

Interim Report

R&D Project 151

CRYPTOSPORIDIUM IN DRINKING WATER

Survey of occurrence

WRc plc

June 1991

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CONTENTS

	Page
SUMMARY	(i)
1. INTRODUCTION	1
2. PROGRESS	1
3. RESULTS	3
3.1 Surface waters	3
3.2 Groundwater	3
3.3 Quality assurance	3
3.4 Epidemiology	4
4. CONCLUSION	4
LIST OF TABLES	
3.1 Summary of surface water sample results	5
3.2 Summary of groundwater sample results	9

CRYPTOSPORIDIUM IN DRINKING WATER - SURVEY OF OCCURRENCE

D G Miller and E G Carrington

SUMMARY

The final three months of the national survey has been completed with sampling of the rivers and borehole sources. Full quality assurance of the analysis has been completed and parallel epidemiological studies have proceeded under the direction of CDSC with funding from DoE.

The period has again shown low levels of oocysts in the river sources and no positive results in the boreholes. No second stage investigations have therefore been carried out on the river sites to identify the sources of oocysts. Overall in the survey oocysts have been low or absent in all sources. No outbreaks of cryptosporidiosis have been detected in the areas served by the sources surveyed as shown by the questionnaire returns to CDSC. The final report on the survey will be prepared with more detailed examination of the positive results.

The detailed survey on Loch Lomond has been put in hand with joint funding from FWR and Central Scotland Water Development Board. Quality assurance will also be funded by DoE. It is hoped that this will be complemented by the proposed survey by the NRA in the South West Region to examine occurrence of cryptosporidium in an intensive agricultural catchment.

KEY WORDS

Cryptosporidium, occurrence, surface waters, boreholes

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1. INTRODUCTION

This is the final progress report covering the national survey of occurrence of cryptosporidium in selected rivers and groundwaters. The work was concluded at the end of March following an extension into the first quarter of 1991. The survey was jointly funded by FWR, five Plcs, NRA and DoE. A full report will now be prepared summarising results for the survey period together with full details of methods used and with statistical analysis of results where justified.

2. PROGRESS

Full sampling was completed for the final quarter on the three river stretches and six boreholes. Full quality assurance has also been maintained with half filters being sent to reference laboratories.

Meetings of the participants' working group were held in January and April to review progress and resolve operational problems. Progress was also reported at a meeting of the Research Steering Committee in March.

The details of the Loch Lomond Study have been agreed and contracts are being finalised. Agreement has been reached on the programme and the quality assurance but finalising the contract with Strathclyde University has taken longer than expected. The start date was delayed therefore to April 1, 1991.

3. RESULTS

3.1 Surface waters

Table 3.1 gives monthly summary for the river sources from the commencement of the survey. During the last quarter levels of oocysts were on no occasion high enough to trigger the follow-up studies. Sites A1 and A2 failed to give positive results except for one sample giving the equivalent of 0.2 oocysts/l. For river stretches B3 to B5 oocysts were more consistently present with 41 of the analyses positive. The range detected, however, was low with levels between 0.1 and 2.48 oocysts/l. However, the bulk of the results were less than 1/l. There are sufficient results on this river stretch to analyse statistically for the effects of sampling site position and season and this will be completed for the final report. Oocysts were only detected in three of a total of 120 samples taken on river sites C7 to C10 (2.5%). The three samples were classified however as 'crypto-like bodies' rather than full positives. No statistical analysis on this river stretch will be possible in view of the virtual absence of oocysts over the 12 month period.

3.2 Groundwater

The monthly summary for the groundwater sources since the commencement of the survey are presented in Table 3.2. The current quarter's sampling on all boreholes produced no positive results, this means that out of 259 results only eight of the early results indicated positives and none have been positive since full quality assurance was introduced on these boreholes. A full discussion of these results will be given in the final report that the evidence is hardening that the results were artefacts, particularly since they were not accompanied by other signs of deteriorating quality.

3.3 Quality assurance

Preliminary statistical analysis of the corresponding half filter results indicates good correlation between water company laboratories and check laboratories. The final report will include analysis of this comparison as well as the performance on the spiked samples distributed by the check laboratory. Final results from all laboratories have only just been received.

3.4 Epidemiology

The study by the Communicable Disease Surveillance Centre (CDSC) is continuing and has been extended until November in view of the survey extension. This will give the opportunity to analyse the returns from questionnaires completed by the districts and the general practices surveyed.

The system for analysing results has been fully tested and is proving successful. Some 137 questionnaires were provided by the end of February. The general position, indicated by national returns, is that cases of cryptosporidiosis were much reduced in 1990 compared with 1989 and that trend is continuing this year. A summary of the conclusions from the epidemiological work will be contained in the final report on the surveys.

4. CONCLUSION

The reported period has again shown low levels of oocysts in the river sources and no positive results in the boreholes. Overall in the survey oocysts have been low or absent in all sources. The final report on the survey will present more detailed examination of the positive results.

Table 3.1 - Summary of surface water sample results

	Site A1	Site A2	Site B3
1990 JAN			
Examinations	12	15	
No Positive	3	2	
Maximum /L	2.50	2.00	
Ave of +ve/L	1.91	1.42	
AveVolExam.L	1.62	1.62	
1990 FEB			
Examinations	11	12	11
No Positive	0	0	8
Maximum /L			2.00
Ave of +ve/L			0.55
AveVolExam.L	0.63	1.34	4.61
1990 MAR			
Examinations	12	12	11
No Positive	0	1	7
Maximum /L		4.00	0.49
Ave of +ve/L		4.00	0.32
AveVolExam.L	0.50	0.32	9.44
1990 APR			
Examinations	15	14	15
No Positive	0	0	8
Maximum /L			0.19
Ave of +ve/L			0.09
AveVolExam.L	0.81	0.96	15.49

Site B4	Site B5	Site B6	Site C7	Site C8	Site C9	Site C10
---------	---------	---------	---------	---------	---------	----------

4	4
2	3
0.54	1.28
0.33	0.59
5.41	5.39

12	12
11	9
1.60	1.00
0.54	0.43
5.27	4.62

10	12	12
9	12	10
0.99	0.85	0.54
0.43	0.42	0.30
11.05	10.42	9.87

15	15	15	5	5	5	5
13	14	12	0	0	0	0
0.58	0.49	0.58				
0.27	0.20	0.20				
11.71	12.67	10.95	8.51	2.59	4.55	5.11

Table 3.1 Continued.....

	Site A1	Site A2	Site B3
1990 MAY			
Examinations	12	12	12
No Positive	1	0	9
Maximum /L	1.00		0.52
Ave of +ve/L	1.00		0.18
AveVolExam.L	1.00	1.00	13.68
1990 JUN			
Examinations	11	11	12
No Positive	1	1	9
Maximum /L	1.00	0.50	0.32
Ave of +ve/L	1.00	0.50	0.15
AveVolExam.L	1.00	3.82	17.11
1990 JUL			
Examinations	13	15	14
No Positive	0	1	9
Maximum /L		0.1	0.29
Ave of +ve/L		0.10	0.15
AveVolExam.L	2.38	2.20	17.51
1990 AUG			
Examinations	12	12	11
No Positive	0	0	2
Maximum /L			0.93
Ave of +ve/L			0.71
AveVolExam.L	10.83	10.00	5.80

Site B4	Site B5	Site B6	Site C7	Site C8	Site C9	Site C10
12	12	12	7	8	8	7
9	9	5	0	0	0	0
0.58	0.82	0.26				
0.29	0.29	0.13				
11.66	10.46	11.12	2.99	1.66	4.02	2.11
12	12	12	6	6	6	6
10	9	5	0	0	0	0
0.97	1.31	0.29				
0.33	0.41	0.16				
11.60	9.80	10.03	1.67	3.80	2.12	4.49
15	15	15	12	8	12	9
8	6	1	0	0	0	0
0.58	0.39	0.39				
0.32	0.23	0.39				
6.90	7.11	6.83	4.74	3.50	5.45	6.39
12	12	12	8	10	9	9
5	4	3	0	0	1	0
0.62	0.60	0.62			0.36	
0.45	0.32	0.44			0.36	
4.19	3.89	3.65	5.22	4.90	4.76	4.29

Table 3.1 Continued.....

	Site A1	Site A2	Site B3	Site B4
1990 SEP				
Examinations	12	12	12	12
No Positive	0	0	9	5
Maximum /L			0.31	0.46
Ave of +ve/L			0.14	0.37
AveVolExam.L	10.00	10.00	11.28	5.85
1990 OCT				
Examinations	15	14	15	15
No Positive	1	1	8	7
Maximum /L	0.07	0.10	0.31	0.44
Ave of +ve/L	0.07	0.10	0.15	0.29
AveVolExam.L	10.33	10.00	7.61	4.81
1990 NOV				
Examinations	12	12	12	12
No Positive	2	1	2	5
Maximum /L	0.10	0.10	0.75	0.95
Ave of +ve/L	0.10	0.10	0.61	0.60
AveVolExam.L	10.00	10.00	2.72	3.85
1990 DEC				
Examinations	15	15	11	10
No Positive	1	0	5	6
Maximum /L	0.20		0.86	0.85
Ave of +ve/L	0.20		0.56	0.59
AveVolExam.L	10.00	10.00	4.17	3.32

Site B5	Site B6	Site C7	Site C8	Site C9	Site C10
---------	---------	---------	---------	---------	----------

12	12	12	12	12	12
6	0	0	0	0	0
0.87					
0.33					
6.71	5.79	7.76	4.83	9.36	9.12

15	15	9	9	9	9
9	8	0	0	0	0
0.41	0.69				
0.24	0.30				
5.17	5.66	3.61	5.27	4.72	4.14

12	12	10	10	10	10
2	3	0	0	1	1
0.92	0.65			0.54	0.38
0.67	0.47			0.54	0.38
2.77	4.40	3.69	2.32	3.48	4.33

11	11	11	12	12	12
5	2	0	0	0	2
2.21	0.28				2.75
1.02	0.23				2.70
2.68	4.84	3.20	2.70	5.29	3.50

Table 3.1 Continued.....

	Site A1	Site A2	Site B3	Site B4	Site B5	Site B6	Site C7	Site C8	Site C9	Site C10
1991 JAN										
Examinations	7	12	12	12	12	12	11	9	9	11
No Positive	0	1	5	4	2	6	0	0	0	3
Maximum /L		0.30	1.65	0.82	2.48	2.08				0.35
Ave of +ve/L		0.30	0.59	0.51	1.63	0.70				0.25
AveVolExam.L	10.00	10.00	3.08	4.52	3.48	4.10	4.19	3.35	4.94	4.55
1991 FEB										
Examinations	12	12	11	11	12	12	8	9	8	8
No Positive	0	0	1	2	4	4	0	0	0	0
Maximum /L			0.83	0.33	0.76	0.98				
Ave of +ve/L			0.83	0.25	0.42	0.38				
AveVolExam.L	10.00	10.00	3.54	4.53	3.56	4.86	5.28	2.94	4.23	2.38
1991 MAR										
Examinations	12	12	12	12	12	12	9	9	10	10
No Positive	0	0	8	7	5	8	0	0	0	0
Maximum /L			0.98	1.59	0.61	3.00				
Ave of +ve/L			0.48	0.82	0.33	0.94				
AveVolExam.L	10.00	10.00	3.63	2.70	2.94	2.32	4.13	3.27	9.57	3.03
SURVEY										
Examinations	183	192	171	160	180	180	108	107	110	108
No Positive	9	8	90	90	100	79	0	0	2	6
Maximum /L	2.50	4.00	2.00	1.59	2.48	3.00			0.54	2.75
Ave of +ve/L	0.91	0.99	0.30	0.41	0.41	0.40			0.45	1.09
AveVolExam.L	5.92	6.01	8.85	6.73	6.32	6.42	4.59	3.49	5.48	4.58

Table 3.2 - Summary of groundwater sample results

	Site D11	Site D12	Site D13	Site E14	Site E15	Site E16
1990 APR						
Examinations				2	1	1
No Positive				0	0	0
Maximum /L						
Ave of +ve/L						
AveVolExam.L				148.3	263.6	107.0
1990 MAY						
Examinations	3	3		4	4	4
No Positive	0	0		1	2	1
Maximum /L				0.011	0.922	0.200
Ave of +ve/L				0.011	0.465	0.200
AveVolExam.L	46.7	56.3		291.8	253.3	101.8
1990 JUN						
Examinations	4	3	3	4	4	4
No Positive	0	0	0	2	0	2
Maximum /L				0.026		0.390
Ave of +ve/L				0.015		0.200
AveVolExam.L	42.8	33.0	50.0	222.0	261.8	167.1
1990 JUL						
Examinations	5	5	5	4	5	5
No Positive	0	0	0	0	0	0
Maximum /L						
Ave of +ve/L						
AveVolExam.L	75.2	70.0	75.0	397.7	269.1	219.3
1990 AUG						
Examinations	4	4	4	4	4	4
No Positive	0	0	0	0	0	0
Maximum /L						
Ave of +ve/L						
AveVolExam.L	70.5	100.0	100.0	192.0	239.0	232.3
1990 SEP						
Examinations	4	4	4	4	4	4
No Positive	0	0	0	0	0	0
Maximum /L						
Ave of +ve/L						
AveVolExam.L	76.8	80.0	87.5	234.8	241.7	273.2
1990 OCT						
Examinations	5	5	5	5	5	5
No Positive	0	0	0	0	0	0
Maximum /L						
Ave of +ve/L						
AveVolExam.L	33.4	55.0	70.0	259.9	206.7	286.4

Table 3.2 Continued.....

	Site D11	Site D12	Site D13	Site E14	Site E15	Site E16
1990 NOV						
Examinations	4	4	4	4	4	4
No Positive	0	0	0	0	0	0
Maximum /L						
Ave of +ve/L						
AveVolExam.L	66.0	80.0	87.5	220.3	249.9	289.9
1990 DEC						
Examinations	3	3	1	4	5	2
No Positive	0	0	0	0	0	0
Maximum /L						
Ave of +ve/L						
AveVolExam.L	57.3	50.0	50.0	141.0	259.4	334.6
1991 JAN						
Examinations	4	3	1	3	4	4
No Positive	0	0	0	0	0	0
Maximum /L						
Ave of +ve/L						
AveVolExam.L	60.0	76.7	100.0	212.0	297.3	303.3
1991 FEB						
Examinations	4	4	3	4	4	3
No Positive	0	0	0	0	0	0
Maximum /L						
Ave of +ve/L						
AveVolExam.L	68.5	47.8	91.7	186.5	339.8	299.2
1991 MAR						
Examinations	4	4	4	4	4	4
No Positive	0	0	0	0	0	0
Maximum /L						
Ave of +ve/L						
AveVolExam.L	87.3	86.3	75.0	95.1	257.5	361.3
SURVEY						
Examinations	44	42	34	46	48	44
No Positive	0	0	0	3	2	3
Maximum /L				0.113	0.992	0.390
Ave of +ve/L				0.048	0.500	0.200
AveVolExam.L	62.3	67.8	79.4	214.6	260.4	252.7