NSIP-KBG-015198#P1-10

CONTENTS

TABLES

None

FIGURES

None

DRAWINGS

None

CHAPTER 15 ECOLOGY

15.1. INTRODUCTION

This chapter provides an overview of studies done by various specialists on different aspects of the Koeberg environment. It describes the environmental impact and current management practices which are being followed.

For the purpose of this chapter, ecology has been defined as consisting of those individual elements that interact to ensure a balanced ecosystem in the natural environment. Distinction is drawn between the marine ecosystem, i.e. the area seaward of the high tide level, and the land ecosystem from the first dunes inland as far as the Eskom properties extend.

15.2. MARINE ECOLOGY

A report by B Currie and PA Cook of the University of Cape Town (***Reference 1***) describes the gross ecological characteristics of the intertidal and shallow sub-tidal marine environment in the vicinity of Duynefontein, with specific reference to the distribution of fauna according to the character of the coastline.

Further experimental work by Dr Cook on the possible effects of the thermal plume from Duynefontein, with particular reference to rock lobster, was undertaken on behalf of Eskom and a report published in 1978 (***Reference 2***).

During the construction phase of the Power Station, Dr Cook continued to do further research in order to establish a more detailed base line and also to determine seasonal variations in population characteristics. He also studied possible differences in susceptibilities to temperature fluctuations during various stages in the life cycles of the dominant species.

Studies carried out by Dr Cook of UCT concentrated on three distinct periods, viz, the pre-operation phase (1981-1984), transitional phase (1985,1986), and the operational phase (1987-1989).

The Baseline Ecological Report of 1984 (***Reference 3***) contains a vast quantity of environmental and ecological data as well as some preliminary findings which can be listed as follows:

- A decrease in specie diversity,
- The white mussel, Donax serra, was identified as an indicator specie,
- It was suggested that the thermal pollution from Koeberg might result in a disruption of the breeding cycle of Donax serra,
- The effects of entrainment on the suspended planktonic organisms, where the water is both heated and chlorinated as it passes through the plant, was not too serious as long as no 'shock' chlorinating took place,

- At that stage there was no evidence of colonisation of opportunistic 'warm water' species,

- Generally metal concentrations in both black and white mussels collected close to Koeberg had remained fairly constant.

In support of the studies carried out by Dr Cook, Eskom undertook to study the extent and volume of the 'warm water plume' and the results are described in the 'Warm Water Plume Report' by Rattey and Potgieter (***Reference 5***). This report describes the dissipation, path and extent of the warm plume. Salient features that were deduced from the interpretation of the plume studies are:

- The dispersion of the plume is governed by the volume of warm water discharged into the sea (subject to the power station status), the vertical mixing process of breaking waves, horizontal eddy diffusion and by the advection of ambient currents.

- Plume trajectory is in correspondence with the prevailing ambient currents which are primarily wind induced.

- The downward penetration of the warm water plume is limited by its buoyancy, especially outside the surf zone where bottom measurements showed ambient temperatures.

- The main impact area of the warm discharge appears to be along the beach to the south side of Koeberg, between the Outfall and the Ou Skip Rocks.

- The relatively small extent of the plume is unlikely to have a dramatic effect on the local marine environment. The effected area is unlikely to extend more than a kilometre or so from the Outfall channel, even in the worst conditions.

- No temperature increase in excess of two degrees above ambient was observed further than 1 km from the Outfall.

A further study was conducted by Rattey and Potgieter to investigate the dynamic variances of the ocean physics (***Reference 6***). The study describes the degradation and propagation of beaches, which could physically effect the monitoring program undertaken by Dr Cook, as well as to qualify the actual temperature increase at Ou Skip (the reference site for marine ecological impact studies) resulting from the warm plume created by Koeberg. The dynamic beach processes and changes and temperature influences can be described as:

- The interrelationships of the sandy shore process. The extent and configuration being dependant upon wave height and period, currents, the range of tides, the degree of exposure to winds and sediment source.

- Although there are seasonal variations of the seabed slope, as confirmed by previous studies, the most significant changes occur at localised positions on the beach due to cell circulation systems in the nearshore zone.
- The wave induced cell circulation is most apparent with rip currents which are strong narrow currents that flow seawards from the surf zone.
- The cell circulation system is dependent on complex wave incident and set-up conditions and can occur at any time of the year.
- The erosion/accretion cycle is of a short duration but is responsible for large amounts of sand being moved.
- It can be assumed that the beaches are in a constant state of dynamic equilibrium indicating little nett loss or gain in the sediment budget.
- Cognizance must be taken of the fact that perturbations in faunal density and population could be affected by beach processes.
- The measurable influence of the warm pollution from Koeberg on the sea temperature at Ou Skip Rocks equals 0.62 ºC. If the long term non-operational differential is applied to the seasonal regimes, the positive temperature influence is 0.66 ºC during summer and 0.56 ºC during winter.
- Koeberg's influence is well within the standard deviation of the natural temperature variation over a long period.

In the final report by Dr PA Cook (***Reference 4***), which culminated the Marine Environmental Impact studies with the operational phase of the study, most of the earlier predictions regarding the extent of the pollution impact were proved incorrect. The main findings can be summarised as:

- No reduction in the specie diversity index was recorded, in fact the index rose during the operative period.
- Overall community structure of beach animals was very variable from year to year, but the dominance of a few key species was maintained throughout the experimental period.
- The predicted colonisation of the area by opportunistic warm water species did not occur.
- The breeding cycle of the main indicator specie, Donax serra, appeared to be significantly influenced by water temperature. Although the cycle was fairly variable before the Power Station began operation, it appeared to be even more unpredictable during the operative phase. There was no evidence however, that this affected the overall number of mussels on the beach.

- Phytoplankton biomass was reduced by an average of about 53 % due to entrainment in the power station cooling system whilst zooplankton mortality averaged 22.3 %. Mortality of plankton during entrainment was not, however, considered to be detrimental to the marine environment because of the very localised area affected.

- The overall conclusion is that the Koeberg Nuclear Power Station has had very little detrimental effect on the ecology of the local sandy beaches.

15.2.1 Ongoing Programme

Since 1990 emphasis has been placed on Donax serra as being the indicator specie and most of the ongoing study has concentrated on this beach animal. In conjunction bi-annual total specie samples are being taken for identification and counting of the samples. The annual reports thus far indicate differences which have little overall biological significance (***Reference 7***).

15.3. DUNE REGIMES

Planting of marram grass to stabilize the dune area was completed in 1983 after a total of 152.75 ha was stabilised.

A stable and diverse plant community has taken over the stabilised area with the result that at present marram grass is removed as needed for stabilization purposes on external reserves or unstable areas.

A total of 280.63 ha of dune area is still untouched and is being conserved with the minimum of disturbance. The stability of these dunes is monitored with the help of aerial photography.

15.4. LAND ECOSYSTEM

Eskom has committed itself to maintain the remaining land around the Nuclear Power Station as a nature reserve (2820 ha). In 1991 the area was proclaimed as the Koeberg Nature Reserve. The main vegetation types of the area include: Strandveld and Acid Sand Plain Fynbos. These form part of the Cape Floristic Kingdom which is the smallest floristic kingdom in the world, but which has the greatest diversity of plant species. An Environmental Management Plan has been drawn up by a consultant (***Reference 8***), and the nature reserve is managed on these principles.

There are a number of recorded and mapped archaeological sites on the reserve. These sites have been recorded by the S. A. Museum and are in the eastern region of the reserve. The largest excavated sites are Duynefontein and Duynefontein 2 which are Middle to Later Stone Age Layers of the Die Kelders Cave 1. Ad hoc excavation work is still being carried out on these sites by the S. A. Museum and Universities.

Herbicides are currently being used for the clearing of road verges, controlling plant growth within electrical live wire chambers and occasionally for the control of alien plants. Use of herbicides must be authorised by the Conservation Officer. Date, time, place, weather conditions, herbicides used, equipment used, chemical concentration, person in charge and amounts used must be noted and logged on each application for audit purposes. It must be stressed that the use of herbicide is normally considered to be the last option and not a standard practice. Herbicides in use are environmentally friendly.

A number of projects receiving attention ~~are~~ the alien eradication programme, environmental education, research and the improvement of visitors facilities on the hiking trails. The reserve offers an opportunity for the local community to gain income by cutting Rooikrans trees in a woodlot area to sell for fire wood. This activity serves a dual purpose. It aids in removing the invasive alien species and supports ±50 - 100 people in receiving an income. After clearing an area of Rooikrans trees the area gets logged as a cleared area and maintenance gets done on a yearly basis. This entails walking through the area and hacking out the young trees. The area owned by Eskom on the eastern side of the R27 is 90% infested by Port Jackson. Biological control methods were introduced into this area in 1991 by the Plant Protection Unit, as a long term solution to the problem.

Two hiking trails exist on the reserve, namely the Dikkop and the Grysbok trails. The trails are most spectacular during the spring when there is an amazing show of wild flowers along the route. On average about 3 000 hikers walk these trails per year and the total is increasing on a yearly basis.

All roads and fences on the reserve are maintained by the Conservation and Land Management Section. The entire fence line has been cleared to a width of ±10 m, using a tractor-drawn bushcutter, to serve as a fire belt. This process is done three times a year, however if any growth is noticed during the year it is cleared.

Both the Cape Metropolitan Council (CMC) and CSIR jointly manage an underground acquifer (naturally occurring underground water) which is used to pump water to Atlantis for their industrial and domestic use. Approximately 5 500 000 m^3 water is drawn each year. Eskom makes use of this method by pumping water from bore holes on the reserve at a rate of ±40 000 m^3 per month to the power station to reduce the use of municipal water.

The reserve ensures that the entire property will be returned to its climax condition. Eskom has created an important research facility not only for local, but foreign students as well, and also a safe reserve for endangered species of fauna and flora. From this, it can be seen that trust has been built between Eskom - Koeberg Nature Reserve, Cape Nature Conservation, National Parks Board and local Environmental groups.

15.5. SUMMARY

The marine system, as well as the land under Eskom's control, is being managed according to the Eskom Environmental Policy (***Reference 9***).

REFERENCES

1) Currie, B and Cook, PA; Report on Biological Investigation for the Proposed Eskom Nuclear Power Station at Duynefontein; University of Cape Town, 1975.

2) Cook, PA; A Prediction of Some Possible Effects of Thermal Pollution on Marine Organisms on the West Coast of South Africa, with Particular Reference to the Rock Lobster, Jasus Lalandii, University of Cape Town 1978.

3) Cook, PA; Baseline Ecological Report 1981 - 1984, Marine Environmental Monitoring Programme, Koeberg Nuclear Power Station, Zoology Department, University of Cape Town, 1984.

4) Cook, PA; Final Report, Marine Environmental Monitoring Programme, Koeberg Nuclear Power Station, Zoology Department, University of Cape Town, December 1989.

5) Rattey, D and Potgieter, F; Warm Water Plume Report, Koeberg Nuclear Power Station, August 1987.

6) Rattey, D and Potgieter, F; Interpretation of Physical Oceanographic Data for Koeberg 1985 - 1988, July 1989.

7) Cook, PA; Marine Environmental Reports, 1990 - 1996, Zoology Department, University of Cape Town.

8) ESK 02 C; Koeberg Nature Reserve, Environmental Management Programme, 1996.

9) ESKPBAAD6; Eskom Environmental Management Policy, January 1996.