

Environmental monitoring of beta doses at Sellafield and Springfields

for

Environment Agency

Final report

**EA Project Contract 13608
Cefas contract report C2977/C2353**

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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, EHS, FSA and SEPA, 2007).

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 a number of customers, and for > 20 years.

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), 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 2.10 (EA, EHS, FSA and SEPA, 2007):

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:

PERIOD: March 2007 (onset of monitoring)

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

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

PERIOD: April 2007

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 lobster pots (1st of 4py)

PERIOD: May 2007

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

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

PERIOD: June 2007

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

Sellafield St Bees – West; beta dose over nets and lobster pots (2nd of 4py)

Sellafield Drigg – Selker; beta dose over gill nets (1st & 2nd of 4py) and lobster pots (2nd of 4py)

Springfields Ribble Estuary; beta dose over gill and shrimp nets (1st of 2py)

PERIOD: August 2007

Springfields Ribble Estuary; beta dose over gill and shrimp nets (2nd of 2py)

PERIOD: September 2007

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

Sellafield #Fishing Vessel M; beta dose over nets and ropes (3rd Qtr)

Sellafield St Bees – West; beta dose over nets and lobster pots (3rd of 4py)

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

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

Sellafield #Fishing Vessel Z; beta dose over nets (3rd of 4py)

PERIOD: October 2007

Sellafield Pipelines; beta dose over lobster pots (4th of 4py)

Sellafield Drigg – Selker; beta dose over lobster pots (4th of 4py)

PERIOD: November 2007

Sellafield Pipelines; beta dose over gill nets (4th of 4py)

Sellafield #Fishing Vessel M; beta dose over nets and ropes (4th Qtr)

Sellafield Drigg – Selker; beta dose over gill nets (4th of 4py)

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

PERIOD: December 2007

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

Figure 1. Beta dose monitoring of gill nets (Sellafield)



Figure 2. Beta dose monitoring of lobster pots (Sellafield)



The results of the monitoring are given in Table 1.

Table 1. Beta dose rate monitoring results

2007 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	27-Apr-07	1st of 4py	2007000294	*	µGy/h
Sellafield Pipelines	Dose over gill net	GNT	22-Jun-07	2nd of 4py	2007000482	0.031	µGy/h
Sellafield Pipelines	Dose over gill net	GNT	12-Sep-07	3rd of 4py	2007001601	0.061	µGy/h
Sellafield Pipelines	Dose over gill net	GNT	14-Nov-07	4th of 4py	2007001931	0.055	µGy/h
Sellafield Pipelines	Dose over lobster pot	LBP	27-Apr-07	1st of 4py	2007000295	*	µGy/h
Sellafield Pipelines	Dose over lobster pot	LBP	22-Jun-07	2nd of 4py	2007000481	0.079	µGy/h
Sellafield Pipelines	Dose over lobster pot	LBP	12-Sep-07	3rd of 4py	2007001596	0.055	µGy/h
Sellafield Pipelines	Dose over lobster pot	LBP	05-Oct-07	4th of 4py	2007001707	0.14	µGy/h
Sellafield #Fishing Vessel M	Dose over net	NET	29-Mar-07	1st Qtr	2007000292	0.133	µGy/h
Sellafield #Fishing Vessel M	Dose over net	NET	25-May-07	2nd Qtr	2007000394	0.144	µGy/h
Sellafield #Fishing Vessel M	Dose over net	NET	14-Sep-07	3rd Qtr	2007001607	0.055	µGy/h
Sellafield #Fishing Vessel M	Dose over net	NET	07-Nov-07	4th Qtr	2007001866	0.079	µGy/h
Sellafield #Fishing Vessel M	Dose over rope	ROP	29-Mar-07	1st Qtr	2007000392	0.054	µGy/h
Sellafield #Fishing Vessel M	Dose over rope	ROP	25-May-07	2nd Qtr	2007000395	0.066	µGy/h
Sellafield #Fishing Vessel M	Dose over rope	ROP	14-Sep-07	3rd Qtr	2007001608	*	µGy/h
Sellafield #Fishing Vessel M	Dose over rope	ROP	07-Nov-07	4th Qtr	2007001867	0.043	µGy/h
Sellafield St Bees - West	Dose over lobster pot	LBP	27-Apr-07	1st of 4py	2007000297	*	µGy/h
Sellafield St Bees - West	Dose over lobster pot	LBP	22-Jun-07	2nd of 4py	2007000486	0.037	µGy/h
Sellafield St Bees - West	Dose over lobster pot	LBP	12-Sep-07	3rd of 4py	2007001595	0.049	µGy/h
Sellafield St Bees - West	Dose over lobster pot	LBP	21-Dec-07	4th of 4py	2007002058	0.146	µGy/h
Sellafield St Bees - West	Dose over net	NET	27-Apr-07	1st of 4py	2007000296	*	µGy/h

Sellafield St Bees - West	Dose over net	NET	22-Jun-07	2nd of 4py	2007000485	*	μGy/h
Sellafield St Bees - West	Dose over net	NET	12-Sep-07	3rd of 4py	2007001599	*	μGy/h
Sellafield St Bees - West	Dose over net	NET	20-Dec-07	4th of 4py	2007002042	0.043	μGy/h
Sellafield Ravenglass (Landed)	Dose over gill net	GNT	27-Apr-07	1st Biann	2007000299	*	μGy/h
Sellafield Ravenglass (Landed)	Dose over gill net	GNT	12-Sep-07	2nd Biann	2007001600	0.049	μGy/h
Sellafield Ravenglass (Landed)	Dose over lobster pot	LBP	27-Apr-07	1st Biann	2007000300	*	μGy/h
Sellafield Ravenglass (Landed)	Dose over lobster pot	LBP	12-Sep-07	2nd Biann	2007001597	0.055	μGy/h
Sellafield Drigg - Selker	Dose over gill net	GNT	01-Jun-07	1st of 4py	2007000402	*	μGy/h
Sellafield Drigg - Selker	Dose over gill net	GNT	22-Jun-07	2nd of 4py	2007000483	0.037	μGy/h
Sellafield Drigg - Selker	Dose over gill net	GNT	12-Sep-07	3rd of 4py	2007001594	0.031	μGy/h
Sellafield Drigg - Selker	Dose over gill net	GNT	14-Nov-07	4th of 4py	2007001932	0.092	μGy/h
Sellafield Drigg - Selker	Dose over lobster pot	LBP	27-Apr-07	1st of 4py	2007000298	*	μGy/h
Sellafield Drigg - Selker	Dose over lobster pot	LBP	22-Jun-07	2nd of 4py	2007000484	*	μGy/h
Sellafield Drigg - Selker	Dose over lobster pot	LBP	12-Sep-07	3rd of 4py	2007001598	0.104	μGy/h
Sellafield Drigg - Selker	Dose over lobster pot	LBP	05-Oct-07	4th of 4py	2007001706	0.159	μGy/h
Sellafield #Fishing Vessel Z	Dose over net	NET	27-Mar-07	1st of 4py	2007000293	*	μGy/h
Sellafield #Fishing Vessel Z	Dose over net	NET	27-Mar-07#	-	2007000350	*	μGy/h
Sellafield #Fishing Vessel Z	Dose over net	NET	25-May-07	2nd of 4py	2007000391	0.096	μGy/h
Sellafield #Fishing Vessel Z	Dose over net	NET	07-Sep-07	3rd of 4py	2007001588	0.054	μGy/h
Sellafield #Fishing Vessel Z	Dose over net	NET	07-Nov-07	4th of 4py	2007001868	0.11	μGy/h
# Additional reading taken prior to onset of fishing (background)							
Springfields Ribble Estuary	Dose over gill net	GNT	19-Jun-07	1st of 2py	2007000479	*	μGy/h
Springfields Ribble Estuary	Dose over gill net	GNT	29-Aug-07	2nd of 2py	2007001587	0.043	μGy/h
Springfields Ribble Estuary	Dose over shrimp net	SHT	19-Jun-07	1st of 2py	2007000480	0.201	μGy/h
Springfields Ribble Estuary	Dose over shrimp net	SHT	30-Aug-07	2nd of 2py	2007001586	0.061	μGy/h

*Not detected

4. References

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

ICRP, 1991. 1990 Recommendations of the International Commission on Radiological Protection. Annal. ICRP 21 (1-3). Pergamon Press, Oxford, 201 pp. (ICRP Publ. 60.).

EA, EHS, FSA and SEPA, 2007. Radioactivity in Food and the Environment, 2006. EA, EHS, FSA and SEPA, Warrington, Belfast, London and Stirling. RIFE (12).

5. Annex 1. The Environment Agency's beta dose rate schedule.

Site	Station	Monitoring	Monitoring frequency	Analyses
New Monitoring for Environment Agency				
Sellafield	Sellafield Pipelines	Dose over gill net	4 py	β dose rate
Sellafield	Sellafield Pipelines	Dose over lobster pots	4 py	β dose rate
Sellafield	Fishing Vessel M	Dose over nets	4 py	Each quarter: β dose rate
Sellafield	Fishing Vessel M	Dose over ropes	4 py	Each quarter: β dose rate
Sellafield	St Bees -West	Dose over lobster pots	4 py	Each sample: β dose rate
Sellafield	St Bees -West	Dose over nets	4 py	Each sample: β dose rate
Sellafield	Ravenglass (Landing place)	Dose over gill nets	2 py	Every half-year: β dose rate
Sellafield	Ravenglass (Landing place)	Dose over lobster pots	2 py	Every half-year: β dose rate
Sellafield	Drigg- Selker	Dose over gill nets	4 py	Each sample: β dose rate
Sellafield	Drigg- Selker	Dose over lobster pots	4 py	Each sample: β dose rate
Sellafield	Fishing Vessel Z	Dose over nets	4 py	Each sample: β dose rate
Springfields	Ribble Estuary	Dose over gill net	2 py	Each sample: β dose rate
Springfields	Ribble Estuary	Dose over shrimp net	2 py	Each sample: β dose rate

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