

# Experiences of Laboratory Accreditation and Intercomparison Exercises for Individual Monitoring of Internal Exposure

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# Outline

- ◆ **Internal Dosimetry Lab of KIRAMS**
  - Internal Dosimetry Laboratory
  - Laboratory Accreditation Experiences
  - Intercomparison Exercises for Performance Test
- ◆ **ARADOS, *Platform for Individual Dosimetry Network***
  - ARADOS Introduction
  - Intercomparison Exercises
  - Future Plans



# **Internal Dosimetry Lab of KIRAMS**

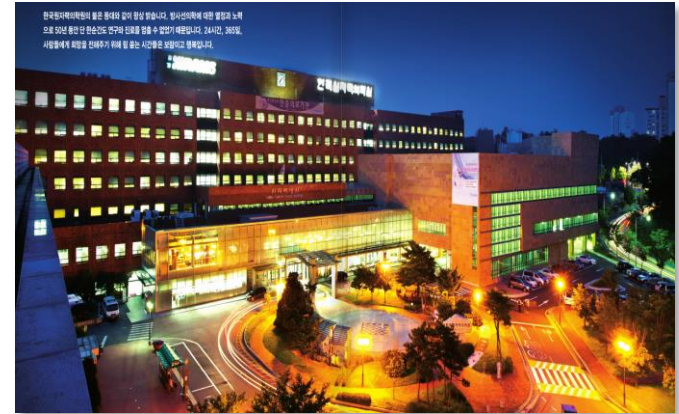
## **(Korea Institute of Radiological and Medical Sciences)**

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# Internal Dosimetry Lab of KIRAMS

- ◆ KIRAMS is a national leading research institute on radiological medical sciences composed of cancer hospital, medical research center, RI production/application center and NREMC.
- ◆ Health physics team under NREMC has operated dosimetry laboratory for individual monitoring of external/internal exposure.
  - Routine individual monitoring (for NM workers)
  - Retrospective dose assessment
  - Research projects for emergency dosimetry
  - Intercomparison exercises

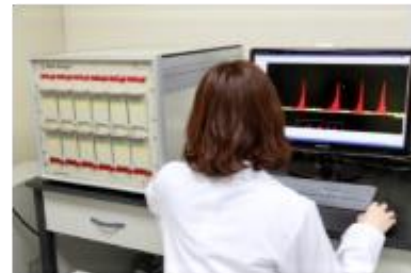
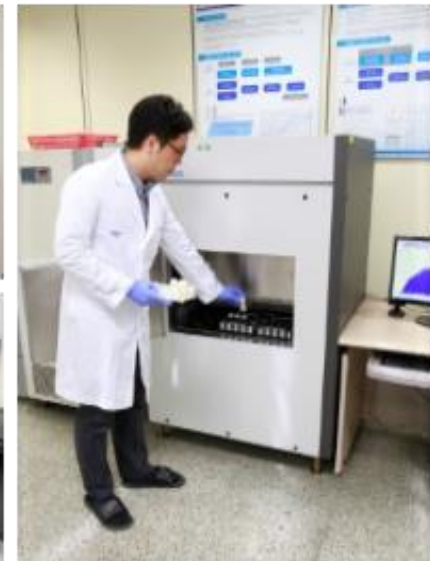


# Internal Dosimetry Laboratory

## ◆ In-vivo Bioassay



## ◆ In-vitro Bioassay



# Internal Dosimetry Laboratory

## ◆ Mobile Bioassay Unit



# Laboratory Accreditation

- ◆ Laboratory accreditation from KOLAS in 2016
- ◆ QMS (Quality Management System) based on **ISO/IEC 17025**
  - Development of quality manual, procedures and guidelines covering the requirements on structure, resource, process and management system
  - Visited IAEA and CIEMAT for consultation



GENERAL REQUIREMENTS FOR THE  
COMPETENCE OF TESTING AND CALIBRATION  
LABORATORIES

# Laboratory Accreditation

## ◆ Key issues for laboratory accreditation

- Trained personnel
- Facilities and environmental condition
- Equipment calibration and performance tests
- Evaluation of measurement uncertainty (Type A and B)
- Control of technical records and reported results
- Periodic internal audits and corrective actions



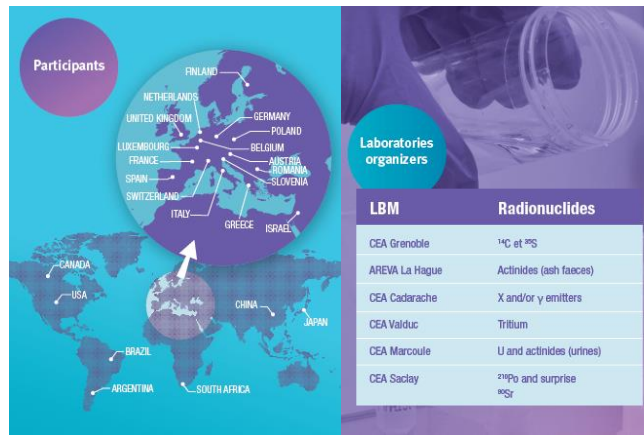


# Intercomparison Exercises

- ◆ Proficiency test through intercomparison results
  - WBC inter-laboratory comparison with IAEA
  - Thyroid monitoring intercomparison (TRIP by US LLNL)
  - Urine bioassay (NRIP, PROCORAD, etc.)

NRIP: NIST  
Radiochemistry  
Intercomparison  
Program

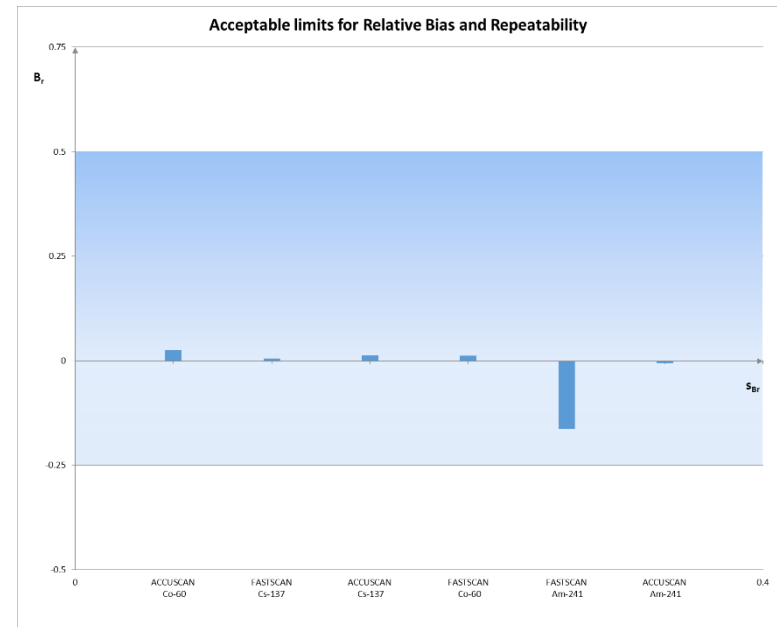
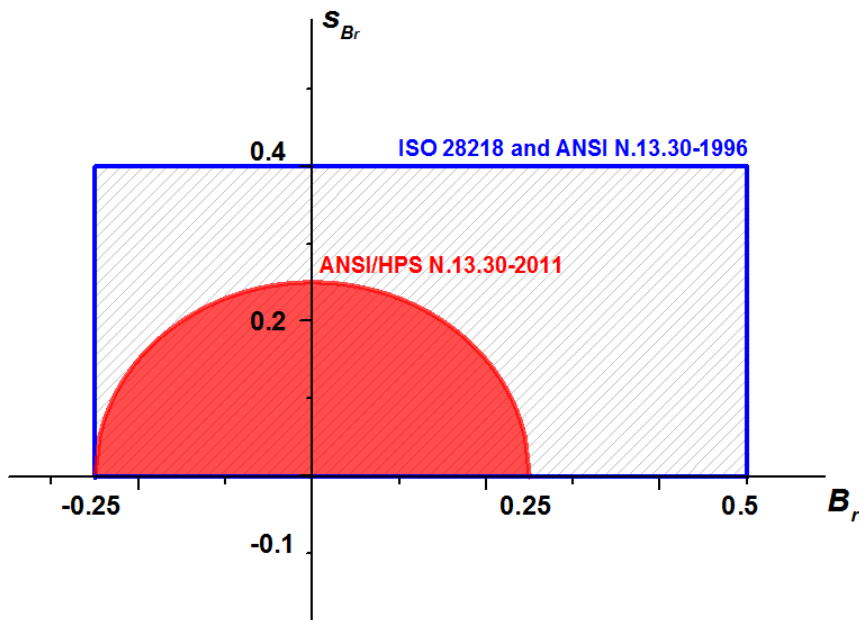
Category	Radionuclides (potentially present)	Maximum Activity (Bq/Sample)	
		Routine	Emergency
Gamma-emitters	$^{54}\text{Mn}$ , $^{57,58,60}\text{Co}$ , $^{65}\text{Zn}$ , $^{133}\text{Ba}$ , $^{134,137}\text{Cs}$ , $^{134,137}\text{Cs}$ , $^{152}\text{Eu}$ , $^{192}\text{Ir}$	250	250
Beta-emitters	$^{89}\text{Sr}$ , $^{210}\text{Pb}$ , $^{228}\text{Ra}$	1	10
Alpha-emitters	$^{210}\text{Po}$ , $^{226}\text{Ra}$ , $^{234,235,238}\text{U}$ , $^{237}\text{Np}$ , $^{238,239,240}\text{Pu}$ , $^{241}\text{Am}$ , $^{244}\text{Cm}$	1	10
	$^{228,230,232}\text{Th}$	2	20
Gross Alpha		60	550
Gross Beta		3000	3000



# Intercomparison Exercises

## ◆ Performance Criteria for Bioassay (from ISO and ANSI standards)

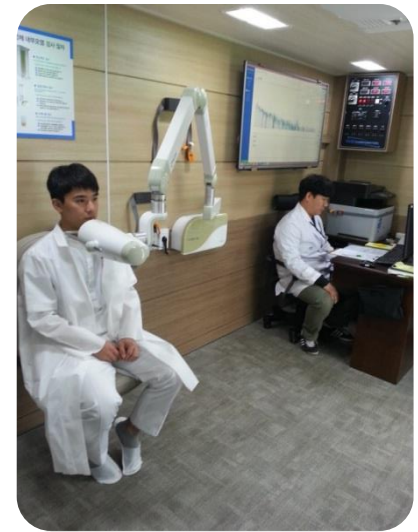
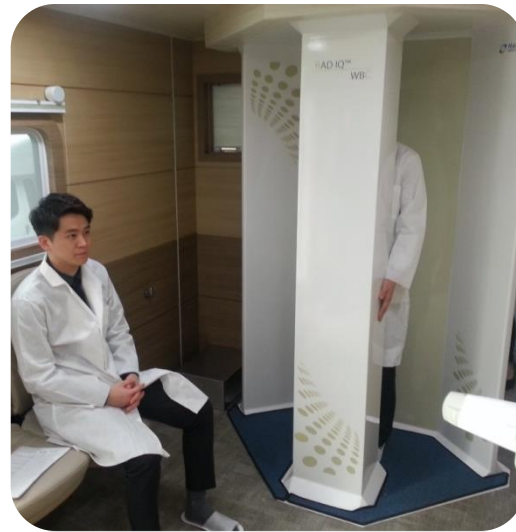
- Relative Bias
  - Repeatability
- ➔ RMSE (combined value)



# Individual Monitoring of Occupational Intakes

## ◆ Individual monitoring for NM workers in hospitals

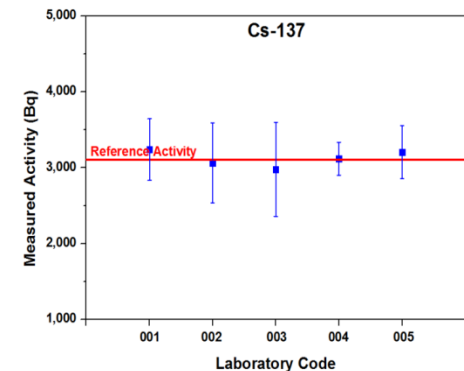
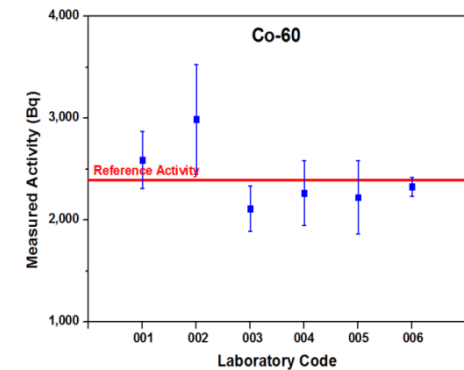
- Preliminary study requested by the NSSC
- About 30 workers in 6 hospitals
- Used mobile unit for WBC and thyroid monitoring



# National Intercomparison Exercise

## ◆ WBC intercomparison

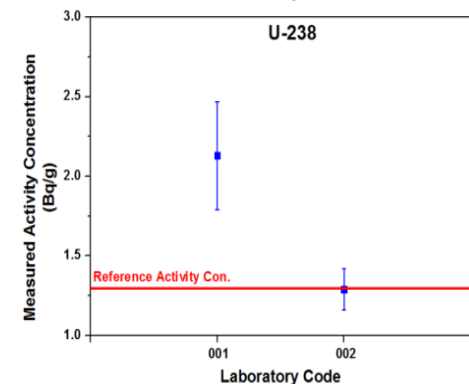
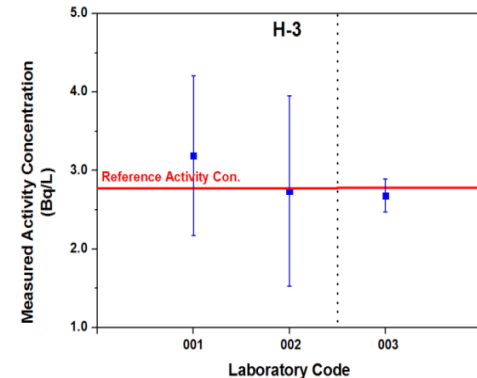
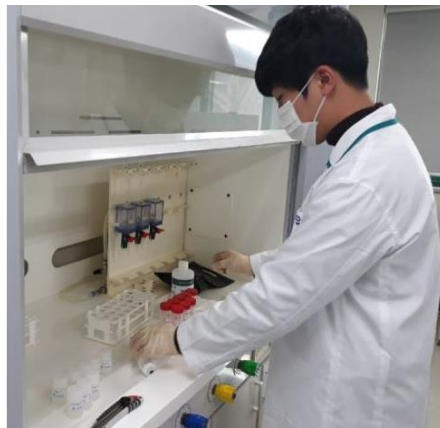
- Used BOMAB phantom and transfer phantom
- Service laboratories from NPPs and research institutions



# National Intercomparison Exercise

## ◆ Urine Bioassay intercomparison

- H-3 measurement in urine samples (CANDU-reactors)
- U isotope measurement in urine samples (Nuclear Fuel Co.)



# IAEA Training Courses

- ◆ **Training Courses on Assessment of Occupational Intakes**
  - Basic course/Advanced course (including hand-on sessions)





# **ARADOS (Asian Radiation Dosimetry Group)**

## ***Platform for Individual Dosimetry Network in Asia***

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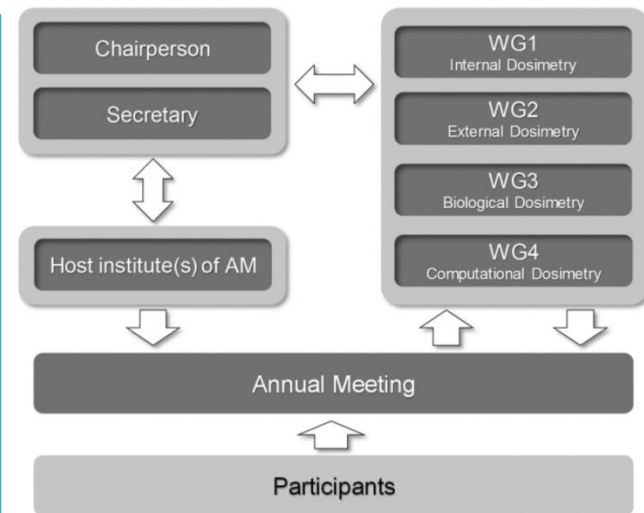


# ARADOS Introduction

- ◆ Founded as a **research platform of radiation dosimetry** among Asian countries in 2015
- ◆ 8 countries, about 20 institutions, more than 70 members
- ◆ Chairperson : Dr. Osamu Kurihara (QST-NIRS, Japan)
- ◆ 4 WGs : Internal, External, Biological and Computational

## *Mission of ARADOS*

1. To enhance and harmonize **radiation dosimetry capabilities** in Asian countries
2. To share information on **research activities on radiation dosimetry** in each country
3. To prepare a **joint response for radiation dosimetry services** in the event of a large-scale radiological/nuclear accident.



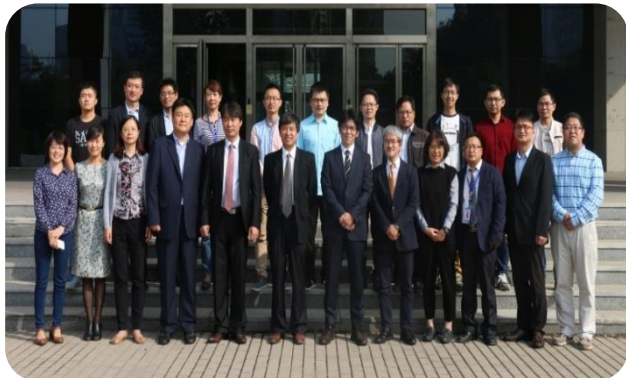
Osamu Kurihara, *Radiat Meas* (2020)





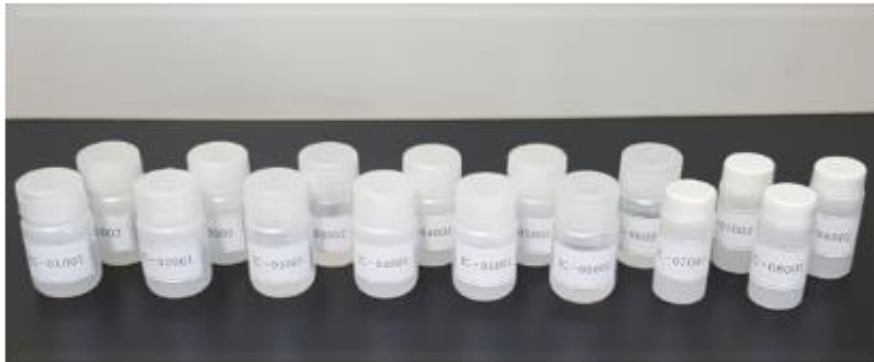
# Main Activities

- ◆ Annual Meetings/Facility Tour
- ◆ Intercomparison (IC) Exercises
- ◆ Joint Research Projects
- ◆ Education and Trainings



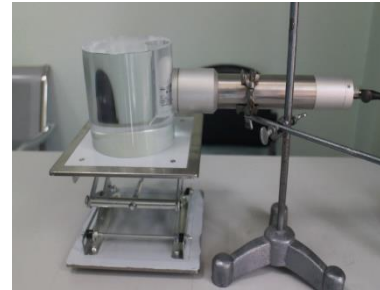
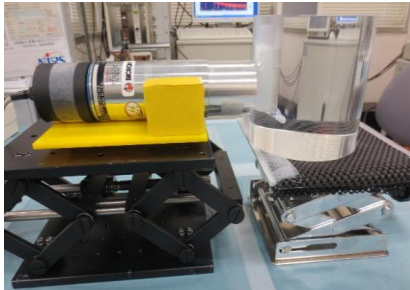
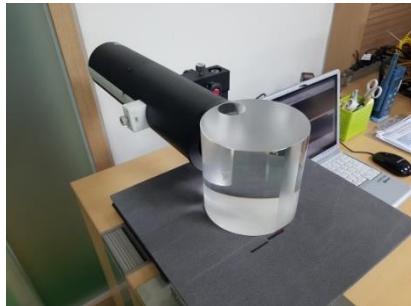
# IC Exercises

- ◆ **Thyroid monitoring intercomparison exercise** in 2017
- ◆ Prepared by QST-NIRS (phantoms) and KIRAMS (samples)
- ◆ Reference value determined by HPGe detector



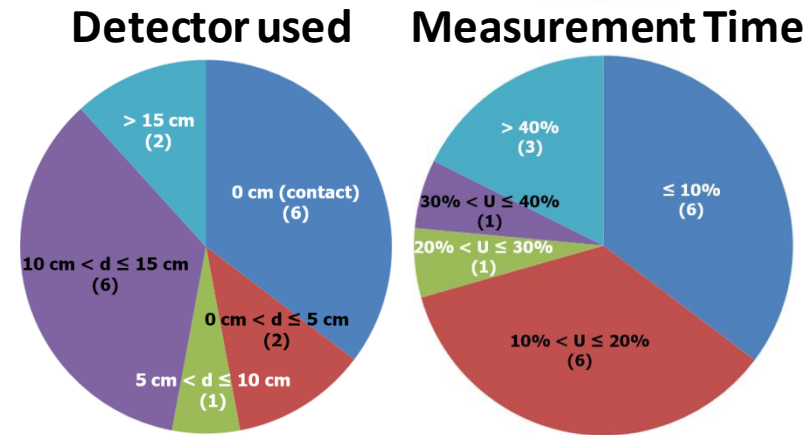
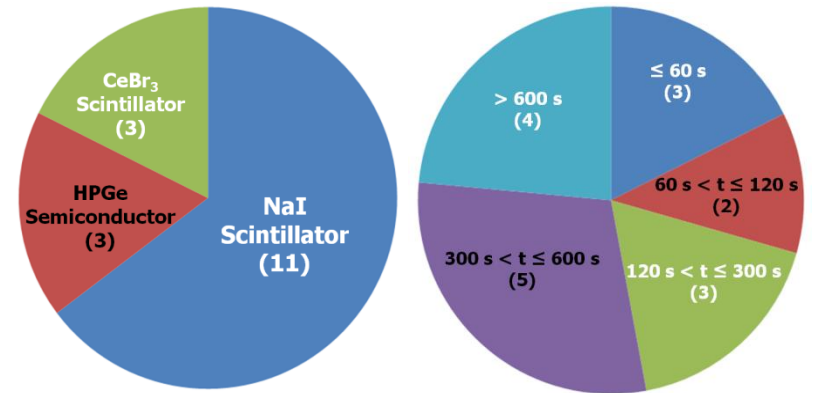
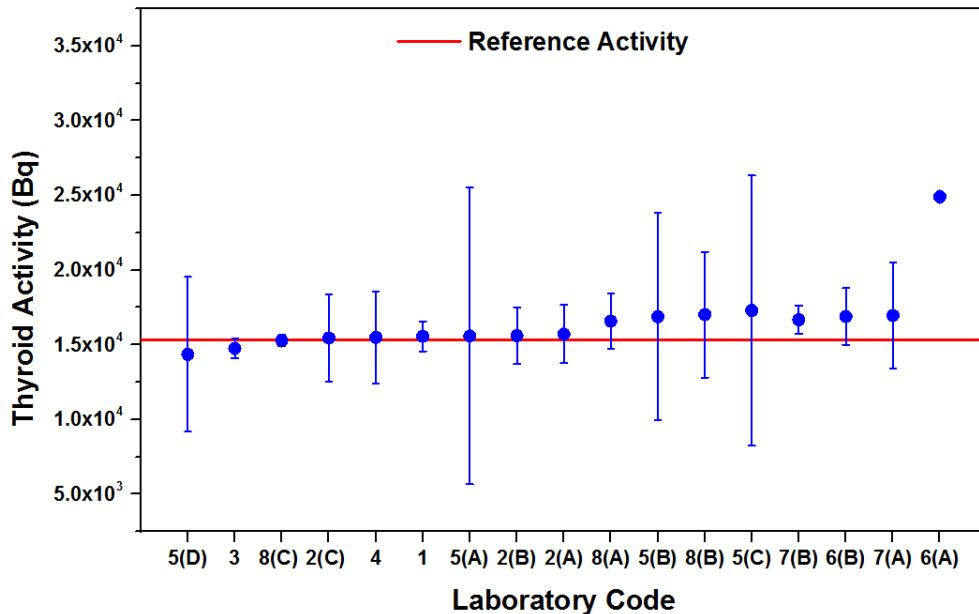
# IC Exercises

- ◆ 8 institutes from Japan, China and South Korea participated.
- ◆ 17 results applying the different detectors or measurement conditions were reported to the organizing group.



# Result of IC Exercises

- ◆ Measurement results of thyroid activity were compared.
- ◆ Thyroid measurement conditions of participating laboratories were surveyed and analyzed to promote **harmonization of the monitoring method** used.



Distance of Detector Expanded Uncertainty

# Other IC Exercises

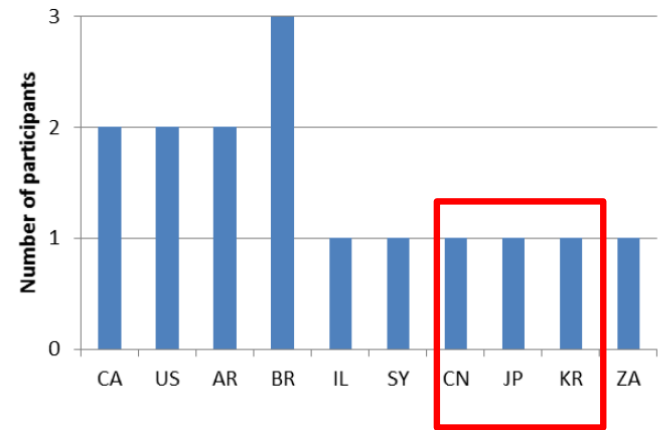
## ◆ EURADOS-LLNL Thyroid IC

- Thyroid activity measurement and dose assessment

## ◆ ICIDOSE project

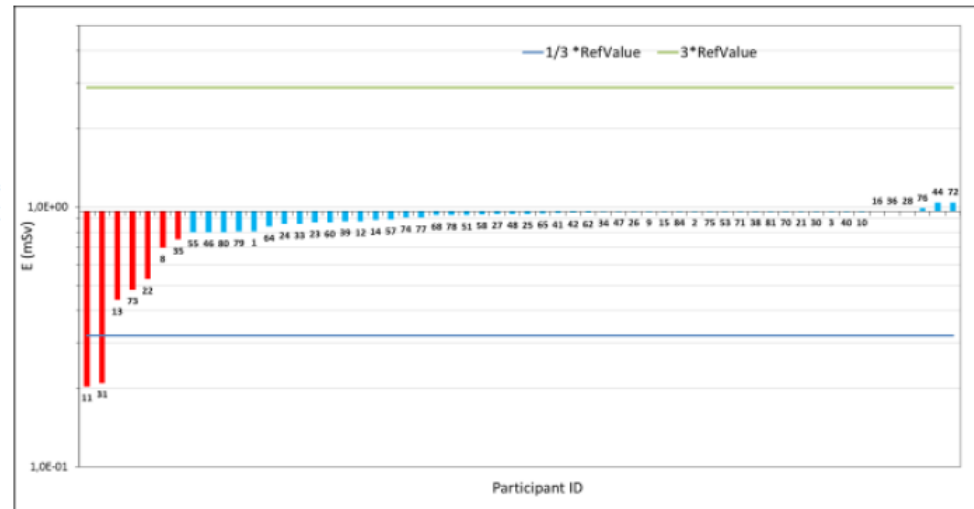
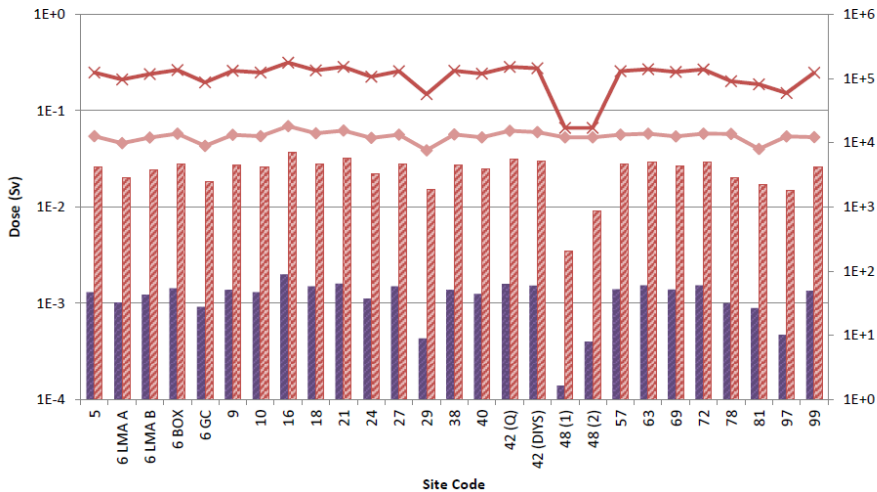
- Internal dose assessment using the given intake scenarios

Number of Non-European participants



Thyroid B, 30 ml I-131

Legend: e(50) (Sv), HT (Sv), Thyroid Activity (Bq), Intake (Bq)



# ARADOS Website

**ARADOS**  
Asian Radiation Dosimetry Group

About us Working Groups Our activities Non-ARADOS events Contact

ARADOS  
Asian Radiation Dosimetry Group

**ARADOS NEWS**

**ARADOS & NIRP & NIM**  
2019/12/03

5th (2019) ARADOS meeting PRESENTATIONS & photo

**SCIENTIFIC NEWS**

**NewScientist**  
2020/06/03

Long space flights can increase the volume of astronauts' brains

**RECENT PAPER**

**HEALTH PHYSICS**

COUNTING EFFICIENCIES DETERMINED BY MONTE CARLO METHODS FOR IN VIVO MEASUREMENT OF  $^{131}\text{I}$  ACTIVITY IN THYROID

Authors: Min-Seok Park, Tae-Eun Kwon, Wi-Ho Ha, Chan Hyeong Kim, Sunhoo Park, and Young Woo Jin  
Published: October 2019 in: Health Physics

[www.nirs.qst.go.jp/usr/ARADOS/index.php](http://www.nirs.qst.go.jp/usr/ARADOS/index.php)

# Future Plans

- ◆ **Intercomparison exercises in each WG**
  - **Internal dosimetry WG** : WBC intercomparison, urine bioassay intercomparison, analysis of biokinetic models and internal dose assessment applying ICRP OIR under planned
- ◆ **Standardized dosimetry protocol**
- ◆ **Expanding the network in Asian and Oceanic Region**
- ◆ **Collaboration work with EURADOS, IAEA, RCA, etc.**
- ◆ **Joint research projects, education and training courses**



# Summary and Conclusions

- ◆ **Experiences of Internal dosimetry lab of KIRAMS**
  - Laboratory accreditation based on **ISO 17025**
  - **Intercomparison exercises** for individual monitoring/internal dosimetry
- ◆ ***ARADOS, a platform for individual monitoring and radiation dosimetry in Asia***
- ◆ **We, ARADOS, welcome everyone who are interested in our activities and collaborations.**







**Thank you for your attention!**

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