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Determination of ambient individual exposure dose rate in Chau Thoi mountain, southern Vietnam Using a NaI(Tl) Detector

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University of Granada, Spain

University of Science
Ho Chi Minh City, Vietnam

https://www.google.com/maps

Locations

Chau Thoi mountain

NaI(Tl) 7,6 cm × 7,6 cm
InSpector™ 1000, Mirion Tech.

Position name	Locations	
	Latitude	Longitude
VT1	$10°54'55,20''N$	$106°48'8,88''E$
VT2	$10°54'55,80''N$	$106°48'9,84''E$
VT3	$10°54'54,78''N$	$106°48'10,86''E$
VT4	$10°54'53,64''N$	$106°48'11,76''E$
VT5	$10°54'54,72''N$	$106°48'11,76''E$
VT6	$10°54'55,02''N$	$106°48'13,02''E$
VT7	$10°54'54,96''N$	$106°48'13,92''E$
VT8	$10°54'54,60''N$	$106°48'14,64''E$
VT9	$10°54'54,42''N$	$106°48'15,00''E$
VT10	$10°54'52,50''N$	$106°48'16,62''E$
VT11	$10°54'52,56''N$	$106°48'17,34''E$
VT12	$10°54'51,36''N$	$106°48'17,40''E$
VT13	$10°54'49,80''N$	$106°48'19,62''E$
VT14	$10°54'48,78''N$	$106°48'19,86''E$
VT15	$10°54'49,20''N$	$106°48'17,76''E$
VT16	$10°54'48,72''N$	$106°48'18,42''E$
VT17	$10°54'48,12''N$	$106°48'19,56''E$
VT18	$10°54'45,48''N$	$106°48'18,30''E$

Methods and materials

Ambient exposure dose rate, D_{air}(μR/h), can be calculated from measured energy spectrum of gamma ray incident to the detector by using a conversion factor G(E)

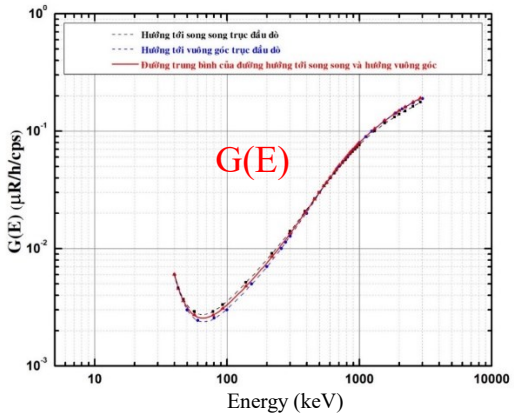
$$D_{air}(\mu R/h) = \sum n(E)G(E)$$

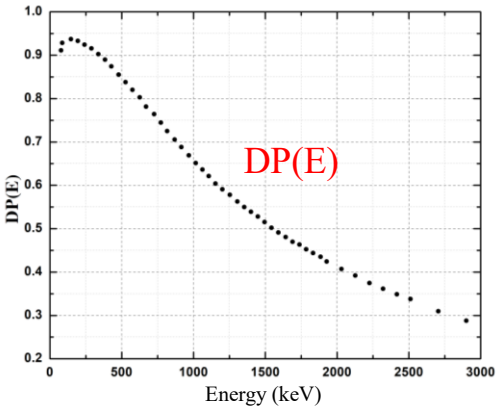
Individual exposure dose rate, DP(E), is dose rate from the net peak with a specific energy to the total dose rate induced from that peak

$$D_{in}(\mu R/h) = \sum_{peak} \frac{n(E).G(E)}{DP(E)}$$

n(E) : Measured energy spectrum . Unit: Count rate versus energy - (cps/keV)
G(E) : Dose conversion factor (μR/h/cps)
DP(E) : Peak-to-Total ratio at the energy for dose rate

For NaI(Tl) with size of 7,6 cm x 7,6 cm

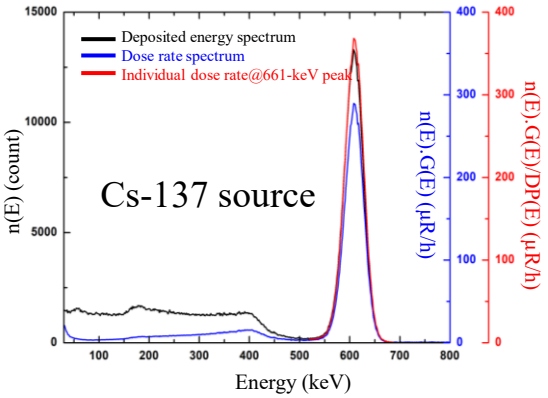




NaI(Tl) detector
7,6 cm x 7,6 cm

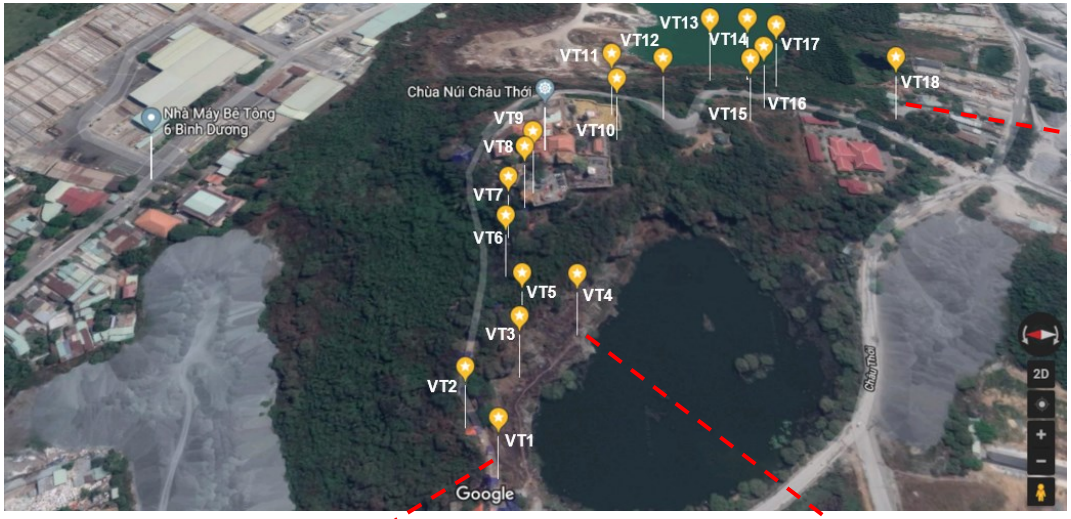
NaI(Tl) 7,6 cm × 7,6 cm
InSpector™ 1000, Mirion Tech.

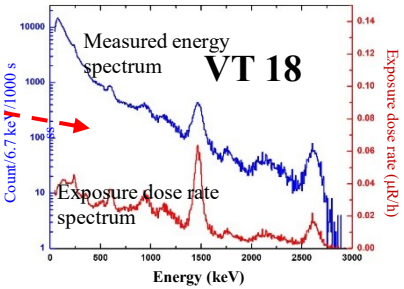
Test with Cs-137 RI source

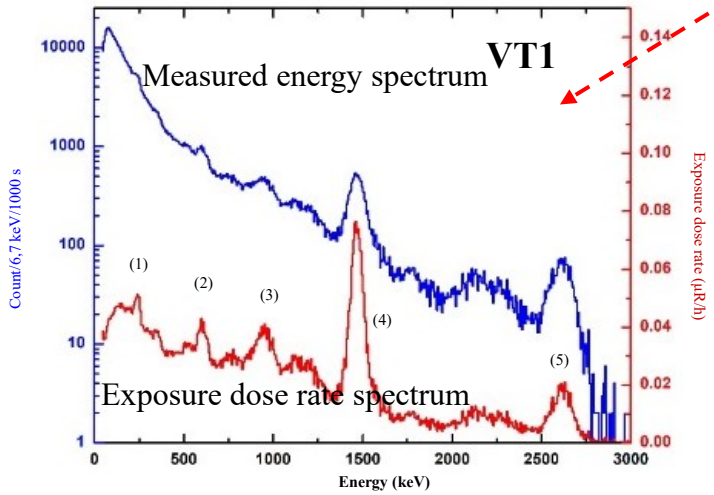


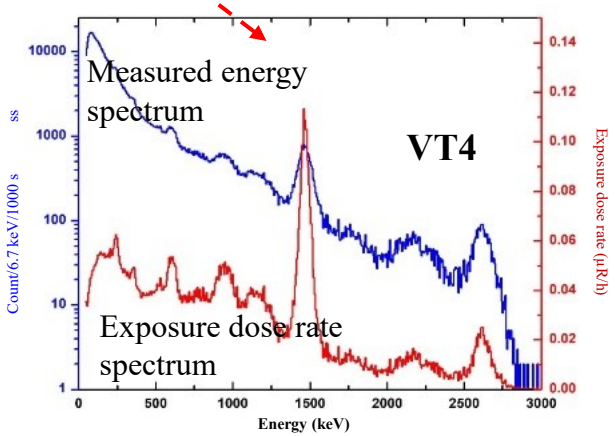
Results and analysis

Measured energy spectra and dose rate spectra

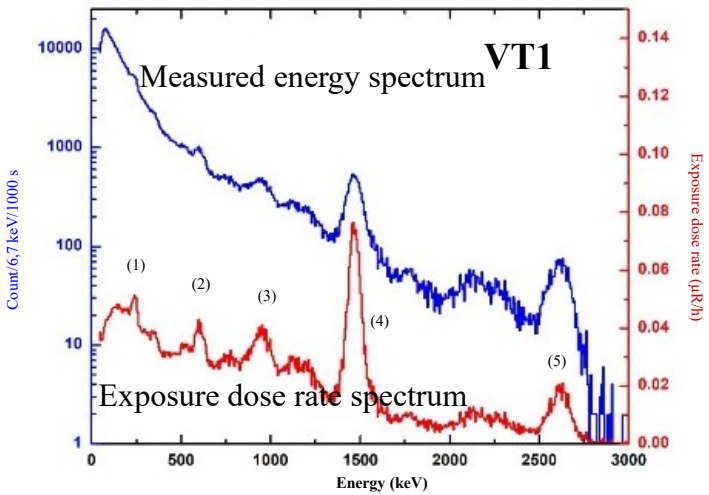


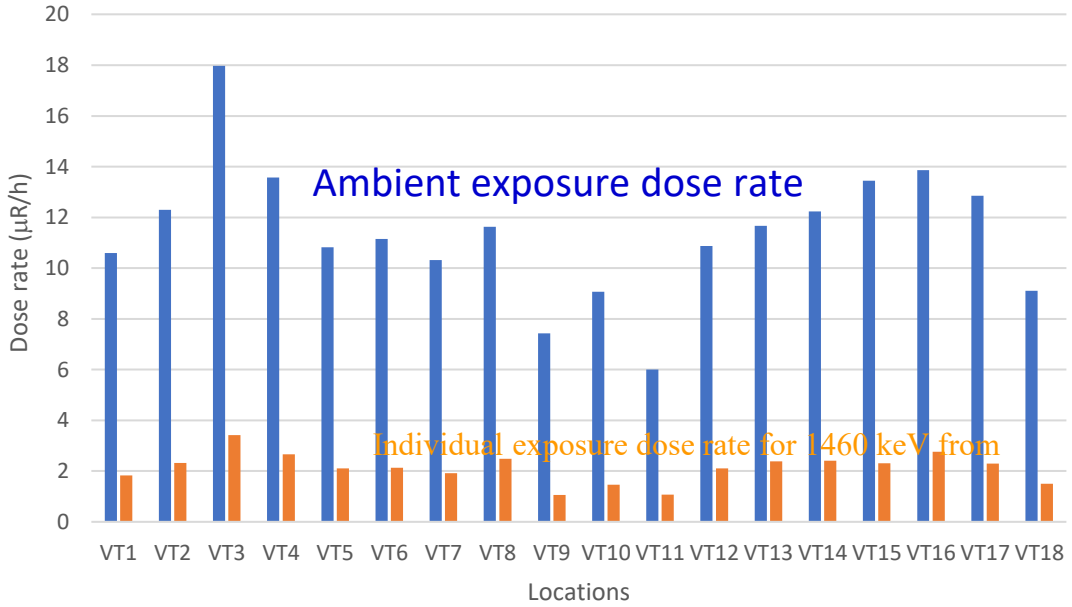






Exposure dose rate at 18 locations



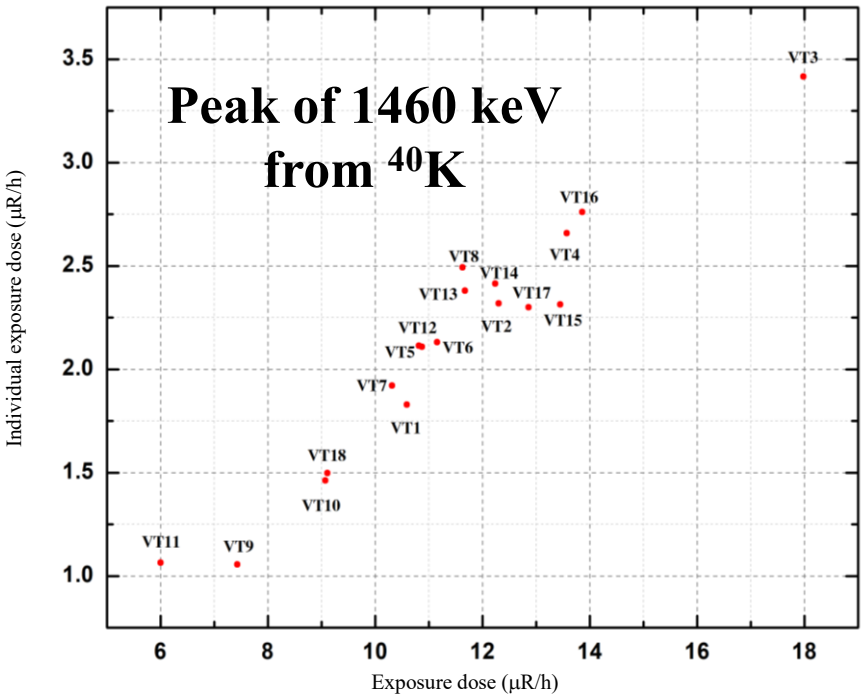


$$D_{air}(\mu R/h) = \sum_{E}^{3000keV} n(E)G(E)$$

$$D_{in}(\mu R/h) = \sum_{peak}^{1460keV} \frac{n(E).G(E)}{DP(E)}$$

We calculate
- Ambient exposure dose rate
- and individual dose rate of energy 1640 keV from K-40.

Individual dose rate of 1460keV to the dose rate at 18 locations



There is a strong correlation between ^{40}K in the exposure dose rate.

conclusions

- The study measured ambient exposure dose rates using a NaI(Tl) detector of 3in. x 3in. in Chau Thoi Mountain, southern Vietnam.
- By measuring the energy spectrum at 18 locations (VT1, VT2, etc.) are measured, exposure dose are determined.
- Individual dose rate of 1460 KeV from K-40 is determined. Significant correlations were found between exposure dose rates and specific energy peaks, such as K-40.

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Short- Biography

Position:
Vice deputy – Deputy head, Office of External Relations, University of Science-VNUHCM.

IEEE member (No. 93983296)

Education background:
PhD: Osaka University, Japan, 2008
MSc: VNUHCM - University of Science, Vietnam, 2004
BSc. VNUHCM - University of Science, Vietnam, 1999

International teaching experience:
International schools on Advanced Technology Training Program for Radiation Measurements, held at Osaka University, Japan, as teaching assistant, in years of 2009, 2010, 2011, 2014, 2015, 2017, 2019, 2022.

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1. Research Areas:
- Nuclear/Particle Physics;
- Nuclear radiation detection technique.
- High-tech radiation detector development

2. Faculty/Department/Laboratory
- Department of Nuclear Physics
- Faculty of Physics – Engineering Physic

3. Research Activities
- Development of Real-time website air-environmental monitoring system.
- High-Tech radiation detector development.
- Advanced-electronic technique of Fast Analog-Digital Converter (ADC) and Embedded Field Programmable Gate Array (FPGA)-based technology for radiation detector development. In the collaboration with Prof. Masaharu Nomachi group, Osaka University, Japan.
- Fast neutron detector development using plastic scintillator and a GSPS digitizer.