
MIRION
TECHNOLOGIES

CJ-3-17263

MIRION TECHNOLOGIES

Radiation Safety. **Amplified.**

Radiation measurement situation for decontaminated (removed) soil and so on around Fukushima Nuclear Power Station

Mar. 7st 2017

Atsuo SUZUKI　Ph.D
Mirion Technologies (Canberra) KK
Custom Solution Manager

CANBERRA

Presentation Summary

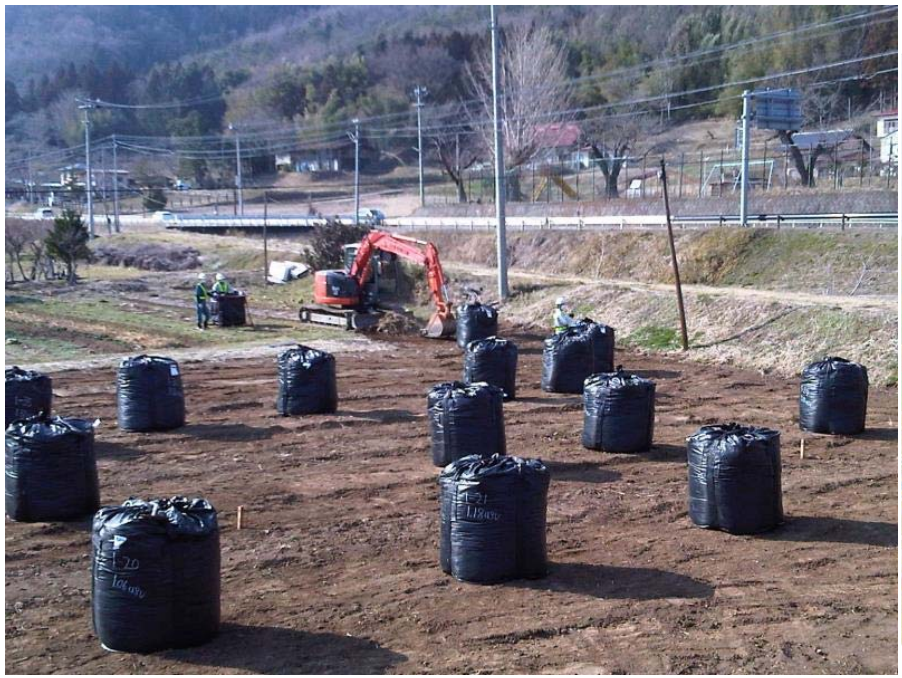
- Introduction
- Regulation / Guideline / Manual
- Removed soil measurement
- Key Technology
- Summary

MIRION TECHNOLOGIES

CANBERRA

Introduction

- By decontamination of land, there are a lot of removed soil, vegetation and so on in Fukushima Prefecture.
- As a result, these removed soil etc. are put into flexible container bags, commonly called SuperSack (1.1m D x 1m H) at Temporary Storage Area.(Estimated 22 M m^3)
- These SSs must be measured efficiently.



Regulation / Guideline / Manual

- **For Radiation monitoring (MEXT)**
  - Regulatory Guide for Gamma ray spectrometry and in-situ measurement
- **For removed soil (MOE)**
- **For Food etc. (MHLW)**
- **Calibration method :**
  All Regulatory Guides require the use of standard sources.

Ge spectroscopy

In-situ measurement

For removed soil

For food

CANBERRA

Removed Soil Measurement (1) Survey meter

- **Survey meter method**
  - Using energy compensated type NaI
  - The result is evaluated by correction factor
- **Strength**
  - Easy to use
- **Weakness**
  - Risk of worker's dose exposure
  - Very high cost
- **Uncertainty**
  - Plus or Minus Bias
  - Greater than +/- 30%

Removed Soil Measurement (2) In-situ measurement

- **In-situ Measurement**
  - In-situ collimated Ge system
  - In-situ collimated NaI system
- **Strength**
  - Very accurate
  - No operator next to SSs for automated system
  - High throughput in case of several detectors and the ability to count multiple sacks at the same time
  - Cost efficient
- **Weakness**
  - High initial cost
  - Calibration is difficult with standard source
- **Uncertainty**
  - No Bias
  - +/- about 10% (single SS)
  - less than +/- 20% (multiple SSs)

Removed Soil Measurement (3) Soil sorting system

- **Soil sorting system**
  - Some detectors on and under belt conveyer or measuring square shaped soil block
- **Strength**
  - Accurate
  - High throughput
- **Weakness**
  - High initial cost
  - Needs large area
- **Uncertainty**
  - No Bias
  - Objective : +/- about 10% (Evaluation in the near future)


Soil Sorting system

CANBERRA

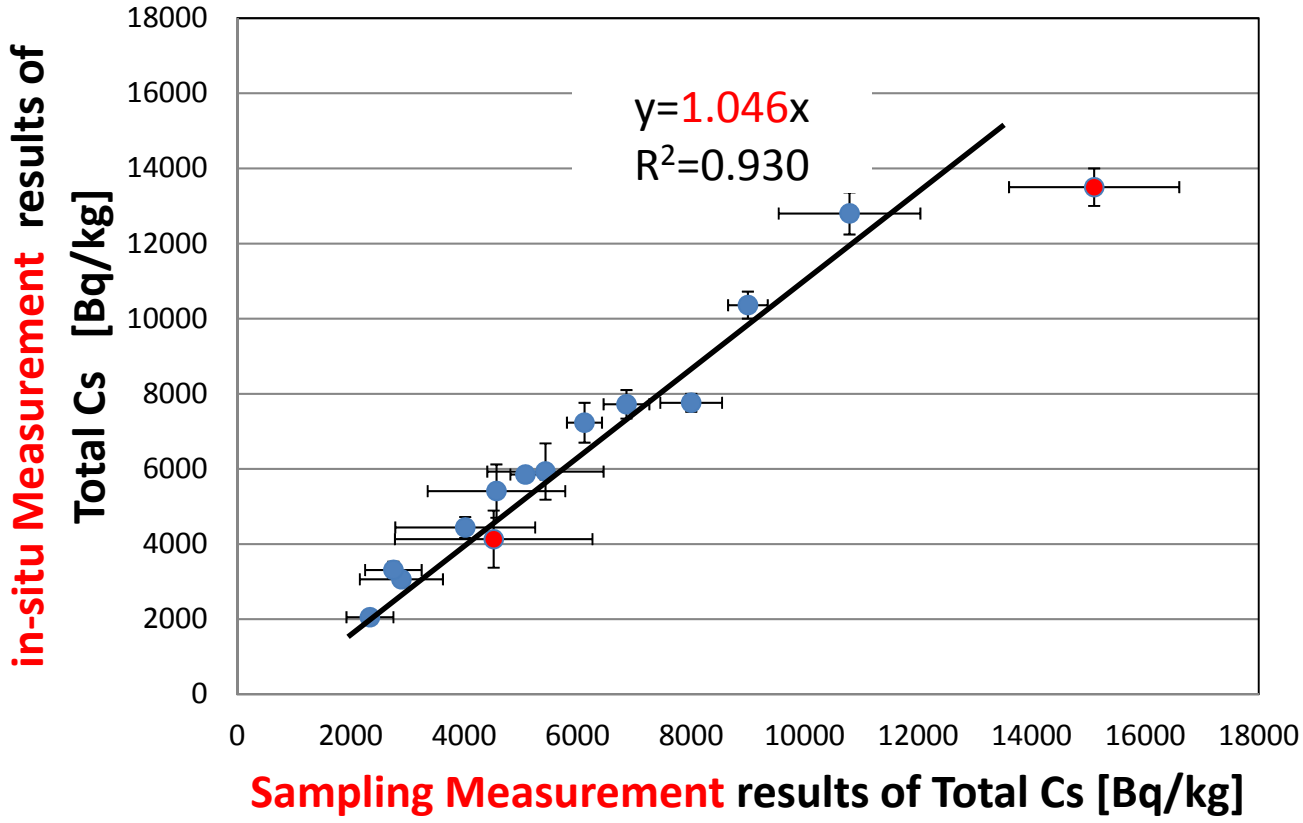
Removed Soil Measurement (4) Sampling

- **Sampling**
  - Using Ge or NaI detector at Lab.
- **Strength**
  - Recognized method
- **Weakness**
  - Not representative in case of heterogeneous SS
  - Very low throughput / high cost
  - Results after several days
  - Risk of worker's dose exposure
- **Uncertainty**
  - Less than +/- 10% for each sample
  - Greater than +/- 30% for SS

CANBERRA

Example of Sampling VS in-situ measurement

Distribution of Sampling vs in-situ measurement



1SD dispersion : Ave. 7% (2.9 – 18.4%) (in-situ from 4 direction)
: Ave. 20% (3.9 – 38.5%) (Sampling : 20 samples)

Key technology for measuring removed soil and so on

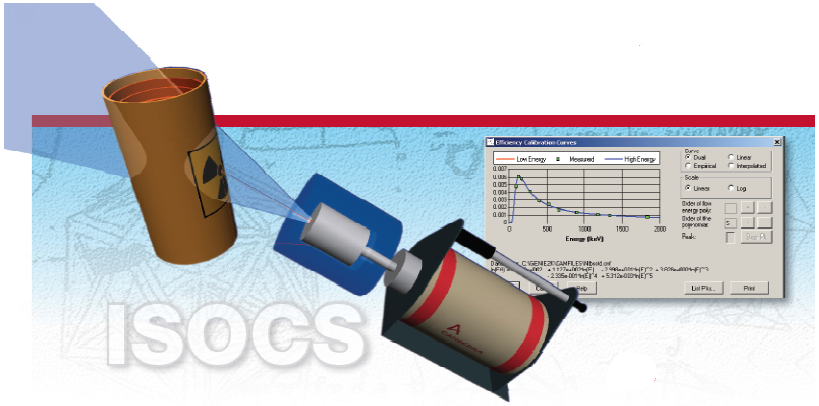
Difficult to applicate calibration with standard source

- Characteristics of object
  - Large size object
  - Complicated shape (height / width)
  - Many different matrixes and densities
  - Heterogeneous / Inhomogeneous
  - etc

Key technology for calibration

- Simulation method

  especially
- MCNP
- ISOCS
  (In-Situ Object Calibration Software)
- Other calibration software



CANBERRA

Solutions developed for food and other potentially contaminated items

- **Monitoring system for :**
  - Rice bag
  - Persimmon
  - Whole body counter for infants and adults
  - Bottom soil of Pond

Summary

- **Developed various measurement technologies**
  - NEW crystal, NEW analysis method and so on
- **Controlling uncertainty factors**
- **Simulation method is key technology**

  For obeying regulation / guideline / manual
- **User / Maker / Regulatory Agency / Academic circle**

→ Discussion about application of NEW technology

Thank You for your attention!