

# Managing radiation risks from point sources

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## Overview

- Radioactive Contaminated Land
- Dalgety Bay - History of the site
- Previous surveys & assessments
- Hazard
- Public protection measures

## Radioactive Contaminated Land (Scotland) Regulations 2007

- Brought into force in October 2007
- Allows for the identification and remediation of land where radioactive contamination is unacceptable in current land use
- Passive regime
- Gives SEPA the statutory responsibility for the identification and assessment of land and for determining whether it should be designated as radioactive contaminated land in order to bring about appropriate protection measures

## RCL Dose Criteria

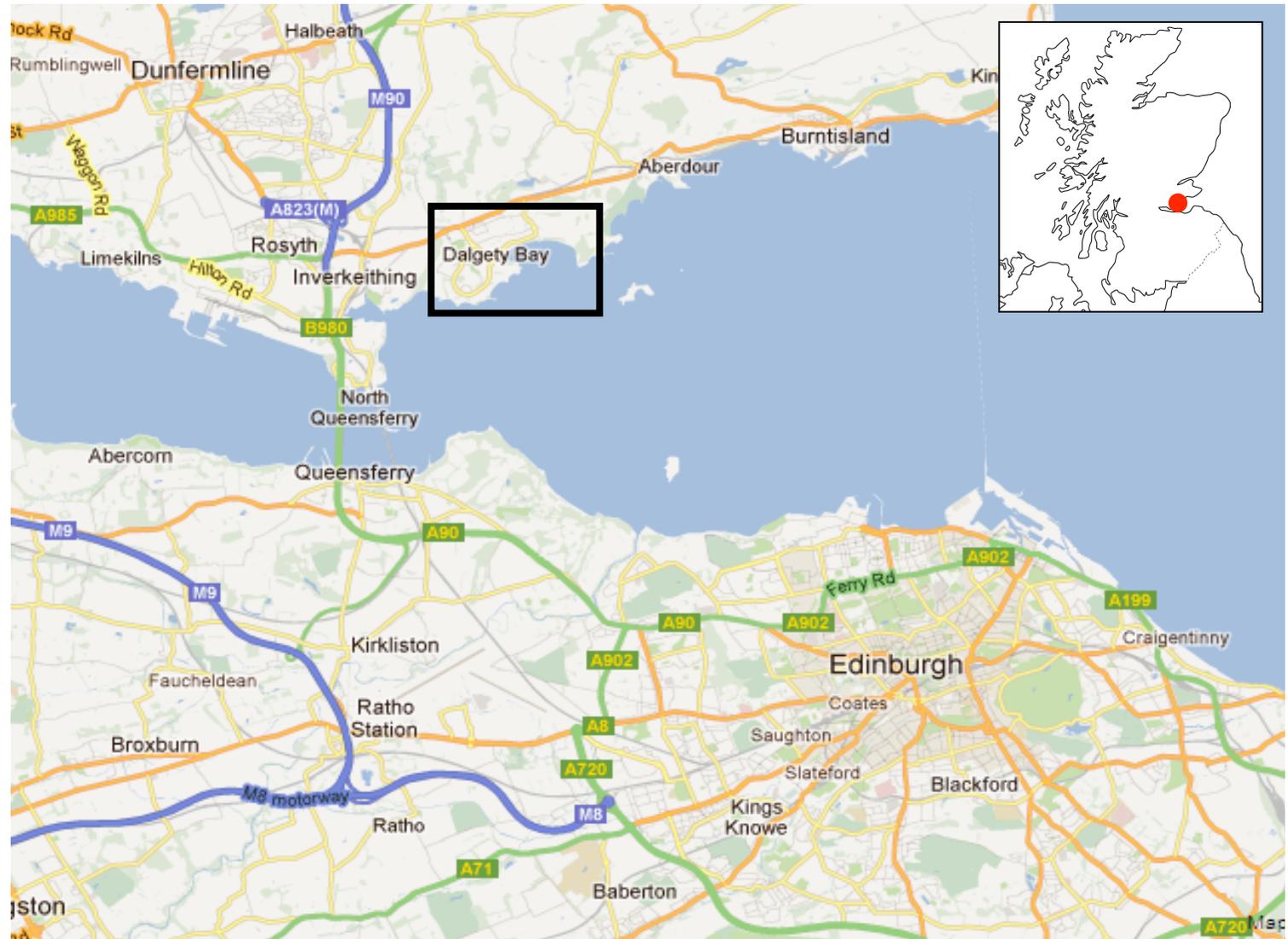
Where exposure is not certain to occur, such as with heterogeneous contamination, the following doses should be considered significant irrespective of the probability of exposure:

- (a) A potential total effective dose of greater than 100mSv; or
- (b) If contact with contamination would result in a dose to the skin greater than 10Gy in 1 hour.

## Why specific criteria

- Passive Regime – may not know full extent
- Clear values allow all parties to determine level where action will occur
- As RCL is a passive regime (unlike CL) levels are set to trigger SEPA inspection, thus there may be greater hazards present than what is already known
- Set to minimise possible deterministic effects

# Dalgety Bay



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# Dalgety Bay



## History of the site

- Dalgety Bay is the site of a former MoD airfield (RNAS Donibristle/HMS Merlin)
- Site was operational between 1917 – 1959
- Main role was as an aircraft repair, re-fitting and salvage yard
- Ra-226 used in paint for dials and other instruments in aircraft
- There is evidence that waste material from the aircraft was incinerated and subsequently disposed of on site

# RNAS Donibristle/HMS Merlin



## Discovery of the contamination

- In 1990, a routine environmental monitoring survey conducted by Rosyth Nuclear Dockyard showed elevated radiation levels in the Dalgety Bay area
- Analysis indicated the presence of point sources of Ra-226 which could not have originated from the dockyard
- Contamination most likely associated with past practices at the RNAS Donibristle/HMS Merlin airfield

## Previous surveys & assessments

1990 – 1994: Surveys undertaken by NRPB

1997 – 2005: Surveys undertaken for SEPA

2006: SEPA undertook a screening assessment which concluded that a further detailed assessment was warranted

2009: SEPA undertook an assessment against the RCL dose criteria and concluded that further work is required. MoD committed to an annual monitoring programme for 3 years.

## Survey results

- Particles were detected and recovered from the surface and at depth
- Around 1000 particles have been recovered since September 2011
- A number of high activity particles were found at depths up to 75cm
- Activities of these particles were 76MBq, 10MBq, 1.8MBq and 1.3MBq.
- A further 2MBq source was recovered from the headland
- Two of these required a specialist contractor and a type-A container for transport from the beach



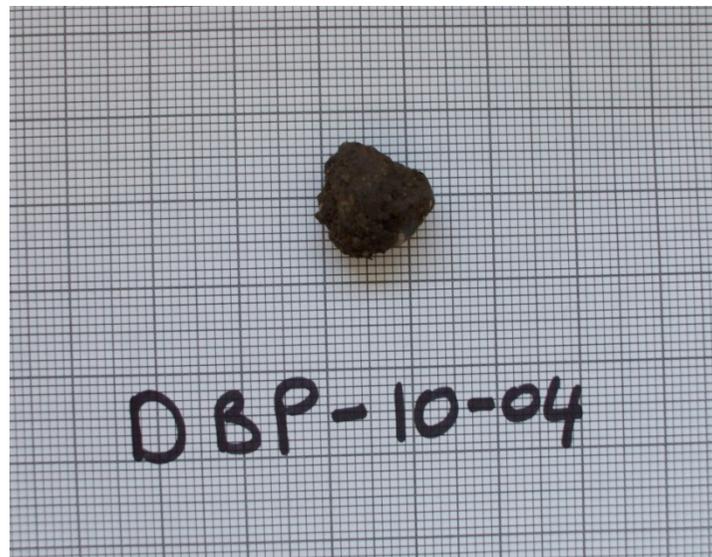
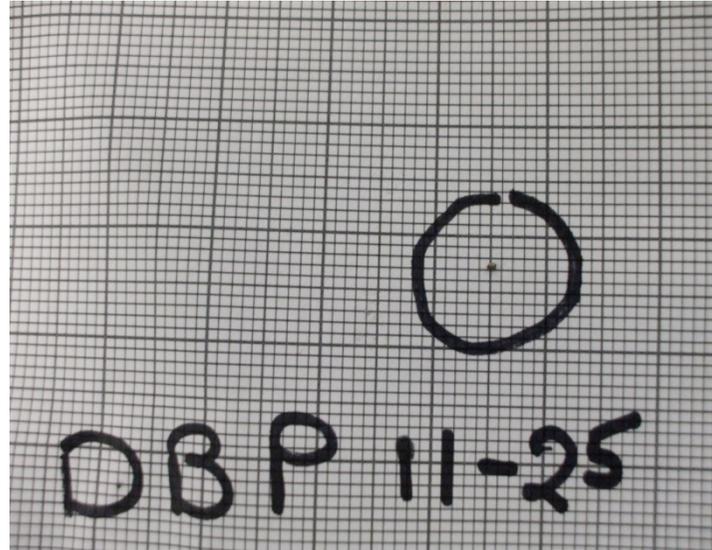
## Particle Characterisation

- Some of the 802 recovered particles were selected for further characterisation
- Measurements were taken of their dimensions, mass and activity
- Particles ranged from the size of a grain of sand to large lumps of clinker
- Activities ranged from 10kBq to 76MBq
- Some particles were friable

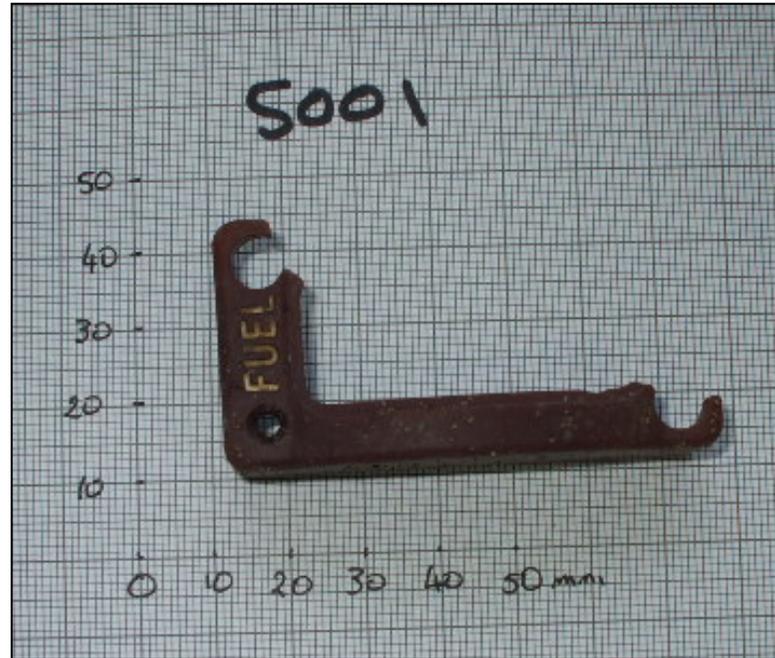
## Protection measures

- Revised risk assessment for SEPA staff
  - Possible deterministic effects
  - Possible airborne sources
- Protection measures for public
  - Access restriction
  - Increased monitoring and recovery
  - Improved detection systems

## Range of particles



# Artifacts



## Hazard – Ingestion doses

Of the particles analysed, the highest committed effective doses which would have been received if the particle were to have been ingested are:

- 206mSv to 3-month old
- 72mSv to a 1yr old
- 39mSv to a 5yr old

This exceeds the RCL criteria which considers a potential total effective dose of greater than 100mSv to be significant regardless of the probability of exposure

# Hazard – High activity particles

## Ingestion dose for 10MBq particle

### Assumptions:

- 10MBq Ra-226 in equilibrium with daughters
- Physical size 20 x 20mm broke into 4 x 4mm pieces with activity evenly distributed
- Using solubilities of 10% and 25%

10MBq particle	10%	25%
3 month	<b>1.56Sv</b>	<b>3.9Sv</b>
1yr	<b>534mSv</b>	<b>1.3Sv</b>
5yr	<b>289mSv</b>	<b>722mSv</b>
10yr	<b>212mSv</b>	<b>530mSv</b>
15yr	<b>200mSv</b>	<b>500mSv</b>
Adult	<b>86mSv</b>	<b>217mSv</b>

## Skin doses – High activity sources

- Difficult to characterise – loss of capability in UK
- High doses > 100's Sv's per hr
- Skin burn in few seconds/minutes
- This exceeds the RCL criteria which considers a dose rate of greater than 10 Gray per hour to be significant regardless of the probability of exposure
- Question remains of alpha dose rates and effect
- HPA work on this continuing

# Public protection measures



# Public protection measures



# Public protection measures

## Shellfish sampling

- Mussels, winkles & cockles
- Monthly sampling started in Feb
- Analysis for Ra-226 particles
- No particles present in samples so far
- Sampling plan will be reviewed after 3 months based on results
- FEPA Ban



## Ongoing work

- On going monitoring by DIO
  - SEPA audit role
- Full site investigation
  - By DIO
  - Supplementary information provided by SEPA
- Remediation options being drawn up
  - Remediation option chosen in May 2013