SCOTTISH ENVIRONMENT PROTECTION AGENCY

Minute of the Dalgety Bay Forum Meeting

Tuesday 16 December at 10am
Lomond Court, Stirling

In attendance

Colin Bayes (CDB) (Chair), SEPA
Byron Tilly (BT), SEPA
Gayle Howard (GH), SEPA
David Stone (DS), SEPA
Joanne Brown (JB), HPA
Linda Turner (LT), Fife Council
Don Taylor (DT), Fife Council
Stuart Hudson (SH), Scottish Government
David Brack (DB), Defence Estates
Stuart Lewis (SL), Scottish Government
Larry Irwin (LI), Moray Estates
Colin McPhail (CM), Dalgety Bay & Hillend Community Council
Dawn Miller (Secretary) SEPA
Paul Dale (PD), SEPA
Debbie Storm (DS), SEPA
Ian Robertson (IRo), SEPA
Iain Robertson (IR), Defence Estates
Douglas Mayne (DM), Fife Council
Ron Brown (RB), Defence Estates
Elizabeth Gray (EG), Scottish Government
Will Munro (WM), Food Standards Agency
David Burnett (DBu), Dalgety Bay Sailing Club
John Burton (JB), HPA

Apologies:

Jackie Hyland (JH), NHS, Fife
Arthur Johnson (AJ), Scottish Government

1.	**Introduction** Colin Bayes introduced himself as Chair and welcomed everyone to the meeting. CDB informed the group that Allan Reid who normally Chairs is on special duties at present.	
2.	**Purpose of the Forum and this meeting** SEPA will present its findings from the latest survey of Radioactivity on Dalgety Bay, Foreshore	
3.	**Update from Defence Estates** DB informed the Forum that the survey from residential properties is now complete. The final report is not through yet but there don't seem to be any problems at this stage. After the residents have been informed/notified of the findings, the Report will be released to the public domain in January. There was nothing found in the Internal Monitoring Survey and residents have all been kept updated and are fully aware of the position. There has been difficulty accessing one property, as the owners are abroad with no exact date of return. Extensive surveys outside of properties have been completed and there were no issues found. Surveys inside of properties were carried out for extra reassurance.	
4.	**Reminder of the Radioactive Contaminated Land Regime** Presentation by Byron Tilly - Copies available	

5.	**SEPA Survey and Analytical Results** Paul Dale Presentation – Copies available	
6.	**SEPA Dose Assessment Work** PD explained that the findings of the Survey were from assessments undertaken purely for Radioactive Contaminated Land (RCL) regulations and a full risk assessment was not carried out. PD's presentation explains why and how these assessments were done.	
7.	**SEPA Regulatory Position** BT Presentation – Copies available The Regulations state, "That Radioactive Substances shall not include radon gas and any radionuclide present as a result of the radioactive decay of radon". In light of this the daughters of radon can not currently be included in the assessment. EG said that the Scottish Government was speaking to lawyers to amend the regulation. SEPA's current position was that while there may be grounds for designating some of the land as radioactive contaminated (subject to resolving the substance definition) it would prefer to seek voluntary arrangements to deal with the problem.	
8.	**Feedback and Response** CDB reiterated that no decision had been made with respect to designation of Dalgety Bay as RCL. Voluntary proposals for risk management from DE would be welcomed. This position was supported by EG, Scottish Government who wants resolution to a situation that has been ongoing for 20 years. Voluntary resolution would be the best option. CDB commented that the results of the assessment, although subject to uncertainty, cannot be ignored and there is enough information for a cause for concern. Ron Brown (DE/MoD) questioned the dose results presented saying that they could cause alarm as they are surprisingly high in terms of radium dosimetry. The dosimetry is dependent on the geometry of the sample and effective measurement would require total dissolution of the point source. Paul Dale disagreed stating that he was confident in the results, Monty Charles who had done the calculations was a recognised expert and that there were no differences between reported results in SEPA's 2006 and 2008 reports. Ron Brown disagreed and stated that there could be a PR problem with respect to historic radium sources in houses and museums etc. EG and CDB reiterated that the issue at Dalgety Bay had been dragging on for 20 years and Scottish Government and SEPA want a resolution and would prefer for it to be voluntary and collaborative on DE's behalf.	

	DB wanted resolution but also more certainty in the data. Suitable risk management arrangement should be put in place and DE would like to review SEPA's 2008 report and come back with ideas. MoD/DE intend to liaise with SEPA and Moray Estate to develop new signage and hazard mitigation approaches. DE would like to know if the contamination is washing onto or from the beach and avoid making the situation worse or moving it elsewhere. The possibility of DE doing their own risk assessment or preventing access to the beach was discussed. CM pointed out that people have been sailing from Dalgety Bay since the 1970s. The involvement of Moray Estates was discussed. CDB believed they were not liable in terms of RCL and BT said that he had invited them to the meeting as it is their land that is being discussed. The discussion moved onto signage and a timescale for their implementation. LT said work would need to be done to reword and relocate the signs. BT commented that the current signs are just not robust enough. The Community Council (CMP) was against the signs saying that people have been using the foreshore for years with no adverse effects noticed by NHS Fife. The signs just attract vandalism. EG stated that the robustness and prominence of the signs is an important factor. DBu said that the sailing club just wants the exposure pathway on the foreshore broken. EG stated that as there was general agreement to new signs we should seek agreement on what they should say. It was pointed out (LT) that cost and availability is an important caveat for Fife Council. IR from DE said that in addition to the quick win of signage long term management plans need to be agreed. EG agreed saying we need a plan and a timescale from DE for consideration by everyone. There was general agreement to this. CDB pointed out that if there was no solution SEPA would have the statutory duty to consider designating the land as RCL with the onus on those responsible. BT said that SEPA can only use a formal legal process to get the land remediated once it is designated. CDB said that there was a consensus (SEPA and Fife Council) for larger better placed signs and DB agreed that once the wording and location of the signs was agreed DE will undertake to put them in place. DE does not want to see the Bay designated and feels there could be issues in identifying the appropriate person. DE wants to see a reasonable approach, will look at the SEPA report and recommendations and engage stakeholders to find a way forward. WM - FSA were content that the current wording re food chain aspects was adequate.	

9.	**Way Ahead and Action by Whom and When** CDB went on to summarise the way forward: • SEPA will provide copies of the draft report on the website • SEPA will provide copies of the regulatory decision document on the website • SEPA will provide copies of the final version of the report by W/E 9th January 2009. • Signage will be implemented in the first few weeks of the new year • Defence Estates will come forward with proposals to take action by 31 January 2009 LT stated that existing signage with new wording could be done quickly and EG/CDB actioned BT to suggest wording for signs to be erected before Xmas and more substantial signs by MoD/DE in the new year. CDB said he would welcome the proposals for action by DE in January. DB responded that there are some issues that DE are not happy with and they will look at the SEPA report and feedback. CDB pointed out that commenting on the report will not address the requirements of the forum and DB said that DE does not want to mislead people into thinking there is an agreed way forward and the output of the report will influence how much work DE will be prepared to do. EG reiterated her understanding that DE will provide intervention plans by the end of January 2009 based on the report. SEPA will consider these plans and the Forum will reconvene. The Sailing Club was asked to reiterate protection measures to its members.	BT/LT DBrack DBurnett
10.	**Media and Communications** The media is aware that this meeting is taking place and it is SEPA's intention to issue a press release this afternoon. This will be a SEPA release and will not be on behalf of the Forum.	
11.	**AOCB** BT has arranged a meeting with Helen Eadie, MSP this afternoon regarding the outcome of this meeting. There is a public meeting being held this evening at 19.00 hosted by Dalgety Bay Sailing Club with the intention of giving an update on the outcome of this meeting. The media is also aware of this meeting.	
12.	**Date of the next Meeting:** 9 February 2009, 13.30 – 16.00 Wallace Room, Lomond Court, Stirling	

Sinclair, Gillian

From: Tilly, Byron

Sent: 16 December 2008 14:03

To: ' (Arthur.johnston@scotland.gsi.gov.uk)'; 'cmcphail.oceanwheels@btinternet.com'; Dale, Paul; 'David Burnett'; 'DE Ops North-CST1 (Brack David Mr)'; 'elizabeth.gray@scotland.gsi.gov.uk'; Howard, Gayle; 'iain.robertson@de.mod.uk'; 'jackie.hyland@nhs.net'; 'John Burton'; 'Larry Irwin'; 'linda.turner@fife.gov.uk'; Salisbury, Russell; Storm, Debbie; 'Stuart.hudson@scotland.gsi.gov.uk'; Toner, Mark; 'Will.Munro@foodstandards.gsi.gov.uk'

Subject: Dalgety Bay Forum Presentations

Attachments: Dalgety Bay Presentation.ppt; Dalgety Bay PD.ppt; Dalgety Bay Forum 1 16-12-2008.ppt

Dear all

Copies of all presentations given at today's meeting are attached.

Note that slide 38 of Paul Dale's presentation (Dalgety Bay PD.ppt) has a copy of the wording of the existing signs.

As actioned at this morning's meeting, if you have any suggestions for changes please let me know by the end of Thursday (18 December) this week.

Byron Tilly
Radioactive Substances Unit Manager
Environmental Protection and Improvement Directorate

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Dalgety Bay Forum

Radioactive Contaminated Land Regime Quick Review

Byron Tilly

Radioactive Substances Unit Manager

16 December 2008

Radioactive Contaminated land Regime

- Regulations issued in 2007
- Modify Part IIA of the Environmental Protection Act 1990
  - Extend the contaminated land regime to include radioactive substances
- Pollutant linkage
  - Source – pathway - receptor
- Statutory Guidance published March 2008 (dated November 2007)

CRITERIA

- For homogeneous contamination
  - Significant Harm
- For heterogeneous contamination
  - Discrete items where encounter is not certain
  - Significant possibility of significant harm

Summary of Process

- Reasonable grounds
- Inspection
  - Monitoring, sampling and analysis
- Dose assessment
- Regulatory decision

Dalgety Bay Contamination

SEPA's Regulatory Position

Byron Tilly
Radioactive Substances Unit Manager

DBF 16 December 2008

Radioactive Contaminated Land (Scotland) Regulations 2007

- Reliant on the existence of source – pathway – receptor model.
- Exposure routes should be realistic.
- The regime applies to human receptors, biota and pollution of the water environment.
- Statutory Guidance provides criteria, in terms of dose to receptor, for determining whether land should be designated as RCL.

Definition of Contaminated Land

- Statutory Guidance defines contaminated land as:
- "*any land which appears to SEPA to be in such a condition, by reason of substances in, or under the land, that-*
  - *significant harm is being caused or there is a significant possibility of such harm being caused; or*
  - *significant pollution of the water environment is being caused or there is significant possibility of such pollution being caused* "

Designation of Radioactive Contaminated Land

- SEPA has to be satisfied that:
  - There is radioactivity present.
  - There is a pathway to a relevant receptor.
  - Exposure via the pathway will give rise to a dose in excess of the criteria set out in the Statutory Guidance.

There is Radioactivity Present

- Beach surveys conducted on behalf of SEPA in 2006 and 2008 detected the presence of homogenous and heterogeneous radioactive contamination on the foreshore at Dalgety Bay.
- This has been identified as Radium-226 and daughter radionuclides resulting from its decay.
- SEPA concludes that radioactivity is present.

There is Radioactivity Present

- It is recognised that the definition of substance in the Statutory Guidance states '……*shall not include radon gas and any radionuclide present as a result of the radioactive decay of radon.'*
- Radon is a decay product of radium-226 and its daughter radionuclides dominate in terms of, for example, skin dose.
- SEPA understands that the Scottish Government intends to amend the Regulations to address this issue.

There is a Pathway to a Relevant Receptor.

- The bay is used by a sailing club and is favoured for dog walking and for children to play.
- Guidance (para. A27) uses the term ‘current use’ and considers that informal use should be included and taken into account in SEPA’s assessment.
- A number of potential inadvertent exposure pathways to the public are considered including ingestion and skin contact.

Potential Exposure Against Criteria in Guidance

- Contamination of concern at Dalgety Bay is heterogeneous.
- The significant possibility of significant harm is the key criterion from the Statutory Guidance that has to be tested.
- In accordance with the guidance, SEPA shall regard the possibility of significant harm as significant, irrespective of the probability of radiation dose being received where:
  - *the potential total effective dose is greater than 100 mSv.*
  - *contact with contamination would result in a dose to the skin greater than 10 Gy in 1 hour*

Potential Exposure Against Criteria in Guidance

- Data indicates that “significant harm” is not occurring - that is heterogeneous contamination does meet the dose criteria
- There is no pollution of the water environment
- It is very unlikely that criteria relating to flora and fauna are met

Potential Exposure Against Criteria in Guidance

- There are insufficient data from the 2008 survey to conclude that any of the particles would have the potential to deliver committed effective doses of greater than 100 mSv from exposure through inadvertent ingestion. (2006 data gives a slightly different picture)
- For infants, potential doses through skin contact, using the data collected in 2008, are potentially of the order of a couple of hundred of Grays per hour. However, the effects of self-absorption of the radiation by surrounding material have not addressed which gives some uncertainty in the assessed doses.

Risk Management

- The Statutory Guidance provides that SEPA should only determine the land to be RCL if *'there are no suitable and sufficient risk management arrangements in place to prevent such harm'* (subject to the other conditions also being met).

Designation?

- Potential skin dose to infants supports the designation of areas of Dalgety Bay as radioactive contaminated land.- But there are uncertainties in the assessments.
- Further sampling and analysis would be required to reduce these uncertainties.
- The application of suitable and sufficient risk management arrangements to prevent significant harm would be grounds for not designating areas of Dalgety Bay as RCL.

Conclusions

- The criteria for RCL may be met, but there is some uncertainty
- Resolving these uncertainties is likely to be both costly and time consuming
- Difficulties with the Regulations need to be resolved
- SEPA is minded to seek voluntary proposals suitable and sufficient risk management arrangements to prevent significant harm being caused.

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Dalgety Bay: Survey and analytical results

Dr Paul Dale
SEPA Radioactive Substances Policy Unit

16th December 2008

Purpose

- Data for RS-EPI to consider RCL
- Criteria:
  - Assessment of doses from homogenous contamination
  - Assessment of doses from point sources
- Pathways:
  - External contact
  - Ingestion
  - Inhalation

RCL Criteria

- *Homogenous contamination*
  - (a) An effective dose of 3 millisieverts per annum;
  - (b) An equivalent dose to the lens of the eye of 15 millisieverts per annum;
  - (c) An equivalent dose to the skin of 50 millisieverts per annum.

- *Heterogeneous contamination*
  - (d) the potential total effective dose is greater than 100 mSv; or
  - (e) contact with contamination would result in a dose to the skin greater than 10 Gray in 1 hour;

Data requirements

- Information on:
  - Hazard
    - Sample of homogenous contamination
    - Point sources
  - Probability of encounter
    - Area affected
    - Number of point sources

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Earlier Work

- Contamination 1st detected in 1990
- Terrestrial and intertidal contamination
- Ra-226 and daughters
- Probability of encounter and hazard for intertidal area
- MoD work on terrestrial contamination

Planned monitoring

- Delineate extent
- Obtain a sample of point sources
- Sample of any homogenous contamination
- In-situ data to support lab work

Data for assessment against RCL criteria

Not a risk assessment

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Area monitored

Contamination detected

- 39 Point sources some of which broke into a number of smaller pieces
- Disperse contamination
- Terrestrial contamination and point sources
- Two areas of interest
- Repopulation of slipway area, 3-4 days after removal

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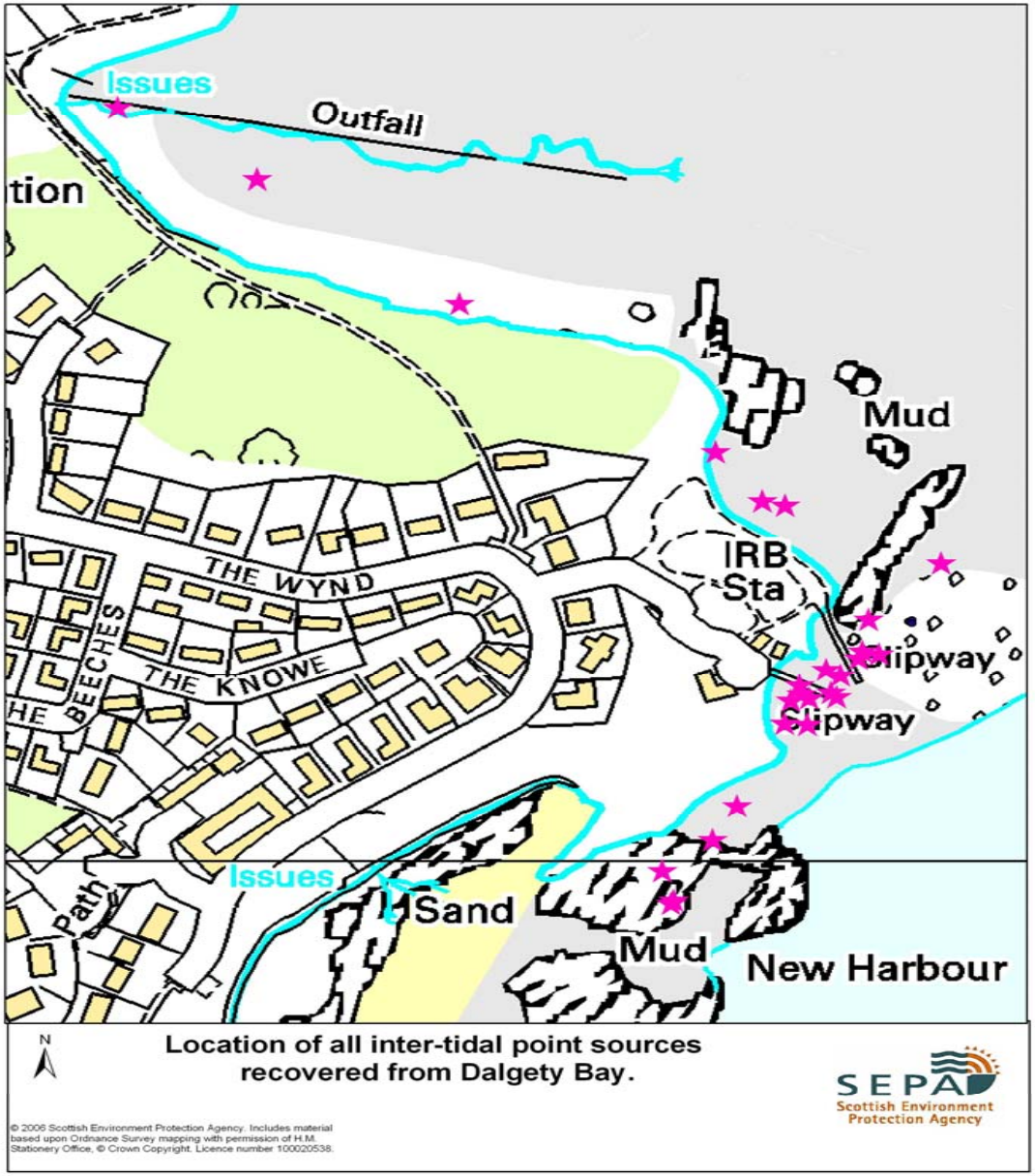

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Location of Point Sources recovered from Dalgety Bay.
Note there is a third slipway at Dalgety Bay (not shown)

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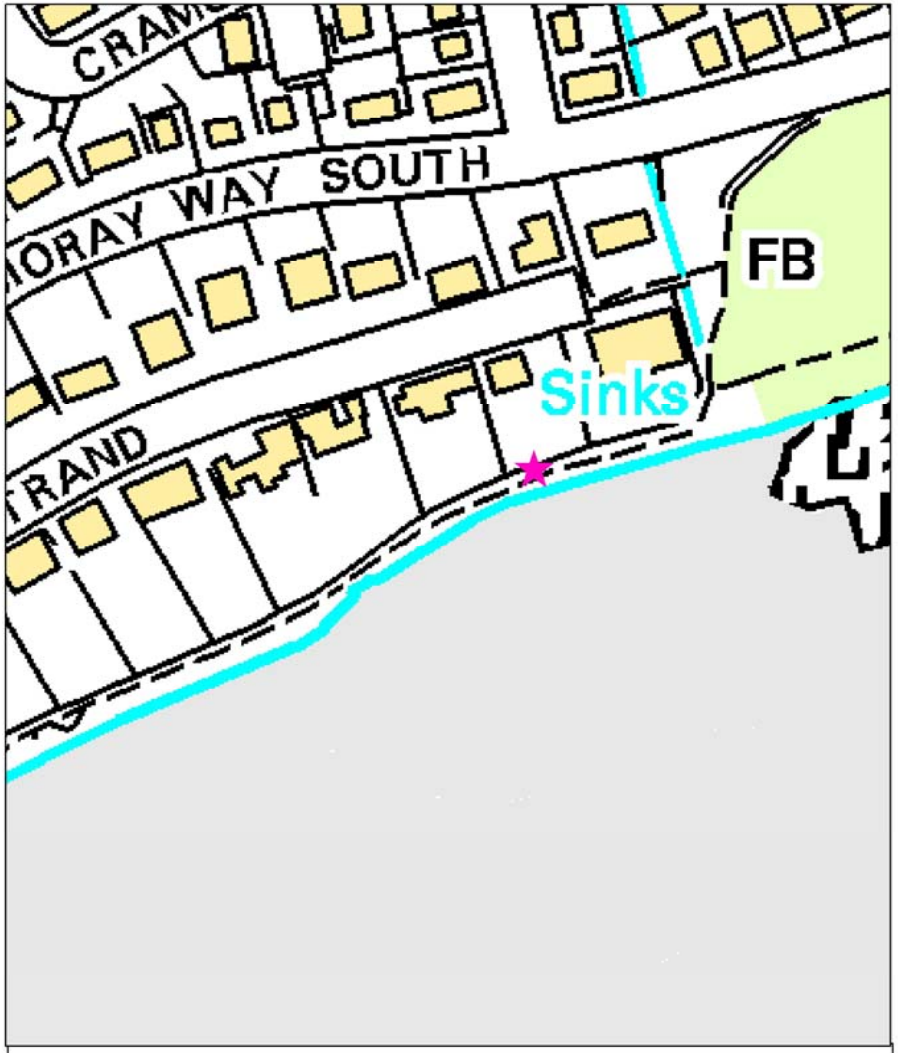

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Location of all two terrestrial point sources recovered from Dalgety Bay and more diffuse contamination

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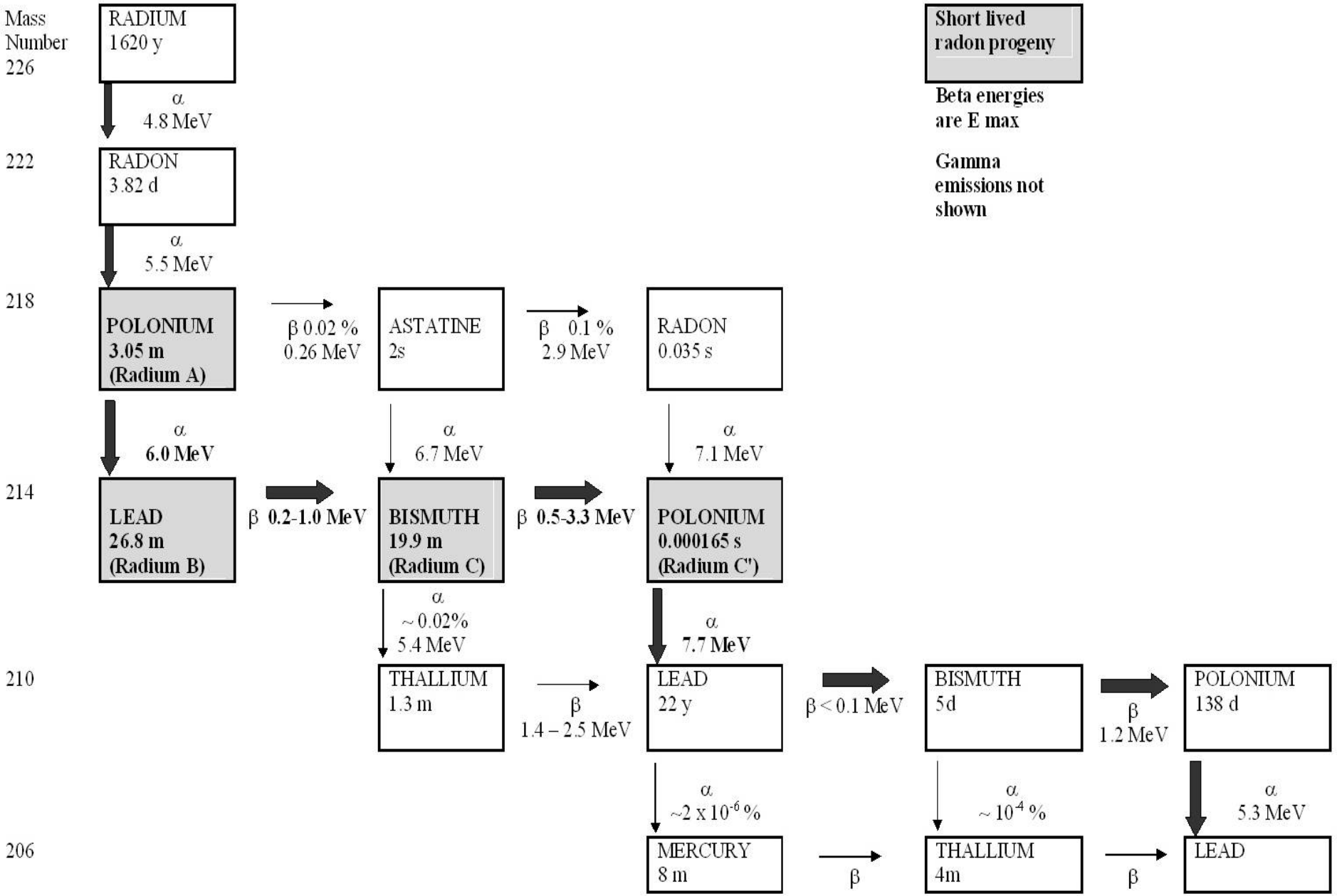
Assessment of Hazard

- Information required:
  - Point source activity
  - Activity in sediment
  - Bioavailability (solubility)
  - Dose rate

Laboratory Analysis

- Gamma spectrometry of sediment samples, point sources and leachate
- Leachate testing 16 of the 39 point sources



The Uranium – 238 decay chain, from Ra-226 to Pb-206 (gamma emissions are not included)

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HPA Ref	NUVIA Ref	Ra-226 Bq/sample ± 2σ	Pb-214 Bq/sample ± 2σ	Bi-214 Bq/sample ± 2σ	Pb-210 * Bq/sample ± 2σ
08-6300	DB/08/001	122000 ± 37000	109000 ± 33000	102000 ± 31000	73000 ± 49000
08-6301	DB/08/002	27000 ± 8100	22800 ± 6900	24400 ± 7400	6900 ± 4800
08-6302	DB/08/003	33100 ± 10000	28400 ± 8600	28900 ± 8700	13000 ± 8800
08-6303	DB/08/004	5500 ± 1700	4490 ± 1400	4370 ± 1400	2000 ± 1900
08-6304	DB/08/005	315000 ± 95000	278000 ± 84000	268000 ± 81000	134000 ± 90000
08-6305	DB/08/006	624000 ± 190000	592000 ± 180000	619000 ± 190000	**Not Available**
08-6316	DB/08/007	313000 ± 94000	257000 ± 78000	252000 ± 76000	108000 ± 73000
08-6317	DB/08/008	187000 ± 57000	159000 ± 48000	152000 ± 46000	90000 ± 60000
08-6318	DB/08/009	90000 ± 27000	81600 ± 25000	78200 ± 24000	53000 ± 3600
08-6319	DB/08/010	3400 ± 1100	3550 ± 1100	4050 ± 1300	106 ± 76
08-6320	DB/08/011	13200 ± 4000	8030 ± 2500	3010 ± 910	2870 ± 800
08-6321	DB/08/012	147000 ± 45000	132000 ± 40000	128000 ± 39000	52000 ± 35000
08-6322	DB/08/013	870000 ± 270000	749000 ± 230000	752000 ± 230000	410000 ± 270000
08-6323	DB/08/014	420000 ± 130000	385000 ± 120000	418000 ± 130000	79000 ± 53000
08-6324	DB/08/015	150000 ± 45000	119000 ± 36000	149000 ± 45000	23000 ± 17000
08-6325	DB/08/016	105000 ± 32000	95000 ± 29000	99000 ± 30000	**Not Available**
08-6326	DB/08/017	5300 ± 1600	4300 ± 1300	4900 ± 1500	710 ± 320
08-6327	DB/08/018	5000 ± 1500	3040 ± 920	1000 ± 300	3500 ± 1100
08-6328	DB/08/019	24000 ± 7200	17900 ± 5400	4200 ± 1300	16000 ± 2600
08-6329	DB/08/020	42000 ± 13000	34400 ± 11000	32000 ± 9600	18800 ± 6500
08-6330	DB/08/021	116000 ± 35000	94000 ± 29000	110000 ± 33000	23000 ± 17000
08-6331	DB/08/022	10000 ± 3000	5600 ± 1700	2070 ± 630	8100 ± 1100
08-6332	DB/08/023	4200 ± 1300	3490 ± 1100	3550 ± 1100	1470 ± 510
08-6333	DB/08/024	36000 ± 11000	30700 ± 9300	32500 ± 9800	16100 ± 3700
08-6334	DB/08/025	8200 ± 2500	6950 ± 2100	7100 ± 2200	2670 ± 920
08-6335	DB/08/026	2240 ± 680	1420 ± 430	510 ± 160	1050 ± 27
08-6336	DB/08/027	2330 ± 700	1480 ± 450	440 ± 140	968 ± 32
08-6337	DB/08/028	920 ± 280	580 ± 180	210 ± 63	343 ± 37
08-6338	DB/08/029	75 ± 23	48 ± 15	17 ± 6	36.00 ± 0.92
08-6339	DB/08/030	201 ± 61	120 ± 36	45 ± 14	77.6 ± 7.6
08-6340	DB/08/031	97 ± 30	61 ± 19	22 ± 7	60.2 ± 5.6
08-6341	DB/08/032	109000 ± 33000	90500 ± 27000	97800 ± 30000	36000 ± 24000
08-6343	DB/08/034	28500 ± 8600	13400 ± 4100	7460 ± 2300	21600 ± 3500
08-6344	DB/08/035	7300 ± 2200	4540 ± 1400	2010 ± 610	5610 ± 150
08-6345	DB/08/036	3220 ± 1000	2000 ± 600	940 ± 290	3010 ± 280
08-6346	DB/08/037	480 ± 150	310 ± 93	150 ± 45	451 ± 44
08-6347	DB/08/038	44000 ± 14000	35700 ± 11000	34800 ± 11000	16000 ± 11000
08-6348	DB/08/039	15000 ± 4500	8680 ± 2700	3000 ± 900	13100 ± 1760

* Result not Accredited by UKAS

In-situ data (selection)

Site IDr	Date & Time	Position	Ra-226 Bq kg^{-1}	2 σ Bq kg^{-1}
DB 0101	15/09/2008 10:12	NT 16478 83088	55.01	55.0
DB 0102	15/09/2008 08:30	NT 16504 83046	28.53	28.5
DB 0103	15/09/2008 08:24	NT 16520 83057	1.36	
DB 0104	15/09/2008 08:44	NT 16512 83067	12.73	12.7
DB 0105	15/09/2008 09:00	NT 16507 83074	52.27	52.3
DB 0106	15/09/2008 09:23	NT 16501 83083	59.66	59.7
DB 0107	15/09/2008 09:43	NT 16493 83089	47.31	47.3
DB 0108	15/09/2008 10:02	NT 16496 83062	21.33	21.3
DB 0109	15/09/2008 10:24	NT 16491 83068	47.48	47.5
DB 0110	15/09/2008 10:46	NT 16486 83078	49.80	49.8
DB 0111	15/09/2008 11:06	NT 16484 83086	94.85	94.9
DB 0112	15/09/2008 11:24	NT 16495 83099	37.81	37.8
DB 0113	15/09/2008 11:45	NT 16486 83104	10.82	10.8
DB 0113b	15/09/2008 11:45	NT 16486 83104	95.68	95.7

Leachate Data

Table 7: Leachate results and selection (HPA)

HPA Ref	NUVIA Ref	Leachate Ra-226 Bq ± 2σ	% of Original Activity	Pb-214 Bq	Bi-214 Bq	Pb-210 Bq
08-6300	DB/08/001	206 ± 20	0.17%	184.05	172.23	123.26
08-6302	DB/08/003	23 ± 3	0.069%	19.73	20.08	9.03
08-6303	DB/08/004	345 ± 33	6.27%	281.65	274.12	125.45
08-6304	DB/08/005	100 ± 12	0.032%	88.25	85.08	42.54
08-6316	DB/08/007	12510 ± 880	4.00%	10271.79	10071.95	4316.55
08-6318	DB/08/009	32 ± 4	0.036%	29.01	27.80	18.84
08-6321	DB/08/012	805 ± 80	0.55%	722.86	700.95	284.76
08-6340	DB/08/031	1.00	1.03%	0.63	0.23	0.62
08-6341	DB/08/032	1.1 ± 0.9	0.00%	0.91	0.99	0.36
08-6342	DB/08/033	1.00	0.01%	0.60	0.59	0.59
08-6343	DB/08/034	72 ± 8	0.25%	33.85	18.85	54.57
08-6344	DB/08/035	7 ± 2	0.10%	4.35	1.93	5.38
08-6345	DB/08/036	28 ± 5	0.87%	17.39	8.17	26.17
08-6346	DB/08/037	1.00	0.21%	0.65	0.31	0.94
08-6347	DB/08/038	426 ± 41	0.97%	345.64	336.93	154.91
08-6348	DB/08/039	950 ± 95	6.33%	549.73	190.00	829.67

- Results for ^{214}Pb, ^{214}Bi, ^{210}Pb are assuming proportional activity from solid component
- Results highlighted in yellow are at the limit of detection (< 1 Bq)

Sediment analysis AoI

Area	Ra-226 (Bq kg^{-1})	error (+/-)	Pb-214 (Bq kg^{-1})	error (+/-)	Bi-214 (Bq kg^{-1})	error (+/-)	Pb-210 (Bq kg^{-1})	error (+/-)
1	409.75	40.06	353.6	24.96	363.45	22.79	301.99	29.23
2	308.11	41.88	280.04	19.6	272.17	16.82	231.38	22.17

Findings (I)

- Dispersed radium contamination detected on the intertidal area
- 39 point sources removed, some of which broke down following recovery
- Two sources detected on the coastal path within an area of elevated contamination
- A further area of elevated contamination located in the new harbour area.

Findings (II)

- Contamination similar to that detected in 2006
- Cleared areas show re-population of point sources within a few tides
- Activities of point sources ranged from less than a 100 to 800,000 Bq Ra-226
- Intertidal contamination appears to be limited to an area between the old pipeline and the New harbour area

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Questions

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Assessment

Assessment

- Hazard (Doses)
  - Disperse contamination
    - Skin and ingestion doses
  - Point sources
    - Skin dose and ingestion dose
- Probability of encounter
  - Assessment for RCL criteria
- Food pathways – not considered

Hazard Assessment

- Use ICRP data for:
  - Dose co-efficient
  - Skin thickness
- Use HPA (NRPB) data for:
  - Inadvertent ingestion rates
  - Generic habits data
- Use HPA/SEPA model for:
  - Contact probability

Disperse Contamination

- Ingestion of 1kg material < 1 mSv (adult)
- Child 20 x

- HPA inadvertent ingestion rate 50 mg hr^{-1}
- 20,000 hrs to consume 1 kg

  (1 year = 8766 hrs)

Areas of interest

- Elevated concentrations
- One location intertidal and one in the coastal path
- Infant inadvertent ingestion need to spend 2000 hrs to receive a dose of around 1 mSv.

Inhalation

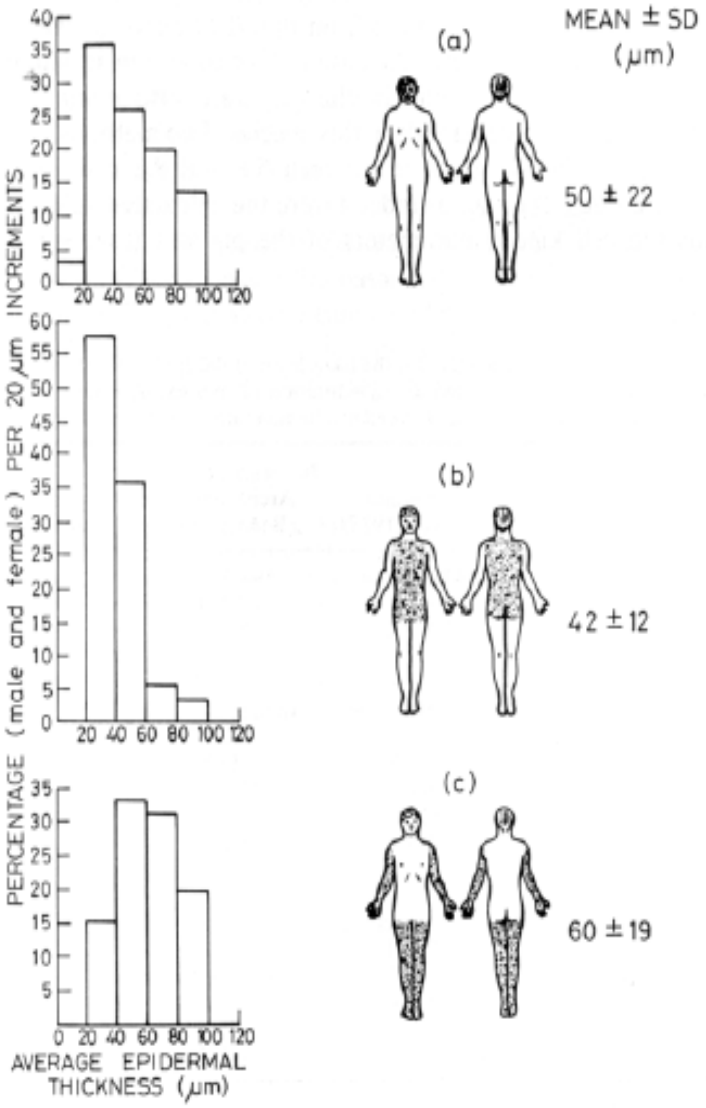
- Size limiting
- Inhalation of point sources unlikely at the time of recovery
- Further breakup could result in inhalable sources

Ingestion

- For the sources leached (16 of 39)
  - Solubility range from <1% to 7%
  - Greatest committed effective dose to an infant ~ 66 mSv

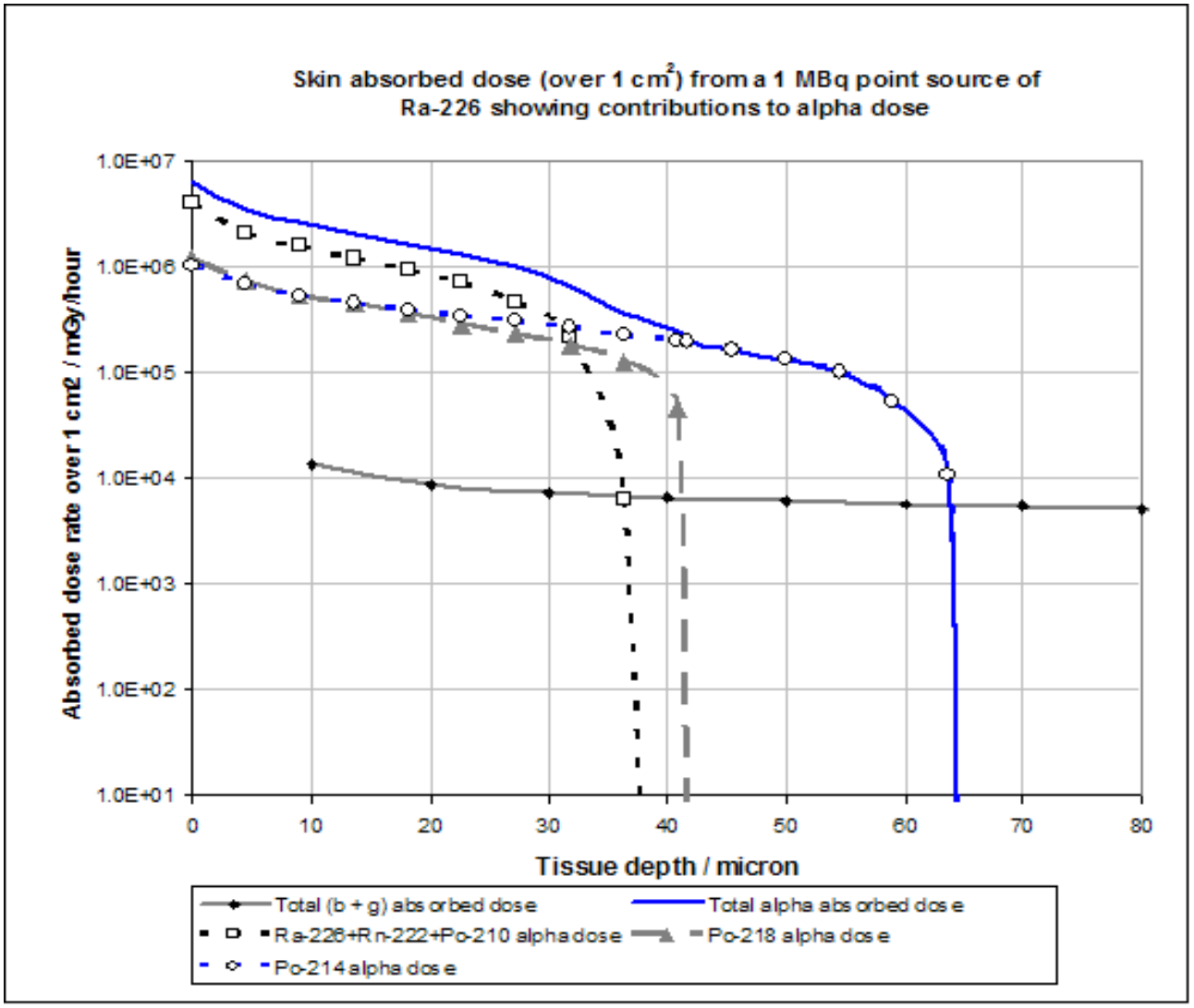
Skin doses

- No direct measurements undertaken
- Estimated by modelling – no allowance has been made for self-shielding
- Assumed that levels in RCL set to protect health



Variation in skin thickness (adult *a* head, *b* trunk and *c* arms and legs).

Skin doses


Skin absorbed dose (over 1 cm²) from a 1 MBq point source of Ra-226 showing contributions to alpha dose
Absorbed dose rate over 1 cm2 / mGy/hour
1.0E+07
1.0E+06
1.0E+05
1.0E+04
1.0E+03
1.0E+02
1.0E+01
0
10
20
30
40
50
60
70
80
Tissue depth / micron
Total (b + g) absorbed dose
Total alpha absorbed dose
Ra-226+Rn-222+Po-210 alpha dose
Po-218 alpha dose
Po-214 alpha dose

Skin doses

For the most active source…..

- Skin surface (dead) ~ thousands of Gray hr^{-1}
- Adult (ICRP) 70 μm ~ seven Gray hr^{-1}
- Child 45-50 μm ~ hundreds of Gray hr^{-1}

Effects of self-shielding need to be considered

Probability of encounter (I)

- Absence of specific habit data
- Observations of dog walkers, bait diggers, horse riders and a person asleep

Criteria 3 mSv and 100 mSv / 10 Gray hr^{-1}

- For point sources with doses < 100 mSv, the probability of encounter (ingestion) would need to be greater than one in 33
- 2006 Assessment showed 1 in 91

Non-detected sources need to be considered

Probability of encounter (II)

- Skin pathway most likely 1 in around 500 per year (slipway area [2006 around 1 in 100])
- Ingestion 1 in 3 million

Hazard summary

- The greatest hazard is to infants
  - For the points sources analysed:

    Ingestion doses could be around 66mSv;

    For skin contact the doses could be in the order of hundreds of Grays per hour (the effect of self shielding needs to be considered).

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Current signs

Current Signage

Public Notice
Dalgety Bay

Mainly for general hygiene reasons, please wash your hands if you handle material on the beach and do not remove any material including fish and shellfish

Minor radioactivity from materials containing luminous paint have been found and removed from this beach.

There is low risk to the public.

For further information see
http://www.show.scot.nhs.uk/livinginfife/
Search - *Dalgety Bay Contamination*

Intervention

- The purpose is to break source-pathway receptor linkage
- Current locations and wording is considered inappropriate

Conclusions

- The potential skin and committed effective doses from Dalgety Bay point sources are significant
- We re-iterate our 2006 recommendation that a full risk assessment is undertaken
- In the absence of such an assessment, the precautionary principle should be considered
- The locations and suitability of the current signage, as an adequate intervention measure, should be reviewed.

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Questions