in cooperation with KOREA, VIETNAM the IAEA was completed successfully



## Always we keep watching our Atomic Power

# Thank You

