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# Development of Dosimeter Technology for First Responder Applications

Tom Partington - Technical and Operations Manager
Tracerco (Johnson Matthey Inc)

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# Scope of presentation

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- Tracerco introduction
- Tracerco PED+
- Features for First Responder applications


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# Tracerco

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**Part of Johnson Matthey PLC**

- Precious metals, catalysts and process technology
- Founded 200 years ago
- 12,000 employees in 30 countries
- JM Inc – 27 sites across US
- Some divisions involved in precious metal handling and opiates production

→ strong security culture

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# Tracerco

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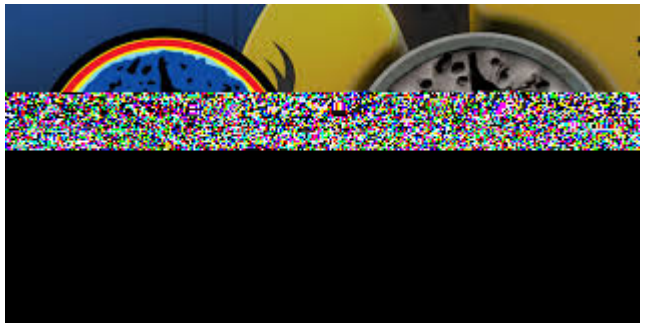
## Measurement solutions – radiation based

- Primarily oil and gas sector
- Operating for 50+ years
- 500 employees
- 11 bases in North America
- Main hub in Houston, which includes radiation meter calibration and repair Service Centre

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# Tracerco Radiation Monitors

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- Designing radiation monitors for 40+ years
- Pioneer for intrinsically safe radiation monitors





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# Design principles – robust and easy to use

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**Highly ruggedised** - designed for rough handling and harsh environments


*IP 67*

*Mount Everest*

→ low life cycle costs

**Easy-to-use** - can be used by anyone

*Tracerco T401*

*Top Gear - Chernobyl*

→ low training burden

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# Tracerco PED Family

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## Tracerco PED+ *Exploiting modern technology*

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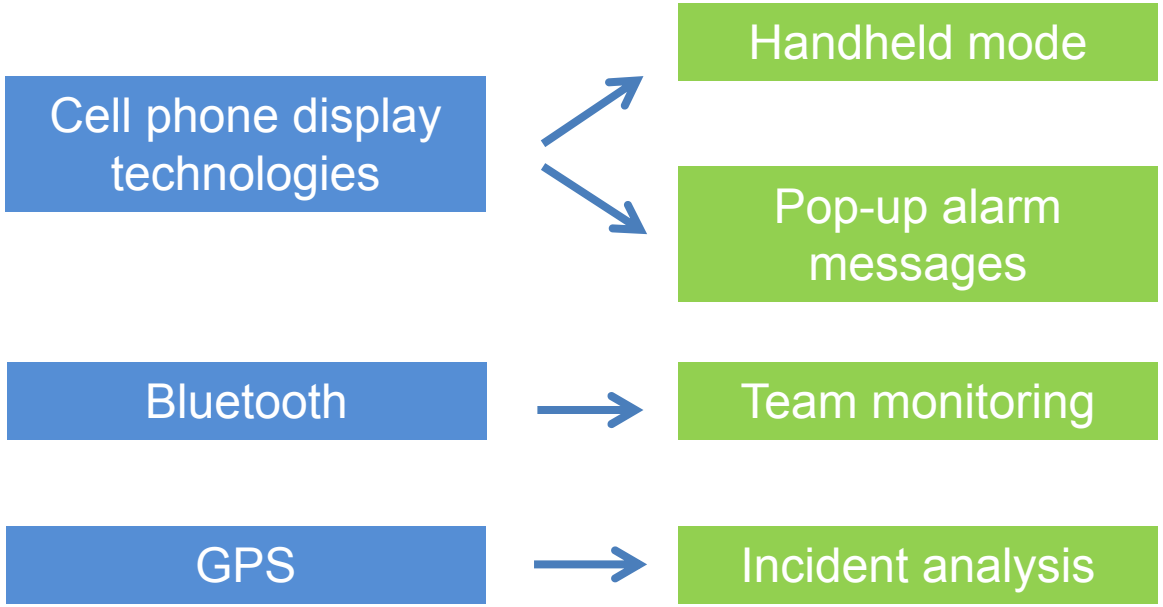
Tracerco PED+ is targeted at users that want more than basic dose info

Modern technology has been used to provide first responders with additional capabilities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# Tracerco PED+ *Handheld mode*

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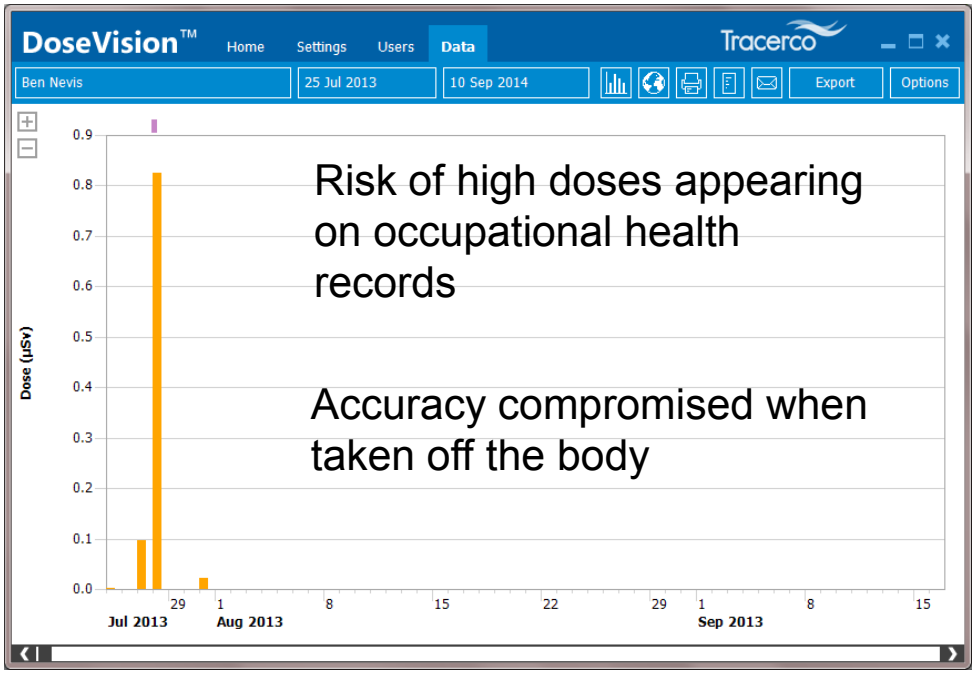
Handheld meter may be needed for:

- general area surveys
- source location searches
- checking suspect packages
- checking around corners……

In times of urgency dosimeters have been used in the hand to survey dose rates

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# Tracerco PED+ *Handheld mode*

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***Source of error***

Personal dosimeters typically calibrated on an ISO standard water phantom to simulate the users body

When dosimeter is removed from the body an error is introduced and measurement accuracy is compromised

Response is reduced

Occurs because during calibration a significant level of gamma photons are backscattered from the water phantom

Once the dosimeter is taken off the body the backscattered contribution is removed

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# Tracerco PED+ *Handheld mode*

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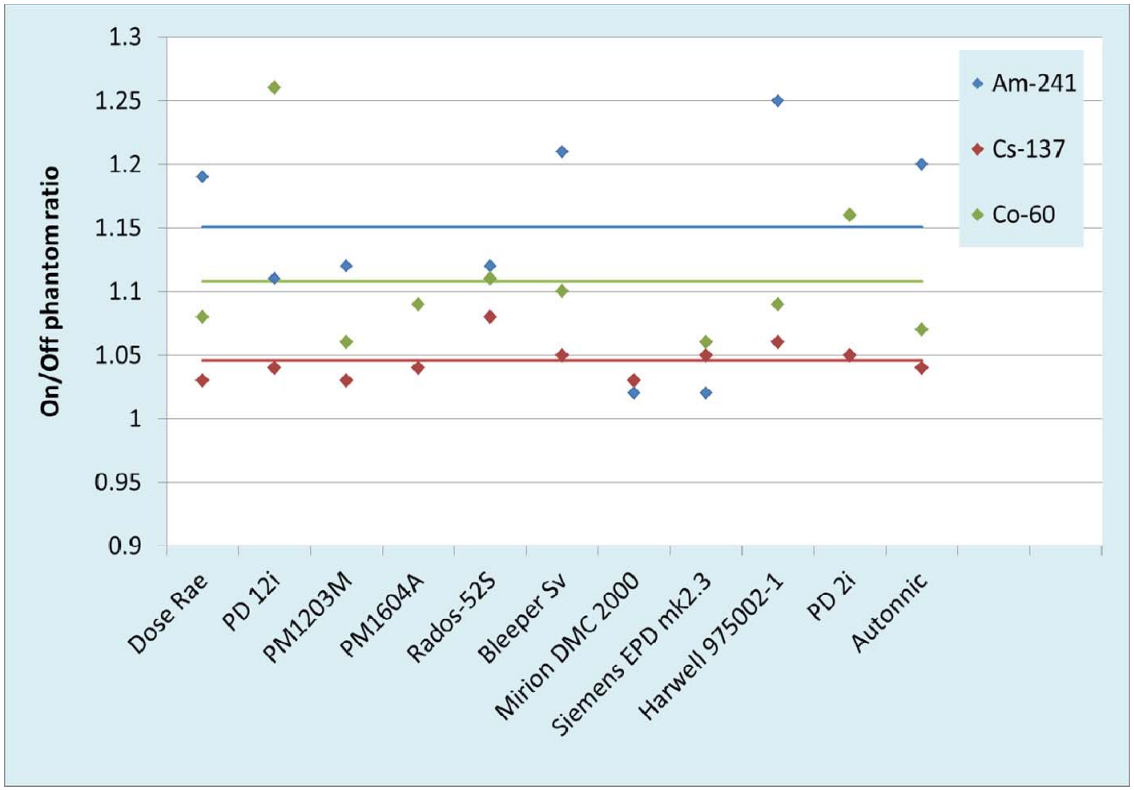
On/off phantom ratio [UK National Physical Laboratory (NPL) Good Practice Guide No. 113]




- Reduced response when off phantom
- Dosimeter under reads when used in handheld mode

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## Tracerco PED+ *Handheld mode*

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Caesium-137 (662 keV) up to 8% under response when used in hand

Americium-241 (59 keV)

Cobalt-60 (1.25 MeV)

both under respond in the hand by up to 25%

Americium-241 photons have greater probability of interacting with water phantom and backscattering into the dosimeter

But, higher energy cobalt-60 has similar ratio to americium-241

Due to higher residual energy of backscattered photons?

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## Tracerco PED+ *Handheld mode*

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**Side note: What about PRDs worn on the belt, then used in the hand?**

Thermo Radeye has an on/off phantom ration of 1.06 for Cs-137.

Opposite effect if calibrated in free air

⟹ will read higher on the belt

Significant?

Implications for false alarms?

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# Tracerco PED+ *Handheld mode*

Tracerco PED+ in handheld mode will ***auto compensate*** for the effect of being off the body.

| Tracerco PED+ mode | On/Off Phantom ratio | |
|---|---|---|
| | Caesium-137 | Americium-241 |
| Personal dosimeter mode constant | 1.08 | 1.27 |
| Handheld mode during off phantom tests | 1.00 | 1.20 |

Off-body errors reduced to zero for caesium-137

Against americium-241 the error is reduced, but still up

# Tracerco PED+ *Handheld mode*

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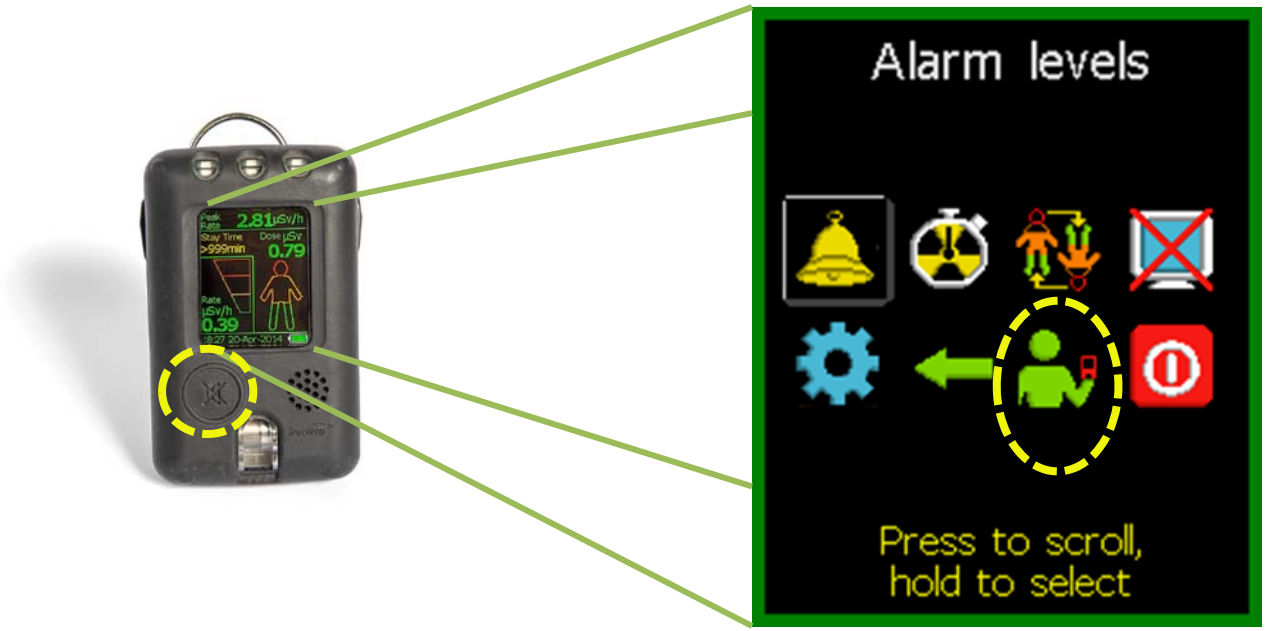
Handheld mode activation is quick and easy

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## Tracerco PED+ *Handheld mode*

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Once handheld mode is activated:

- ❑ Off body correction is automatically applied
- ❑ Display flips


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## Tracerco PED+ *Handheld mode*

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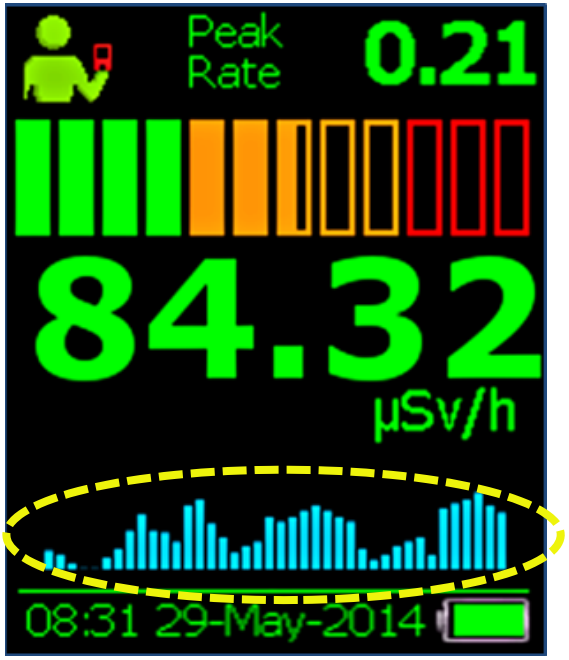
- Personal dose accumulation is paused
- Display dedicated to dose rate only




- Search Tool trending is displayed

  Useful for identifying hotspots or locating lost sources.

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## Tracerco PED+ *Pop-up messages*

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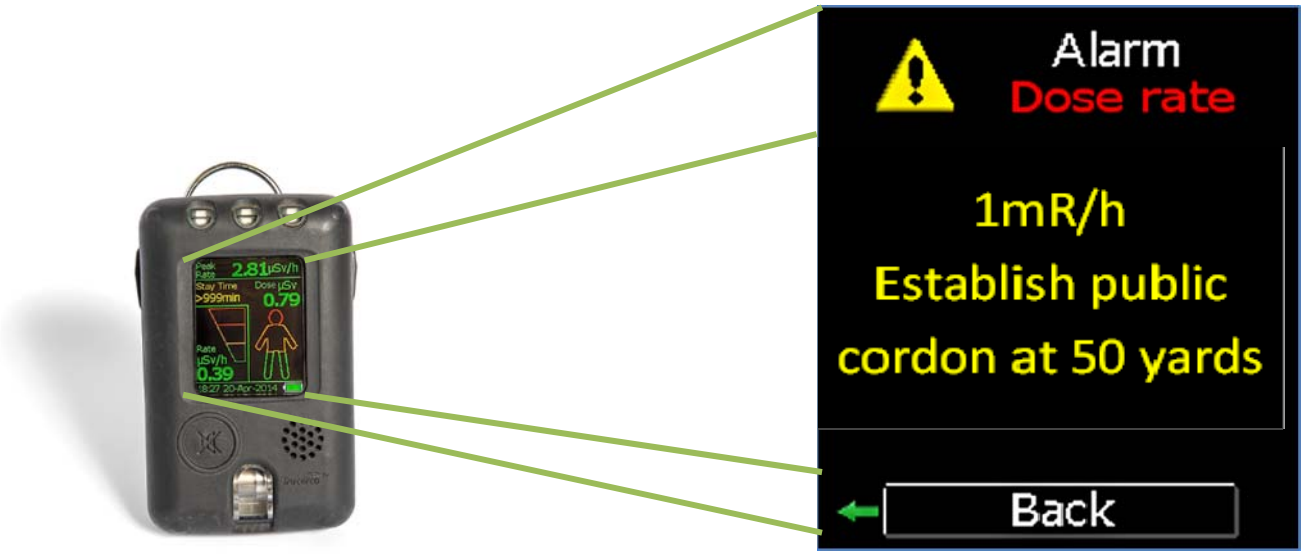


Text based “pop up” messages are associated with alarms

Text customized by Administrator / RSO

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## Tracerco PED+ *Pop-up messages*

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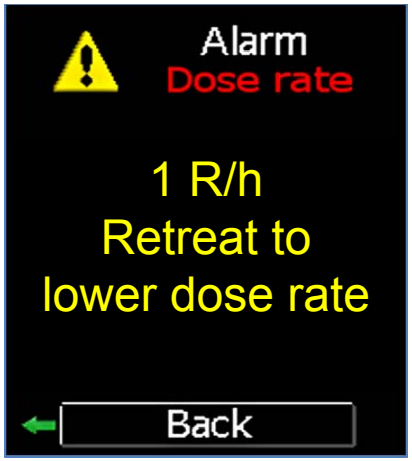


- ❑ Breaks the dependency on remembering procedures
- → real benefit in high stress, fast moving response scenarios
- ❑ Helps ensure the user responds correctly to a radiation incident
- ❑ Reduces training burden

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# Tracerco PED+ *Remote team monitoring*

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Bluetooth output allows communication with Android based mobile devices.


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# Tracerco PED+ *Remote team monitoring*

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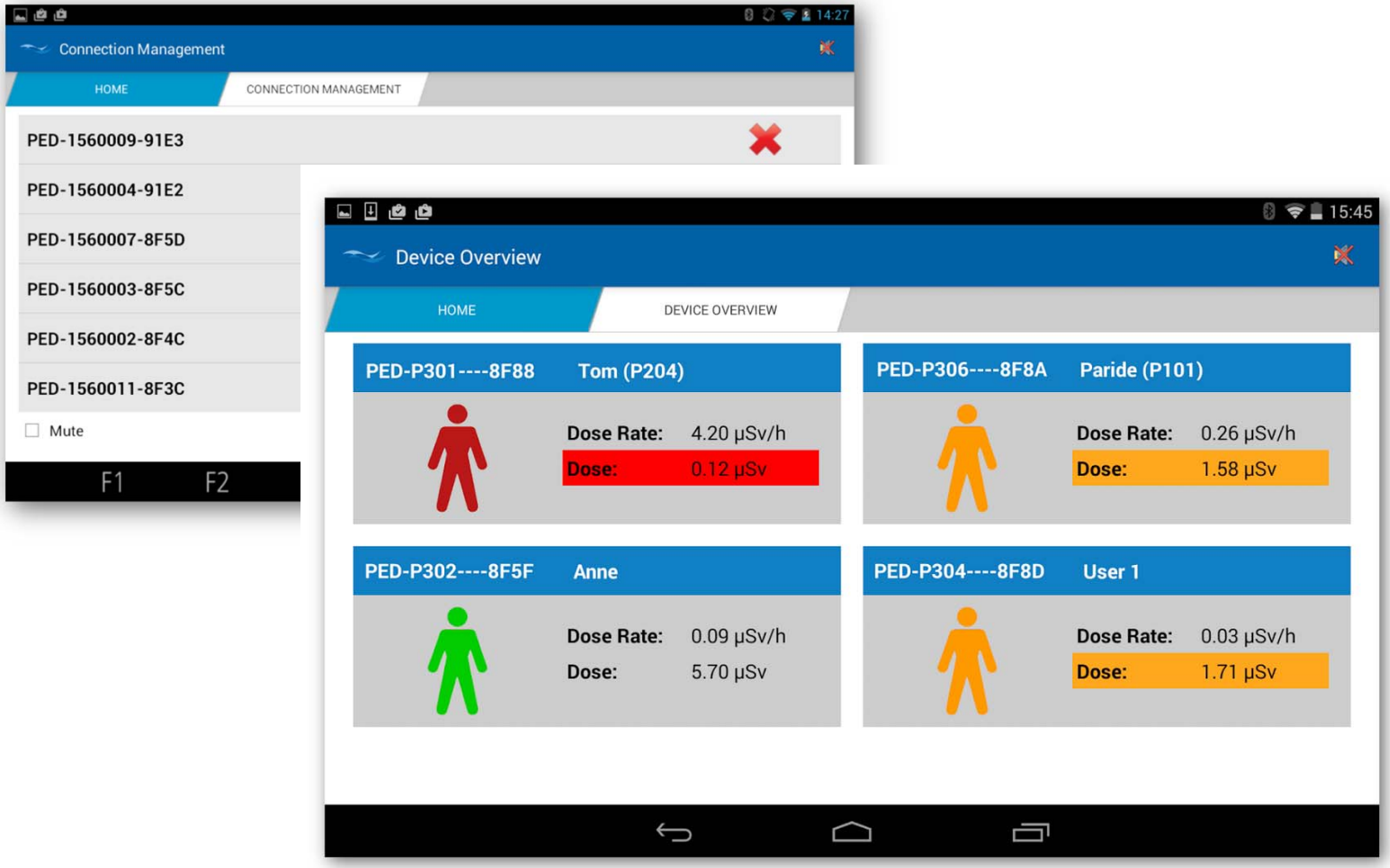


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# Tracerco PED+ *Remote team monitoring*

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- Real time data to support decision making

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# Tracerco PED+ *Remote team monitoring*

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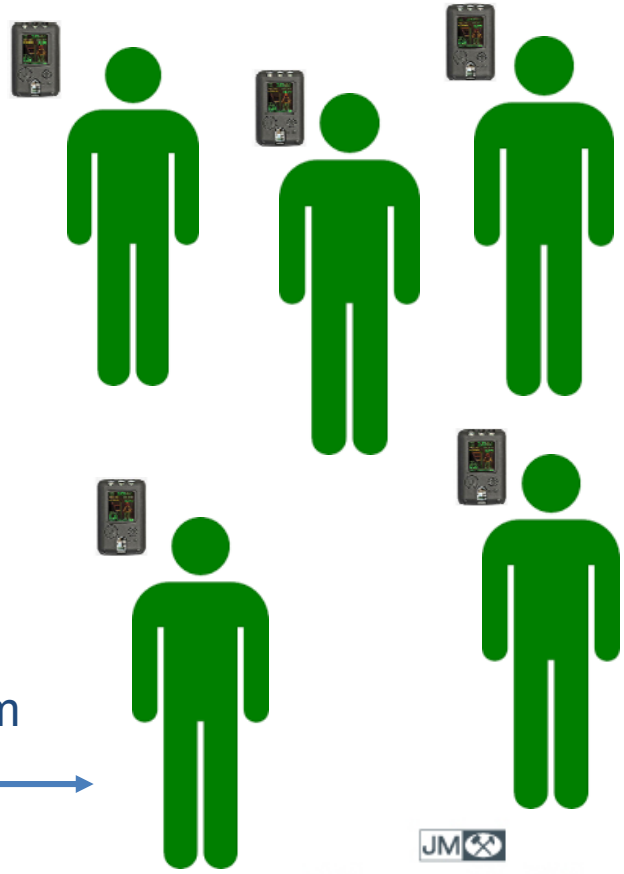
3G / 4G

Clean zone | Dirty zone

Bluetooth



Standard Bluetooth range = 15m

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# Tracerco PED+ *Incident analysis*

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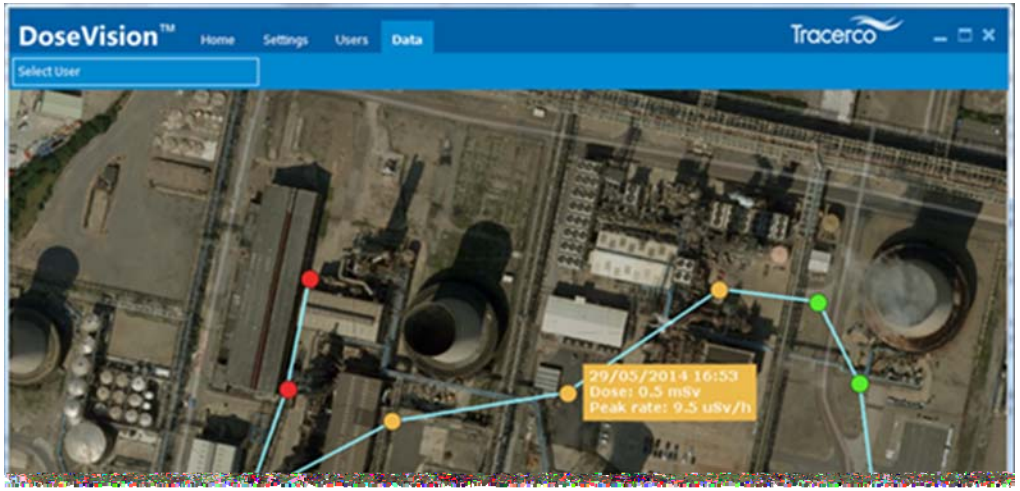
PED+ has on-board GPS for recording location data

Data downloaded to laptop can be viewed with Tracerco DoseVision software

Bing used to generate radiation intensity display

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# Tracerco PED+ *Incident analysis*

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- Can be used to help identify hot spots/source locations
- An aid to response planning
- Post incident analysis


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# Tracerco PED+ *Future directions*

Tracerco PED+ can be seen as a flexible platform

Ready to adapt to new requirements as they arise

Future directions will be driven by the end users

**Suggestions always welcome!**



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