Radiological Habits Survey:
Chapelcross Liquid Effluent Pipeline, 2002

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SUMMARY

This report describes the results of two surveys conducted in 2002 to review public occupancy and measure gamma dose rates near the Chapelcross liquid effluent pipeline. The surveys were done as an accompaniment to the full habits survey conducted around the Chapelcross power station in 2000 (Tipple *et al*, 2002).

Interviews were conducted with members of the public who were spending time in close proximity to the pipeline. Gamma dose rate measurements were taken along the length of the pipe in order to produce a profile of gamma radiation. At selected locations, transects of gamma dose rates were produced by taking measurements at increasing distances from the pipe.

The majority of public activity was observed at the seaward end of the pipe where lower gamma dose rates were observed. The highest gamma dose rates were recorded at locations where the pipe was exposed near to the site perimeter fence and the sports centre and play area in Annan.

The occupancy observations made in 2002 were similar to those recorded during the 2000 survey, with again, the majority of public activity taking place at the southern end of the pipeline and limited activity observed elsewhere.

1 INTRODUCTION

The survey was conducted on behalf of the Scottish Environment Protection Agency (SEPA) to assess external exposure to members of the public whose activities placed them close to sections of the British Nuclear Fuels Plc (BNFL) Chapelcross liquid effluent pipeline. An initial survey was conducted during July 2000 when observations of public occupancy were limited. SEPA decided further work was required during 2002 to supplement the findings of this previous survey.

2 CONDUCT OF THE SURVEY

The Chapelcross liquid effluent pipeline was visited twice during 2002 by CEFAS staff. Two members of the habits survey team visited on 6th and 7th April during the Easter school holiday and 3 members of the team visited on 17th and 18th August during the summer school holiday period. The surveys were conducted during weekends as it was hoped this would maximise the number of leisure activities observed near the pipeline. The UKAEA police and the Chapelcross power station were informed in advance of our work.

2.1 Pipeline description

Figure 1 shows a diagrammatic layout of the liquid effluent pipeline and locations cited in this report.

After passing beneath the BNFL site perimeter fence, the liquid effluent pipeline emerges above ground approximately 170 metres out from the fence. It remains above ground for approximately 550 metres before returning below ground level. It stays below ground for the next 2000 metres. The tract of land it passes through is mainly grassed with woodland bordering each side, which contained abundant wildlife, including edible species such as

rabbits, pigeons and pheasants. No signs of hunting was observed on the 2002 visits, although during the 2000 visit an individual was seen hunting for rabbits with terrier dogs.

Before the pipe re-emerges above ground a short distance north of Shawhill Road in Annan, the tract of land is bordered by the gardens of houses. Children where observed playing in this location on occasions. After passing under Shawhill Road, the pipeline remains above ground for the rest of its length to the coast (with the exception of passing under the B721). It passes the Annan sports centre and the town play area for children. The play area had recently been fenced off from the pipeline restricting public access to it from this side. The tract of pipeline land passing between the playing field and Standalane was well maintained with the grass regularly mown and ornamental shrubs planted along it. From here it goes under the B721 and passes another area of bushes and trees and a scrap metal yard, which was also fenced off from the pipeline. Finally, it passes over the Seaforth Bridge and travels a further approximate 1500 metres to the outfall at Seafield. For most of this last section the pipe's tract of land is composed of a mixture of gravel and well-trodden grass.

2.2 Occupancy

The team divided the length of pipeline, which is approximately 5 kilometres, into roughly equal sections and were responsible for one section each. Staff walked these sections of the pipeline and also waited at access points to it, seeking members of the public to interview. The interviews consisted of questions to ascertain the number of hours per year that individuals spent in close proximity to the pipe, along which sections of the pipeline their activities took place and their approximate distance from the pipe when engaged in these activities. For children, age data were also recorded.

2.3 Gamma dose rate measurements

During the April survey, gamma dose rate measurements were taken using Mini 6/81 instruments. A profile of gamma radiation (shown in Figure 2) beginning at the site perimeter fence end and finishing at the seaward end of the pipe was created. This was achieved by walking alongside the pipe (where the pipeline was above ground level) and holding the detector tube in close contact with it. Each measurement was taken by walking along 2 sections of the pipeline (approximately 11m) whilst conducting a 30 second count on a Mini 6/81 instrument. Where the pipe was below ground, 30 second counts were conducted at certain identifiable positions (such as manholes for access to the pipe) along the route of the pipe.

Transects to show how the gamma dose rates decreased with increasing distance in a perpendicular direction to the pipe were conducted at three locations and the results are shown in Figure 3. A Mini 6/81 instrument was used, supported by a tripod at 1 metre above ground level and 300 second counts were recorded. One measurement was taken between 0 and 1 metres from the pipeline (depending on the pipe's height above ground level), a second was taken approximately 4 metres away from the pipe and a third was taken between 5 and 40 metres away, depending on local features.

3 SURVEY FINDINGS

3.1 Occupancy

A total of 50 occupancy observations in the vicinity of the effluent pipeline were recorded during the 2 visits. The occupancy times, shown in Table 1, ranged from 1 to 730 hours per year. The activities noted were playing, walking, dog walking, gardening and repainting the pipeline. Companies under contract to BNFL carried out the last two activities. The

majority of observations were noted as occurring at the seaward end of the pipeline, from pipe section 285 to its outfall (pipe section 554).

3.2 Gamma dose rate measurements

The profile of gamma dose rates along the length of the pipeline (Figure 2) shows that the highest readings occurred where the pipe is exposed, particularly at the sections nearest to the site perimeter fence and the sections near the sports centre and children's play area. The highest reading was recorded at sections 13 and 14 of the pipe, approximately 250 metres from the site perimeter fence. There was then a steady decline in gamma dose rates over the next 300 metres where the pipe went below ground. The pipe re-emerged at approximately 2.5 km from the site and gamma dose rates stayed at a relatively constant rate for the next kilometre, after which there was a decrease down to much lower levels. Where the pipe was above ground the figure background colour is blue and where the pipe was below ground the background colour is yellow.

The transects (Figure 3) show that in locations where the pipe is exposed, the gamma dose rate decreases significantly after the first metre from the pipe. Where the pipe is under ground no elevated levels are seen even directly in line with pipe.

The reading at the children's play area in Annan appears slightly higher than the reading at sections 13 and 14. This was dependent on the height of the pipeline above ground level, and therefore the distance of the detector tube was from the pipe. Adjacent to the play park, the pipe was approximately 1 metre above ground level very close to the detector tube, whereas at sections 13 and 14, the pipe was at ground level – further away from the detector tube.

4 CONCLUSIONS

The majority of public activities were observed at the seaward end of the pipe where lower gamma dose rates were observed. The 2 highest occupancy times recorded were for dog walkers, with 2 walkers and 4 contractors painting the pipe all having occupancy times of 300 h/y or greater. The highest gamma dose rates were recorded at places where the pipe was exposed near to the site perimeter fence and near the sports centre and play area in Annan.

10 person days effort was spent undertaking this survey. Times were chosen to coincide with possible high occupancy of children. Although other occupancies may have been observed from a more extensive survey, the evidence from existing interviewees suggests that any further observations would be unlikely to change the general view established from this survey.

5 REFERENCE

Tipple, J. R., Sherlock, M. and Taylor, B., 2002. Radiological habits survey, Chapelcross, 2000. RL21/00 SEPA, Stirling.

Table 1. Chapelcross pipeline observations, April and August, 2002

Observation number	Age	Month	Area of pipeline	Approx. distance along pipeline from site perimeter fence (m)	Comments about pipe	Distance from pipe (metres)	Activity	Hours per year
1	10 or 11	April	50 m north of section 77	2510	Below ground	0 to 50	Playing	131
2	10 or 11	April	50 m north of section 77	2510	Below ground	0 to 50	Playing	131
3	10 or 11	April	50 m north of section 77	2510	Below ground	0 to 50	Playing	1
4	10 or 11	April	50 m north of section 77	2510	Below ground	0 to 50	Playing	1
5	10 or 11	April	50 m north of section 77	2510	Below ground	0 to 50	Playing	1
6	10 or 11	April	50 m north of section 77	2510	Below ground	50	Playing	1
7	10 or 11	April	50 m north of section 77	2510	Below ground	50	Playing	1
8	13	April	Springbells Rd walking north	1780 to 2250	Below ground	0 to 5	Walking	5
9	15	April	Springbells Rd walking north	1780 to 2250	Below ground	0 to 5	Walking	5
10	65	April	Sections 285 to 554	3600 to 5000	Above ground	0 to 5	Dog walking	104
11	14	April	Sections 285 to 554	3600 to 5000	Above ground	0 to 5	Walking	10
12	14	April	Sections 285 to 554	3600 to 5000	Above ground	0 to 5	Walking	10
13	Adult	April	Sections 285 to 554	3600 to 5000	Above ground	0 to 5	Dog walking	336
14	Adult	April	Sections 285 to 554	3600 to 5000	Above ground	0 to 5	Dog walking	168
15	Adult	April	Sections 285 to 554	3600 to 5000	Above ground	0 to 5	Dog walking	240
16	Adult	April	Sections 285 to 554	3600 to 5000	Above ground	0 to 5	Dog walking	240
17	80	April	Sections 269 to 310	3530 to 3710	Above ground	0 to 5	Dog walking	210
18	13	April	Sections 77 to 80	2560 to 2570	Above ground	0 to 5	Playing	28
19	14	April	Sections 77 to 80	2560 to 2570	Above ground	0 to 5	Playing	28
20	45	April	Shawhill Road to perimeter fence	10 to 2700	Above and below ground	0 to 5	Walking	18
21*	Adult	April	Springbells Road to B721	2250 to 2900	Above ground	0 to 5	Gardening	162
22*	Adult	April	Springbells Road to B721	2250 to 2900	Above ground	0 to 5	Gardening	162
23*	Adult	April	Springbells Road to B721	2250 to 2900	Above ground	0 to 5	Gardening	162

Table 1 (cont). Chapelcross pipeline observations, April and August, 2002

Observation number	Age	Month	Area of pipeline	Approx. distance along pipeline from site perimeter fence (m)	Comments about pipe	Distance from pipe (metres)	Activity	Hours per year
24	Adult	August	Sections 285 to 554	3600 to 5000	Above ground	0 to 5	Dog walking	241
25	Adult	August	Sections 285 to 419	3600 to 4175	Above ground	0 to 5	Walking	50
26	Adult	August	Sections 285 to 554	3600 to 5000	Above ground	0 to 5	Dog walking	730
27	Adult	August	Sections 285 to 554	3600 to 5000	Above ground	0 to 5	Walking	320
28	Adult	August	Sections 285 to 554	3600 to 5000	Above ground	0 to 5	Walking	320
29	Adult	August	Sections 285 to 554	3600 to 5000	Above ground	0 to 5	Dog walking	274
30	Adult	August	Sections 285 to 554	3600 to 5000	Above ground	0 to 5	Dog walking	274
31	14 or 15	August	Seaforth Bridge	3600	Above ground	0 to 5	Playing	84
32	14 or 15	August	Seaforth Bridge	3600	Above ground	0 to 5	Playing	84
33	14 or 15	August	Seaforth Bridge	3600	Above ground	0 to 5	Playing	84
34	14 or 15	August	Seaforth Bridge	3600	Above ground	0 to 5	Playing	84
35	14 or 15	August	Seaforth Bridge	3600	Above ground	0 to 5	Playing	84
36	14 or 15	August	Seaforth Bridge	3600	Above ground	0 to 5	Playing	84
37	14 or 15	August	Seaforth Bridge	3600	Above ground	0 to 5	Playing	84
38	14 or 15	August	Seaforth Bridge	3600	Above ground	0 to 5	Playing	84
39	14 or 15	August	Seaforth Bridge	3600	Above ground	0 to 5	Playing	84
40	14 or 15	August	Seaforth Bridge	3600	Above ground	0 to 5	Playing	84
41	15	August	Bellsprings Bridge	1400	Below ground	0 to 5	Playing	20

Table 1 (cont). Chapelcross pipeline observations, April and August, 2002

Observation number	Age	Month	Area of pipeline	Approx. distance along pipeline from site perimeter fence (m)	Comments about pipe	Distance from pipe (metres)	Activity	Hours per year
42	15	August	Bellsprings Bridge	1400	Below ground	0 to 5	Playing	20
43	16	August	Bellsprings Bridge	1400	Below ground	0 to 5	Playing	20
44	51	August	Sections 285 to 554	3600 to 5000	Above ground	0 to 5	Dog walking	152
45	47	August	Sections 285 to 554	3600 to 5000	Above ground	0 to 5	Dog walking	152
46	64	August	Sections 285 to 554	3600 to 5000	Above ground	0 to 5	Dog walking	52
47*	Adult	August	Entire length	100 to 5000	Above ground	In contact	Painting	300
48*	Adult	August	Entire length	100 to 5000	Above ground	In contact	Painting	300
49*	Adult	August	Entire length	100 to 5000	Above ground	In contact	Painting	300
50*	Adult	August	Entire length	100 to 5000	Above ground	In contact	Painting	300

Notes

* = contracted by BNFL

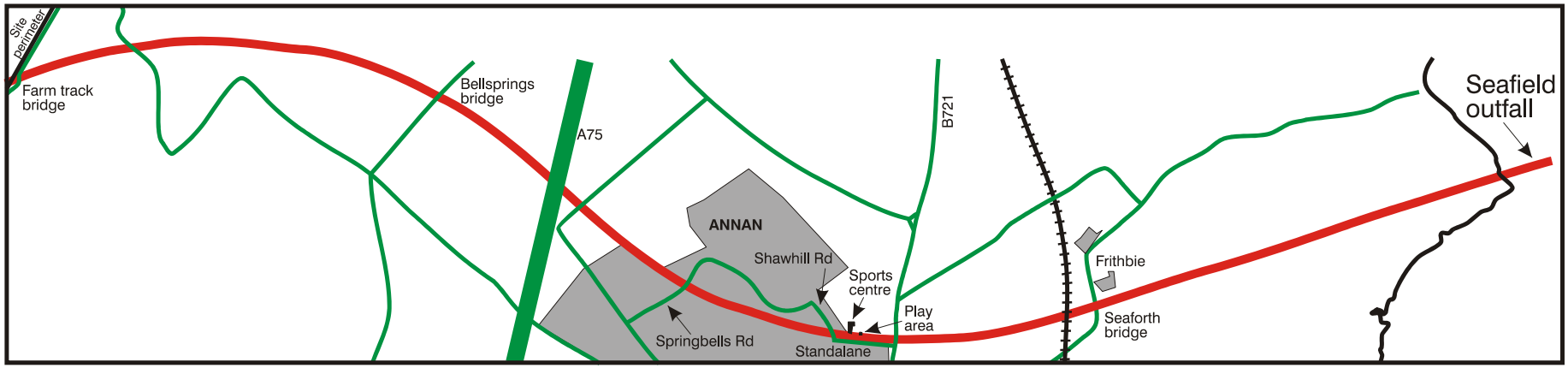

Figure 1. The Chapelcross liquid effluent pipeline

Figure 2. Gamma dose rates recorded along the length of the Chapelcross pipeline

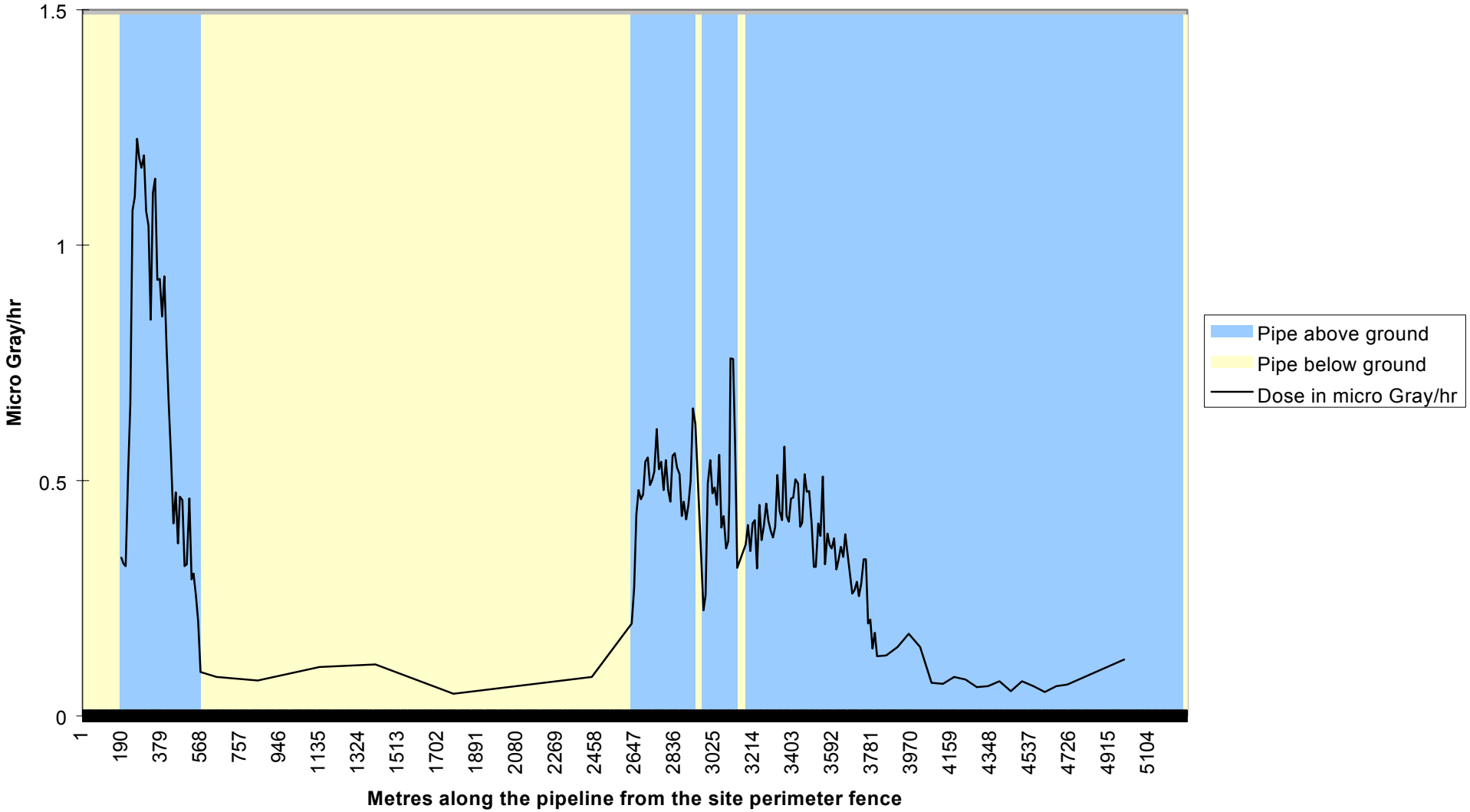

Figure 3. Showing gamma dose rate transects (at 1 metre above ground level) at locations along the Chapelcross pipeline