Study on Treated Water Discharge into the Ocean (Study Area: 1. Chiba prefecture, 2.Ibaraki prefecture)		
Whole term	1993.10～1996.3	

(Purpose)

Recently, a new environmental quality standard has been established accompanying with the effluent standards for nitrogen and phosphorus in closed water areas, such as Tokyo Bay, Ise bay and the Inland Sea, where preventive measures need to be taken to deal with the eutrophication problem. Accordingly in future, more consideration should be given to the sewage treatment technologies and the quality of treated water discharged from sewage treatment plants into these coastal waters. Besides, considerations should also be given to the fact that, the population around those coastal waters is more than tens of millions and a large number of sewerage treatment plants discharge treated water into these coastal waters.

Therefore, to improve the sewerage system, such as to introduce advanced wastewater treatment, proper steps should be adopted considering the whole environment in these coastal waters.

Accordingly, this study discussed the possibilities from various points of view for more appropriate sewerage systems for these coastal waters.

(Results)

The followings are the main results of the study conducted in 1995.

1. It was estimated that nitrogen (N) and phosphorus (P) loadings which flow into Tokyo Bay will be decreased by approximately 20% (N) and 30% (P) when an advanced wastewater treatment process is introduced, and 40% (N) and 45% (P) when the secondary effluent is discharged into the ocean, compared to the case where secondary effluent is discharged into the Tokyo Bay.
2. Water quality improvement effects by advanced treatment and ocean discharge were evaluated through numerical simulation.
   As a result, it was estimated that, it is impossible to meet the environmental quality standards in either case where treated water with advanced treatment is discharged into Tokyo Bay or where secondary effluent is discharged into the ocean. The concentrations of nitrogen and phosphorus were both lower in the case of ocean discharge.
3. Effects of ocean discharge on organisms and marine production at the discharge points and Tokyo Bay were discussed.
   1) Effects of salinity
      No effect was estimated on the organisms in Tokyo Bay. Fish at the discharge points are mainly plankton-feeding kind, such as sardines, and the salinity application range for them is about 1 permillage. If the salinity becomes less than 1 permillage, some effects will show up. (At 20km off-shore of the Kamogawa river salinity decreased to less than 1 permillage.)
   2) Effects of nutrients (N, P)
      It was estimated that, the water quality of Tokyo Bay would improve along with N and P influent loading decrease to the level of the 1960's. However, seaweed is sensitive to nutrient concentration change, thus its production and quality can be affected. At the discharge points, plant plankton will increase along with the N and P supply and accordingly, production of plankton-feeding sardines will increase.
4. Carbon dioxide balance was discussed in the case of ocean discharge.
   On the condition that the discharge outlet is set up at a depth of 180m, fixed carbon dioxide by primary production is not recirculated by the decomposition but is sedimented onto the ocean bed and removed from water, as a result about 15% of current primary production is fixed. On the other hand, the amount of carbon dioxide absorbed from air into the ocean is about 2% of primary production according to literature review. Moreover, along with the increase of the nutrient concentration, primary production will also increases at a same rate, thus increasing the fixation amount of carbon dioxide.

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Keywords	discharge into the ocean, carbon dioxide balance, water quality improvement