(ACE Paper 20/2001)

For information

Update on the Results of Environmental Monitoring for Contaminated Mud Disposal at East Sha Chau

Purpose

There has been some public concern about the adverse impact that the disposal of contaminated mud at East Sha Chau might have on the nearby marine environment and on the Chinese White Dolphins. The purpose of this paper is to provide Members with updated information on results of the environmental monitoring programme for this mud disposal site.

Background

2. Since late 1992, the East Sha Chau area has been the site of a series of purpose-dredged seabed pits for confined marine disposal of contaminated mud arising from dredging and reclamation activities in Hong Kong. After receiving the mud up to the designed level, the pits are capped with clean material to isolate the contaminated material from the marine environment. These contaminated mud pits (CMPs) are managed and monitored by consultants and contractors commissioned and directed by the Civil Engineering Department (CED).

3. By 1996, nine CMPs had been backfilled and capped. From 1997, the disposal of contaminated mud took place at three larger pits collectively known as CMP IV, which were formed after the dredging of sand as fill material by the Airport Authority. The locations of the CMPs are given in Figure 1. Prior to contaminated mud disposal to CMP IV, an Environmental Impact Assessment (EIA) study had been carried out to assess the impacts and the findings were reported to the Advisory Council on the Environment (ACE) in February 1997.

Environmental Monitoring Programme

4. The main objectives of the environmental monitoring programme are to detect impacts arising from contaminated mud disposal; to assess whether the impacts are acceptable; and to detect and assess changes and trends in the marine environment.

5. The monitoring commenced in October 1992 at the onset of mud disposal. Since then the monitoring has progressively developed into a comprehensive programme of physical, chemical, ecological and fishery resources monitoring. The current programme covers water and sediment quality, sediment toxicity tests, surveys of benthic community (e.g. seabed worms, shellfish, crabs etc), fisheries resources and measurements of contaminant levels in marine organisms. The monitoring frequencies ranged from monthly to six-monthly, depending on the type of survey. Locations of the monitoring stations for the various types of survey are also given in Figure 1. From this monitoring, a human health and ecological risk assessment is also carried out by the consultants annually.

6. The environmental monitoring results obtained by the consultants and contractors are reported regularly to CED and other relevant government departments including the Agriculture, Fisheries and Conservation Department, the Government Laboratory and EPD. To ensure that the monitoring works are done properly and effectively, the CED also employed independent experts and academics to audit the monitoring programme and results.

Updated Environmental Monitoring Results

7. Updated findings of the environmental monitoring and risk assessment for the East Sha Chau CMPs are summarised below. These are based on the Quarterly Report for August to October 2000 and the Second Annual Risk Assessment Report of February 2000 produced by CED's consultants. Apart from updated results, these reports also provided summaries of previous environmental monitoring and assessment results.

Sediment Quality and Toxicity

8. In the monitoring programme, seabed sediments from stations near to and remote from the CMPs are sampled and measured for a comprehensive list of chemicals. The chemicals measured include nine heavy metals and metalloids, trace organic contaminants such as PCBs, PAHs, DDTs and TBT.

9. Up-to-date results indicate that the levels for the seven metals that are used for contamination classification in EPD Technical Circular No.(TC)1-1-92, for PCBs and for DDTs in the seabed sediment outside the active CMP were below the levels of environmental concern. There is no trend of increasing sediment contaminant levels with time. Nor is there a trend of increasing contaminant levels with increasing proximity to the CMPs. These results are illustrated in Figures 2(A) to 2(I) for the seven metals, PCBs and DDTs measured in the sediment monitoring between November 1997 and July 2000.

10. Apart from measuring chemicals, the monitoring programme also carried out toxicity tests using three different sensitive marine organisms such as shellfish larvae. The tests were done for sediment sampled from two areas near to and remote from the CMPs so as to evaluate the risk of toxicity to biota living near the pits. Up-to-date results indicate that there is no difference between the toxicity of sediment collected near to and remote from the CMPs, and there is no trend of increasing sediment toxicity over time.

Water Quality

11. In the monitoring programme, water quality is measured at a number of locations at various distances from the CMPs. The measurements include dissolved metals, dissolved oxygen, nutrients, suspended solids and a range of other physiochemical parameters.

12. Up-to-date results indicate that the water quality in the East Sha Chau area generally complied with the Water Quality Objectives (WQO) of the North Western Water Control Zone except for total inorganic nitrogen. The relatively high nitrogen levels in the area were assessed to be related to the impacts of the Pearl River discharge rather than contaminated mud disposal at the East of Sha Chau. As regards the dissolved metals, the levels were found to be low and generally complied with the water quality standards adopted by the European Union.

Benthic Community, Fisheries Resources and Biota Contaminant Levels

13. Surveys of marine organism living within the sediment were carried out with an aim to assess the status of growth of organism at the seabed of the capped CMPs. Up-to-date results indicate that for the benthic community at the capped CMPs, increases in biomass, number of individuals and species richness over time were found, indicating progressive recolonisation.

14. Trawling surveys were carried out at locations near to and remote from the CMPs so as to assess impact of the mud disposal on fishery resources. Compositions and biomass of the trawled marine organisms were studied. In addition, a number of targeted species of prawn, crab and fish collected during the trawling were tested for contents of metals and trace organic contaminants.

15. Up-to-date trawling results indicate that fisheries in the area varied with seasons significantly. Summer catches are typically larger and composed of more species. So far no evidence of adverse impact on fishery resources caused by the mud disposal activities has been found.

16. The chemical test results indicate that the contaminant levels in the bodies of fishes and invertebrates near the CMPs were not higher than those collected at areas remote from the CMPs. This is illustrated in Figures 3(A) and 3(B) on the levels of PCBs and DDTs found in the August 2000 survey. Also, as shown in Figures 3(C) to 3(F), the levels of metals including Cd, Cr, Pb and Hg were found to be below the Food Adulteration Regulations maximum permitted concentrations for human consumption. Moreover, no trend of increasing contaminant levels over time was found.

Human Health and Ecological Risk Assessment

17. The environmental monitoring programme also includes an annual assessment on risk to human health and dolphins that might be caused by the consumption of seafood and marine prey species from the East Sha Chau areas. This risk assessment is based on the results of contaminant contents found in the fishes and invertebrates.

18. The risk assessment conducted in early 2000 concluded that the risk of the general population and fisherman in acquiring cancer or non-cancer chronic diseases due to eating seafood from the East Sha Chau area is low and within the acceptability guidelines. The assessment also found that the health risks of eating seafood from the East Sha Chau area were similar to those from other areas in Hong Kong.

19. As regards risks to the Chinese White Dolphin caused by the consumption of marine prey species, the assessment in early 2000 determined that such risk in the East Sha Chau area was low and similar to that in other marine areas in Hong Kong.

Concluding Remarks

20 There is an on-going comprehensive environmental monitoring programme to detect impacts arising from the disposal of contaminated mud to East Sha Chau.

21. Up-to-date monitoring and risk assessment results indicate that the disposal of contaminated mud at the CMPs has not affected the marine environment adversely nor caused an increase in health risk to humans and the Chinese White Dolphins.

Environmental Protection Department
May 2001

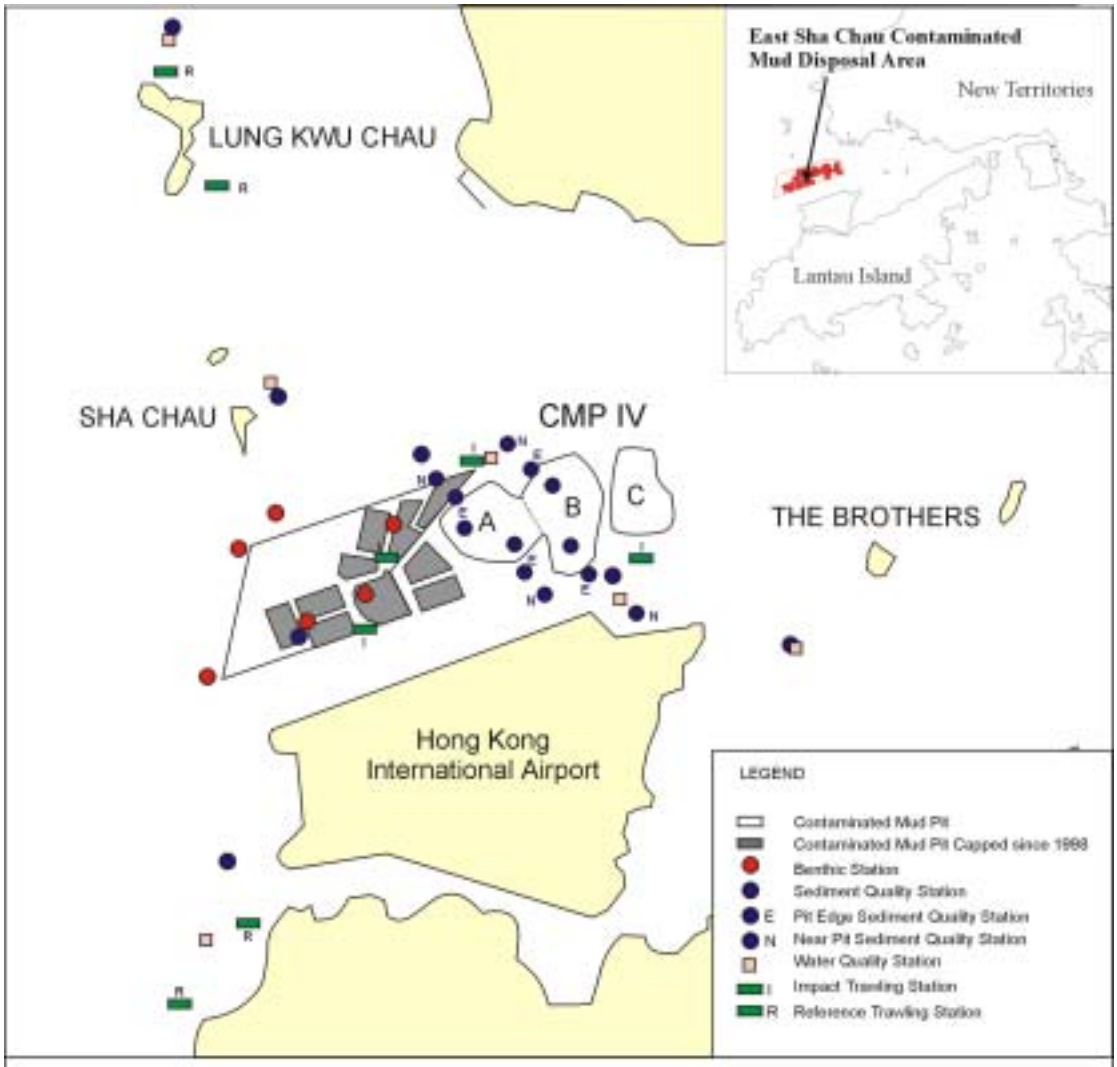
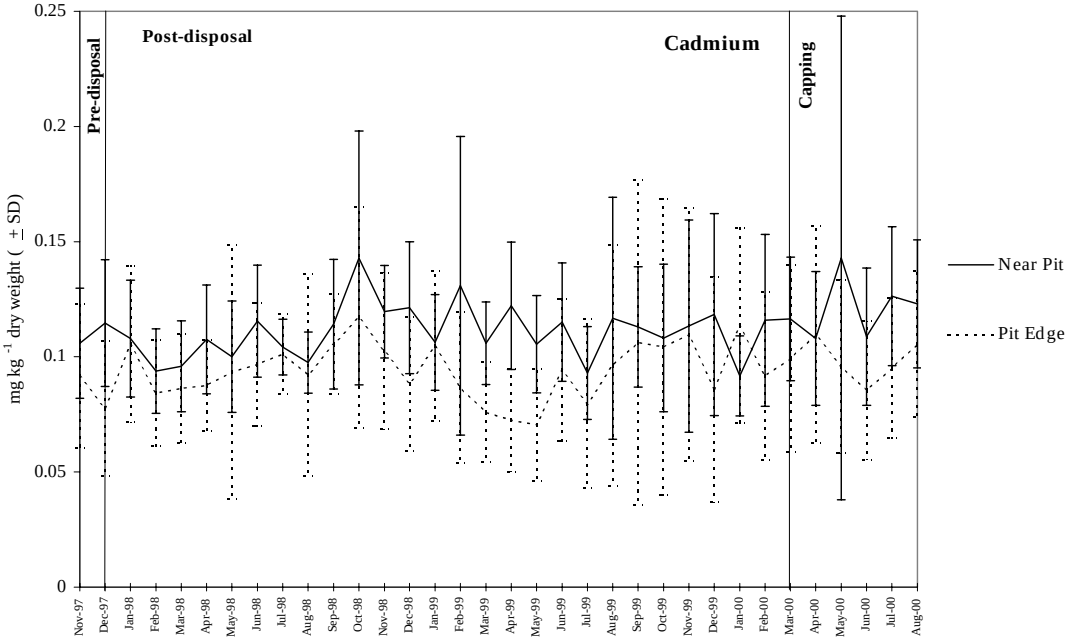


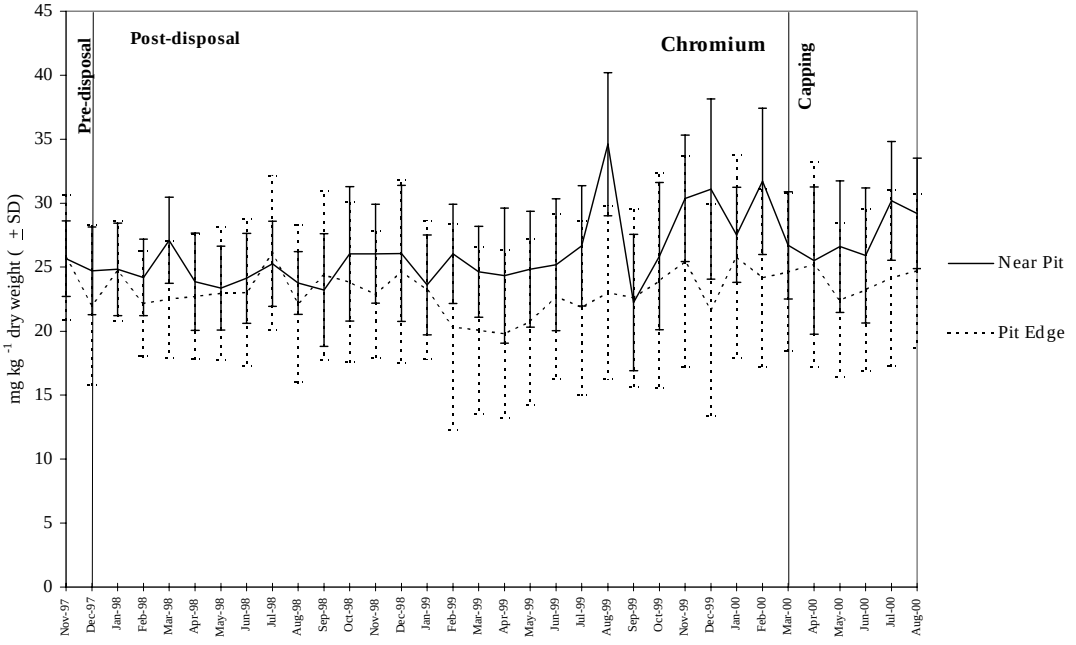
Figure 1 Location of monitoring stations at the East Sha Chau Contaminated Mud Disposal Area

(A) Cadmium *



* Note: Classification of seriously contaminated material: ≥ 1.5 mg.kg^{-1} dry weight.
(EPD Technical Circular No. (TC) NO 1-1-92)

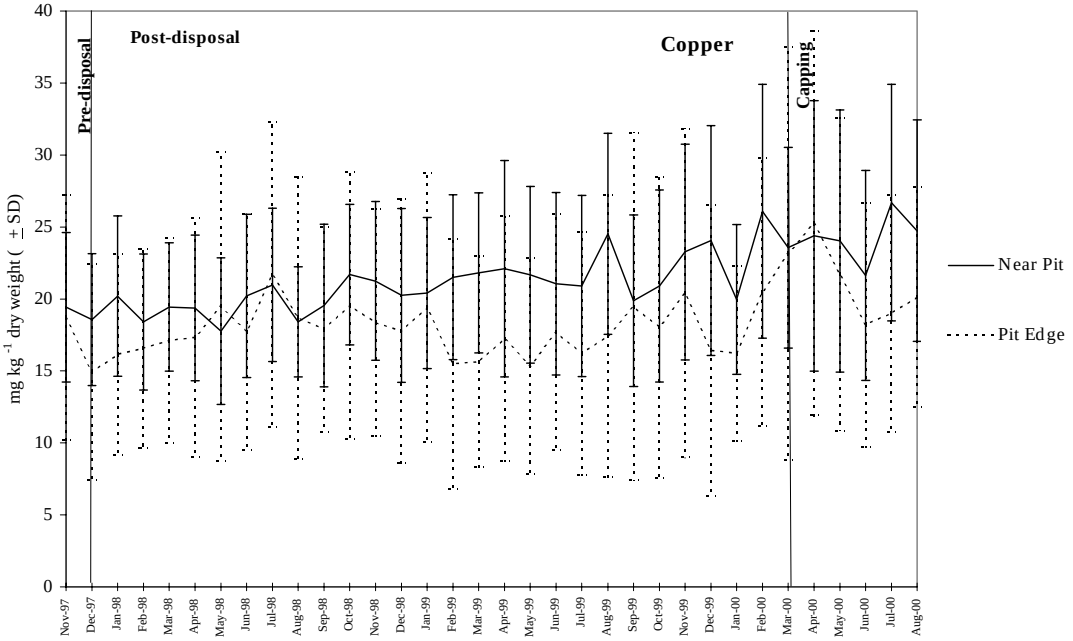
(B) Chromium *



* Note: Classification of seriously contaminated material: ≥ 80 mg.kg^{-1} dry weight.
(EPD Technical Circular No. (TC) NO 1-1-92)

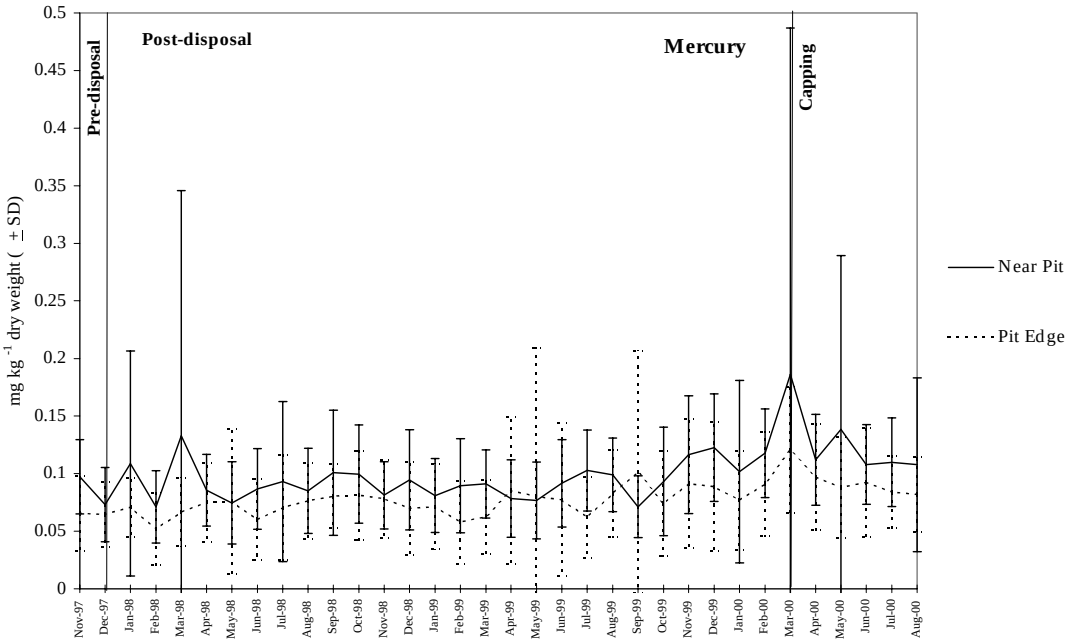
Figure 2. Mean concentrations of metals and trace organics detected in sediment samples taken near CMP IVa during November 1997 – August 2000.
(Source: CED. 2001. *Environmental Monitoring and Audit for Contaminated Mud Pit IV at East Sha Chau. 12th Quarterly Report, August – December 2000*).

(C) Copper *



* Note: Classification of seriously contaminated material: ≥ 65 mg.kg^{-1} dry weight.
(EPD Technical Circular No. (TC) NO 1-1-92)

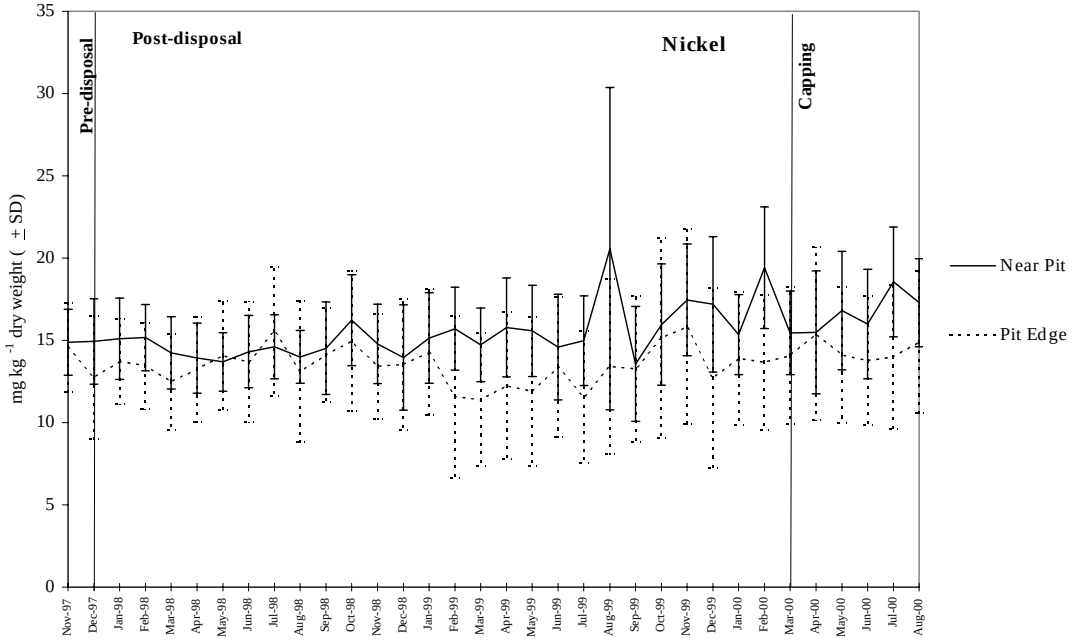
(D) Mercury *



* Note: Classification of seriously contaminated material: ≥ 1.0 mg.kg^{-1} dry weight.
(EPD Technical Circular No. (TC) NO 1-1-92)

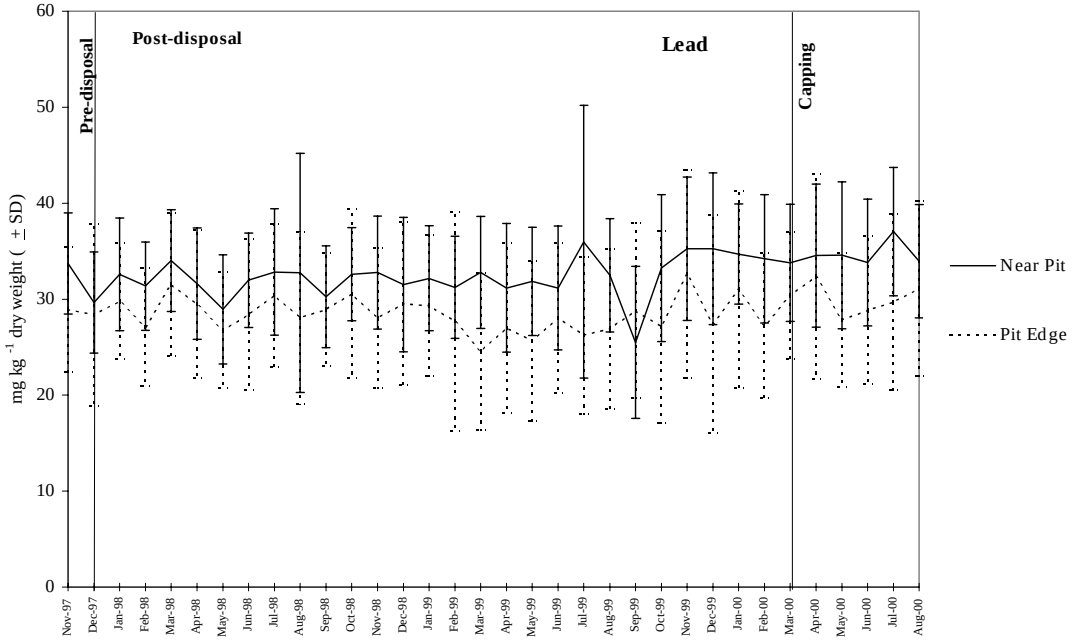
Figure 2. (*continued.*) Mean concentrations of metals and trace organics detected in sediment samples taken near CMP IVa during November 1997 – August 2000.
(Source: CED. 2001. *Environmental Monitoring and Audit for Contaminated Mud Pit IV at East Sha Chau. 12th Quarterly Report, August – December 2000*).

(E) Nickel *



* Note: Classification of seriously contaminated material: ≥ 40 mg.kg^{-1} dry weight.
(EPD Technical Circular No. (TC) NO 1-1-92)

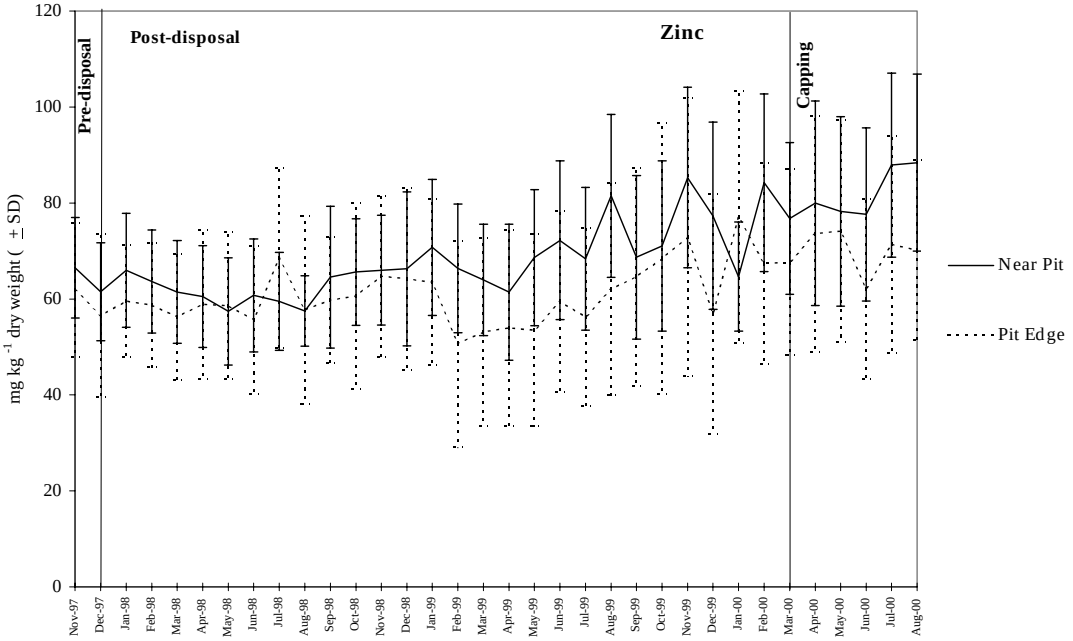
(F) Lead *



* Note: Classification of seriously contaminated material: ≥ 75 mg.kg^{-1} dry weight.
(EPD Technical Circular No. (TC) NO 1-1-92)

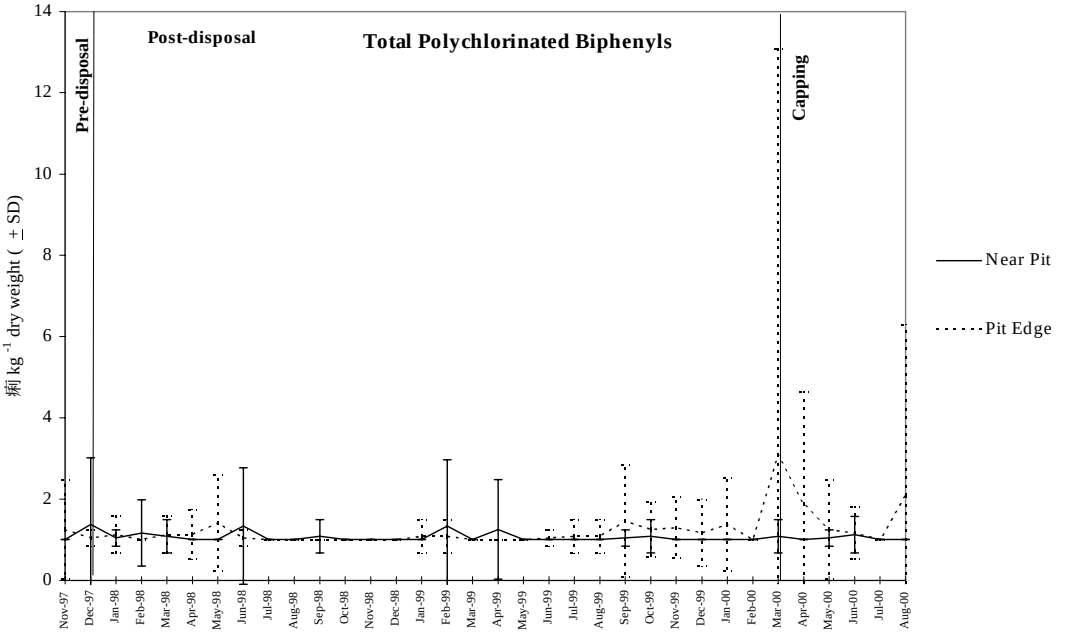
Figure 2. (*continued.*) Mean concentrations of metals and trace organics detected in sediment samples taken near CMP IVa during November 1997 – August 2000.
(Source: CED. 2001. *Environmental Monitoring and Audit for Contaminated Mud Pit IV at East Sha Chau. 12th Quarterly Report, August – December 2000*).

(G) Zinc *



* Note: Classification of seriously contaminated material: ≥ 200 mg.kg^{-1} dry weight.
(EPD Technical Circular No. (TC) NO 1-1-92)

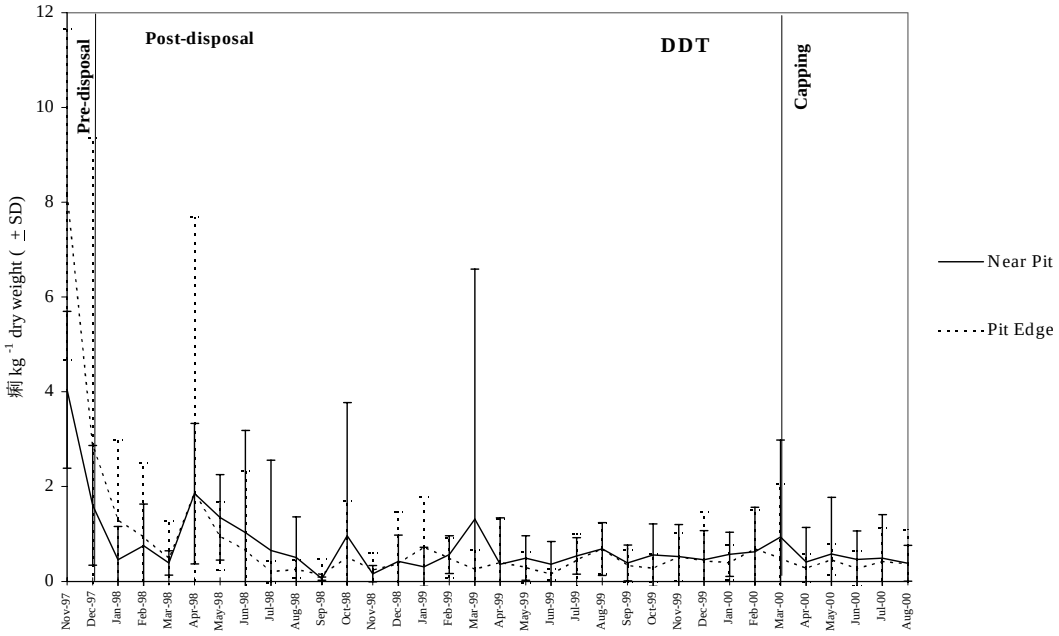
(H) Total Polychlorinated Biphenyls *



* Note: Classification of Category M sediment: >23 and <180 μg.kg^{-1} dry weight.
(Works Bureau Technical Circular No. 3/2000)

Figure 2. (*continued.*) Mean concentrations of metals and trace organics detected in sediment samples taken near CMP IVa during November 1997 – August 2000.
(Source: CED. 2001. *Environmental Monitoring and Audit for Contaminated Mud Pit IV at East Sha Chau. 12th Quarterly Report, August – December 2000*).

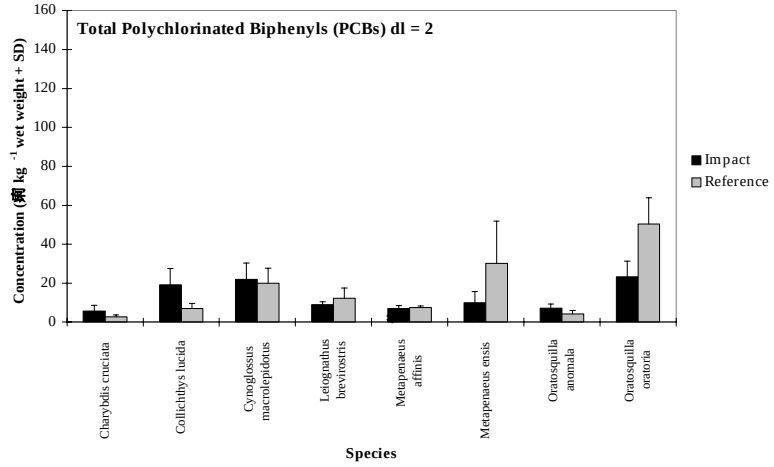
(I) DDT *



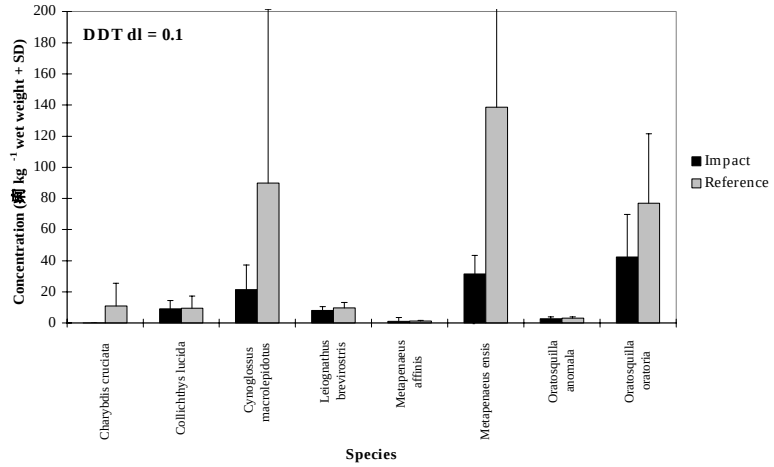
* Note: Interim Sediment Quality Value – Low: <1.58 μg.kg^{-1} dry weight. (CED, 2001)

Figure 2. (*continued.*) Mean concentrations of metals and trace organics detected in sediment samples taken near CMP IVa during November 1997 – August 2000.
(Source: CED. 2001. *Environmental Monitoring and Audit for Contaminated Mud Pit IV at East Sha Chau. 12th Quarterly Report, August – December 2000*).

(A) Total Polychlorinated Biphenyls



(B) Organochlorine DDT



(C) Cadmium

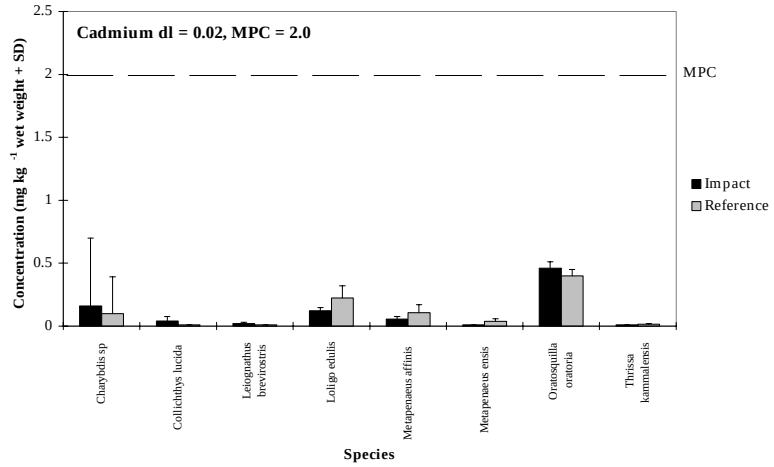


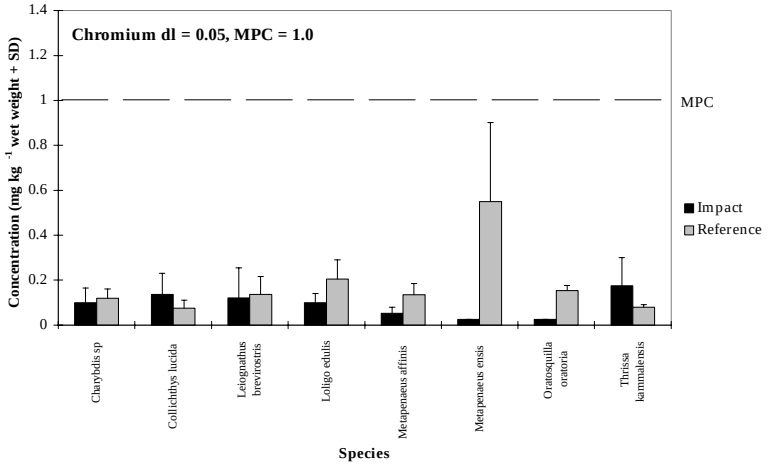
Figure 3. Concentrations of trace organics and metals detected in Tissue Analysis from trawl stations during August 2000.

Legends: dl = detection limit;
MPC = Maximum Permitted Concentration (Food Adulteration Regulations)

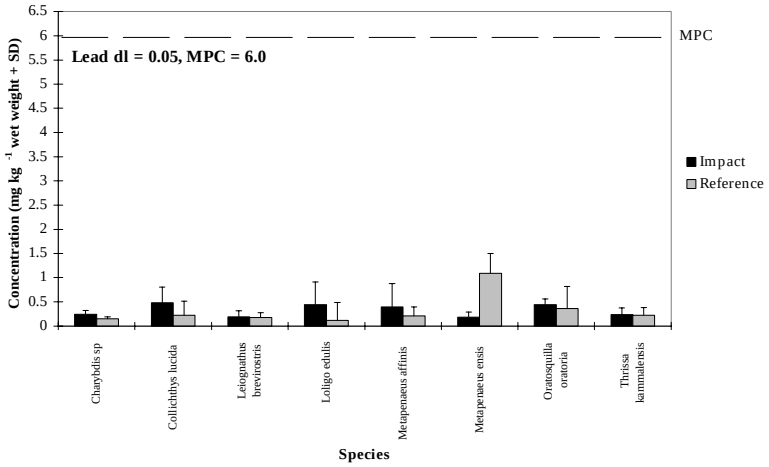
Species: Fish – *Collichthys lucida*, *Leiognathus brevirostris,*
Cynoglossus macrolepidotus and *Thrissa kammalensis*
Crab – *Charybdis cruciata* and *Charybdis* sp.
Cuttlefish – *Loligo edulis*
Shrimp – *Metapenaeus affinis* and *Metapenaeus ensis*
Mantis shrimp – *Oratosquilla anomala* and *Oratosquilla oratoria*

(Source: CED. 2001 as in Figure 2).

(D) Chromium



(E) Lead



(F) Mercury

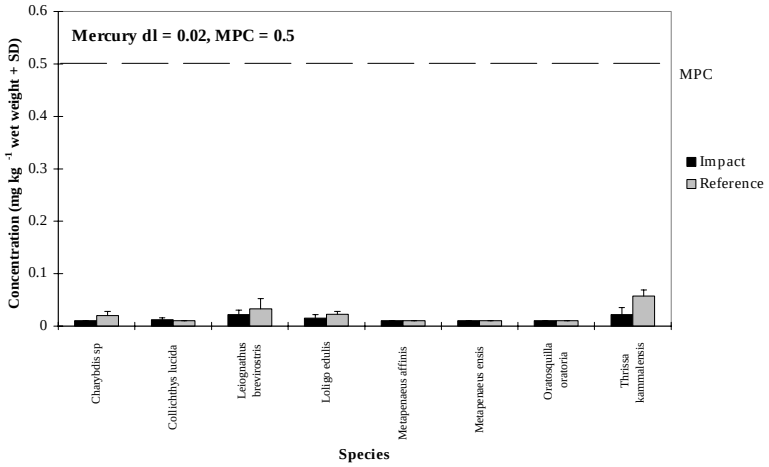


Figure 3. (*continued.*) Concentrations of trace organics and metals detected in Tissue Analysis from trawl stations during August 2000.

Legends: dl = detection limit;
MPC = Maximum Permitted Concentration (Food Adulteration Regulations)

Species: Fish – *Collichthys lucida*, *Leiognathus brevirostris,*
Cynoglossus macrolepidotus and *Thrissa kammalensis*
Crab – *Charybdis cruciata* and *Charybdis* sp.
Cuttlefish – *Loligo edulis*
Shrimp – *Metapenaeus affinis* and *Metapenaeus ensis*
Mantis shrimp – *Oratosquilla anomala* and *Oratosquilla oratoria*

(Source: CED. 2001 as in Figure 2).