

SEA WATER QUALITY MONITORING IN RHODES AND COS (GREECE)

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During the years 1983–1986, a program aiming at monitoring water quality of the most crowded beaches, as well as assessing and minimizing pollution from certain land based sources was carried out in Rhodes and Cos. The program was directed towards inspections of treatment plants as well as laboratory analyses of treated effluents from large hotels. As a result, almost one in four hotels was obliged to construct a new treatment plant. In order to help personnel to improve plant efficiency through day-to-day maintenance a three day seminar was held in June 1985. Sea water quality parameters (total coliforms and *E. coli*) were found to be well below the limits set by E.E.C. directives.

INTRODUCTION

Rhodes as well as Cos are crowded each year with a great number of tourists. Therefore, tourism is by far the main activity in the islands. The obvious benefits to the region are accompanied with certain problems that must be faced. These are: (a) The danger of bathing water quality deterioration due to effluent emissions from large hotels (in addition to municipal sewage), (b) The danger for fresh water shortages due to increased consumption. The program had to overcome several bureaucratic and other obstacles. One of them was the task to coordinate the many different authorities so as to work together for a common project. Until July 1986, the program managed to work successfully.

CONTROLS OF BIOLOGICAL TREATMENT PLANTS

All hotels in Greece, belonging to classes Lux and A, as well as a few B class hotels are obliged to construct and operate a sewage treatment plant. In some occasions they discharge directly, without any treatment, to municipal sewage systems.

Thirteen hotels in Rhodes discharge treated effluents into the sea. These have to comply with the following parameters: B.O.D. 60 mg/l, C.O.D. 180 mg/l, T.S.S. 40 mg/l.

All other hotels in Rhodes, as well as those in Cos, discharge either on the

Table 1 Number of inspections and analyses performed during 1983–1985

Year	No. of inspections		
	Rhodes	Cos	Total
1983	38	0	38
1984	66	3	69
1985	93	15	108

Table 2 Sampling sites (July–October 1987)

P1:	Faliraki A
P2:	Faliraki B
P3:	Hotel Colossos
P4:	Hotel Sunwing
P5:	Aquarium (East)
P6:	Aquarium (West)
P7:	Hotel Beach 33
P8:	Ixia A
P9:	Ixia B
P10:	Hotel Golden Beach

ground (land disposal) or underground (absorption beds). However, it must be kept in mind that many of these absorption beds are very close to the sea, so that organic load can easily find its way into sea. Eutrofication problems in some areas can be attributed to these absorption beds.

We were mainly concerned with those hotels discharging treated effluents into the sea. Just over 50% were found to comply with the limits set. Disinfection was less satisfactory than one could expect. The number of inspections (and analyses) performed during 1983–1985 is shown above (Table 1).

Extensive modifications or even new plants had to be constructed in one out of every four hotels in order to improve efficiency.^{1,2}

SEA WATER MONITORING

Determinations of total coliforms and *E. coli* were performed fortnightly. The results indicate that all organized beaches in Rhodes and Cos are well below the parameters set by E.E.C. directives.^{1,2} Latest results (Summer 1987) from ten sampling sites in Rhodes (Table 2), which are in accordance with the results obtained previously are shown below (Tables 3, 4).

SEMINAR FOR BIOLOGICAL TREATMENT PLANT PERSONNEL

During the program, it was realised that due to personnel ignorance, several

Table 3 Sea water microbiological characteristics (coliforms/100 ml)

Date	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
13- 7-87	<25	<25	<25	<25	40	—	—	—	—	—
20- 7-87	—	—	—	—	—	200	40	90	40	<25
27- 7-87	<25	<25	40	<25	90	—	—	—	—	—
3- 8-87	—	—	—	—	—	450	<25	90	40	40
10- 8-87	40	90	<25	<25	<25	—	—	—	—	—
17- 8-87	—	—	—	—	—	90	<25	90	<25	—
24- 8-87	<25	<25	<25	40	<25	—	—	—	—	—
31- 8-87	—	—	—	—	—	<25	<25	90	<25	<25
7- 9-87	<25	<25	<25	40	<25	—	—	—	—	—
14- 9-87	—	—	—	—	—	<25	<25	250	950	<25
21- 9-87	<25	<25	<25	40	<25	—	—	—	—	—
28- 9-87	—	—	—	—	—	<25	250	90	90	<25
5-10-87	<25	<25	<25	<25	—	—	—	—	—	—
12-10-87	—	—	—	—	—	<25	<25	90	150	<25
26-10-87	<25	<25	<25	<25	90	—	—	—	—	—

Table 4 Sea water microbiological characteristics (*E. coli*/100 ml)

Date	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
13- 7-87	<25	<25	<25	<25	40	—	—	—	—	—
20- 7-87	—	—	—	—	—	200	40	90	40	<25
27- 7-87	<25	<25	0	<25	0	—	—	—	—	—
3- 8-87	—	—	—	—	—	90	<25	40	0	0
10- 8-87	40	90	<25	<25	<25	—	—	—	—	—
17- 8-87	—	—	—	—	—	40	<25	90	<25	—
24- 8-87	<25	<25	<25	0	<25	—	—	—	—	—
31- 8-87	—	—	—	—	—	<25	<25	0	<25	<25
7- 9-87	<25	<25	<25	0	<25	—	—	—	—	—
14- 9-87	—	—	—	—	—	<25	<25	250	950	<25
21- 9-87	<25	<25	<25	40	<25	—	—	—	—	—
28- 9-87	—	—	—	—	—	<25	0	90	90	<25
5-10-87	<25	<25	<25	<25	—	—	—	—	—	—
12-10-87	—	—	—	—	—	<25	25	40	40	<25
26-10-87	<25	<25	<25	<25	40	—	—	—	—	—

serious mistakes resulted in poor plant performance. Among those mistakes were for example, (a) chlorination of aeration tanks, (b) avoidance of recirculation of sludge.

The seminar was attended by more than 80 persons, who were instructed how to improve plant efficiency both theoretically as well as on-the-spot.^{1,3}

CONCLUSIONS

- a) The program resulted in improvement of efficiency of the sewage treatment plants.

- b) Bathing waters in organized beaches conform with the limits set.
- c) In order to improve even more plant efficiency, as well as to permanently safeguard our beaches, inspections and analyses must be continued.
- d) Government and private efforts in collaboration can bring better results.
- e) Water reuse must be looked at more seriously, since fresh water shortages are very probable in the near future. The negative impact on tourism cannot be overlooked.

References

1. *Sea Water Quality Control Program in Rhodes and Cos* (1984).
2. *Sea Water Quality Control Program in Rhodes and Cos* (1985).
3. *Operation of Sewage Treatment Plants* (Seminar Proceedings), (1986).