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Environmental monitoring of beta doses at Sellafield and Springfields

for

Environment Agency

Final Report

**EA Project Contract 13608
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**Environmental monitoring of beta doses
at Sellafield and Springfields**

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1. Introduction

Handling sediment, while bait digging or mollusc collecting, or handling commercial fishing gear, can potentially give rise to skin exposure from beta radiation. Doses to the skin need to be considered, as there is a separate dose limit for skin for members of the public. There is also a contribution to effective dose due to skin exposure (ICRP, 1991).

During immersion in seawater, particles of sediment on which radioactivity is adsorbed may become associated with fishing gear. Fishermen handling this gear may be exposed to external radiation, mainly to skin from beta particles. Fishing gear is regularly monitored using surface contamination meters.

The scope of this work is to undertake the beta dose monitoring of fishing nets and lobster pots in the vicinity of Sellafield and Springfields nuclear sites, on behalf of the Environment Agency. Results of this monitoring are included in the annually published monitoring and assessment report, Radioactivity in Food and the Environment (RIFE) (e.g. EA, NIEA, FSA and SEPA, 2008).

2. Monitoring and methodology

The beta dose monitoring of fishing nets and lobster pots in the vicinity of Sellafield and Springfields, was carried out as specified in the schedule provided by the Environment Agency. The schedule is given in Annex 1.

Measurements of beta dose rates were undertaken using a calibrated Berthold LB122 instrument. Measurements were made as described in Cefas' Standard Operating Procedure, (**Cefas/BET-4A**). Cefas does not currently have UKAS accreditation for this specific method. Cefas has been successfully undertaking beta dose rate measurements, for over 20 years, for a number of different customers.

Each Berthold LB122 used for field work contained:

- A Berthold LB122 bearing the same number as the case
- A clip-on aluminium beta shield
- The manufacturer's instruction manual

Technical Data of the Berthold LB122 (Portable Combination Monitor) is as follows:

The Berthold LB122 is equipped with a sealed xenon probe (type LB6357-F) for beta/gamma measurement; the window area is 120mm x 190mm and is used with a removable aluminium beta shield that is 4mm thick. Calibration of the equipment is completed annually by the Health Protection Agency or more frequently if a problem occurs with the instrument. During calibration, a range of nuclides is tested including Sr-90/Y-90, Cl-36, Co-60, Pm-147, C-14, I-129 and Am-241. The typical overall uncertainty on the calibration is 20% expressed at the 95% confidence level.

For each individual beta dose result provided, a set of 10 separate readings were taken. Each of the 10 readings consisted of a beta & gamma reading (combined) and a gamma reading only. The aluminium shield was taken off for the beta & gamma (combined) reading, and the shield was placed over the detector for the gamma only reading. The gamma only mean reading (from 10 individual results) was then subtracted from the mean beta & gamma reading (from 10 individual results) to provide the beta result. If the beta & gamma and the gamma only provided the same result, then a zero dose rate (“not detected”) was recorded for the beta dose.

For reporting purposes (e.g. RIFE), beta dose rates are reported as an average over the same substrate (including “not detected”). If a “not detected” is included, a zero result is used for the purposes of determining the overall mean and this mean is reported as a “less than” value. The following Station Names are designated as follows in RIFE, Table 2.3(b) & 2.10 (Springfields and Sellafield, respectively) (EA, NIEA, FSA and SEPA, 2008):

Sellafield #Fishing	Vessel M
Sellafield St Bees – West	Vessel S
Sellafield Pipelines	Vessel T
Sellafield Ravenglass (Landed)	Vessel W
Sellafield Drigg – Selker	Vessel X
Sellafield #Fishing	Vessel Z

3. Results

The schedule for beta dose readings was 100% completed, as specified.

Cefas staff completed the following monitoring during the period stated, and comments where relevant are included (*in italics*):

PERIOD: February 2008 (onset of monitoring)

Sellafield #Fishing Vessel Z; beta dose over nets (1st of 4py)

PERIOD: March 2008

Sellafield #Fishing Vessel M; beta dose over nets and ropes (1st of 4py)

PERIOD: May 2008

Sellafield Pipelines; beta dose over gill nets and lobster pots (1st of 4py)

Sellafield St Bees – West; beta dose over nets and lobster pots (1st of 4py)

Sellafield Ravenglass (Landed); beta dose over gill nets and lobster pots (1st Biann)

Sellafield Drigg – Selker; beta dose over gill nets and lobster pots (1st of 4py)

Sellafield #Fishing Vessel Z; beta dose over nets (2nd of 4py) – *The net measurements were taken at sea after trawling off Drigg with the nets still on the drum.*

Springfields Ribble Estuary; beta dose over shrimp nets (1st of 2py) – (see Figure 1)

PERIOD: June 2008

Sellafield #Fishing Vessel M; beta dose over nets and ropes (2nd of 4py)

PERIOD: July 2008

Springfields Ribble Estuary; beta dose over gill nets (1st of 2py) – (see Figure 2)

PERIOD: August 2008

Sellafield Pipelines; beta dose over gill nets (2nd of 4py) - *Due to bad weather the gill nets were brought ashore and the measurements were taken over the nets in plastic drums standing on concrete.*

Sellafield St Bees – West; beta dose over nets (2nd of 4py) - *Due to bad weather the nets were brought ashore and the measurements were taken over the nets in plastic drums standing on concrete.*

Sellafield Drigg – Selker; beta dose over gill nets (2nd of 4py) - *Due to bad weather the nets were brought ashore and the measurements were taken over the nets in plastic drums standing on concrete.*

PERIOD: September 2008

Sellafield Pipelines; beta dose over gill nets (3rd of 4py) and lobster pots (2nd & 3rd of 4py)

Sellafield #Fishing Vessel M; beta dose over nets and ropes (3rd of 4py) – *The measurements were taken with the nets still on the drum and the ropes still on the winch out at sea.*

Sellafield St Bees – West; beta dose over nets (3rd of 4py) and lobster pots (2nd & 3rd of 4py) – *The lobster pot measurements were taken with the pots on the wooden pontoon in Whitehaven Harbour.*

Sellafield Ravenglass (Landed); beta dose over gill nets and lobster pots (2nd Biann)

Sellafield Drigg – Selker; beta dose over gill nets (3rd of 4py) and lobster pots (2nd & 3rd of 4py)

Sellafield #Fishing Vessel Z; beta dose over nets (3rd of 4py) - *The measurements were taken with the nets still on the drum.*

Springfields Ribble Estuary; beta dose over gill and shrimp nets (2nd of 2py) - *The measurements were taken over the nets in storage due to the closed fishing season.*

PERIOD: October 2008

Sellafield Pipelines; beta dose over gill nets and lobster pots (4th of 4py) - *The gill net measurements were taken over the nets in plastic drums standing on concrete. The lobster pots had been brought ashore (27/10/08) for the winter, so the measurements were taken with the pots stacked on a steel floored trailer, which was parked on concrete.*

Sellafield St Bees – West; beta dose over nets and lobster pots (4th of 4py) *Due to bad weather the nets were brought ashore and the measurements were taken over the nets in plastic drums standing on a mixture of soil and concrete. The lobster pots had been brought ashore (27/10/08) for the winter, so the measurements were taken with the pots stacked in the yard on a mixture of soil and concrete.*

Sellafield Drigg – Selker; beta dose over gill nets and lobster pots (4th of 4py) - *Due to bad weather the nets were brought ashore and the measurements were taken over the nets in plastic drums standing on a mixture of soil and concrete. The lobster pots had been brought ashore for the day of monitoring, so the measurements were taken with the pots stacked on a wooden floored trailer, which was parked on a mixture of soil and concrete.*

Springfields Ribble Estuary; beta dose over shrimp nets (2nd of 2py) - *The measurements were taken with the nets on board a boat in a muddy creek with the tide out.*

PERIOD: November 2008

Sellafield #Fishing Vessel M; beta dose over nets and ropes (4th of 4py) *The measurements were taken with the nets still on the drum and the ropes still on the winch in Whitehaven harbour.*

Sellafield #Fishing Vessel Z; beta dose over nets (4th of 4py) - *The measurements were taken with the nets still on the drum in Whitehaven Harbour.*

Figure 1. Beta dose monitoring of shrimp nets (Springfields)



Figure 2. Beta dose monitoring of gill nets (Springfields)



The results of the monitoring are given in Table 1.

Table 1. Beta dose rate monitoring results

2008 Sellafield and Springfields Beta Dose results on behalf of EA							
Station Name	Definition	Code	Date	Period	LSN (Sample Identifier)	Result	Unit
Sellafield Pipelines	Dose over gill net	GNT	17-May-08	1st of 4py	2008000308	0.037	µSv h-1
Sellafield Pipelines	Dose over gill net	GNT	22-Aug-08	2nd of 4py	2008000768	0.073	µSv h-1
Sellafield Pipelines	Dose over gill net	GNT	26-Sep-08	3rd of 4py	2008000813	0.024	µSv h-1
Sellafield Pipelines	Dose over gill net	GNT	30-Oct-08	4th of 4py	2008001008	0.102	µSv h-1
Sellafield Pipelines	Dose over lobster pot	LBP	17-May-08	1st of 4py	2008000307	0.055	µSv h-1
Sellafield Pipelines	Dose over lobster pot	LBP	10-Sep-08	2nd of 4py	2008000791	0.043	µSv h-1
Sellafield Pipelines	Dose over lobster pot	LBP	26-Sep-08	3rd of 4py	2008000804	0.042	µSv h-1
Sellafield Pipelines	Dose over lobster pot	LBP	30-Oct-08	4th of 4py	2008001007	0.042	µSv h-1
Sellafield #Fishing Vessel M	Dose over net	NET	27-Mar-08	1st of 4py	2008000141	0.043	µSv h-1
Sellafield #Fishing Vessel M	Dose over net	NET	11-Jun-08	2nd of 4py	2008000416	0.085	µSv h-1
Sellafield #Fishing Vessel M	Dose over net	NET	26-Sep-08	3rd of 4py	2008000788	0.036	µSv h-1
Sellafield #Fishing Vessel M	Dose over net	NET	07-Nov-08	4th of 4py	2008001025	0.096	µSv h-1
Sellafield #Fishing Vessel M	Dose over rope	ROP	27-Mar-08	1st of 4py	2008000145	0.049	µSv h-1
Sellafield #Fishing Vessel M	Dose over rope	ROP	11-Jun-08	2nd of 4py	2008000417	0.049	µSv h-1
Sellafield #Fishing Vessel M	Dose over rope	ROP	26-Sep-08	3rd of 4py	2008000787	0.024	µSv h-1
Sellafield #Fishing Vessel M	Dose over rope	ROP	07-Nov-08	4th of 4py	2008001024	0.042	µSv h-1
Sellafield St Bees - West	Dose over lobster pot	LBP	17-May-08	1st of 4py	2008000309	0.031	µSv h-1
Sellafield St Bees - West	Dose over lobster pot	LBP	10-Sep-08	2nd of 4py	2008000790	*	µSv h-1
Sellafield St Bees - West	Dose over lobster pot	LBP	26-Sep-08	3rd of 4py	2008000806	0.024	µSv h-1
Sellafield St Bees - West	Dose over lobster pot	LBP	30-Oct-08	4th of 4py	2008001009	0.102	µSv h-1
Sellafield St Bees - West	Dose over net	NET	17-May-08	1st of 4py	2008000310	0.031	µSv h-1

Sellafield St Bees - West	Dose over net	NET	22-Aug-08	2nd of 4py	2008000793	0.073	μSv h-1
Sellafield St Bees - West	Dose over net	NET	26-Sep-08	3rd of 4py	2008000812	0.018	μSv h-1
Sellafield St Bees - West	Dose over net	NET	30-Oct-08	4th of 4py	2008001010	0.054	μSv h-1
Sellafield Ravenglass (Landed)	Dose over gill net	GNT	17-May-08	1st Biann	2008000312	0.024	μSv h-1
Sellafield Ravenglass (Landed)	Dose over gill net	GNT	26-Sep-08	2nd Biann	2008000807	0.024	μSv h-1
Sellafield Ravenglass (Landed)	Dose over lobster pot	LBP	17-May-08	1st Biann	2008000311	0.024	μSv h-1
Sellafield Ravenglass (Landed)	Dose over lobster pot	LBP	26-Sep-08	2nd Biann	2008000808	0.042	μSv h-1
Sellafield Drigg - Selker	Dose over gill net	GNT	17-May-08	1st of 4py	2008000313	0.024	μSv h-1
Sellafield Drigg - Selker	Dose over gill net	GNT	22-Aug-08	2nd of 4py	2008000770	0.079	μSv h-1
Sellafield Drigg - Selker	Dose over gill net	GNT	26-Sep-08	3rd of 4py	2008000810	0.018	μSv h-1
Sellafield Drigg - Selker	Dose over gill net	GNT	30-Oct-08	4th of 4py	2008001012	0.078	μSv h-1
Sellafield Drigg - Selker	Dose over lobster pot	LBP	17-May-08	1st of 4py	2008000314	0.037	μSv h-1
Sellafield Drigg - Selker	Dose over lobster pot	LBP	10-Sep-08	2nd of 4py	2008000792	0.055	μSv h-1
Sellafield Drigg - Selker	Dose over lobster pot	LBP	26-Sep-08	3rd of 4py	2008000809	0.078	μSv h-1
Sellafield Drigg - Selker	Dose over lobster pot	LBP	30-Oct-08	4th of 4py	2008001011	0.060	μSv h-1
Sellafield #Fishing Vessel Z	Dose over net	NET	19-Feb-08	1st of 4py	2008000041	0.073	μSv h-1
Sellafield #Fishing Vessel Z	Dose over net	NET	27-May-08	2nd of 4py	2008000346	0.073	μSv h-1
Sellafield #Fishing Vessel Z	Dose over net	NET	26-Sep-08	3rd of 4py	2008000789	0.090	μSv h-1
Sellafield #Fishing Vessel Z	Dose over net	NET	07-Nov-08	4th of 4py	2008001026	0.108	μSv h-1
Springfields Ribble Estuary	Dose over gill net	GNT	16-Jul-08	1st of 2py	2008000775	0.055	μSv h-1
Springfields Ribble Estuary	Dose over gill net	GNT	04-Sep-08	2nd of 2py	2008000776	0.043	μSv h-1
Springfields Ribble Estuary	Dose over shrimp net	SHT	12-May-08	1st of 2py	2008000283	0.146	μSv h-1
Springfields Ribble Estuary	Dose over shrimp net	SHT	15-Oct-08	2nd of 2py	2008000921	0.132	μSv h-1

*Not detected

4. References

Cefas/BET-4A. Environmental beta dose rate and strandline beta/gamma monitoring. SOP BET-4A (Cefas, Commercial in Confidence).

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EA, NIEA, FSA and SEPA, 2008. Radioactivity in Food and the Environment, 2007. EA, NIEA, FSA and SEPA, Warrington, Belfast, London and Stirling. RIFE (13).

Annex 1. The Environment Agency's beta dose rate schedule (2008).

Site	Station	NGR	Monitoring	Monitoring frequency	Analyses
Sellafield	Sellafield Pipelines	NY 018 033	Dose over gill net	4 py	β dose rate
Sellafield	Sellafield Pipelines	NY 018 033	Dose over lobster pots	4 py	β dose rate
Sellafield	Fishing Vessel M	NX 971 182	Dose over nets	4 py	Each quarter: β dose rate
Sellafield	Fishing Vessel M	NX 971 182	Dose over ropes	4 py	Each quarter: β dose rate
Sellafield	St Bees -West	NX 959 116	Dose over lobster pots	4 py	Each sample: β dose rate
Sellafield	St Bees -West	NX 959 116	Dose over nets	4 py	Each sample: β dose rate
Sellafield	Ravenglass (Landing place)	SD 083 961	Dose over gill nets	2 py	Every half-year: β dose rate
Sellafield	Ravenglass (Landing place)	SD 083 961	Dose over lobster pots	2 py	Every half-year: β dose rate
Sellafield	Drigg- Selker	SD 050 940	Dose over gill nets	4 py	Each sample: β dose rate
Sellafield	Drigg- Selker	SD 050 940	Dose over lobster pots	4 py	Each sample: β dose rate
Sellafield	Fishing Vessel Z	NX 972 184	Dose over nets	4 py	Each sample: β dose rate
Springfields	Ribble Estuary	SD 395 265	Dose over gill net	2 py	Each sample: β dose rate
Springfields	Ribble Estuary	SD 395 265	Dose over shrimp net	2 py	Each sample: β dose rate

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