Queensland Health

The right tool for the right job

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What would using the wrong tool do?



- Personal injuries
- Damaged equipment
- Poor quality work
- Slower progress
- Reduced efficiency
- Inaccurate measurement





Let's take a hypothetical case study!

Context:

- A legacy site: sand processing industry abandoned
- Contaminated by NORM (Naturally Occurring Radioactive Material) - typically heavy mineral sand
- Re-development
- Unknown spread of contamination





Objectives:

- Determination of volume of contaminated material
- Determination of activity concentration





What is NORM?













Detector Type	Dimensions (Volume)	Detector density (g/cm ³)	Sensitivity cps / µSv.h ⁻¹ @ 662 keV - ¹³⁷ Cs	Response Time seconds
Organic scintillation (e.g. Bicron µSievert)	25 x 25 mm dia. (~ 12.5 cm ³)	1.2	290	~ 5
Nal(TI) scintillation (e.g. RS220)	50 x 50 mm dia. (~ 100 cm ³)	3.67	1500	~ 2
Nal(TI) scintillation (e.g. Envinet MONA)	2 x 100 x 400 mm dia. (~ 8000 cm ³)	3.67	15100	~ 1
Csl scintillation (e.g. RADEYE PRD)	18 x 18 mm (~ 6 cm ³)	4.51	200	~ 5
BGO scintillation (e.g. GF VARIO)	50 x 50 mm dia. (~ 100 cm ³)	7.13	2500	~ 2
Geiger-Müller (e.g. RAMGAM)	55 x 15 mm dia. (~ 10 cm ³)	-	1.7	~ 25
Geiger-Müller (e.g. Mini Enviro tube)	300 x 30 mm dia. (~ 210 cm ³)	-	22	~ 25
Geiger-Müller (e.g. RADEYE B20, no filter)	20 x 50 mm dia. (~ 40 cm ³)	-	0.2	~ 25
Germanium Semiconductor (e.g. HPGe)	60 x 70 mm dia. (~230 cm ³)	5.32	-	~ 1

ARPS2 23 Environmental Level Gamma Measurement background corrections





- Radiation detector response and instrumentation dependant
- Location dependant elevation, local geology
- Environmental conditions soil moisture content
- Built environment radioactivity in building materials, geometry (underground carparks)



Back to our site - options

- Walk-over survey
 - Need an instrument that is suitable for NORM detection
 - Calibrated for environmental level
 - GPS recording is a bonus
- Sub-surface detection
 - Borehole logging
 - Sample collection for analysis
 - In-situ
 - In lab



Extensive mineral resources along the coast of Mannar Island / Credit: Virakesari.

ARPS2®23

What does the regulatory governance say?

- ICRP & IAEA have recommended action reference levels to be set at an annual effective dose to a person between 1 and 20 mSv, depending on practicability of controlling the situation (ICRP 2007, IAEA 2014)
- ARPANSA adopted the IAEA recommendation for selection of reference levels and suggests an intermediate reference level of 10 mSv per year as an appropriate starting point for remediation of legacy and post-accident sites (ARPANSA 2017)
- Queensland experience is that most sites contaminated by radioactive material can be remediated to a level where annual dose is less than 5 mSv per year (Queensland Health 2020)
- It is to note that the annual limit to radiation exposure is 1 mSv, so for a site development for public use, this would be the remediation target. (Radiation Safety Regulation 2021)







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In summary

Reference Effective Dose Level (mSv)	Existing exposure Situations
	Consider environmental assessment on sites that support a wildlife population. Enforcement action may be taken to ensure remediation is undertaken.
10	Remediation is necessaryConsider implementing a site management plan.Remediation is almost always justified.Site should be recorded on the register.
5	Remediation is likely to be justified. Under some circumstances the land should be recorded on the register.
~0.3	Remediation may be justified if it is reasonably easy to achieve. No need for further investigation or action if estimated dose is not significantly different from natural background.

11 Reference level and existing exposure situations taken from Land Contaminated with Radioactive Material – A guide to assessment, management and remediation









mSv/y_↓



To conclude with some tips - BECS

- Know what you want to achieve
- What are you looking for?
- What sensitivity to measure to meet data quality objective?

• <u>BECS</u>

- Background (what is the intrinsic and cosmic response of your instrument?)
- Efficiency (can it detect the levels you want?)
- Calibration dates (When was the last calibration performed?)
- Sensitivity of your instrument (Can it detect the type of emission your are looking for?)
- NOTE: if your unsure ask the manufacturer or calibration facility



Questions?