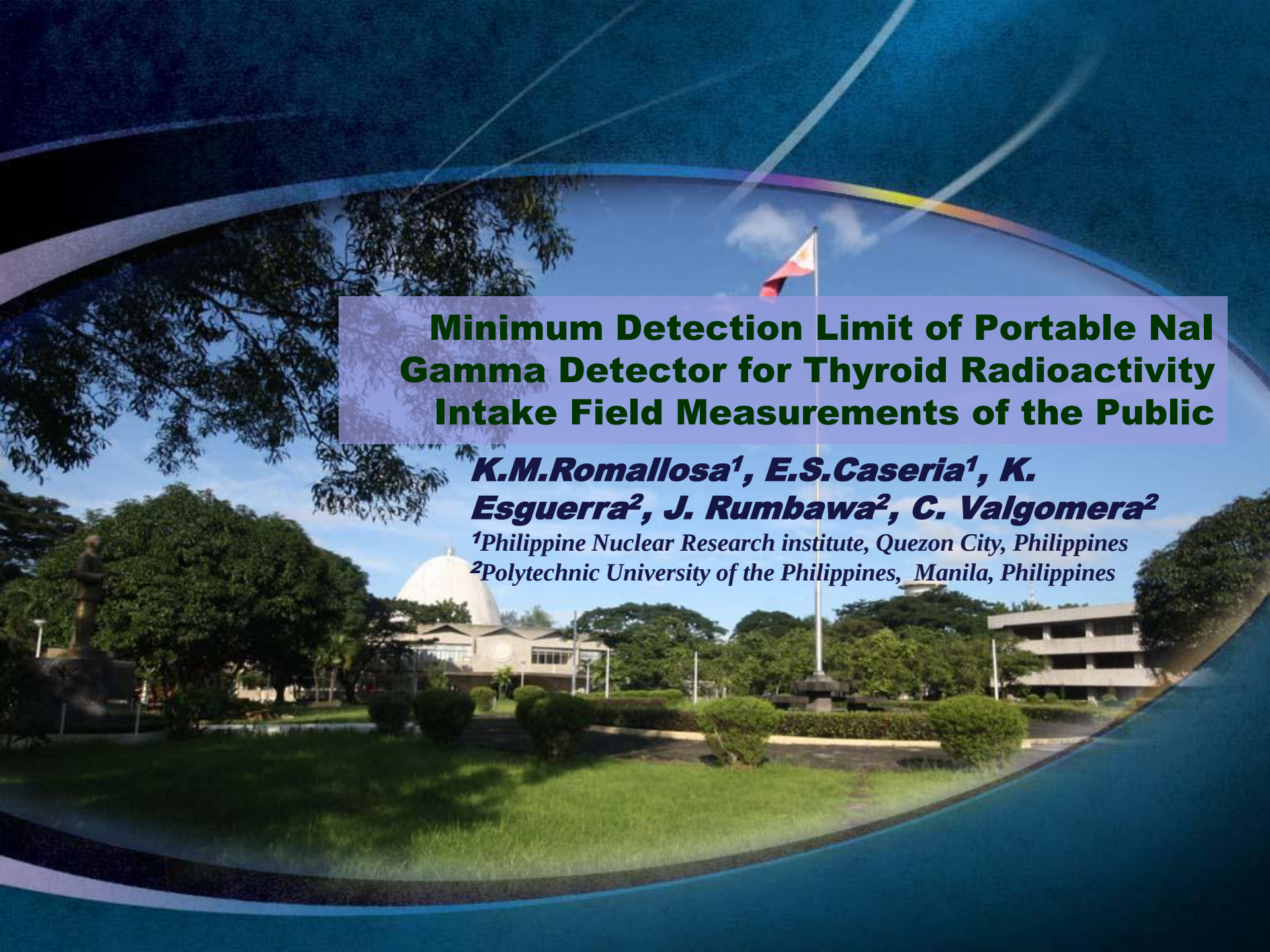

Minimum Detection Limit of Portable NaI Gamma Detector for Thyroid Radioactivity Intake Field Measurements of the Public

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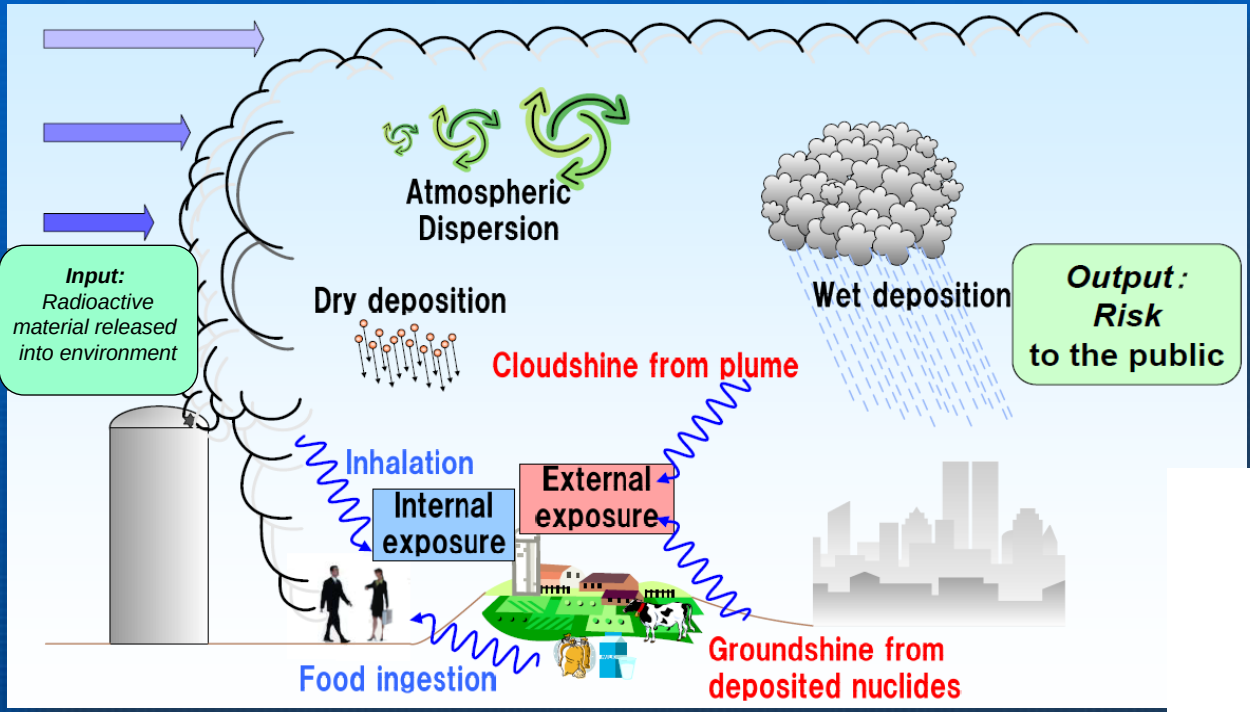
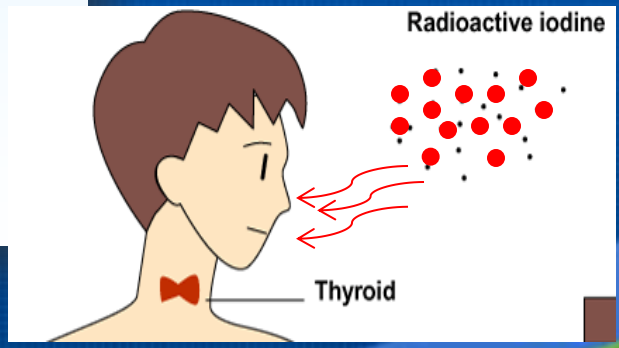
During nuclear accidents, radioactive materials maybe released into the environment and may pose health risks to the public

deterministic effects, stochastic effects, contamination, psychological effects



T. Homma, JAEA, ITC Reactor Engineering, 2011

Nuclear power accidents, e.g. Chernobyl & Fukushima, resulted into the release of fission products such as Cs-137 & I-131



Exposure of thyroid to higher concentrations of radioidine may increase the risk of thyroid cancer

United Nations Scientific Committee on the Effects of Atomic Radiation. Sources and Effects of Ionizing Radiation. UNSCEAR 2000 Report to the General Assembly, with Scientific Annexes. Vol. II: Effects. New York, 2000.

Emergency Response: Protecting the Public through Radioiodine Intake Monitoring

http://www.radek.ru/en/product/Spectrometers-and-radiometers-of-radiation/48/

http://www.fukkousien-zaidan.net/en/body/index.html

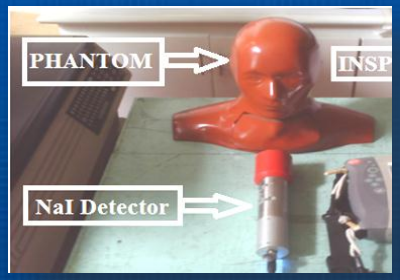
It is important to monitor the radioidine intake to the thyroid of the public → in order to implement the appropriate operational intervention levels in the affected population.

Requires specialized instrumentation, & bulky setup, and quite expensive.

Monitoring Radioactivity in Thyroid Using Portable NaI Gamma Detector

Portable NaI Gamma Detectors maybe used for initial screening of a population for thyroid radioactivity intake.
Portable, fast & easy setup, not very expensive

MINIMUM DETECTION LIMIT (MDL)



$$L_D = 3 + 4.65\, s_B$$

s_B – standard deviation of the background counts

Detection limit is the net count having a 95% probability of being detected when a sample contains residual activity at L_D.
If the net counts > the L_D, there is 95% confidence that residual radioactivity is detected.

Guidance Level = 3 mSv → total effective dose equivalent to any other individual from exposure to the released patient after radionuclide therapy

1. Nureg 1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants & Field Conditions, US Nuclear Regulatory Commission, Washington DC, June 1998
2. Philippine Nuclear Research Institute, Code of PNRI Regulations Part 13, LICENSES FOR MEDICAL USE OF UNSEALED RADIOACTIVE MATERIAL, Rev 3, 2013

MDL OF PORTABLE NAI DETECTORS FOR THYROID RADIOACTIVITY MEASUREMENTS

NUCLIDE	MDL (Bq/mL)	GROSS RADIOACTIVITY (kBq)	THYROID-DETECTOR DISTANCE (max)
I-131	302	10.5	9 cm
Cs-137	106	3.7	3 cm

Committed radiation weighted dose to the thyroid[Ref1] resulting from intake of radioidine with gross radioactivity as above = 4.5 mSv.

MDL of the detector is sensitive enough to detect within the reference level, i.e. release criteria for patient undergoing radionuclide therapy. The committed dose is also considered to have no statistically demonstrated risk based on generic reference levels for medical actions during radiation emergency[Ref1, Table F2], i.e. <50 mSv

Portable NaI detectors may therefore be used by radiological assessors in monitoring and fast screening of the public for thyroid radioactivity intake during nuclear emergencies and may use the results for initial implementation of interventional levels

1. International Atomic Energy Agency, EPR-Medical 2005, Generic procedures for medical response during a nuclear or radiological emergency, Vienna, 2005