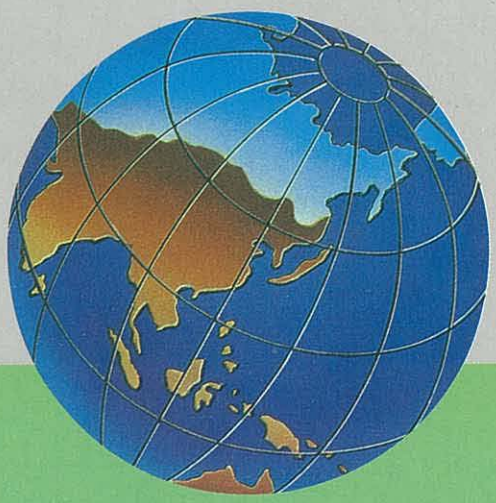
40,000 Ton Lifting Capacity Floating Dock

Yam O, North Lantau

Environmental Impact Assessment Final Report

AXIS Environmental



058/BC

HONGKONG UNITED DOCKYARDS LTD.

40,000 TON LIFTING CAPACITY FLOATING DOCK

YAM O, NORTH LANTAU

ENVIRONMENTAL IMPACT ASSESSMENT FINAL REPORT

APRIL 1995

AXIS Environmental

AXIS Environmental Consultants Ltd.

HONGKONG UNITED DOCKYARDS LTD

FINAL ENVIRONMENTAL ASSESSMENT FOR THE 40,000 TONNE LIFTING CAPACITY FLOATING DOCK, UNITED

April 1995

CONTENTS

List of Figures

List of Tables

List of Appendices

Section 1

SUMMARY

1.0 SUMMARY

Hongkong United Dockyards Ltd (HUD) propose to operate a floating dock, United, in Yam O Wan, North Lantau. Following the removal of a Yiu Lian floating dock, there are four other floating docks moored off Yam O of which one, the Taikoo, is owned and operated by Hongkong United Dockyards Ltd. The area has been identified in previous studies as being suitable for the operation of floating docks.

United has been constructed with the intention of replacing the floating dock, the Tsing Yi, currently moored at the company's land based facility at Tsing Yi. This dock will cease to operate in May and has to be relocated on Tsing Yi Island for dismantling before the onset of the typhoon season to prevent it from becoming a safety hazard.

Following the Initial Assessment Report (IAR)[1] undertaken in December 1994 by AXIS, it was requested by the Hong Kong Environmental Protection Department (EPD) that a more detailed investigation of the potential impacts of the floating dock, "United" be undertaken.

The key issues identified in the IAR and investigated in detail for this report were the release of contaminants, including tributyltins, present in washwaters into the marine environment and the noise impacts on identified sensitive receivers.

Noise impacts are not considered to be significant given the relatively low levels of noise produced by the docks and the large distance separating the docks, including United, from the sensitive receivers.

The release of washwaters into the marine environment from the Taikoo were found to be having an impact on the surrounding area. Washwaters have the potential to carry paint flakes containing TBTs, dissolved TBTs and other contaminants from alternative antifoulant treatments, such as copper. The project is not expected to increase the impact of floating docks as overall, discharges into Hong Kong Waters from floating docks will be reduced, and discharges into Yam O will remain the same given that Yiu Lian are removing one of their docks from the area.

Sediments were found to contain elevated levels of TBTs, zinc and copper. Seawater around the Taikoo also contained elevated levels of TBTs although the source of this was difficult to determine and likely to be a result of the other floating dock operations in the area.

The following recommendations have been made given the findings of this environmental impact assessment:

i. Approval be granted for HUD to commence operations of United at Yam O subject to the removal from service of Tsing Yi in order to prevent any net increase in TBT releases to the marine environment.

ii. As part of their Waste Pollution Control Ordinance license, HUD should formulate and implement an operational procedure, incorporating best practice in minimising contaminant releases, as far as is currently practicable. The procedure should be suitable for audit by EPD.

iii. HUD should initiate an investigation of the partitioning between particulate and dissolved fractions for both TBT and toxic metals.

iv. As a result of this EIA, it is recommended that other floating dock operators also undertake a review of the engineering feasibility of collecting waste water, separating waste water and ballast water, and installing settlement tanks. Practicability, cost, operational and licensing implications should all be considered. This review could then be used to help EPD formulate controls for floating docks in the future if it is considered appropriate.

v. There is a need for further assessment of the ecological impact of elevated TBT concentrations in the area around operating docks in order to determine the necessary reduction in discharges required to protect sensitive receivers. Further appraisal of TBT in Hong Kong waters should also investigate the issue of bioaccumulation of TBTs in fish and higher organisms.

An environmental monitoring and audit programme has been proposed in this report so that the impacts of the dock can be investigated and appropriate controls can be determined for floating docks in the future.

Monitoring of washwaters should be undertaken every time a TBT painted ship is repaired at United and sediments should be sampled on an monthly basis. Sediment and sea water should also be monitored for TBT accumulation together with heavy metal accumulation in the surrounding sediments. It has been recommended that HUD produce an operations manual detailing good housekeeping procedures on the dock. Given this, compliance to the procedures set out in the manual can be audited after an initial 3 month operational period and yearly thereafter. The effectiveness of monitoring and mitigation measures should also be reviewed on a regular basis.

Section 2

INTRODUCTION

2.0 INTRODUCTION

2.1 OVERVIEW

Hongkong United Dockyards Ltd (HUD) propose to operate a floating dock, "United", in Yam O Wan, North Lantau. The area was identified by the Marine Department in 1989 as a suitable location for floating drydocks (docks). This decision was subsequently supported by the Port Development Board and by relevant Government Consultancy Reports, such as the March 1992 North Shore Development Options Report (Lantau Port & Western Harbour Development Studies). Following the recent removal of a dock by Yiu Lian, there are now only four other floating docks moored off Yam O (Figure 2.1), of which one, the "Taikoo", is owned and operated by Hong Kong United Dockyards Ltd. The locations and lifting capacities of these docks are presented in Appendix 1.

United has been constructed with the intention of replacing the floating dock, "Tsing Yi", currently moored at the company's land based facility at Tsing Yi. This dock will cease to operate in May and has to be relocated on Tsing Yi Island for dismantling before the onset of the typhoon season in order to prevent it from becoming a safety hazard.

Following the Initial Assessment Report (IAR)[1] undertaken in December 1994 by AXIS, it has been requested by the Hong Kong Environmental Protection Department (EPD) that a more detailed investigation of the potential impacts of the floating dock, "United" be undertaken.

2.2 PROJECT DESCRIPTION

2.2.1 Location and Description of Dock

The 40,000 ton lifting capacity floating dock, "United", has been built to comply with the Rules and Regulations of Lloyd's Register of Shipping and was constructed and outfitted in accordance with good marine practice using materials, equipment and machinery of approved type and standard.

"United" was constructed in Singapore and arrived in Hong Kong at the beginning of February, 1995. The operational requirement for water depth under the keel of the dock, when the dock is raised, is approximately 14 metres. Following a detailed bathymetric survey, it was indicated that 6 - 8m of marine sediment had to be dredged to provide the required depth. Therefore, between December and the dock's arrival, approximately 208,000 m^3 of seabed mud was dredged to provide the necessary operational depth and for anchoring pockets for the dock.

The principal dimensions of the floating dock are approximately 56m by 290m. The dock will be able to accommodate ships of up to about 150,000 Dead Weight Tonnage (DWT). Details of the new floating dock, including its physical dimensions and proposed mooring arrangements are provided in Appendix 2. The general arrangement of the dock is given in Figure 2.2.

Power will be supplied to the new floating dock via three diesel fueled generators of which one will normally be running on a continuous basis, with a separate emergency generator arranged to start automatically to provide power to essential services in the event of loss of power supply.

The dock will contain its own Sewage Treatment Unit; a Hamworthy Super Trident Model ST20. This unit employs the extended aeration process to produce an effluent quality which consistently meets the following discharge criteria:

- BOD40mg/l;
- Suspended Solids40mg/l; and
- Total Coliforms (MPN)200/100ml.

The figure for total coliforms was obtained from the specifications of the sewage treatment unit, since the total coliform count is predicted to be below the specifications of the technical memorandum, E. coli counts in the discharge will not exceed the limits set out in the Water Pollution Control Ordinance (4000/l). The dock will also be fitted with a comprehensive fire fighting system which will consist of a fixed carbon dioxide system with alarms, portable extinguishers, fire alarms, fire pumps, hydrants and hoses. There will be two strategically located Fire Control stations on the dock and regular fire drills will be undertaken.

2.2.2 Dock Activities

Dock activities, operations, controls and impacts were described in detail in Section 5 of the IAR[1]. The main activities to be carried out on the dock will include:

- Hull repairs;
- Mechanical overhauls and repairs;
- Hull cleaning and painting; and
- Regulatory surveys and inspections.

Processes undertaken on the dock will potentially release emissions to atmosphere and to water and result in the production of solid wastes. Discharges to water will occur through a series of drainage ports along the dock and over both ends of the dock. Due to the design of the dock, the majority of the washwater will drain through the ports rather than over the ends of the dock.

2.3 PROJECT SCOPE

The scope of the final assessment was determined by the findings of the IAR which identified areas of concern, such as discharges to water, noise impacts and emissions to air, which warranted further investigation. The full scope of the phase II study is set out below:

- Monitoring noise emissions from HUD's existing floating dock during a period of ship repair and assessing the noise impact of the new dock on identified sensitive receivers.
- Analysis of marine sediments and seawater around HUD's existing dock at Yam O, Taikoo.

- Review of the relevant literature to investigate the potential impacts of Tributyl tins (TBTs) on the marine environment.
- Review of International Legislation and guidelines relating to the control of comparable activities.
- Review of relevant local environmental legislation so that appropriate licensing and approval can be sought prior to the operation of the new floating dock.
- Assessment of potential impacts and recommendations for future controls

2.4 REPORT STRUCTURE

Section 3 of this report contains a literature review of TBTs in the marine environment, highlighted in the IAR as the area of greatest concern. The review considers uses and sources of TBTs; chemical behaviour of TBTs in the marine environment, their potential environmental impacts and legislative limits which have been implemented in Hong Kong and other countries.

Section 4 addresses the discharges to the marine environment and considers the results obtained from the analysis of sediments for TBTs and metals.

Section 5 addresses noise impacts, a key issue identified in the IAR. Noise monitoring and predicted impacts on identified sensitive receivers are considered.

Section 6 outlines the licenses and approvals which need to be obtained by HUD before the operation of the dock can commence.

Section 7 presents the conclusions, proposals for mitigation of impacts addressed in earlier sections and lists recommendations for the future.

Finally Section 8 presents the recommended environmental monitoring and audit work which should, in the light of this EIA, be undertaken.

Proposed location for "United"

Existing Docks (not to scale)

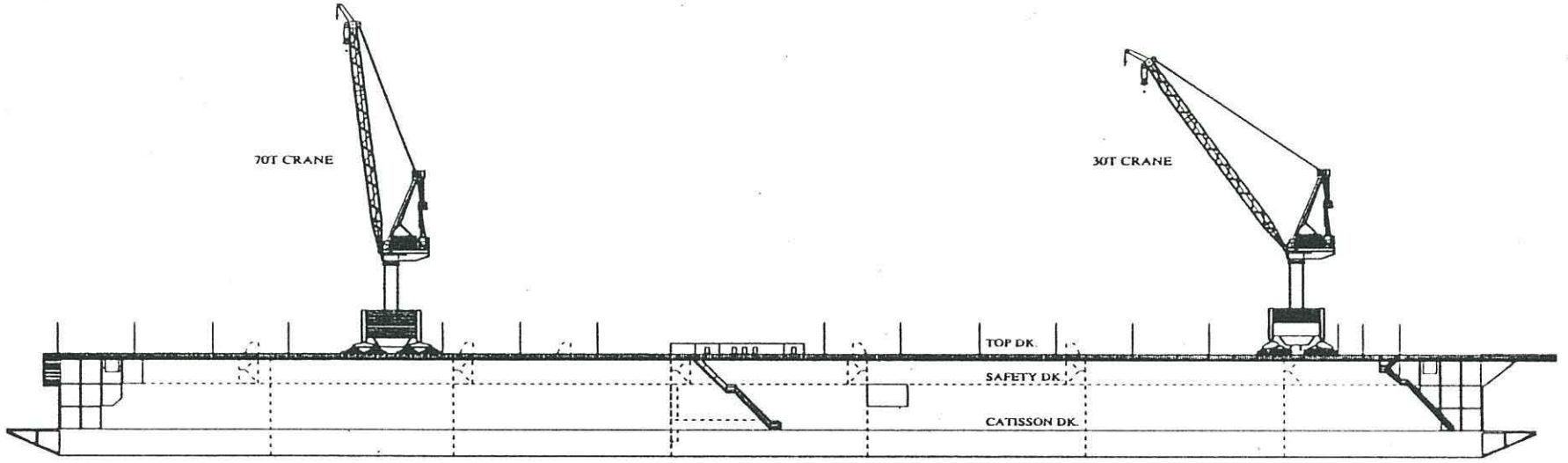
Probable extent of reclamation over next 5 years

AXIS Environmental

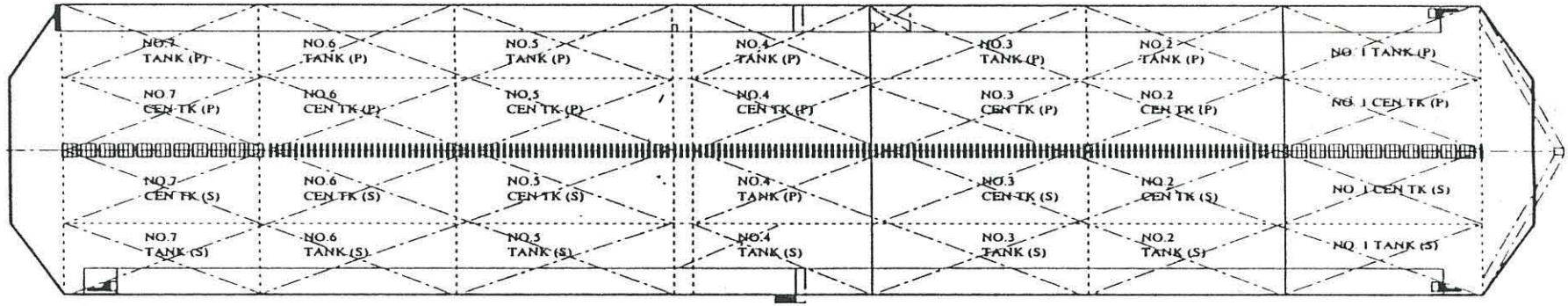
Floating Dock, Yam O

Figure 2.1 Location of United and other Floating Docks in Yam O Wan

Job No 140 001 March 1995



Elevation



CAISSON DK

AXIS Environmental

Floating Dock, Yam O

Figure 2.2: Cross-Sectional and Plan View of New Floating Dock.

Job No 140 001 March 1995

Section 3

CHEMISTRY AND IMPACT OF TBTs

3.0 CHEMISTRY AND IMPACT OF TRIBUTYL TINS

3.1 INTRODUCTION

A literature review of research into the chemistry and environmental impact of TBTs was undertaken. Also, legislative limits and operational constraints which have been enforced in other parts of the world were investigated. Previous investigations into TBT contamination in other parts of Hong Kong were also reviewed. This study was undertaken to provide a thorough understanding of TBTs on which a prediction of the impact of TBTs released from United could be based.

TBT containing paints were developed in the mid 1960s for use as an antifoulant or biocide on ships. These paints provide effective long term protection to ships' surfaces from marine growth, such as barnacles algae, tubeworms, hydroids and sponges, and are therefore favoured by ship owners due to the savings that can be achieved through their use. Marine growth can reduce the speed of ships in the water, therefore, the use of an effective biocide such as TBTs can result in annual savings in fossil fuels by reducing the frictional effects of biofouling by up to fifteen percent.[2] TBT treated ships require less maintenance since TBTs do not promote corrosion unlike other antifoulants.[3] Due to the effectiveness of TBTs the paint only requires replacing every five - seven years unlike conventional copper oxide antifoulants which last only two years.[2]

3.2 SOURCES OF TBTS IN THE MARINE ENVIRONMENT

TBT containing paints have been widely used on commercial and pleasure boats over the last three decades, and as a result have caused significant levels of this man-made compound to accumulate in the marine environment. In many parts of the world it has been found that concentrations of TBTs have become high in sea water, particularly in sheltered marinas and harbours where boat use is intensive. Adverse environmental impacts have occurred where TBTs levels are elevated; in particular, population declines and deformities in non-target organisms[2,3,4,5] and these are discussed in more detail below.

TBTs can enter the marine environment from several sources, those relevant to this project are briefly outlined below:

- Cleaning of ships hulls using high pressure water wash down can remove as much as 60mg TBT cm^{-2} of hull surface[6]. Research into typical loads of TBTs entering the marine environment from washing down before repainting, found loads to be greatest from yachts rather than ships, possibly due to the formulations used on yachts being softer than those employed on larger vessels.

  The TBT concentration in waste water from the dry dock was about 40 mg/l [6] for "free association" paints and an order of magnitude higher for copolymer paints (depending on the age of the paint layer as free association paints release most of their TBTs more rapidly than copolymer paints).

- Sand or grit (utility slag or copper slag) blasting are common methods of surface preparation in commercial yards because of their removal speed and costs. When employed, the spent abrasive, including old paint, is collected by

manual means and disposed of as a controlled waste. Particle sizes of the used grit range from fine dust to approximately one-eighth inch in diameter.

Some of this grit can also fall directly into drainage gutters and, together with material that is not swept up and disposed of, may be washed into the dock's drainage system by storm water or shipboard waste water and therefore be present in the dry dock discharge. The potential also exists for the fine particles of abrasive to be blown away.

The requirement for abrasive blasting can be avoided through the use of self polishing paints which can be applied directly to the hull following water cleaning. As these paints do not require the underlying layers of antifoulants paint to be removed, the overall loss of TBT to the environment can be reduced. Typical levels, quoted in the literature as being released in hull run off, are about 1 mg/l. [6]

- Painting takes place in commercial yards after water cleaning and/or blasting. The paint is sprayed onto the ship's surface and therefore has the potential to drift into surface water. According to the literature, paint drift occurs to a greater extent in floating docks than in slipways and drydocks, and when applied airless in open air, the emission of paint by drift is 2 - 20%.[6] The literature quotes a typical level of TBTs in the hull runoff during this process of about 10 µg/l [6]. Several factors help to reduce emissions of TBTs from paint application:

  1. the sophisticated painting equipment encourages skill specialisation and training in the safe and efficient use of equipment, minimising paint losses to the environment;
  2. restricting the use of TBT paints to commercial ship yards only; and
  3. the high cost of the paint which discourages waste[6].

- Waste material present on the floor of the dock can enter the aquatic environment. Paint scrapings, blasting grit, paint splashes and paint left in containers, on brushes and rags are all potential sources of TBTs to the aquatic environment.

Appendix 3 details the results from recent studies undertaken to quantify inputs of TBTs to the aquatic environment from wash down and paint application.

3.3 THE CHEMISTRY OF TBTS

Organotins, of which TBT is the most toxic compound, are formed by the attachment of alkyl or aryl groups to the tin atom by a covalent bond. There is no evidence that TBT is a naturally produced compound in any measurable quantity and the presence of TBTs in marine sediments and waters is almost entirely attributable to the use of antifoulant paints. Antifoulant paints contain the tributyl tin oxide (TBTO) form of TBT.

When antifoulant paints containing TBTs were first devised, the TBTs were physically dispersed in a hard insoluble matrix, often referred to as "free association" paints. As the TBTs leach out of these paints, pores are left behind through which the seawater can percolate encouraging further dissolution and release of the biocide. Eventually

the pores become clogged with insoluble compounds such as calcium carbonate inhibiting the effects of the biocide. All conventional TBT paints containing free associated TBTs release the TBTs exponentially, beginning with a high release rate and are effective for an average of three - five years.[7]

Release of TBTs from paints can be reduced through the use of paints where the TBT is bound into a copolymer "backbone" as opposed to using the original "free association" TBT paints. Self Polishing Copolymer (SPC) paints are widely used in preference to free association paints as they do not have to be removed from the hull of a ship before repainting. All ships repaired and cleaned by HUD requiring TBT paints use SPC paints which are effective for up to seven years.[2] HUD only grit blasts TBT paints from the hull of a ship when rusty areas of the hull need painting or when paints other than SPCs have been used previously.

The action of the seawater on the copolymer paint film causes hydrolysis of the organotin linkage. These freely associated groups then help to erode the paint and expose a fresh surface of the TBT containing paint. Since the TBT release rate is governed by the hydrolysis of the TBT group, the release of TBTs can be more effectively controlled than in free association paints, where release is governed by the rate of diffusion. Leach rates into the marine environment from copolymer paints fall between 6 - 11 $\mu g/cm^2$ /day.[4]

At equilibrium, TBTs dissolved in seawater form a mixture of compounds; tributyl tin chloride, tributyl tin carbonates, tributyltin hydroxide and the aqua complex ($TBTOH_2^+$). The relative contribution of these species depend on the total salt content of the water, the dissolved carbon dioxide and the hydrogen ion concentration. The distribution of these compounds also partly determines the bioaccumulation of TBTs by marine organisms.[3] The lipophilic nature of TBTs allows them to accumulate in the tissues of marine organisms.[8]

The persistence of TBTs in the marine environment is poorly known but the literature quotes a half life of between one and three years, however this can be significantly longer when the TBTs are bound with anaerobic sediments. Degradation of TBTO involves the splitting of the carbon-tin bond. It is thought that photolysis (breakdown by sunlight) may be an important mode of abiotic degradation of the TBT to dibutyl and monobutyl tin ions which are considered to be relatively harmless compared to TBT itself.[3]

Once in the marine environment the TBT compound may be adsorbed onto particulates and removed from the aqueous environment through sedimentation. Between 10% and 95% of TBTO introduced into the water is estimated to undergo particulate adsorption.[8] Sediment analysis often reveals a non-uniform distribution of TBTs due to the quick association of the TBT compounds with the sediment. In this form in the sediment the TBT remains readily available to marine organisms, especially those in the benthos. Progressive disappearance of adsorbed TBT from the sediment is largely due to biotic and/or abiotic degradation and not due to desorption into the seawater. Micro-organisms, for example, can limit the persistence of TBTs (through biodegradation into monobutyl tins) to 162 and 815 days for aerobic and anaerobic sediments respectively.[2] TBTs which enter the marine environment as part of a paint chip have been quoted as being not readily available to organisms and therefore would be less likely to have an impact on the benthos.[2]

3.4 IMPACTS OF TBTS ON THE MARINE ENVIRONMENT

TBT has become a problem in the marine environment due to its impact on non-target organisms. Research has shown that many marine organisms are killed by continuous exposure to levels in waters containing less than one part per billion of the substance. TBTs have been implicated in fish kills, lobster mortalities and the disappearance of many indigenous organisms from the harbours of the world.[2]

Early research into the toxicity of TBTs tended to concentrate on the effect of short term exposures of high concentrations of TBTs on organisms. These studies are not particularly environmentally relevant as they did not consider the role of bioaccumulation and metabolism when determining the toxic effects of TBTs. Bioaccumulation occurs where TBTs taken from the environment are concentrated into the tissues of non-target organisms by factors from 1,000 to over 10,000. This is a result of TBT"s high solubility in fat. For example, in the Pacific oyster (*Crassostrea gigas*) TBT tissue concentrations have been found to be in the region of up to 30,000 times higher than the environmental concentration of TBTs. Molluscs tend to have high bioaccumulation rates since they process relatively large amounts of water when feeding. There is, however, no indication that TBT is transferred to terrestrial organisms via the food chains.

More recently, in many countries of the world, particularly in the northern hemisphere where there has been more extensive use of TBTs, correlations between exposure to TBTs from antifouling paints and population decreases in commercial fisheries have been identified. Two examples are given below:

- Poor tidal flushing in the French Bay, Baie d'Arcachon, which had had a flourishing oyster industry in the early 1970s, allowed TBTs released from antifoulant paints on pleasure crafts to accumulate. Malformation and thickening of oyster shells, the reduction or absence of spat fall (the development of young bivalves through larval settlement) and the death of 50% of healthy oysters transplanted into the area resulted from the accumulation of TBTs.[3]
- Between 1982 and 1984, the UK Ministry of Agriculture, Fisheries and Foods (MAFF) undertook extensive laboratory and field trials which confirmed that some UK estuaries contained sufficient organotin compounds, up to 2,200 ng TBT/l, to cause reduced meat yields and shell thickening in the Pacific oyster and the economically important European flat oyster, *Ostrea edulis*. The disruption of growth was found to occur at 250 ng TBT/l in *O. edulis* and 160 ng TBT/l in *C. gigas*, or an average of 200 ng/ TBT/l.[9]

The effect of TBTs on marine organisms has been studied in order that a safe limit for TBTs can be found. Fish, bivalves, gastropods and crustaceans exposed to low concentrations of organotins, can show many symptoms before death occurs. Accumulation of relatively low background concentrations of TBTs in tissues can result in a loss of appetite, organ and tissue changes, reduction in reproductive capacity, decreased growth, poor co-ordination, loss of mobility, changes in enzymatic pathways, shell deformations and inhibition of development of newly laid eggs.[7] Overseas studies, laboratory testing and field experiments have established TBT to be toxic at the following low, sublethal levels to:

- Fish at 200 ng TBT/l;

- Bivalves at 50 ng TBT/l;
- Gastropods at 20 ng TBT/l; and
- Crustaceans at 250 ng TBT/l.

It is also of note that in North America, on the basis of preliminary observations it was found that where TBT levels are greater than 100 ng TBT/l in marinas, the native organisms had disappeared.[3]

A safe level for TBTs in marine waters has been difficult to determine due to the different responses of organisms to TBT in terms of bioaccumulation and effect. The most sensitive marine organism to TBTs (so far identified) is the mysid shrimp whose larvae are disturbed by acute exposures of 0.5 µg/l in seawater. Chronic toxicities have not yet been determined in the shrimp but a safe level for TBTs is estimated to be *at least* a factor of ten below the acute toxicity level, that is, 0.05 µg/l.[2]

The impact of TBTs in the sediment has not been widely investigated, therefore the determination of a safe level for TBT in marine sediments poses further problems. One study attempted to investigate the impact on benthic dwelling organisms. Abraded paint was used to produce the material most likely to normally contaminate sediments. Sediment samples containing 0.1, 1, 10 and 100 mg TBT/kg were prepared and placed in excavated trenches. Recolonisation could then take place through the settlement of organisms from above and through lateral transfer of organisms from adjoining mud. Surface sediment was found to decontaminate rapidly as a result of water movement and deposition of new sediment whereas the subsurface TBT levels remained reasonably stable. Burrowing activity of the polychaete worms, *Arenicola marina* was reduced at all concentrations of TBT, although the effect of 0.1mg TBT/kg disappeared over the first three months. A dose related effect in populations of the burrowing polychaete *Scoloplos armiger* and the burrowing amphipod *Urothoe poseidonis* was observed over the concentration range. Generally it was noted that surface dwelling organisms, such as the cockle, which filter feed from the overlying sea water rather than feeding on particles in the sediment, were less effected than species dwelling in the bottom layers, such as *U. poseidonis*.[8]

3.5 LEGISLATIVE CONTROLS ON TBTS

3.5.1 General Legislation to Control TBTs

The potential disruption of valuable fisheries and communities of organisms in coastal areas has led to the development of some regulation controlling the use of TBT in antifouling paint. Several strategies have been employed throughout the world to reduce TBTs in water. These include the regulation of paint composition and prohibiting their use on small boats, which tend to congregate in enclosed waters such as marinas. Some countries of the world, such as Germany and Switzerland, have prohibited the use of any organotin compounds in antifouling paints[7].

In the UK and France, TBTs were regulated in the aftermath of the events described in section 3.4 above. In 1982, as a result of the findings at Arcachon Bay, the French Government banned the use of TBT-containing paints on all pleasure craft less than 25m in length. This measure has since been widely adopted and also applies in Hong Kong.

In the UK, the average TBT concentration found by MAFF to cause the disruption of growth in oysters, was used to set target limits for marine water quality. A safety factor of 10, which takes into account the extrapolation of these acute data to the chronic situation, reduces the value to 20 ng/l. This concentration was adopted by the UK as a target value for marine waters in 1985 with an improved target of 2 ng/l for 1989[3]; this level has since been adopted by Canada and Australia.[7]

TBT copolymer paints with more than 7.5% TBT, and other paints with copper or other antifouling agents with more than 2.5% TBT have been banned since 1986 in the UK on all vessels under 25m (which has effectively prohibited the use of free-association paints). In May 1987 in the UK, under the Control of Pollution (Antifouling Paints and Treatments) Regulations 1987, the retail and supply for retail sale of antifouling paints containing a triorganotin compound was prohibited for ships smaller than 25m. Under the UK's Food and Environment Protection Act 1985, all surface treatments and antifouling paints applied to yachts and larger vessels are subject to the pesticide approval scheme. A similar situation has been introduced to Hong Kong whereby all users of TBTs are registered by the Agriculture and Fisheries Department (AFD) under the Pesticides Ordinance, Cap 133.

In Australia, particularly in New South Wales, six different pieces of legislation provide the framework for control needed to regulate the use of organotins. Most relevant to this study is the Clean Waters Act, 1970. This Act is designed to control water pollution and requires any person wishing to discharge waste to obtain a license. Through this legislation washdowns from slipways can be controlled as the discharge may contain organotins in the form of soluble paint residues, paint chips and dust resulting from shipyard equipment and procedures. Complementary controls are, however, required to cover disposal and collection of wastes on slipways.

Chemical Control Orders (CCO), gazetted under the Environmentally Hazardous Chemicals Act, 1989 in New South Wales are currently being revised with respect to controlling TBT wastes. The *likely* concentrations which will define wastes that will be subject to the new CCO are:

- Solid Wastes containing over 0.004 mg/kg.
- Liquid wastes containing over a yet to be determined value, probably in the range of 2-50 ng/l.

However it is unlikely that this CCO can be applied for large ship cleaning since it would not be practical to collect such large volumes of water for treatment prior to discharge (up to 500 tonnes of water). The Hong Kong Water Pollution Control Ordinance (WPCO), Cap.358, is similar to this in that a license is required to discharge into the Water Control Zones (WCZ) of Hong Kong. The WPCO does not currently set limits for TBTs in the effluents or receiving waters but it does prohibit the release of all toxic substances into the WCZ, which effectively bans the release of TBTs .

3.5.2 TBT Legislation with Regard to Floating Docks and Commercial Shipyards

Floating Docks are found in other areas of the world. In Australia for example a floating dock is moored off Newcastle, New South Wales and the Royal Australian Navy operates a floating dock in Sydney. NSW EPA have attempted to get floating docks to comply with pollution control requirements since 1993. The achievements to date have been a result of general housekeeping, control of atmospheric emissions and

solid waste disposal. Little has been achieved regarding the control of waste water. Controls are applied to a certain extent to minimize paint flakes and particulates entering the marine environment through the use of sandbags to filter particulates and impede discharge allowing particulates to settle out and then be collected. One of the dock's licenses contains a requirement to investigate the TBT contamination in waters and sediments, monitor TBT in washwater discharged during hull blasting as well as numerous conditions relating to housekeeping.

It should be noted that none of the floating docks investigated were found to be located off shore and cases are considered on a site specific basis. All requirements for discharge control have been given a phasing in period to enable feasible solutions, both economically and practically to be found and implemented.

In the UK, the Royal Yachting Association in conjunction with the UK DoE and other bodies in the UK have produced a leaflet[10] referring to the safe disposal of TBT paint removed from ships and boats in an attempt to reduce TBT pollution from old paint. However, this booklet does not consider floating docks.

In the European Union (EU) a draft Directive, "Biocidal Products Directive", COM (93) 351, is currently under review which could completely ban the application of TBT paints in the EU from 1997. This is currently arousing great concern amongst dock operators in Europe as the possible ban on application of TBT paints will in all likelihood merely result in ship operators going elsewhere to dry dock.

3.6 EPD'S STUDY OF TBT CONTAMINATION IN HONG KONG SEDIMENTS

EPD commissioned a study of the extent of TBT contamination in the sediments of Hong Kong's shipyards and marinas[11]. Sediment samples were taken from shipyards along a transect to demonstrate the concentration variation with distance, and randomly from the sediments of marinas. Hypotheses were formulated and tested for statistical validity.

The results indicated that sediments in the shipyards and marinas of Hong Kong were highly contaminated with TBTs. The average concentration of TBTs found in the sediments are given in Table 3.1. Analysis of subsamples produced greatly differing results indicating that TBT pollution is very localized depending on the presence of a paint chip or a particulate which has associated with a TBT ion. The highest concentration measured was 137,800 ng TBT/g dry weight which was found at Causeway Bay Marina and Typhoon Shelter.

Having statistically tested the hypotheses formulated at the outset of the study the following was found:

- *Levels of sediment associated TBT are significantly elevated in the vicinity of the local marina.* Found to be valid from the results.
- *Levels of sediment toxicity are significantly elevated in the vicinity of the local marina.* Not valid from the data set obtained.
- *Levels of sediment associated TBT are significantly elevated in the vicinity of shipyards.* Valid for all shipyards except for one site at Tsing Yi North where dock operations only commenced recently.

- *Levels of sediment toxicity are significantly elevated in the vicinity of shipyards.* This was valid for Tai Po and one of the sites studied at Tsing Yi South and Tsing Yi North.
- *The TBT concentration at 50m distance from the shipyard is elevated above the background concentration.* This was only valid at Tai Po and one site at Tsing Yi South.
- *There is a significant correlation between the levels of TBT contamination and toxicity of the sediments.* Found to be valid.
- *TBT levels in sediment near shipyards were significantly different from that near marinas.* Not valid.
- *Shipyards that mostly handle larger(>25m) boats show significantly higher TBT level than shipyards that mostly handle smaller (<25m) boats.* Not valid.

Overall it was concluded that high TBT concentrations were found in the sediments taken from the shipyards and marinas of Hong Kong. Shipyards were found to be as contaminated as marinas and so it was not possible to demonstrate which was the more significant source of TBTs - paint removal operations or leaching into the seawater. Despite a ban on the use of paints containing TBTs on boats under 25m in Hong Kong, shipyards that handle boats over 25m did not have significantly greater concentrations of TBTs in sediments than those mostly handling boats under 25m. A correlation was found between TBT concentrations in the sediment and the toxicity of the sediment to micro-organisms, although the sediment toxicity results for marinas are conflicting. Finally, it was found that sediments taken from new shipyards had significantly lower TBT concentrations than those from older sites.

3.6.1 Comparison of TBT Levels in Hong Kong Sediments to those found in Other Countries.

The results can be compared to sediment concentrations found in other areas of the world. A review of the literature has revealed that maximum levels found elsewhere are less than or equivalent to average levels found in EPD's study. In New Zealand the highest values were found to be 240 and 150 ng TBT-Sn /g in the Tamaki estuary; 240 ng TBT-Sn /g in Toronto Harbour and as much as 10,800ng TBT-Sn/g in Vancouver Harbour; 12 - 44 ng TBT-Sn/g in New Hampshire and 41 ng TBT-Sn/g in Osaka, Japan.[12] Most of the average values found in Hong Kong sediments were similar but levels found at Aberdeen Boat Club, Aberdeen Shipyards and Tsing Yi North were an order of magnitude above these values. TBT concentrations found at Causeway Bay Marina were two orders of magnitude above maximum levels found in other parts of the world.

The impact of TBTs in sediments has not been widely studied and as a result the fate and its bioavailability to marine organisms is not fully understood. One study did however find levels above 100 ng TBT/g to be harmful to polychaete worms which feed on fine particles in the sediment. The effect of TBTs on the populations of other burrowing organisms was found to be proportional to TBT concentration.[8] Contaminated sediments are also thought to cause an impact if remobilised by storms, currents and dredging of marinas, mooring areas and shipping channels.

Table 3.1 Mean TBT Concentrations Found in Sediments Around Hong Kong

SITE	MEAN TBT CONCENTRATION (ng Sn/g)	MEAN TBT CONCENTRATION (ng TBT/g)
Causeway Bay Marina	11,618.0	30,206.8
Marina Cove	507.0	1,318.2
Hebe Haven marina	598.0	1,554.8
Aberdeen Boat Club	3,468.0	9,016.8
Gold Coast Marina	6.0	15.6
Pak Sha Wan Shipyards	747.0	1,942.2
Sai Kung	349.0	907.4
Tsing Yi North 1	35.0	91
Tsing Yi North 2	1,970.0	20,722
Tsing Yi South 1	319.0	829.4
Tsing Yi South 2	372.0	967.2
Tai Po	190.0	494
Aberdeen South	1,153.0	2,997.8
Aberdeen 2 Typhoon Shelter	181.0	470.6
Control	17.2	44.7

3.7 SUMMARY

The literature review has clearly indicated the extent of the problem that has arisen through the use of TBTs in marine paints. TBT is the most effective antifouling agent found to date and as a result can save ship owners money on maintenance costs, increase ship speed and reduce fuel costs. As a result it has been widely used over the last three decades.

Non target marine organisms have been found to be effected by very low concentrations of TBTs in sea water. The most sensitive marine organism to TBTs so far recorded is the mysid shrimp whose larvae are disturbed by acute exposures of 0.5 µg/l TBT in seawater. Chronic toxicities have not yet been determined in the shrimp but a safe level for TBTs is estimated to be at least a factor of ten below the acute toxicity level, that is, 0.05 µg/l.

Marine sediments act as a sink for TBTs and levels in sediments greatly exceed concentrations found in overlying waters. Accumulation in sediments occurs through adsorption of dissolved TBTs to particulates and through the settlement of paint chips.

The availability of TBTs in sediments is not clearly understood and is site specific depending on, amongst other things, organisms present and their sensitivity. One study has however demonstrated sediment levels of 100ng TBT/g to cause a reduction in populations of mud dwelling organisms.

Legislation now exists to limit the use of TBTs and guideline values have been adopted in certain areas for marine waters. These values range between 5 - 20 ng/l. World wide the release of TBTs from floating docks has not been addressed in terms of legislation and the setting of achievable goals. Hong Kong legislation currently prohibits the release of TBTs into Water Control Zones although this has not yet been enforced on floating docks and would not be practical to do so.

Sediment concentrations of TBTs around marinas and shipyards in Hong Kong are elevated when compared to background levels and concentrations found in the harbours of other countries. Levels found in marinas were not found to be declining when compared to EPDs last study in 1989, as is the case elsewhere in the world, despite the ban on the use of TBTs on pleasure boats.

Section 4

DISCHARGES TO THE MARINE ENVIRONMENT

4.0 DISCHARGES TO THE MARINE ENVIRONMENT

4.1 INTRODUCTION

Associated with the operations of a floating dock there will be a number of discharges to the marine environment. In general the discharges can arise from the following activities:-

- ballast water during the raising of the floating dock;
- hull washdown water during high pressure cleaning;
- painting and degreasing;
- sewage and grey water;
- oil spills; and
- stormwater run-off

The majority of the above have been discussed in detail in the study IAR[1]. Thinners and degreasing agents used during maintenance and repair of ships on the dock will generally only be used within the engine room of a ship. Spills, should they occur, can therefore be contained within the ship and subsequently cleaned up. Oil spills can be dealt with using special equipment kept on the dock and on HUD's work boat, used for the transportation of oily wastes. Thinners and solvent use on the dock is minimal. Chemicals are not stored on the dock and small quantities are transporteed from the Tsing Yi site to the dock only when they are required. Any spilage will be cleaned up prior to wash down of the dock to prevent release into the marine environment. General housekeeping already employed on HUDs floating Docks will minimise the risk of contamination from solvents and thinners and oily wastes.

The IAR identified the discharge of TBT compounds, heavy metals and sewage as a key issue which required further study. The following sections discuss the key discharges, assesses their relative importance and identifies mitigation measures for the reduction of any unacceptable impacts.

4.1.1 Sediment and Water Sampling

To establish the degree of TBT and metal contamination a number of sediment and water samples were taken from around the "Taikoo". The sampling pattern was designed so that the results would indicate the extent of the contamination attributable to the dock and the contamination that was more likely to be historical or a result of other more recent activities. A cruciform sampling pattern, see Figure 4.1, was followed and samples taken at 5, 10, 25, 50, 100 and 250 metres along 'Taikoo's" major axis and at 5, 10, 25, 50 and 100 metres along the minor axis. Water samples were also taken at a distance of 50m from the "Taikoo" at two levels; 1m below the surface and 1m above the sea bed, this would allow for any stratification in the water column.

Sediment Sampling and Handling Procedure

The sampling was undertaken on 27th January 1995, the "Taikoo" was not repairing a ship at the time of the sampling. Sediment samples were taken using a 0.05m^2 Van Veen sediment grab from each of the sampling points. The surficial sediment was slowly raised onto the deck to minimize sediment disturbance and emptied into a clean plastic bucket.

Two samples of approximately 250ml were taken from the sediment and placed into clean polycarbonate bottles. The grab and bucket were then thoroughly washed out to avoid any cross contamination between the samples. Upon retrieval, the samples were chilled to below 4°C until delivery to the laboratory for analysis.

Two water samples were taken at four sampling sites, 50m from the floating dock. The samples were taken at two levels, 1m below surface and 1m above seabed. The sample was emptied into clean 1 litre glass jars which were then chilled.

All of the samples were transported to accredited laboratories in Australia for the relevant analysis, heavy metals analysis was carried out by Australian Laboratory Services Ltd., and the TBT analysis by a specialised laboratory, CSIRO. The analytical methodology followed by the laboratory is attached as Appendix 4.

4.2 TBT COMPOUNDS

4.2.1 Introduction

As identified in Section 3.2, a floating dock will produce a number of discharges which have the potential for allowing the release of TBTs and the subsequent contamination of marine sediments and waters.

4.2.2 Results

The results of the TBT analysis of the sediments are given below in Table 4.1, Figure 4.2 provides a graphical illustration of the TBT levels around "Taikoo". As can be seen the results are spread over a wide range with concentrations of TBT ranging from 16 to 12,760 ng/g dry weight. The mean TBT concentration is 1,516 ng/g, while the median value is 546 ng/g.

Table 4.1 Levels of TBT and its Breakdown Products in Sediments Around "Taikoo"

Sample Location.	Monobutyltin	Dibutyltin	Tributyltin		Moisture
	ng Sn/g	ng Sn/g	ng Sn/g	ng TBT/g	%
1	24	50	180	468	56
2	14	19	390	1,014	58
3	25	41	230	598	51
4	75	200	440	1,144	61
5	16	9	68	177	37
6	18	15	200	520	58
7	22	22	170	442	61
8	23	14	140	364	56
9	15	16	130	338	56
10	65	70	1,700	442	62
11	140	250	4,900	12,760	61
12	35	27	850	2,210	61
13	40	26	450	1,170	62
14	17	19	62	161	59
15	22	22	220	572	61
16	58	225	280	728	62
17	10	3	6	16	59
18	23	6	81	211	46

Although the results are spread over a wide range it is possible to see a pattern of TBT contamination around the dock, the highest levels of TBTs were found in the vicinity of the "Taikoo" with the concentrations decreasing with increasing distance from the dock. The main axis of the dock is aligned in the same direction as the tidal currents in the area; higher levels were found along the main axis of the "Taikoo" indicating that the deposition and/or adsorption of TBTs onto the seabed is influenced by the tidal currents along which the dock is aligned, with the ebb flow being stronger than the flood.

The results of the TBT analysis of the water samples are given below in Table 4.2 and Figures 4.3 and 4.4 provide a graphical illustration of the soluble TBT levels around "Taikoo". It should be noted that at the time of sampling no ships were being overhauled/serviced by the "Taikoo".

Table 4.2 Levels of TBT and its Degradation Products in Sea Water Around "Taikoo"

Sample Location.	Monobutyltin	Dibutyltin	Tributyltin	
	ng Sn/l	ng Sn/l	ng Sn/l	ng TBT/l
3 S	68	100	31.0	80.6
3 B	68	88	180.0	468.0
8 S	65	61	56.0	145.6
8 B	64	109	24.0	62.4
12 S	110	94	160.0	416.0
12 B	72	71	23.0	59.8
17 S	53	61	23.0	59.8
17 B	38	29	22.0	57.2

Notes: *S* = *Surface*
B = *Bottom waters*

Of the bottom water samples a maximum value of 468 ng TBT/l was found, for the upper water (1m below surface) a value of 416 ng TBT/l was recorded. As with the sediment samples the values of TBT varied over a wide range, however, unlike the results of the sediments, no discernible pattern to the TBT levels can be formed. The levels of monobutyl and dibutyl tins are relatively high and are generally in concentrations greater than the tin in the tributyl form. The presence of these TBT degradation products in such large quantities indicates that there are effective degradation processes in this area [2].

- The TBTs found in the water column samples are probably a result of the activities of the other floating docks operating along the North Lantau coast. It is possible to make this assumption given the following factors:TBT has a high affinity for adsorption onto particulates, and given the generally high levels of suspended particulates in the waters of North Lantau, the time the TBT would be expected to stay in solution is generally very short; and that

- at the time of the sampling, the "Taikoo" was not repairing a ship and therefore there were no discharges of contaminated effluent.

4.3 METAL CONTAMINATION OF SEDIMENTS

The samples taken from the "Taikoo" were analyzed for a range of trace metals which are known to be harmful when present in elevated concentrations. The results of the analysis are set out in Table 4.3. below.

Table 4.3 Results of Marine Sediment Analysis for Heavy Metals

Sample	Element and Analytical Method							
	Moisture EA-055	As EG-005T	Cd EG-005T	Cr EG-005T	Cu EG-005T	Ni EG-005T	Pb EG-005T	Zn EG-005T
1	57.5	14	<2	32	58	15	48	151
2	55.4	16	<2	40	36	21	59	111
3	51.0	10	<2	27	32	12	39	72
4	77.0	22	<3	59	57	28	72	143
5	39.4	9	<1	20	11	11	26	48
6	58.7	16	<2	34	44	17	45	92
7	63.0	16	<2	35	39	16	50	91
8	57.4	15	<2	32	23	16	49	77
9	53.6	9	<2	40	32	19	59	97
10	64.0	13	<2	38	104	18	44	121
11	62.9	19	<2	39	98	16	51	121
12	62.4	12	<2	37	39	17	52	90
13	62.7	9	<2	34	42	15	48	92
14	59.1	9	<2	28	39	13	56	86
15	62.2	12	<2	30	53	15	41	97
16	62.2	16	<2	30	37	13	46	89
17	60.5	6	<2	30	33	13	52	82
18	48.4	12	<1	22	18	11	47	66

Note: *All metal values are mg/kg dry weight, moisture is % dry weight*

Class B contaminated sediment

Class C contaminated sediment

In Hong Kong the categorization of sediments for marine disposal is based on a three tier scale:

- A - Uncontaminated Sediment,
- B - Moderately Contaminated Sediment; and
- C - Seriously Contaminated Sediment,

The classification criteria for the contamination of sediments is given below in Table 4.4.

Table 4.4 Sediment Contamination Classification Criteria

Class	Metal						
	Cd	Cr	Cu	Hg	Ni	Pb	Zn
A	0.0 - 0.9	0 - 49	0 - 54	0.0 - 0.7	0 - 34	0 - 64	0 - 140
B	1.0 - 1.4	50 - 79	55 - 64	0.8 - 0.9	35 - 39	65 - 74	150 - 190
C	1.5 or more	80 or more	65 or more	1.0 or more	40 or more	75 or more	190 or more

Note: *The test results should be rounded off to two significant figures before comparing with the table, e.g. Cd to the nearest 0.1mg/kg, Cr to the nearest 1mg/kg and Zn to the nearest 10mg/kg, etc.*
Source: *EPD, TC No. 1-1-92*

Of the 18 samples, the majority of results show no contamination and the sediment would be classed as Class A, a clean sediment. However, at five of the sample stations (Stations 1, 4, 10, 11 & 15) the results showed elevated levels of metals, in particular copper. In these five samples, the levels of copper were above Class B contamination levels with two of these samples falling into Class C, stations 10 and 11. Station 1 showed Class B Zinc and Copper contamination. At Station 4 the levels of Chromium, Copper and Lead were within the Class B contamination group. Station 15 showed Class B contamination with Copper.

4.4 SEWAGE DISCHARGES

The dock is expected to employ a maximum of 200 workers. All sewage produced on the dock, unlike on other floating docks, will be treated in the dock's own sewage treatment plant. Sewage discharges from "United" are not expected to cause a problem in terms of water quality. The unit employs an extended aeration treatment process and on-line chlorination which will ensure that effluent meets the required standards under the WPCO. Monitoring of effluent quality will be a requirement of the license to discharge under the WPCO.

4.5 ASSESSMENT

There are a number of sources of data which the results of the recent monitoring can be compared with, these include:

- results of the analysis carried out for the assessment of sediment quality of the dredged material during the formation of the mooring for "Taikoo" at Yam O, HUD, 1992;
- results of the analysis carried out for the dredging of the mooring area for "United", HUD 1995;
- the EPD survey of Tributyl Tin contamination in Coastal Waters of Hong Kong; EPD 1995; and the
- results of EPD's regular sediment quality monitoring, EPD 1992.

4.5.1 Assessment of Sediment Quality for Disposal of Dredged material from the "Taikoo" Mooring Site, 1992

Before the 'Taikoo" could be relocated to north Lantau the seabed had to be dredged to provide sufficient water depth to hold the dock. Before dredging commenced, 38 sediment samples were taken from around the proposed dock site and submitted for analysis, the sampling and analysis was carried out in accordance with EPD Technical Circular 1-1-92.

The results of monitoring undertaken as a part of this Study were compared with those obtained from the dredging site for the 'Taikoo", results of which are attached as Appendix 5.

The data from the 1992 survey revealed that there were some hotspots of contaminated material, especially with copper. High level of zinc were also found in the sediments. These results are similar to the latest results in that in general the sediments are clean except for a small number of sites with highly contaminated material.

Given the overall similarity between the two sets of results, it is possible that a certain degree of the contamination found in the sediments during the recent survey is historical and not a result of the operational discharges from the 'Taikoo".

4.5.2 Assessment of Sediment Quality for Disposal of Dredged material from the "United" Mooring Site, 1994

As part of the requirements for dredging and dumping licenses, HUD commissioned an extensive survey of sediment quality to assess contamination levels at the proposed mooring site for "United" in October 1994 [1]. When the results of the analyses for trace metals were obtained they were compared to the classification criteria for contamination levels. EPD concluded from these results that the sediments to be dredged were unlikely to be contaminated[1]. The results from the site, which is in close proximity to the 'Taikoo" and other floating docks, would indicate that the area is not generally contaminated. The relatively high levels found in hot spots around the "Taikoo" are, therefore, probably due to its operations. The results would also suggest that the discharges of metals from the existing five floating docks are not having a significant cumulative impact on the surrounding area..

4.5.3 EPD's regular sediment quality monitoring;

The EPD carry out a regular territory wide sediment sampling programme, the results of the sampling are published annually in the EPD report "*Marine Water Quality in Hong Kong*" yearbook, the most recent published data is for the surveys carried out in 1992. Of the 52 open water sediment sampling stations one is located near to Yam O Wan on the north shore of Lantau Island, Station NS1. Analysis is carried out on a range of parameters, including metals, nutrients, etc., however, at present EPD do not carry out regular monitoring of TBT, or its degradation products, in sediment. The results for NS1 are summarised below in Table 4.5.

Table 4.5 EPD Sediment Quality Data for Station NS1

Metal	Cr	Cu	Zn	Ni	Pb
Range, mg/kg	25 - 40	< 50	< 80	15 - 20	30 - 50

Source: Marine Water Quality in Hong Kong for 1992, EPD.

Comparing the above EPD results with the recent sediment monitoring undertaken as a part of this Study it can be seen that generally the levels of metals in the sediments around "Taikoo" are similar to those recorded by EPD at NS1, the sediment could be classed as clean, Class A. However, the exceptions to this are at the stations where Class B and Class C contaminated sediment is encountered, at these locations the levels are generally much higher than the surrounding material, possibly indicating the presence of a discrete point source.

4.5.3 EPD survey of Tributyl Tin contamination in Coastal Waters of Hong Kong;

EPD's survey was discussed in detail in section 3.6. The sediments around Hong Kong's marinas and shipyards were found to contain elevated concentrations of TBTs compared to the background levels measured at control stations in the study. The concentrations ranged greatly within samples and between sites but averages were found to be equivalent to or greater than maximum concentrations recorded in harbours, marinas and estuaries in other parts of the world. The results obtained from sediments around the Taikoo are comparable to those obtained in EPD's study.

Average concentrations found in Hong Kong sediments ranged from 6-11,618 ng/g the highest being found in Causeway Bay Marina and Typhoon shelter, and the lowest at Gold Coast Marina, a relatively new Marina. All values obtained around the Taikoo fell within the range measured in the EPD study. The calculated mean TBT value for Causeway Bay, (11,618 ng /g) exceeded the highest value obtained in this Study (4,900 ng/g) by an order of magnitude. Ten of the eighteen sites studied by EPD had a median value of TBT in excess of the median value (210 ng/g) obtained in this Study.

A comparison of this study's results with EPD's results indicates that levels around the "Taikoo" are elevated compared to background levels found around Hong Kong and although the results are generally similar to those concentrations found in other parts of the world, two samples were an order of magnitude higher. The results are, however, not unusual for TBT levels currently being found in Hong Kong's shipyards and marinas and were, in fact, lower than many other sites in Hong Kong.

4.5.4 Assessment of metals found in sediments

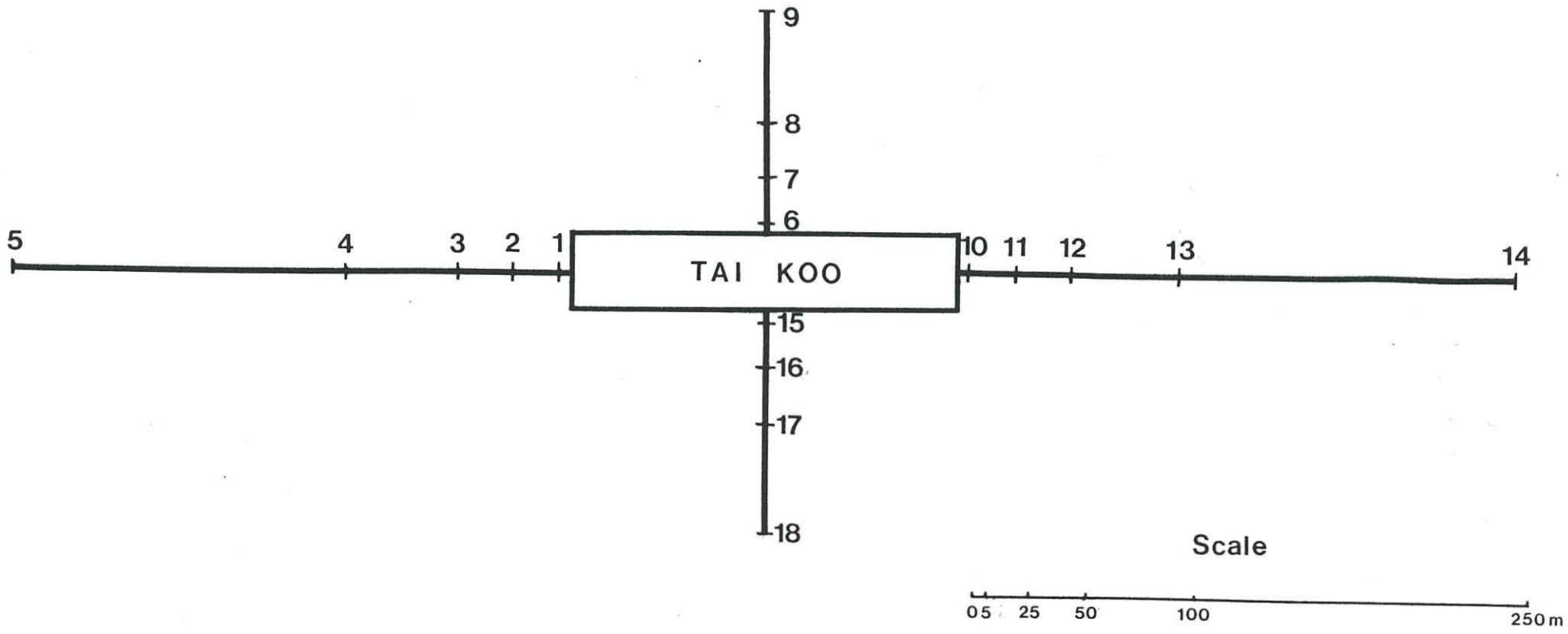
Elevated levels of copper were found in the samples which had also contained the highest concentrations of TBTs. This would seem to indicate that operations on the "Taikoo" were leading to sediment contamination around the dock.

It is of note that high levels of both zinc and copper were found in the sediments as these are often used in antifoulants as an alternative to TBTs. Also, prior to painting the hull of a

ship, the old paint is removed by blasting with a grit of copper slag. This grit may, therefore, be responsible for the high levels of copper found in the vicinity of the dock.

4.5.5 Overall Impact

Given the recent removal of a Yiu Lian dock from Yam O, the overall impact of floating docks in the area is not expected to increase. Also, given the removal of Tsing Yi from HUD's land based facility, releases of TBTs and metals from floating docks in Hong Kong will decrease overall.

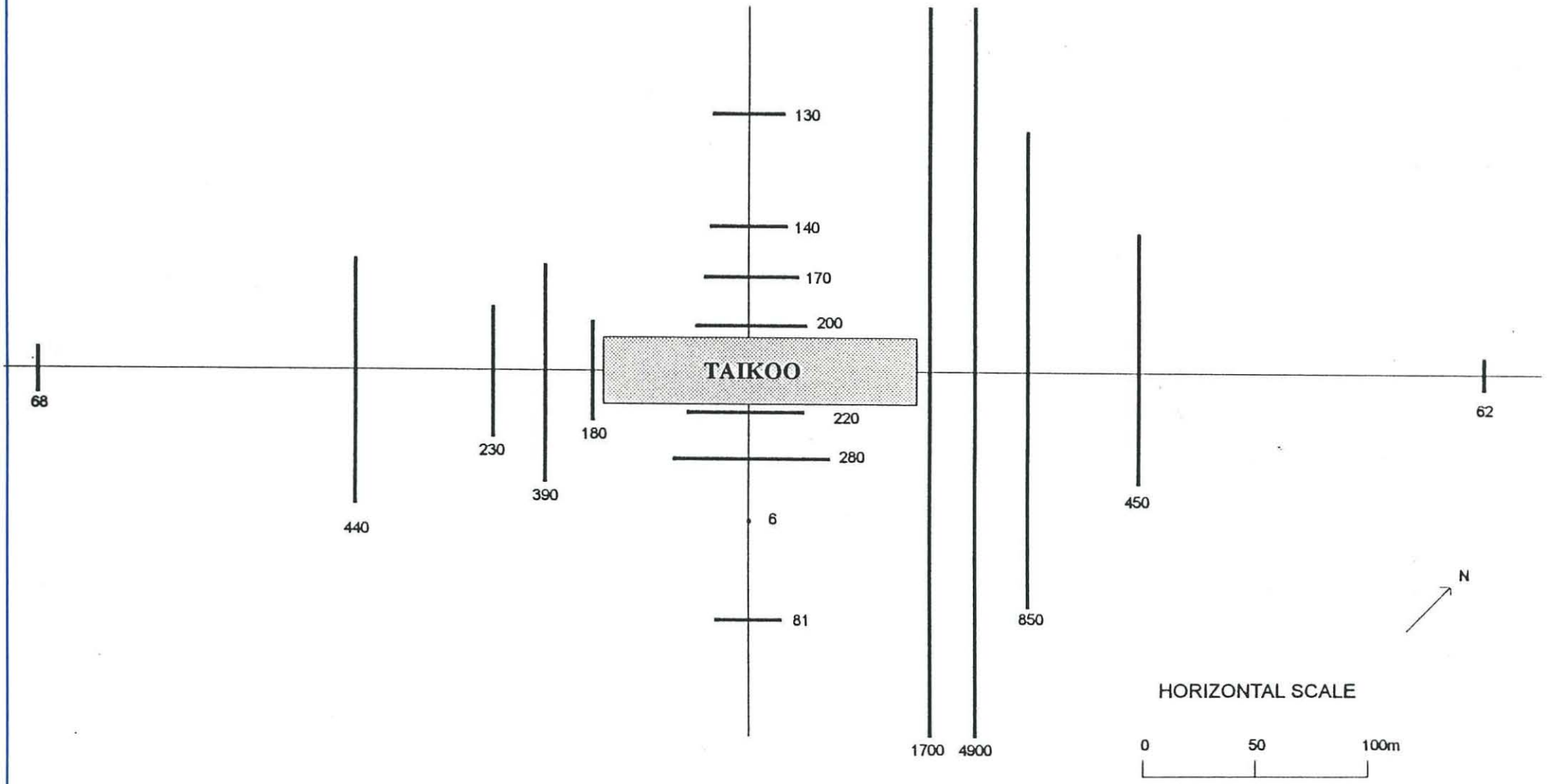


AXIS Environmental

Floating Dock, Yam O

Figure 4.1 Pattern for Sampling of Sediments and Waters around Taikoo

Job No 140 001 March 1995

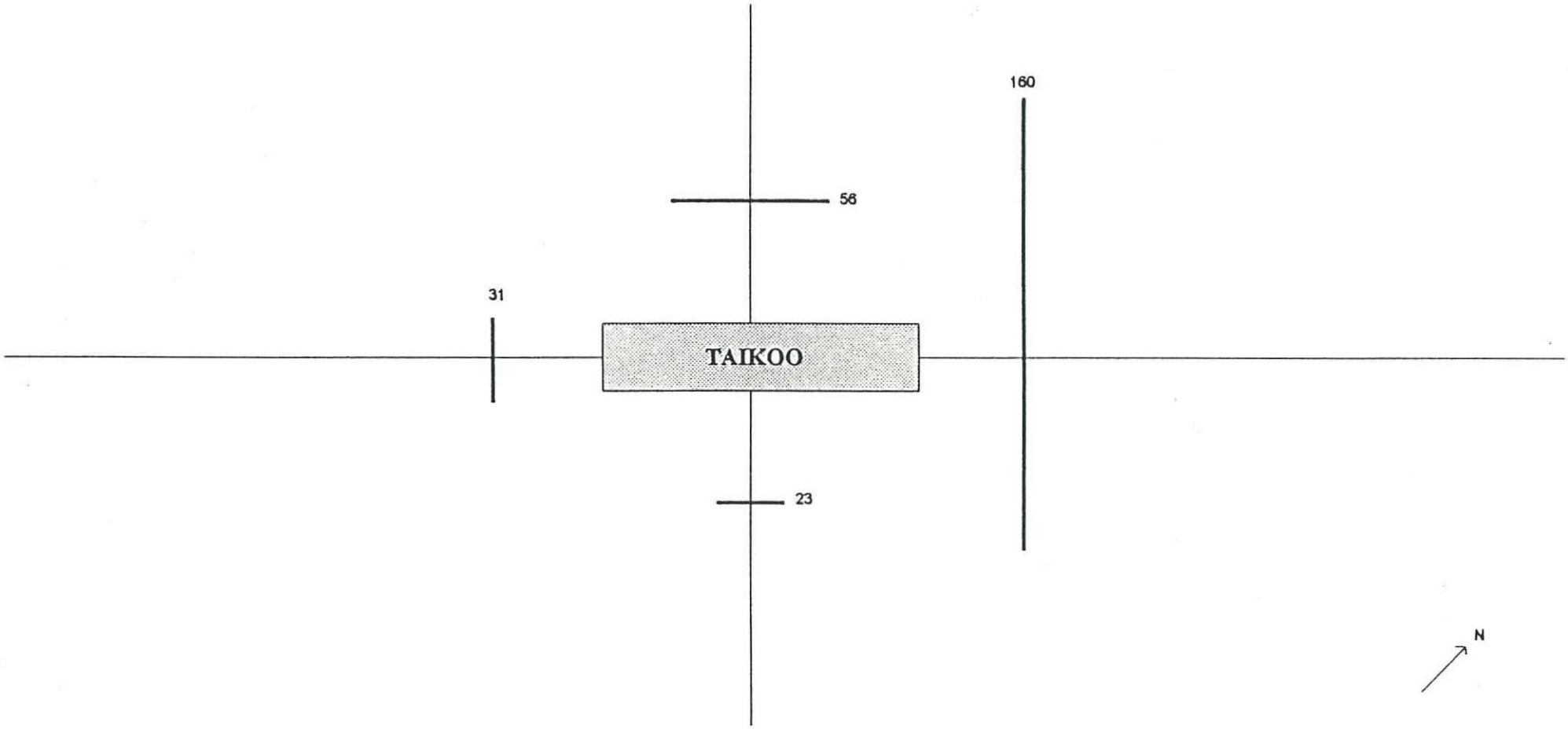


AXIS Environmental

Floating Dock, Yam O

Figure 4.2 Sediment concentrations of TBT (ng Sn/g)

Job No 140 001 March 1995

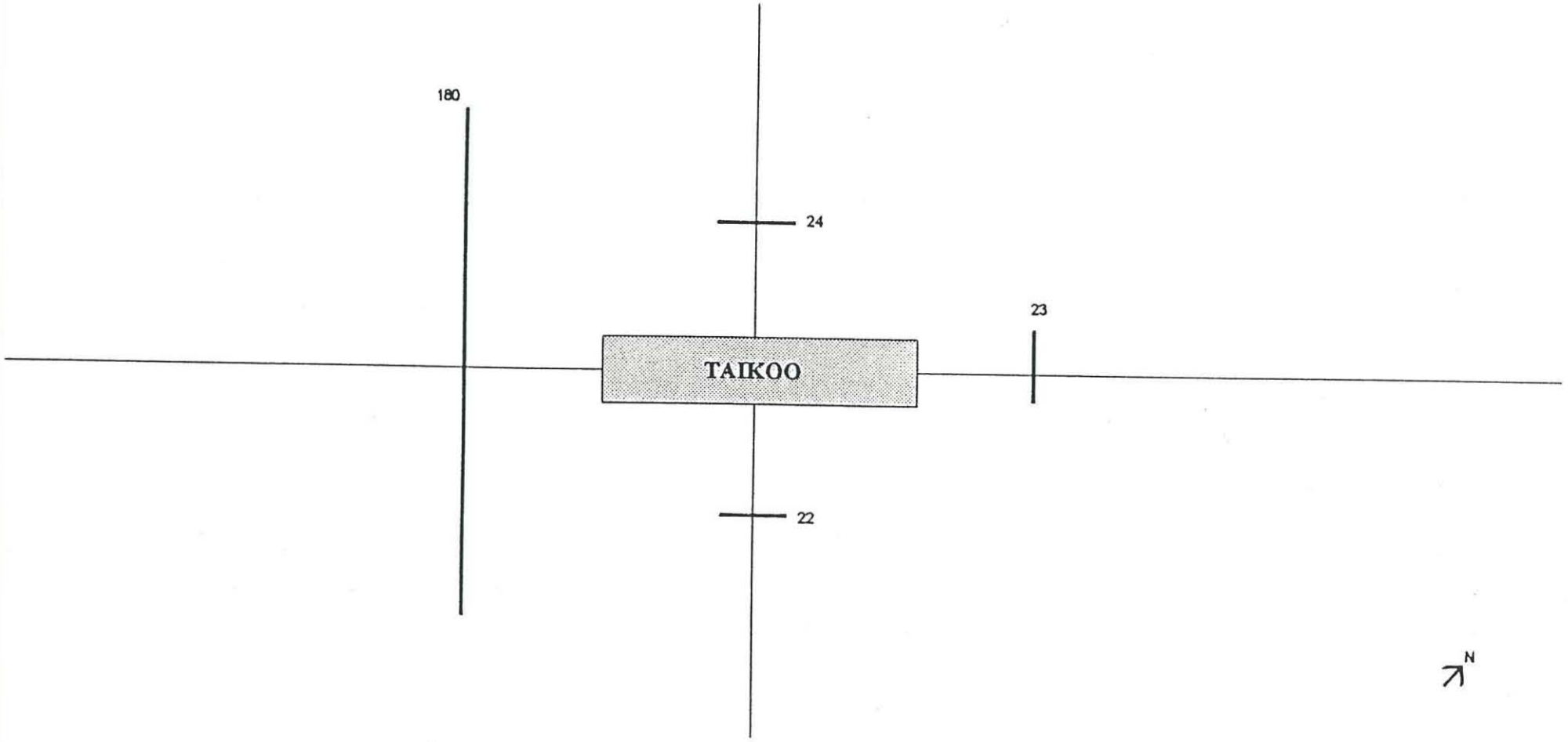


AXIS Environmental

Floating Dock, Yam O

Figure 4.3 Surface Water Concentrations of TBT (ng Sn/l)

Job No 140 001 March 1995



AXIS Environmental

Floating Dock, Yam O

Figure 4.4 Concentrations of TBT in water 1m above sea bed (ng Sn/l)

Job No 140 001 March 1995

Section 5

NOISE IMPACTS

5.0 NOISE

5.1 INTRODUCTION

The operation of the dock in Yam O Wan was investigated in terms of noise impact on noise sensitive receivers (NSRs) in the vicinity of the 'United". Background noise levels at the NSRs and noise levels around the "Taikoo" whilst ship maintenance work was taking place were measured. A sound level meter which conforms to IEC 651 (Type 1) standard was used to measure daytime Leq, L_{10}, L_{90}, and L_{max} noise levels. Standard acoustic principles were adopted throughout the noise measurements.

5.2 SENSITIVE RECEIVERS

Two NSRs were identified in the vicinity of Yam O Wan. The location of the villages of Luk King Tseun and Tsing Chau Tsai (here on referred to as NSR 1 and NSR 2 respectively) are shown in Figure 4.5.

5.3 BACKGROUND NOISE AND POTENTIAL IMPACTS

Background noise levels were monitored during the daytime over a 30 minute period at the sensitive receivers. Background readings (L_{90}, i.e. the average noise levels experienced for 90% of the time) were found to be 57.5 dB(A) at NSR 1 and 59.0 dB(A) at NSR 2. The background noise was mainly due to the nearby construction activities including the dumping of sand for reclamation. Noise from the five docks which were present at the time of monitoring were found to have relatively little contribution.

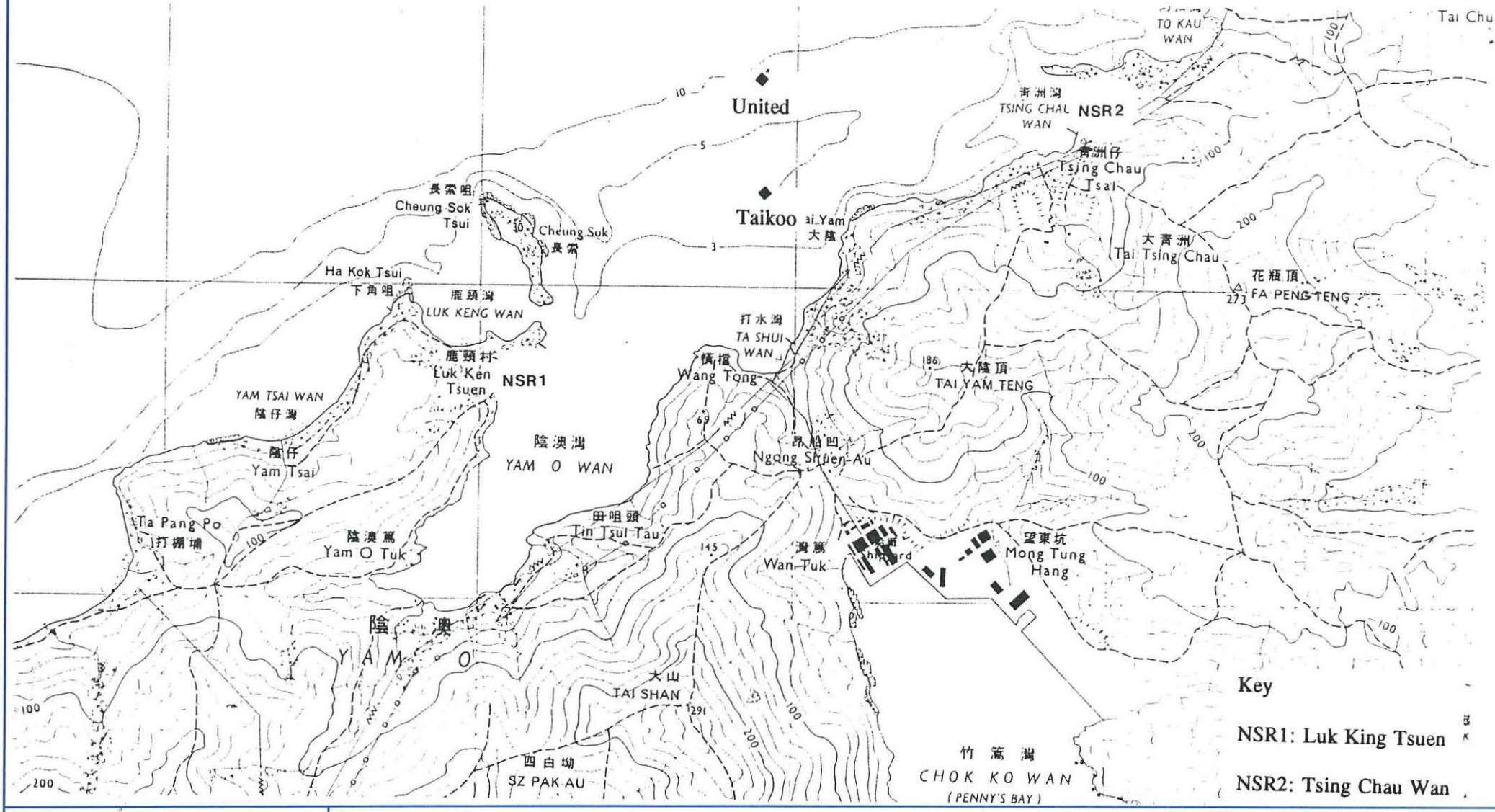
The Hong Kong Planning Standards and Guidelines for fixed noise sources is 5dB(A) below the relevant Acceptable Noise Level (ANL) given in the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites, or the prevailing background noise levels. The affected NSRs are in rural areas and the ANL is 60dB(A) during the working hours (0700 - 1800) of the new dock. The noise standard of 55 dB(A) was, therefore, used for assessing the impact of operational noise from the new dock.

Noise emissions from the "Taikoo" whilst repairing a ship were monitored at four points around the dock from a boat. The full results and methodology used are attached in Appendix 6.

Noise levels recorded around the "Taikoo" were not exceptionally high. The combined noise level of maintenance activities undertaken on each of the docks present at the time of monitoring have been calculated and are shown in Appendix 6. Maintenance activities generating noise are grit blasting to remove rust and paint, lifting operations using an electric hoist system, painting and the use of electric motors. Hammering activities are minimal on the dock and therefore are not a significant noise source. From the noise calculations, the predicted noise level at the two NSRs are well below the noise standard of 55 dB(A). Predicted levels ranged between 36-45 dB(A) which would be barely noticeable at the NSRs.

The calculations also show that the introduction of the new HUD dock will increase noise levels by only 0.4 dB(A) above the background noise levels measured at the NSR, Tsing Chau Tsai and 1.8 dB(A) at Luk King Tsuen. Increases in noise levels of less than 3 dB(A) would not be subjectively noticeable.

Given the noise calculations that have been undertaken, the additional dock is not expected to result in any significant increase in the ambient noise levels. Also, the removal of Yiu Lian 2 from Yam O since this noise monitoring was undertaken would mean that the background noise levels will probably remain unchanged in the vicinity of the sensitive receivers.



AXIS Environmental

Floating Dock, Yam O

Figure 5.1 Noise Sensitive Receivers around the Taikoo and United

Job No 140 001 March 1995

Section 6

LICENSING REQUIREMENTS

6.0 LICENSE REQUIREMENTS

6.1 INTRODUCTION

The operation of the United will require licensing under the Water Pollution Control Ordinance (WPCO), Chapter 358 since discharges from United will enter a gazetted Water Control Zone (WCZ). The installation of diesel generators on United requires approval under the Air Pollution Control Ordinance (APC), Chapter 311, 1983. The Waste Disposal (Chemical Waste) (General) Regulations, enacted on March 18, 1992 under the Waste Disposal Ordinance, Chapter 354 also apply to the operation of United. Finally, the use of antifoulant paints containing TBTs is controlled under the Pesticides Ordinance, Chapter 133.

6.2 AIR POLLUTION CONTROL - APPROVAL FOR THE INSTALLATION OF DIESEL GENERATORS

6.2.1 Introduction

The Air Pollution Control Ordinance, (Cap 311), 1983 requires industry to abate emissions of all air pollutants that may give rise to nuisance or seek prior approval from the EPD where fuel burning equipment is being newly installed or altered. The diesel generators proposed for use on the United require approval under Section 2.2 of the Air Pollution Control (furnaces, ovens and chimneys) (installation and alteration) Regulations, 1989, from the EPD Local Control Office prior to installation.

6.2.2 Generators on United

It is proposed that the dock will be installed with three 1550 KVA main diesel generating sets and one 900 KVA emergency generating set. The generating sets will be run on industrial diesel fuel and use an estimated 5 tons of fuel a day. Under normal operating conditions one of the three main 1550 KVA generators will be running on a continuous, 24 hour basis. When a ship docks or undocks on United it is anticipated that two of the generators will be sufficient to pump out the ballast water and to raise the floating dock. Since this process takes an estimated 2 hours and happens on average twice a week, two 1550 KVA generators will be required for a total of 16 hours per month. The third generator is required for standby purposes only. If all of the main generators fail, the 900 KVA generator will be used to provide power for the essential services.

The diesel generators are automatically controlled so that when the electrical loading capacity of one generator is exceeded a second will automatically cut in and run in parallel. In the event of an emergency, the 900 KVA generator, which will be kept on standby, will automatically cut in and supply power to all essential machinery.

Relevant information, as set out in the Regulations has already been submitted to the Tseun Wan local control office of EPD in order that approval can be sought for the installation of these generators on "United".

6.3 WATER POLLUTION CONTROL ORDINANCE - APPLICATION FOR A DISCHARGE LICENSE.

6.3.1 Introduction

The North West Water Control Zone, which includes the Yam O area was declared on 1 April 1992. The effluent discharge standards and Water Quality Objectives for the North West Water Control Zone are attached in Appendix 7.

The effluents to be discharged from United into the North West WCZ and which, as a result, require licensing are:

- The release of treated sewage effluent from the Hamworthy sewage treatment unit on board United; and
- The discharge of TBTs and other contaminants in the washwater and storm water run off.

6.3.2 Sewage effluent

The sewage treatment unit is designed to treat up to 17,500 litres per day and is an approved U.S Coast Guard Marine Sanitation Device (MSD). The sewage treatment works employs the extended aeration process and includes an on-line chlorination system to produce an effluent quality which consistently meets the following discharge criteria:

- BOD 40mg.l;
- Suspended Solids 40mg/l; and
- Total coliforms (MPN) 200/100 ml.

The effluent is discharged from above the water surface and the average daily volume of effluent discharged is expected to be less than 4000 litres. The United will be the first floating dock in the area to house its own sewage treatment unit.

6.3.3 Discharges of toxicants

Discharges to the marine environment of greatest concern have been identified as wash water and storm water run off due to the contamination with TBTs and other contaminants such as copper and zinc. This discharge is largely a result of the washing down of a ship's hull prior to painting and maintenance work, and the washing down of the dock following the removal and application of paint.

High pressure water washing is the first operation carried out on the majority of ships moved into the floating dock. The high pressure jet is sufficient to remove marine growths and tends to simultaneously remove the surface area of antifouling. This operation takes approximately 2 days per ship and requires about 450 - 500 tonnes of water per ship at a rate of 40 litres per square metre. Grit blasting, using copper slag is used to remove paint including SPC-TBT paint from around damaged areas. Paint chips, spent grit and marine organisms collect on the floor of the dock where they are then cleared and disposed of in industrial skips.

The waste water discharging into the marine environment could potentially contain antifoulant material, including TBTs in concentrations of 0.1-0.6 mg/l where TBT paints have been used and particulates such as paint flakes, marine organisms, and grit. The discharge does not occur on a continuous basis and is a relatively short term release over about 2 days in any month.

A copy of the completed Form A, "*Application for a license to discharge into the North West Water Control Zone*", is attached in Appendix 6. Extracts from the Initial Assessment Report[1] were included in support of the application which has since been submitted to the Tseun Wan Local Control Office.

6.4 WASTE DISPOSAL ORDINANCE - REGISTRATION AS A CHEMICAL WASTE PRODUCER, COLLECTOR AND TRANSPORTER.

6.4.1 Introduction

The main objective of this piece of legislation is to provide a statutory scheme of control to ensure that chemical waste is properly managed by all parties concerned. The Regulation provides for the registration of persons producing chemical waste and the control of the possession, storage, collection, transport and eventual disposal of the waste.

6.4.2 Chemical Waste produced on and collected from "United"

HUD are currently licensed to produce, transport and collect chemical waste under the Waste Disposal (Chemical Waste) (General) Regulations. Up until recently, this license included HUD's Tsing Yi site, the Tsing Yi and the Taikoo.

Recently the license has been amended to include likely waste arising from the operations on "United". Chemical waste includes waste mineral oil, lubricating oil, oily sludges, contaminated bilge water, and waste material containing TBTs. Drums containing chemical waste will be temporarily stored in a designated storage area on the working platform until they are transported ashore by the work boat which is licensed to collect and transport to HUD's onshore facility at Tsing Yi.

Licenses have been amended by HUD in anticipation of commencing operations on United by early April.

6.5 PESTICIDE CONTROL ORDINANCE - PERMIT TO USE TBT BASED PAINTS

6.5.1 Introduction

The use of TBT based antifoulants is covered in the provisions of the Pesticides Ordinance. In accordance with this ordinance, the Director of Agriculture and Fisheries is empowered to regulate the use of "inert ingredients" of toxicological concern in pesticides. This involves the registration of users, issuing of licenses and permits to import, possess and use unregistered pesticides. Users are required to hold a permit for each type of TBT paint used.

6.5.2 Permission for Use of TBT paints

HUD are currently registered with AFD as users of TBT based paints. HUD have been granted seven permits which allow them to use different formulations of TBT based paints. Each permit states the maximum allowable concentration of TBT, Copper (I) Oxide and Zineb where appropriate.

AFD have recently issued a new application form for a permit to use pesticides and this will be filled by HUD accordingly.

Section 7

CONCLUSIONS AND RECOMMENDATIONS

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 KEY ISSUES

The IAR identified discharges of TBT compounds as being the likely key environmental issue associated with the operation of the floating dock United in the area of Yam O. Following responses to the IAR, this issue, the discharge to the marine environment of other toxic metals and potential noise impacts have been considered in greater detail.

7.1.1 Noise

The detailed assessment of the potential impact of noise emissions associated with the operation of the dock on the sensitive receivers identified by EPD, indicates that the likely increase in noise levels is of the order of 1dB on an existing noise level of between 57.5 dB(A) and 59.0 dB(A). The resulting noise levels will remain well within the guideline value of 67.5 dB(A). It is therefore concluded that potential noise impacts are acceptable.

7.1.2 TBT Compounds

TBT is a toxic substance and its discharge is therefore formally disallowed under the requirements of the Technical Memorandum associated with the WPCO. The operation of floating docks results in TBT compounds being released into the marine environment through high pressure water washing of ship's hulls; through the washing overboard of flakes of material from sand or grit blasting of ship's hulls; and from the release of fresh paint during application, either directly as airborne droplets or indirectly as fresh paint deposited on the floor of the dock is washed overboard. All floating docks in Hong Kong undertake a similar range of activities and demand from ship owners for the continued use of TBT based paints is high because of their operational benefits.

Surveys undertaken by EPD of dockyards, marinas and typhoon shelters around Hong Kong (but excluding the Yam O area) and observations in the immediate vicinity of the floating dock Taikoo operated by HUD in Yam O indicate that TBT concentrations in sediments in the vicinity of dockyards, are elevated, although levels in some marinas are higher. The observations around the Taikoo showed a distribution pattern which indicated that the majority of TBT remained close to the point of discharge, suggesting that the TBT is either contained within paint flakes or adsorbed onto particulates which have been deposited rapidly.

The levels of TBT found both locally to Taikoo and more widely in the survey of dockyards, marinas and typhoon shelters are high. The elevated concentrations found in this Study in the sediments are considered attributable to the operations of the dock. However, the elevated concentrations in the water column are considered to be the result of the collective activities of the Taikoo and the other docks in the area.

Levels of TBT in the water column around Taikoo were measured at between 57.2 ng/l and 468.0 ng/l. There are currently no internationally agreed guidelines on acceptable levels of TBT in marine waters, nor are there any countries which have introduced legislation which would provide an appropriate model for use in Hong Kong. Where individual countries have recommended values, they are for concentrations in the water column of

between 2 ng/l and 50 ng/l. Clearly therefore, the TBT concentrations found in this Study must be considered high.

The available literature indicates that the majority of TBT released into the water column will tend to be adsorbed onto particulate material and is therefore likely to be deposited. It is therefore to be anticipated that sediment concentrations will be higher than those in the water column. Almost no information is available on appropriate TBT concentrations in marine sediments to protect the environment. However, by being bound into the sediment, their bioavailability may be reduced making them less likely to result in a significant environmental impact. This will depend on the benthic ecosystem and is likely to be highly site specific. Despite this, the concentration in the sediments in the area of Taikoo, with a mean of 583 ng/g and a median of 210 ng/g, are in the region of five orders of magnitude greater than the recommended concentrations in the water column and therefore must also be considered high.

Although the concentrations in both the water column and the sediment are high, they are comparable to and, in some cases, lower than the concentrations found in shipyards and marinas elsewhere in Hong Kong. Despite the widespread occurrence of TBTs in Hong Kong, no information exists on their ecological impact, and it is therefore not clear whether there is any associated environmental damage. Attempting to differentiate any impact due to Taikoo from any due to the other floating docks operating in Yam O would be impossible and was therefore considered inappropriate for the proposes of this EIA.

Floating docks provide a vital element of the infrastructure associated with the commercial success of port and shipping operations in Hong Kong and their viability would be severely impaired by the unilateral banning of the use of TBT based antifouling paints. Similarly, any implementation of controls on United without simultaneous application to other floating dock operations would be counter to EPD policy of treating all dischargers equitably.

Given that TBT is known to be toxic and that floating docks are clear sources in Hong Kong waters, some controls to reduce discharges are considered desirable. The extent of the controls and the potential mitigation measures to satisfy these controls are considered in more detail below.

7.1.3 Discharges of Toxic Metals

In addition to the analysis of TBT and associated compounds in the marine sediments in the region of Taikoo, the samples were analysed for the range of metals used to determine whether soils are contaminated for the purposes of marine disposal.

The results show that the samples in the areas with the highest levels of TBT and associated compounds also have high concentrations of copper and/or zinc, with some samples having sufficiently high concentrations to put them in category C (according to the limits defined in TM-91-1-1), imposing controlled handling and disposal practices should the material be dredged. Since these metals are associated with certain of the paints used on the dock and with the grit blasting operation, it is reasonable to conclude that some proportion of the contamination is associated with the dock operation. However, the numerous other sources of contamination, both historical and current, plus the level of reclamation and other activities in the area, necessitates caution in establishing this relationship.

Releases of these substances are anticipated to be associated with the same activities which result in the release of TBT compounds; in particular the losses to the marine environment through washing overboard of paint flakes and similar fine waste, including the material used in grit blasting. The potential mitigation measures are therefore the same, involving the control of washwater and the release of fine wastes.

The WPCO provides an existing framework within which discharges of these substances can be controlled. However, the discontinuous nature of the wastewater discharge from the United and other floating docks will require care in the formulation of the license.

7.2 MITIGATION MEASURES

The primary sources for releases to the marine environment of both TBT compounds and other controlled substances, such as Copper and Zinc, is considered to be through the loss of fine waste material and wastewater from hull cleaning operations. No simple solution exists for controlling either of these discharges. Potential control methods are engineering modifications and improved operational practice, both of which are considered below.

7.2.1 Engineering Modifications

Where controls have been introduced on floating dock activities elsewhere in the world, they have typically been applied to floating docks moored adjacent to land based facilities, enabling wastewater streams to be transferred ashore for treatment. This is not feasible in Hong Kong where the majority of floating docks are isolated from the shore.

One of the practical problems is that hull washing, which generates the most significant wastewater stream, is carried out simultaneously with the draining of the ballast water from the vessel in dock. Failure to drain the ballast water can cause problems of condensation on the hull, affecting the application of the new paint. Both activities are normally carried out simultaneously over the initial two days period following the ship docking, and any delay in this programme would seriously impact on the competitiveness and therefore commercial viability of the dock. The volume of wash water used in hull cleaning is typically of the order of 500m^3, whereas the volume of ballast water will typically be 5,000m^3, therefore unless the wastewater streams can be separated, 5,000 to 6,000m^3 of water would have to be collected and transferred ashore for treatment.

The design of the dock currently allows both washwater and ballast water to drain through a series of ports along the sides and over the ends of the dock. Hence, any requirement to collect the wastewater streams would require significant engineering retrofit. The practicality of such modifications, their safety implications and therefore their acceptability for Lloyds registration is unknown.

An alternative to collecting all of the potentially contaminated waste water, is to provide an on-line separator or settling tank facility. Since the majority of the contaminants are in the form of particulates or are known to exhibit a strong tendency to adsorb onto particulates, it is anticipated that removal of particulate material would substantially reduce the contaminant load to the marine environment.

However, the provision of an engineered solution for the collection and settlement of waste water, would present the same problems as those faced in collecting the waste water for transfer. The design of any facility would require careful consideration of the operational

and safety implications, and modifications would require the approval of Lloyds. Diversion of the drained ballast water to minimise the flow rate through the settlement tank would improve performance and recovery rates for any given sized facility.

The determination of feasible engineering modifications and the assessment of their likely efficacy requires more detailed consideration. The differing design of the various floating docks operating in Hong Kong means that a standard solution is unlikely to be feasible, suggesting that an assessment of potential engineering retrofit modifications should be initiated for all existing operational docks as well as for United. An assessment of the partitioning between particulate and dissolved form for the contaminants is required in order to determine the potential discharge associated with a separator as opposed to collection of all waste water.

It is anticipated that the identification of necessary levels of treatment, the necessary associated engineering modifications, their approval by Lloyds and Marine Department and their implementation will require a period of approximately two years.

7.2.2 Operational Procedures

Even assuming that feasible engineering modifications can be identified and implemented, they are unlikely to be implemented within a two year period. During this period, discharges of TBT and other contaminants can only be reduced through improved operational procedures. Procedures which encompass "good housekeeping" have been identified as an effective means of achieving significant reductions in TBT discharges, with direct observations indicating that reductions of up to 40%[6] are achievable. The Good Housekeeping Rules for Dockyards which result in these reductions are attached as Appendix 8. While some of these rules for normal docks will be applicable to the floating dock others, such as the closure of all of the ports during painting and washdown, result in an unacceptable environment in which to work in terms of safety to workers.

Additional measures which should be considered include the use of fine filters on drains and the placement of sand bags or similar across either end of the dock to provide a small lip which will encourage particulate material to settle. The adoption of such practices will require consideration of the operational and safety implications, but would appear to offer an effective means of reducing discharges quickly and cost-effectively.

Good housekeeping requires clear organizational responsibility and lines of delegation if they are to be effective. HUD have the benefit of operating an ISO 9002 accredited Quality System for part of their operations. Although the adoption of ISO 9002 is inappropriate for the dock operations, the experience of developing and implementing accredited organizational structures and procedures will facilitate the development of an appropriate operational procedure to encourage good housekeeping practice on the dock. HUD are already utilising non-accredited procedures to improve their organizational effectiveness and encompassing legislative requirements within such procedures, an example of one such procedure is the Operational Procedures for the Testing and Examination of Lifting Appliances and Lifting Gear as attached in Appendix 8.

7.3 CONCLUSIONS

i. The key environmental impact associated with the proposed operation of the United in Yam O is the discharge of TBT and other contaminants, primarily as a result of hull

pressure washing and through the loss overboard of fine waste material from other activities, particularly grit blasting.

ii. Concentrations of TBT in the area around operating docks are high, both in the water column and particularly in the sediment. No information exists on the ecological impact of these elevated levels but, as in the IAR no sensitive marine sites have been found in the vicinity.

iii. Similar problems in controlling TBT discharges associated with dock operations occur in many countries and no international solution is imminent.

iv. The offshore location of floating docks in Hong Kong precludes the use of simple pumping to shore options.

v. Engineering modifications to collect the waste water, or even to settle particulates from the waste water, would require careful and detailed consideration and approval. Implementation, if feasible, would take at least two years.

vi. Good housekeeping practice is able to significantly reduce discharges and should be implemented as an auditable operational procedure.

7.4 RECOMMENDATIONS

i. Approval be granted for HUD to commence operations of United at Yam O subject to the removal from service of Tsing Yi in order to prevent any net increase in TBT releases to the marine environment.

ii. As part of their WPCO license, HUD should formulate and implement an operational procedure incorporating best practice in minimising contaminant releases as far as is currently practicable. The procedure should be suitable for audit by EPD.

iii. HUD should initiate an investigation of the partitioning between particulate and dissolved fractions for both TBT and toxic metals.

iv. As a result of this EIA, it is recommended that all floating dock operators should review engineering feasibility of collecting waste water, separating waste water and ballast water, and installing settlement tanks. Practicability, cost, operational and licensing implications should all be considered. This may then be used to help EPD formulate controls for the operation of docks in the future if it is considered appropriate.

v. This EIA has indicated the need for further assessment of the ecological impact of elevated TBT concentrations in the area around operating docks in order to determine the necessary reduction in discharges required to protect sensitive receivers. It is also recommended that further appraisal of TBT in Hong Kong waters investigates the issue of bioaccumulation of TBT in fish and higher organisms.

vi. A monitoring and audit programme should be initiated to assess the accumulation of TBT and toxic metals in the area of the new dock.

Section 8

ENVIRONMENTAL MONITORING AND AUDIT

8.0 ENVIRONMENTAL MONITORING AND AUDIT

8.1 MARINE DISCHARGES

8.1.1 Discussion

Environmental monitoring is considered essential for the proposed discharge due to the potential for TBT contamination. In the absence of legislative limits on the acceptable concentrations either in the waste water stream or in the receiving waters, the focus of the monitoring will be to enhance the information available for the determination of appropriate future controls. In particular the monitoring should seek:

- to determine the quality of waste water discharged from the dock under a variety of operational conditions in order to quantify loads;
- to determine the relative partitioning between dissolved and particulate forms in order to assess the potential efficacy of filtering or settling options; and
- to determine the rate of accumulation of TBT and other toxicants in the sediment in the area around the new dock.

A schedule of monitoring programmes is therefore proposed which would form part of the license agreement for the approval of the operation of the dock.

It is expected that the effluent discharge license for the sewage treatment plant will require that regular monitoring of the effluent quality be carried out. typically on a monthly basis. Given reliability and high treatment level of the plant it is not proposed to carry out additional monitoring to that which will be required under the WPCO discharge license.

8.1.2 Proposed monitoring Schedule

Washdown:

During washdown of a TBT treated hull a series of samples will be taken from the effluent stream. The washdown process takes approximately 2 days. During this time, hourly samples of the washwater will be taken and collected in 1 litre clean, glass jars. The sampling point would be the point prior to discharge into the sea so that an accurate determination of the composition of effluent reaching the marine environment can be made. It is most likely that this sampling location will be adjacent to a drainage port on the dock and the exact locations can be determined during a washdown period prior to monitoring. A total of approximately 14 samples would be taken over a washdown period.

Following the completion of the release of washwaters from the dock, sea water samples will be taken at 50m from the dock at four points around the dock at 1m below the surface and 1m above the sea bed. A total of eight 1 litre samples would be collected. These samples together with the samples collected on the dock would be stored at 4°C and transported to a laboratory for analysis.

In the Laboratory, with the aid of filter paper, the samples collected on the dock would be filtered to separate the particulates from the soluble fractions in the water samples . Analysis for Total TBT, and its degradation products, would be carried out on both sets of

samples and the sea water samples. Detailed analytical methodology would be in line with that used by CSIRO in this study, attached as Appendix 4.

Monitoring frequency would depend on the frequency that a TBT treated ship is brought in for repair on United. It is proposed that this monitoring be carried out for every TBT treated ship which the United services for the first year, approximately 14 TBT coated ships would be expected in this period. this monitoring programme would be audited after 3 months to assess the suitability of the proposed programme and to make any necessary amendments.

Sediment Sampling:

It is proposed that HUD carry out similar sediment sampling as carried out in this study. Using the same cruciform sampling pattern samples of sediment would be taken at distances of 5 10, 25, 50, 100 and 250m from the United. TBT analysis would be carried out on all samples while analysis for a range of toxic metals (Cu, Cr, Hg, As, Pb, Zn and Ni) would be carried out on the first 4 samples, (i.e. those taken at 5, 10, 25 and 50m).

It is recommended that sediment sampling is undertaken during the next few months to obtain a baseline of TBT and metal contamination in the surrounding sediment to which future results can be compared. Sediment should be sampled on a 3 monthly basis for the first year to assess the rate and extent of contaminant accumulation in the surface sediment around the United.

Results:

Results from water monitoring would be used to determine the concentration of TBT discharged from the dock. Sea water samples would indicate the concentration remaining in the water column after the wash waters have been released. Following the implementation of the approved operations procedure, the TBT levels would also be monitored to determine the effectiveness of procedures and housekeeping undertaken on the dock.

Results from the monitoring will aid the determination of the proportion of TBT released in the form of particulates compared to the concentrations present in dissolved form in the water. This data will determine the effectiveness of certain engineering measures - if TBT release is mainly in the form of particulates, engineering solutions could be investigated which would enable sedimentation of the washwater prior to discharge.

Sediment monitoring will provide an indication of the rate of accumulation of TBTs and metals in the sediment around the United. TBT levels in the sediment can be compared to TBT concentrations detected in the sea water and concentrations detected in the washwaters when TBT treated ships have been repaired.

In the event that high levels of metals are detected, then the source of contamination will be investigated and operation procedures on the dock can be revised in an attempt to prevent contaminant release.

8.2 NOISE IMPACTS

Predicted noise levels have been calculated at the identified NSRs. It is not considered likely that any adverse noise impacts will occur due to the operation of United and therefore, no

regular operational noise monitoring is proposed. However, if complaints are received about the operation of United from the noise sensitive receivers, HUD will undertake to carry out investigative noise monitoring to identify the noise source and take remedial action to reduce any excessive noise emissions.

8.3 AUDITING

HUD will produce an Operations Manual detailing good housekeeping procedures over the first three months of United's operation. The manual will be checked by an independent body and sent for approval by EPD. Following this the procedures will be implemented and audited on a regular basis. it is anticipated that auditing of procedures will take place after the first three months of operation and thereafter, on an annual basis.

The operational phase auditing should also review the effectiveness of the housekeeping measures in terms of mitigating the release of TBTs into the sea water and recommend improvements in environmental controls wherever possible. Monitoring work will be reviewed after 3 months to assess the effectiveness of the monitoring programme which will be revised if it is considered necessary.

REFERENCES

1. Axis Environmental Consultants Ltd., (1994). *Initial Assessment Report; 40,000 Tonne Lifting Capacity Floating Dock, Yam O, North Lantau.*

2. Goldberg, E. D., (1988), Information Needs for Marine Pollution Studies. In: *Environmental Monitoring and Assessment* **11**; pp 293- 298.

3. Goldberg, E.D. (1986) TBT, An Environmental Dilemma. In: *Environment* Vol **28**, No 8.

4. Portmann, J.E., and R. Lloyd (1986), Safe Use of Assimilative Capacity of the Marine Environment for Waste Disposal - Is It Feasible? In: *Water Science and Technology.* Vol **18**, Plymouth.

5. Cocchieri, R.A., A. Biondi, A. Arnese, A. Pannaccione, (1993), Total Tin and Organotin in Seawater from the Gulf of Naples, Italy. In: *Marine Pollution Bulletin,* Vol **26** No 6.

6. European Commission (1989), *Technical and Economic Aspects of Measures to Reduce the Water Pollution Caused the Discharge of TBT Compounds.* Haskoning Royal Dutch Consulting Engineers and Architects. Ref: **OP-EC/3421**.

7. New South Wales Environmental Protection Agency, (1990), *Assessment of Organotin Compounds, Especially TBT Compounds used as Antifoulants* .

8. World Health Organization (1990). *Environmental Health Criteria 116. Tributyl Tin Compounds.* Published under the joint sponsorship of UNEP and the International Labour Organization and WHO.

9. Thain, J.E. and M.J. Waldock (1986), The Impact of TBT Antifouling Paints on Molluscan Fisheries. M.A.F.F. In: *Water Science and Technology.* Vol **18**, pp 193 - 202.

10. UK Department Of The Environment, Royal Yachting Association. *Dont Foul Things Up.* Not available at time of this report.

11. Environmental Protection Department (Hong Kong), Consultants in Environmental Science (Asia) Ltd (1994), *TBT Contamination in Coastal Sediments in Hong Kong* (Final Report).

12. King,N., M. Miller, S. de Mora (1989) Trributyl tin levels for Seawater, Sediment and Selected Marine Species in Coastal Norhtland and Auckland, New Zealand. In: *New Zealand Journal of Marine and Freshwater Research,* 1989, Vol **23**; 287 -294.

APPENDICES

Appendix 1

Floating Docks in Yam O, North Lantau

APPENDIX 1

FLOATING DRY DOCK IN YAM O WAN, NORTH LANTAU

Licence No. and Name OPERATOR	Length Overall (m)	Breadth Mould (m)	Lifting Capacity (tons)	Point Forward	Point After
17V Tai Koo H.U.D	175.25	35.36	11,500	22 20'24.189"N 114 01'53.134"E	22 20'25.194"N 114 01'52.592"E
97V Yiu Lian 2 YIU LIAN	190	40.3	12,000	22 20'34.93"N 114 02'05.270"E	22 20'33.7"N 114 01'59"E
137V Yiu Lian 3 YIU LIAN	252.2	54.8	36,000	22 20'42.151"N 114 02'07.373"E	22 20"47.586"N 114 02'14.252"E
157V Yiu Lian 4 YIU LIAN	155	32.4	8,500	22 20'37.952"N 114 02'00.242"E	22 20'37.021"N 114 01'54.994"E
167V Yiu Lian 5 YIU LIAN	82	24	1,800	Along side eastern Seawall of Yiu Lian Shipyard	

N.B Yiu Lian 2 was removed from the Yam O area at the beginning of March, 1995.

Appendix 2

Details of New Floating Dock, United

NEW FLOATING DOCK FOR HONG KONG

Hongkong United Dockyards (HUD), which has been repairing ships in Hong Kong for over 130 years, will shortly bring a new floating dock into operation.

With a length of **290 metres**, an operational width of **40 metres** and a lifting capacity of **40,000 tonnes**, this floating dock will be the largest built anywhere in the world for many years. While capable of servicing a wide range of vessels requiring repair, the specification of the dock has been particularly geared to the latest and future generations of container vessels trading in the Far East. The new dock will supplement HUD's current three docks which have lifting capacities of 24,000 tonnes, 20,000 tonnes and 11,500 tonnes.

The organisations involved in this project are impressive. Working to detailed parameters set by HUD, the dock has been designd by GVA Consultants of Sweden. Construction is underway at Far East Levingston Shipbuilding in Singapore, and the dock will be classed with Lloyd's Register. The underlying philosophy for the project mirrors HUD's philosophy towards serving its customers; the key priorities are performance and quality. A second-hand dock could have been bought, but it would not have met the high performance specifications required. A new dock could have been built considerably more cheaply, but it may not have met the quality standard required. As befits its history, HUD has taken a long term view and intends its new dock to be the prime shiprepair feature in Hong Kong for many years.

The dock will be completed in Singapore in January 1995 and, following towage to Hong Kong and installation, will come into service by April 1995. The general arrangement, together with technical and operational data, is shown overleaf.

APPENDIX 2

PRINCIPAL PARTICULARS OF "UNITED"

Length overall	290.00m
Length over Caisson	270.00m
Moulded width of Caisson	56.00m
Width between side walls	46.00m
Moulded depth up to top deck at inner side wall	18.50m
Moulded depth up to safety deck	13.50m
Heught of Keel Blocks	1.40m
Freeboard at caisson Centre	0.41m
Lifting Capacity	40,000 tonnes
Lifting Time	130 minutes
Length Over blocks	270.00m
Operational Width	40.00m
Max Draught Above keel Blocks	10.00m

FACILITIES ON "UNITED"

Mobile staging	4 x 25 m Dock arms
High Pressure water washing	250 Bar
Compressed Air	7 Bar
Travelling cranes	1 x 70 Tonnes 1 x 30 Tonnes
AC 3 Phase 50 Hz	380/400 Volt, 650 amp
AC Phase 60 Hz Frequency changer	440 Volt, 600 amp
DC Supply	230/115 volt, 1000 amp.

Appendix 3

Results of Past Studies to Quantify Inputs of TBTs into the Aquatic Environment

APPENDIX 3

RESULTS OF PAST STUDIES TO QUANTIFY INPUTS OF TBTS INTO THE AQUATIC ENVIRONMENT FROM DOCKS

Table 1 Inputs of TBT Into the Aquatic Environment From Yacht and Ship Washdown (Waldock et al. 1988)

Formulation	Vessel	Wash water concentration (mg/l)	TBT removed from hull (g)	Input into the aquatic environment (µg/cm²)
Free Association	Yacht	1.4	0.4	2
	Commercial Vessel	0.25	3.0	1
Copolymer	Yacht	12	3.6	20
	Navy Vessel	12	100[1]	6

1) Readily extractable TBT; the operation could result in 900g of total TBT being introduced into the aquatic environment, a portion of which would eventually become biologically available.

Table 2 Emissions of TBT into the Aquatic Environment During Dock Activities (after RIVM, 1987; CBS, 1987; CBS, 1988)

Activity	Floated Dock (kg/ship)	Dry Dock (kg/ship)	Total (%)
Drift of grit and paint	3.6 (3.9%)	1.8 (2.0%)	3.4
Direct discharge of grit + paint + waste water	5.4 (5.9%)	1.8 (2.0%)	4.9
Leaching from grit and paint	0 (0%)	3.6 (3.9%)	1.0
Total	9 (9.6%)	7.2 (7.9%)	9.3

Note: About 75% of the ships are treated in floated docks and 25% in dry docks and an average amount of 91.25 kg TBT per ship is used. Normally about 1.5kg paint per 4m² is used containing approx 20% TBT, implying the use of 1.5kg TBT per 20 m² . An ocean going vessel has a painted surface of about 4,000 m² indicating a use per vessel of 600 kg TBT per paint.

Appendix 4

Methodology Used for the Analysis of TBTs

APPENDIX 4

1. TBT ANALYSIS - METHODOLOGY

The analysis of the sediments for TBT contamination was undertaken by CSIRO in Australia. The method used involved extraction of TBT from sediments with 50%v/v methanol in 10M hydrochloric acid in an ultrasonic bath. The supernatant was then extracted with dichloromethane in the presence of tropolene and finally back extracted into dilute nitric acid followed by conversion of the butyltins into volatile tin hydrides uwith the addition of sodium borohydride to the nitric acid solutions. The hydrides were then vaporized in a stream of helium enavling them to be trapped onto a packed column at -190°C and thermally desorbed into the light path of an electrically heated quartz furnace atomic absorption spectrophotometer (AAS), where tin absorption was measured. External Calibration and blank reagents were measured at the same time as the samples. All analytical tests complied with the laboratory QA/QC protocols recommended by the Australian National Association of Testing Authorities.

As there was no extraction required for the water samples, recovery was assumed to be 100%. The mean recovery from the sediment samples was 86%+/- 6%.

This analytical method of using AAS detects the elemental tin of the speciated organotins. Forms of TBT, for example, as an oxide, chloride, fluoride etc. cannot be distinguished. Data is therefore obtained in ng/Sn/g sediment.

In accordance with EPDs recent study which undertook a similar sampling and analysis programme, the units were converted to TBT ng/g assuming 100% TBT-oxide which required multiplying the results by approximately 2.6.

2. GENERAL ANALYTICAL METHODS FOR MEASUREMENT OF ORGANOTINS

(Source: UNEP & WHO)

The control levels of contamination of different environmental compartments (water, sediment, biota) and the interpretation of laboratory experimental and field study results regarding levels, fate, biodegradation, and bioaccumulation of TBT compounds require sensitive analytical techniques to allow identification and quantification.

Measurement of organotins can be undertaken by a variety of methodologies as summarised in the table. Methods must be sufficiently sensitive and specific to allow monitoring of ng/litre levels and they need to be able to distinguish between the different forms of organic tin derivatives present in the environment, i.e mono-, di-, tri-

, or tetra -butyl tins and different species of alkyl moeities (butyl, methyl). They have also to avoid all interference from other metals and other organometallic derivatives.

Table 1. Sampling, preparation, and analysis of tributyltin compounds

Medium	Sampling method	Sample volume	Analytical method	Detection limit	Reference
Air	adsorption on Chromosorb, cation exchange resin, or tenax	50-100 litres	derivatization with RMgX; GC/MS or GC/FPO		Zimmerli & Zimmermann (1980); Muller
Water		250ml	$NaBH_4$ conversion to hydride; separation by fractional distillation; AA	0.1-2 ng/litre	Hodge et al. (1979); Michel (1987); Donard et al. (1986); Braman & Tompkins (1979); Valkirs et al. (1986); Weber et al.
Water and sediments	extraction with dichloromethane	8 litres (water) or 1 g (sediment dry weight)	derivatization with C_5H_{11} MgBr; GC-FPO or GC-FAA	1 ng/litre (water) or 5 ng/mg (sediment dry weight)	Maguire & Huneault (1981); Maguire & Tkacz (1983, 1985); Maguire et al. (1986)
Water, biota, or sediments		200 ml or 16 litres	$NaBH_4$ Conversion to hydride; extraction with dichloromethane	5 ng/litre or 0.2 ng/litre	Matthias et al. (1986a,b); Bjorklund (1987a)
Water, biota or sediments		60 litres (water) or 10 g (sediment)	extraction with dichloromethane / tropolone; derivatization with C_5H_7Br; GC-MS	0.07 ng/litre (water) 0.2 mg/kg (sediment)	Humphrey & Hope (1987)
	macroreticular resin adsorption	1 litre	extraction with *n*-pentane (water) diethylether (sediment); derivatization with CH_3 MgCl; GC-MS	< 1 ng/litre (water) 0.5 mg/kg (sediment)	Muller (1984)

Formation of volatile derivatives

Mono-, di-, and tri-butyltins are not sufficiently volatile to assure their separation on gas-phase chromatography; it is, therefore, necessary to prepare more volatile derivatives to allow better separation. Two procedures have been advocated:

- formation of alkyl derivatives (methyl or pentyl) by the use of Grignard's reagent (reactive or ganomagnesium);
- formation of hydrides with the general structure R_nSnH_{4-n} by reaction with sodium borohydride ($NaBH_4$) (Hodge et al ; 1979).

These volatile derivatives can then be extracted using organic solvents, such as dichloromethane, or purged by a stream of hydrogen.

Separation of organotin derivatives

Less sensitive methods for direct separation of mono-, di-, and tri-butyltins include high performance liquid chromatography (Jewett & Brinckman, 1981) and thin-layer chromatography. The latter method is only qualitative and little used because of its low sensitivity.

Detection and Measurement of different forms of organotin

Volatile derivatives prepared in the laboratory may be swparated by two procedures:

- separation as a dunction of boiling point with collection in a cold trap ("purge and trap" procedure);
- separation by gas chromatography.

After separation by GLC or by the "purge and trap" procedure, it is possible to detect and quantify, at the ng/litre level, different forms of organotin using the following methods:

- a flame photometric detector selective for tin (EPD) is considered satisfactory;
- a flame atomic absorption (AA) spectrometer or flameless atomic absorption (FAA) spectrometer using a graphite furnace (tin is detected at 286.3 nm or 244.6 nm);
- a mass spectrometer (MS); this is useful for precise identification of the dubstance but has limited sensitivity.

There are several methods available for measuring TBT down to detection limits of 0.2 to 5 ng/litre in water and 5 to μg/kg (in tissues of biota and in sediments). Some of them can be adapted for routine monitoring purposes. It is necessary, however, to have sophisticated equipment and the difficulty of the methods requires experienced laboratories.

His & Robert (1980, 1985) developed a biological assay on toxic effects on larvae of the Pacific oyster, *Crassostrea gigas,* sensitive only above 20 ng/litre and nonspecific between organotin and other toxic compounds. Colorimetric methods (Sherman & Carlson, 1980) have been based on forming coloured derivatives with phenylfluorone (nonspecific and with a sensitivity around 0.1 to 4 μg tin).

Interlaboratory calibrations

Interlaboratory comparison of assay methods have been performed to compare the various proposed methods and to validate their usefulness as standards.

Young et al. (1986) reported the conclusions of a workshop and held in the USA to examine the problems posed by the analysis of organotins in water. Nine methods, based on the principles outlined above, were considered as satisfactory, since the range of results fell within + 15% of the mean when the TBT concentration was in the order of ng/litre.

Stephenson et al. (1987) reported the results of interlaboratory calibrations conducted in 1986-1987 and carried out on TBT derivatives in mussel tissues and in sediments. The measurements were made in seven laboratories, each using its own technique and using its own technique and using different extraction conditions, derivative formation,

and detection . A first examination of results showed that they did not vary by more than a factor of 3. The results were considered satisfactory.

Blair et al. (1986) took part in an interlaboratory calibration exercise organised by the National Bureau of Standards (NBS) in 1984 in the USA and carried out determinations of TBT in water (at a concentration of 1 µg/litre).

Under the auspices of the OECD, it was decided recently to organize a new worldwide intercalibration to be carried out on:

- water samples containing 10 ng/litre each of mono-, di-, and tri-butyltin;
- samples of dried sediment containing the above compounds at a concentration of 100µg/kg;
- samples of mussel tissue, frozen or freeze-dried, containing the above compounds at 100µg/kg.

It seems premature to impose a single analytical method and preferable to allow a certain freedom of choice between methods to allow sufficient sensitivity to be attained. However, control of the competence of laboratories that carry out such difficult and complex analysis is required through new calibration procedures.

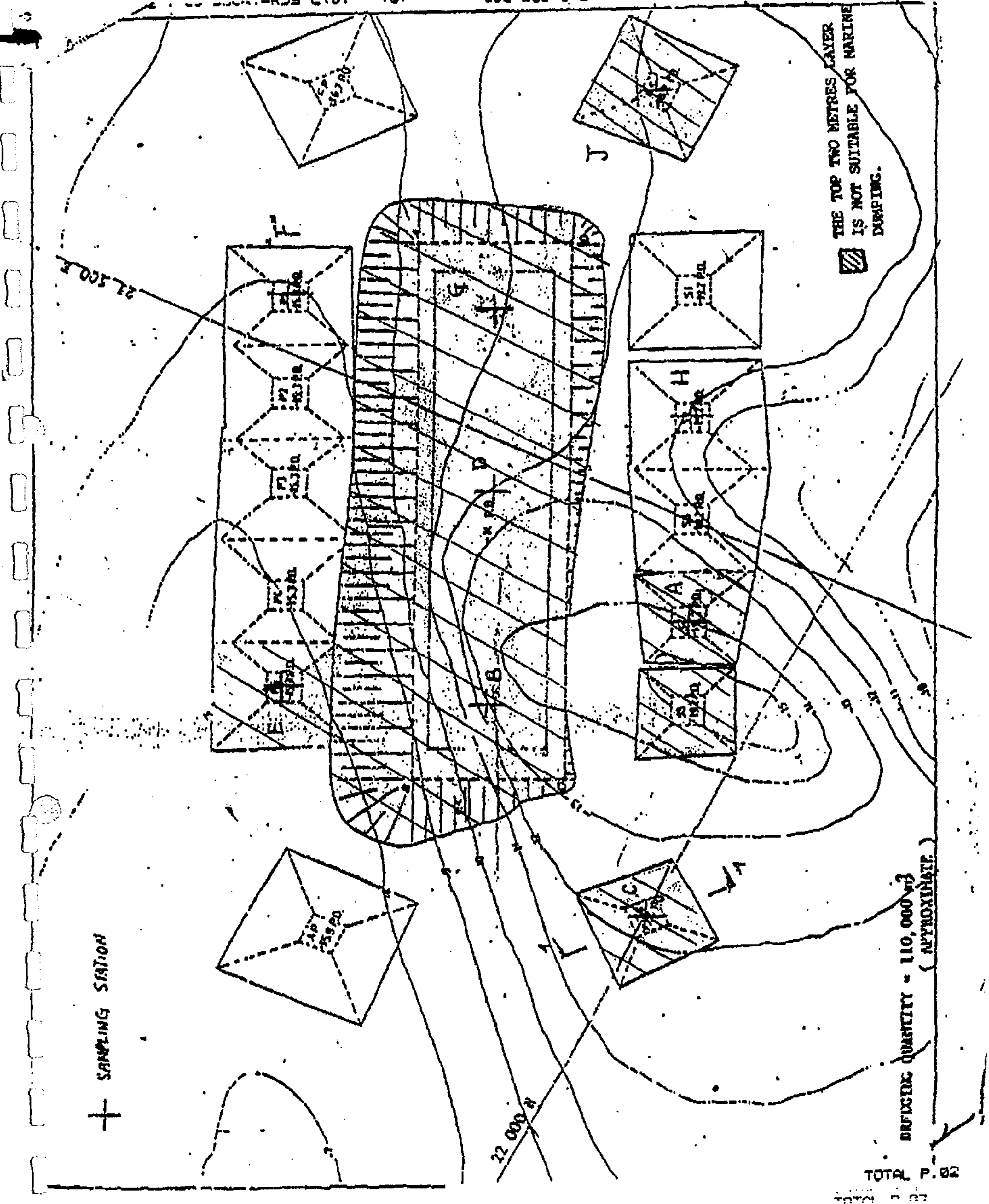
Appendix 5

Results of Sediment Analysis Undertaken Prior to the Mooring of Taikoo

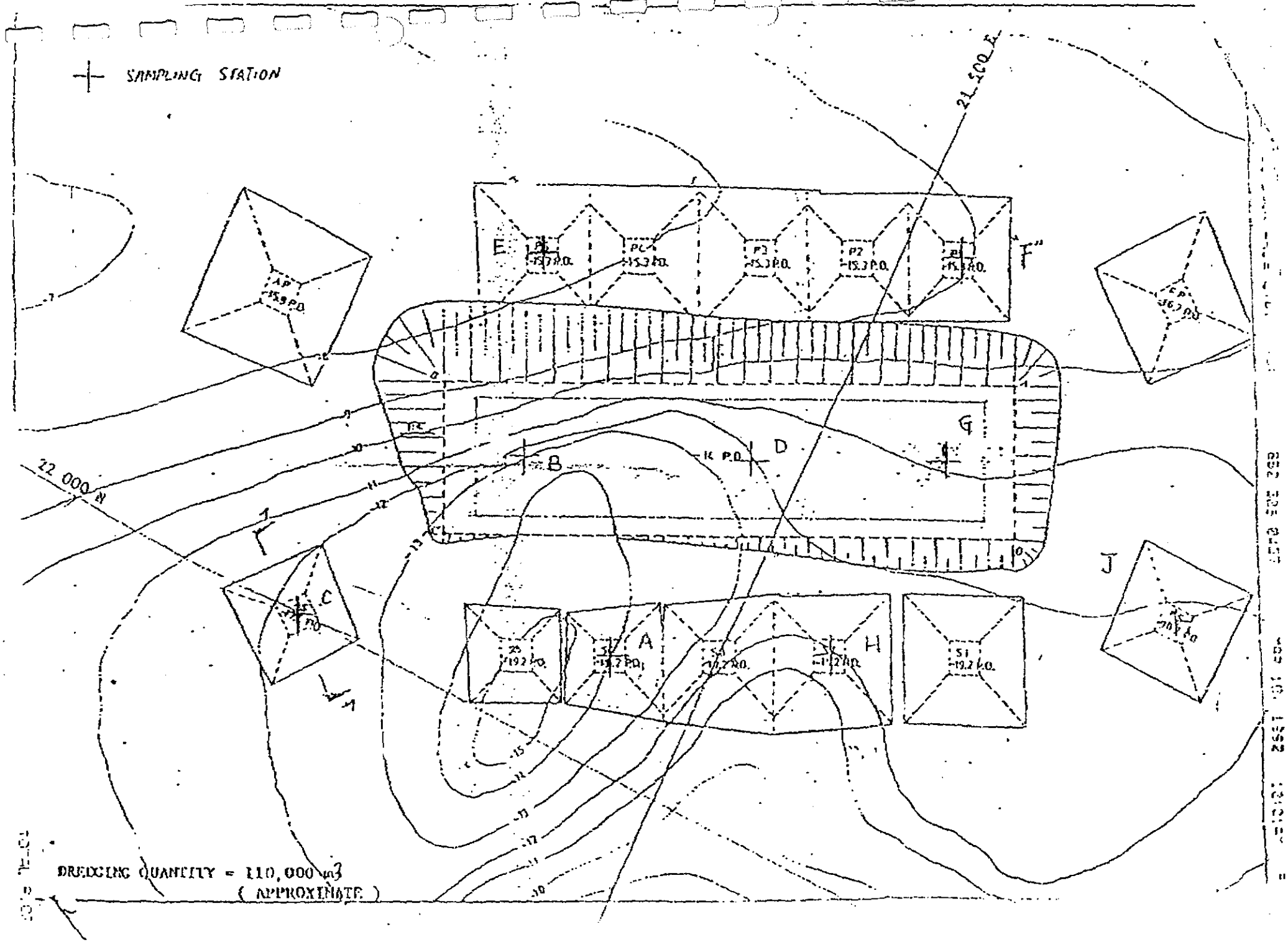
+852 305 0453 P.03

12-MAY-1992 13:19 EPD WT

852 305 0437 MAR 10. 1992



TOTAL P.02



TEL No.
852 525 0457
11.05.92 15:34 P.02

MaterialLab

Our Ref. No. : 920249e20096

Results :

LIMITS : ≤1.0 ≤65 ≤80 ≤1.5 ≤40 ≤75 ≤200

Sample I.D.	Mercury content mg/kg	Copper content mg/kg	Chromium content mg/kg	Cadmium content mg/kg	Nickel content mg/kg	Lead content mg/kg	Zinc content mg/kg
E4	0.2	70	22	<0.1	17	34	104
E5	0.2	49	24	<0.1	20	41	122
F1	0.3	41	27	<0.1	19	46	117
F2	0.2	50	22	<0.1	17	38	104
F3	0.1	63	22	<0.1	17	36	103
F5	0.2	29	20	<0.1	18	43	107
G1	0.2	46	23	<0.1	19	17	119
G2	0.2	49	24	<0.1	20	40	109
G3	0.2	57	23	<0.1	15	40	108
G4	0.2	66	24	<0.1	17	40	113
G5	0.2	25	20	<0.1	18	42	100
H1	0.1	28	13	<0.1	9	22	59
H2	0.1	28	10	<0.1	7	21	67
H5	<0.1	7	9	<0.1	7	14	40
J1	0.3	50	25	<0.1	19	45	115
J2	0.2	65	23	<0.1	17	39	114
J3	0.2	35	23	<0.1	18	44	121

Supervised by : K.F. Wong

Certified by :

Approved Signatory : K.M. Ho

Date : 24/4

MaterialLab

Our Ref. No. : 920249e20096

Results :

Sample I.D.	Mercury content mg/kg	Copper content mg/kg	Chromium content mg/kg	Cadmium content mg/kg	Nickel content mg/kg	Lead content mg/kg	Zinc content mg/kg
A1	0.2	49	23	<0.1	20	43	112
A2	0.1	44	21	<0.1	18	39	95
A3	0.1	127	24	<0.1	18	47	143
A5	0.1	27	17	<0.1	13	33	83
B1	0.1	53	24	<0.1	20	41	109
B2	0.1	59	11	<0.1	18	41	111
B3	0.1	146	26	<0.1	19	49	149
B4	0.1	98	28	<0.1	19	47	130
B5	0.2	49	23	<0.1	19	44	111
C1	0.4	21	19	<0.1	16	33	92
C2	0.2	208	26	<0.1	19	51	212
C3	0.1	132	36	<0.1	22	45	141
C4	0.2	50	19	<0.1	21	44	123
C5	0.2	29	30	<0.1	19	45	102
D1	0.2	35	24	<0.1	21	46	118
D2	0.2	61	20	<0.1	21	43	116
D3	0.2	28	19	<0.1	17	48	112
D5	0.2	25	19	<0.1	17	45	105
E1	0.2	31	21	<0.1	17	47	108
E2	0.2	46	23	<0.1	19	48	117
E3	0.1	45	21	<0.1	16	29	101

MaterialLab

Our Ref. No. : 920249e20096

REPORT ON ANALYSIS OF MARINE MUD

Client : Universal Dockyard Limited

Project : Yam O

Sample decription : Thirty-eight samples of mud

Tests required :
1. Mercury content
2. Copper content
3. Chromium content
4. Cadmium content
5. Nickel content
6. Lead content
7. Zinc content

Date received : 1992-04-02

Date completed : 1992-04-23

Method used :
1. Ref. "Standard Methods for Examination of Water and Wastewater" APHA, 17ed.
2.to 7. Ref. ASTM D3974

(9) in EP 62/D2/1/U01 IX
OUR REF:
TEL. NO.: 7553442
FAX NO.: 3050453

Hong Kong Government
Environmental Protection Department
Headquarters
28th Floor, Southorn Centre,
130 Hennessy Road,
Wan Chai, Hong Kong.

環境保護署總部
香港灣仔
軒尼詩道
一百三十號
修頓中心廿八樓

ENVIRONMENTAL PROTECTION DEPARTMENT
Solid Waste Control Group
9/F. World Trade Square, Tower 1
123 Hoi Bun Road, Kwun Tong,
Kowloon

Universal Dockyard Ltd.,
44 Ko Fai Road,
Yau Tong Bay,
Kowloon.

(Attn.: Mr. Siu Kung)

12 May 1992

Dear Sir,

Application for Marine Dumping Licence
Relocation of Floating Dock "Taikoo" in Yam O

I refer to your analysis report of the mud samples from the captioned site.

The report reveals that some of mud samples contain highly contaminated material which is not acceptable for marine disposal at an existing spoil ground. However, for those less contaminated mud, marine dumping is allowed. Therefore, it is our intention to issue you only a licence for those less contaminated mud at South of Cheung Chau spoil ground, and you still need to arrange other means of disposal of the highly contaminated mud.

Mud within the top two metre layer of the highlighted areas shown in the enclosd drawing is not accepted for marine disposal. Please promptly confirm your acceptance of the arrangement so that we could proceed with the licensing procedure. You are also reminded to provide us the reduced mud quantity for our record.

Yours faithfully,

(J.K.F. Ng)
for Director of Environmental Protection

c.c. Hong Kong United Dockyards Ltd.
(Attn.: Mr. M.T. Wong)

Ref. No. SC-AFMDL in disk SC(35)

The results presented in this appendix are historical data and this sampling and analysis programme was not undertaken for this EIA. The analysis was undertaken prior to the mooring of the Taikoo in its present location.

The method used for assessing the mercury concentration was developed for analysing water and waste water. It is possible to use such methods for analysing sediments with a high water content rather than use analytical techniques devised for soils.

All methods used by Materialab are given on page 1 of 3 of the results.

Appendix 6

Noise Monitoring Results

APPENDIX 6

1.H.U.D. NOISE MONITORING

Meter Setting: Fast, 30 - 110 dB, A-weighting
Microphone Position: 1.5m above ground level.

Table 1: Baseline Measurements at Sensitive Receivers

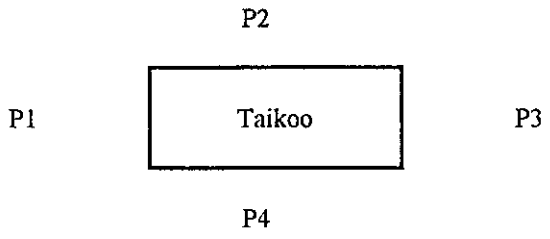
Sensitive Receivers	Noise Levels				Nearby Noise Sources
	L_{eq} (30 min)	L_{10}	L_{90}	L_{max}	
Luk King Tsuen (NSR1)	61.2	63.0	57.8	64.2	-
Tsing Chai Tsai (NSR2)	61.4	63.0	59.0	70.9	Dumping Sand

Table 2: Noise Source Measurement

Measurement Position	Leq (15s), dB(A)	Measured Noise Activities
P1, 5m from Taikoo	68.3	Painting and de-rusting work - i.e grit blasting.
P2, 5m from Taikoo	67.0	Electric Motor
P3, 5m from Taikoo	69.9	De rusting work (grit blasting)
P4, 5m from Taikoo	69.0	Lifting work involving use of electric hoist system

Microphone position was set to 1.5m above the deck level of the boat which was positioned at the four measuring stations shown below.

Measurement Locations:



2. DETAILED NOISE CALCULATIONS

1) Derivation of Sound Power Level of Typical Maintenance Activity.

a) The sound power level (SWL) of a typical maintenance activity has been calculated from the measured sound pressure level (SPL, in terms of the Leq(15s) index) using the following standard equation :

$$SWL = SPL + 10 \log S$$

where S is the sound radiating surface area (m^2)

The sound radiating surface is taken to be the sidewall of the dockyard that is closest to noise measurement point. This assumption would lead to a conservative estimate of the sound power level.

b) For measurement location P_1,
$SWL_1 = 68.3 + 10 \log (35x16.6)$
$= 96$ dBA

For measurement location P_3,
$SWL_3 = 69.9 + 10 \log (35x16.6)$
$= 98$ dBA

For measurement location P_2,
$SWL_2 = 67.0 + 10 \log (175x16.6)$
$= 102$ dBA

For measurement location P_4,
$SWL_4 = 69.0 + 10 \log (175x16.6)$
$= 104$ dBA

Thus the average sound power level of a typical maintenance activity is 100 dBA.

2) Noise Prediction at Sensitive Receivers

a) In predicting the dock noise at the sensitive receivers, the following assumptions have been used :

based on the dimension of 17V Tai Koo dock, the height for the other docks are assumed to be 0.475 of its breadth ;

based on site observation and past experience of similar projects, the maximum number of maintenance activities undertaken simultaneously is assumed to be 10 for the HUD's 17V Tai Koo Dock ;

for other docks, the maximum number of maintenance activities done at the same time is assumed to be proportional to the size of the dock (2 x length x height) ;

for instance, this maximum number is 19 for the new HUD dock (290mL x 40mW x19mH), and 3 for the smallest 167V Yin Lian 5 dock (82mL x 24mW x11mH) ;

the sound power level of noise emitted from a dock (SWL_d) is assumed to be related to the activity sound power level (SWL_a) by the equation : $SWL_d = SWL_a + 10 \log N$, where N is the number of maintenance activity undertaken simultaneously.

D.A. represents Distance Attenuation of noise due to its geometric spreading, which is assumed to follow the inverse square law ;

A.A. represents Air Absorption = - distance/120, dBA ;

The attenuation due to air absorption used in our calculation is based on the reference "Basic Acoustics" by Donald E. Hall. Figure 1.4 of the reference is attached in this appendix and shows the sound at mid-frequencies rangingfrom 1-2 kHz in air temperature 20°C and 70% relative humidity, approximately achieve a reduction of 1dB per 120m.

a screening factor of - 10 dBA is applied where the dock is obstructed from view at the receivers by topographical features and a factor of - 5 dBA for partial screening ;

b) The number of maintenance activities undertaken simultaneously at individual docks are estimated in the following table. The estimates are considered conservative.

Dock Name	Length m	Breadth m	Height m	Area m^2	Activity No. N	10 log N
167V Yiu Lian 5	82	24	11.4	935	3.2	5.1
137V Yiu Lian 3	252	55	26.1	6584	22.6	13.5
157V Yiu Lian 4	155	32	15.2	2356	8.1	9.1
97V Yiu Lian 2	190	40	19.0	3610	12.4	10.9
17V HUD Tai Koo	175	35	16.6	2909	10.0	10.0
new HUD dock	290	40	19.0	5510	18.9	12.8

c) **The noise level at Tsing Chau Tsai is predicted below :**

Dock Name	Activity SWL_a	10logN	Dock SWL_d	*Dist m	DA dBA	AA dBA	Screening dBA	Facade dBA	Level dBA
167V Yiu Lian 5	100	5.1	105.1	400	-60.0	-3.3	-10.0	3.0	34.7
137V Yiu Lian 3	100	13.5	113.5	650	-64.3	-5.4	-10.0	3.0	36.9
157V Yiu Lian 4	100	9.1	109.1	670	-64.5	-5.6	-5.0	3.0	37.0
97V Yiu Lian 2	100	10.9	110.9	620	-63.8	-5.2	-5.0	3.0	39.9
17V HUD Tai Koo	100	10.0	110.0	820	-66.3	-6.8	-5.0	3.0	34.9
new HUD dock	100	12.8	112.8	1000	-68.0	-8.3	-5.0	3.0	34.4

** distances were measured from figure 2.1 of main report*

Combined noise level due to five existing docks = 44.1 dBA
Combined noise level including new dock = 44.5 dBA
Thus the noise increase due to the new dock = 0.4 dBA

d) **The noise level at Luk King Tsuen is predicted below :**

Dock Name	Activity SWL_a	10logN	Dock SWL_d	*Dist m	DA dBA	AA dBA	Screening dBA	Facade dBA	Level dBA
167V Yiu Lian 5	100	5.1	105.1	2366	-75.5	-19.7	-10.0	3.0	2.9
137V Yiu Lian 3	100	13.5	113.5	2184	-74.8	-18.2	0.0	3.0	23.6
157V Yiu Lian 4	100	9.1	109.1	1820	-73.2	-15.2	-5.0	3.0	18.7
97V Yiu Lian 2	100	10.9	110.9	1820	-73.2	-15.2	-5.0	3.0	20.6
17V HUD Tai Koo	100	10.0	110.0	1092	-68.8	-9.1	0.0	3.0	35.1
new HUD dock	100	12.8	112.8	1092	-68.8	-9.1	-5.0	3.0	32.9

Combined noise level due to five existing docks = 35.7 dBA
Combined noise level including new dock = 37.5 dBA
Thus the noise increase due to the new dock = 1.8 dBA

e) The above calculations show that the predicted noise levels at the two sensitive receivers are well below the noise standard of 55 dBA.

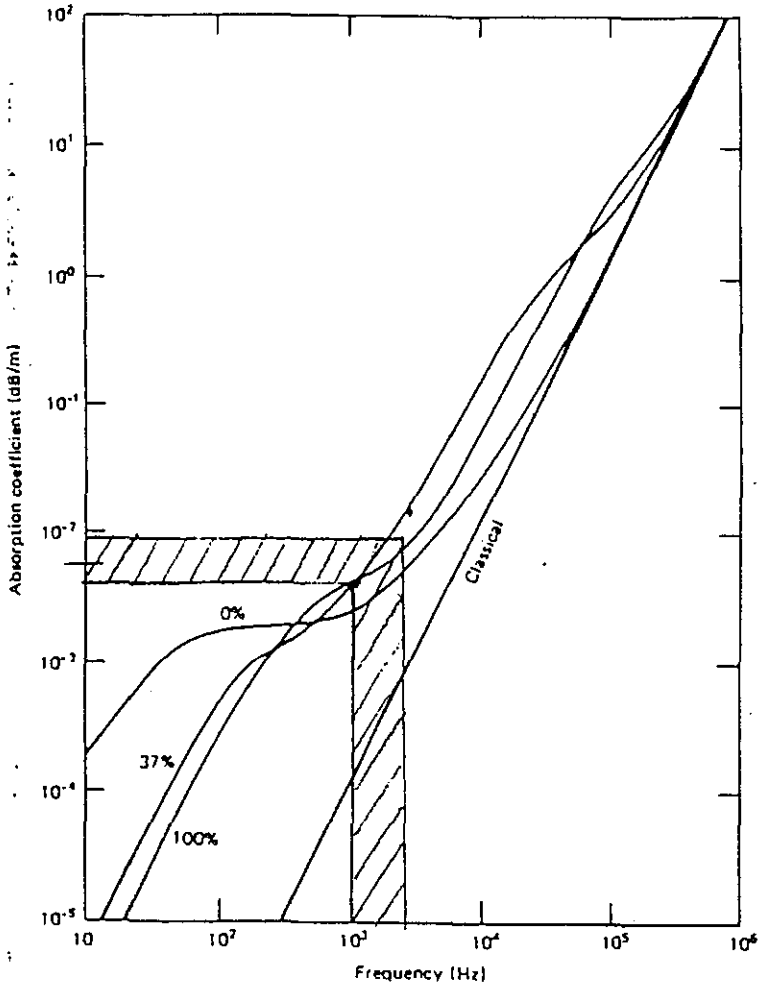
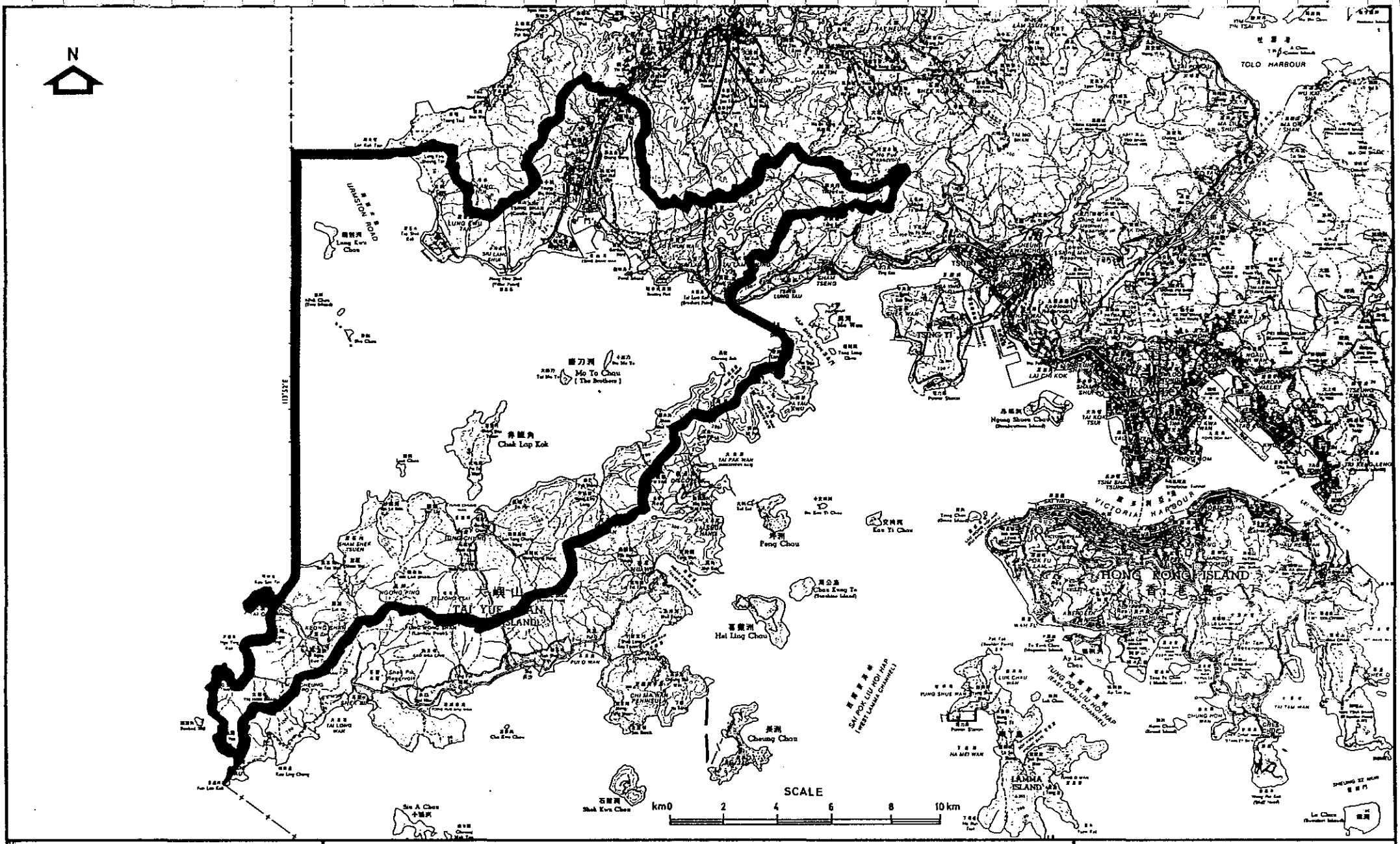


Figure 1.4 Absorption coefficient α (dB/m) for sound in air of temperature 20°C as a function of frequency. Irregular curves represent data for different relative humidities. Straight line represents "classical" absorption, that portion due to viscosity and thermal conduction alone, which is proportional to f^2. (Reproduced by permission from Kinsler et al., *Fundamentals of Acoustics*, John Wiley & Sons, New York, 3d ed., 1982, p. 154. Based on results from Bass et al., *JASA*, 52, 821, 1972.)

0.008 dB/m
= 1 dB/120 m

Appendix 7

Effluent Discharge Standards, Water Quality Objectives and Form A, Application for a Discharge License



The area edged grey on map is designated as a Water Control Zone under Section 4(1)(a) of the Water Pollution Control Ordinance Cap. 358.

西北區水質管制區

NORTH WESTERN WATER CONTROL ZONE

PLANNING, ENVIRONMENT AND LANDS BRANCH GOVERNMENT SECRETARIAT

WP/M/5 (NTHQ 8/91)

Plan prepared by Survey and Mapping Office, Buildings and Lands Department

Table 10a Standards for effluents discharged into the inshore waters of Southern, Mirs Bay, Junk Bay, North Western, Eastern Buffer and Western Buffer Water Control Zones
(All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated)

Determinand \ Flow rate (m^3/day)	≤10	>10 and ≤100	>100 and ≤400	>400 and ≤600	>600 and ≤800	>800 and ≤1000	>1000 and ≤1500	>1500 and ≤2000	>2000 and ≤3000	>3000 and ≤4000	>4000 and ≤5000	>5000 and ≤6000
pH (pH units)	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9
Temperature (°C)	40	40	40	40	40	40	40	40	40	40	40	40
Colour (lovibond units) (25mm cell length)	1	1	1	1	1	1	1	1	1	1	1	1
Suspended solids	30	30	30	30	30	30	30	30	30	30	30	30
BOD	50	20	20	20	20	20	20	20	20	20	20	20
COD	100	80	80	80	80	80	80	80	80	80	80	80
Oil & Grease	30	20	20	20	20	20	20	20	20	20	20	10
Iron	15	10	10	7	5	4	3	2	1	1	0.8	0.6
Boron	5	4	3	2	2	1.5	1.1	0.8	0.5	0.4	0.3	0.2
Barium	5	4	3	2	2	1.5	1.1	0.8	0.5	0.4	0.3	0.2
Mercury	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Other toxic metals individually	1	1	0.8	0.7	0.5	0.4	0.3	0.2	0.15	0.1	0.1	0.1
Total toxic metals	2	2	1.6	1.4	1	0.8	0.6	0.4	0.3	0.2	0.1	0.1
Cyanide	0.2	0.1	0.1	0.1	0.1	0.1	0.05	0.05	0.03	0.02	0.02	0.01
Phenols	0.5	0.5	0.5	0.3	0.25	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Sulphide	5	5	5	5	5	5	2.5	2.5	1.5	1	1	0.5
Total residual chlorine	1	1	1	1	1	1	1	1	1	1	1	1
Total nitrogen	100	100	80	80	80	80	50	50	50	50	50	30
Total phosphorus	10	10	8	8	8	8	5	5	5	5	5	5
Surfactants (total)	20	15	15	15	15	15	10	10	10	10	10	10
E. coli (count/100 ml)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

Table 10b Standards for effluents discharged into the marine waters of Southern, Mirs Bay, Junk Bay, North Western, Eastern Buffer and Western Buffer Water Control Zones
(All units in mg/L unless otherwise stated; all figures are upper limits unless otherwise indicated)

Determinand \ Flow rate (m^3/day)	≤10	>10 and ≤100	>100 and ≤400	>400 and ≤600	>600 and ≤800	>800 and ≤1000	>1000 and ≤1500	>1500 and ≤2000	>2000 and ≤3000	>3000 and ≤4000	>4000 and ≤5000	>5000 and ≤6000
pH (pH units)	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10
Temperature (°C)	45	45	45	45	45	45	45	45	45	45	45	45
Colour (lovibond units) (25mm cell length)	4	1	1	1	1	1	1	1	1	1	1	1
Suspended solids	500	500	500	300	200	200	100	100	50	50	40	30
BOD	500	500	500	300	200	200	100	100	50	50	40	30
COD	1000	1000	1000	700	500	400	300	200	150	100	80	60
Oil & Grease	50	50	50	30	25	20	20	20	20	20	20	20
Iron	20	15	13	10	7	6	4	3	2	1.5	1.2	1
Boron	6	5	4	3.5	2.5	2	1.5	1	0.7	0.5	0.4	0.3
Barium	6	5	4	3.5	2.5	2	1.5	1	0.7	0.5	0.4	0.3
Mercury	0.1	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.1	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Other toxic metals individually	2	1.5	1.2	0.8	0.6	0.5	0.32	0.24	0.16	0.12	0.1	0.1
Total toxic metals	4	3	2.4	1.6	1.2	1	0.64	0.48	0.32	0.24	0.2	0.14
Cyanide	1	0.5	0.5	0.5	0.4	0.3	0.2	0.15	0.1	0.08	0.06	0.04
Phenols	0.5	0.5	0.5	0.3	0.25	0.2	0.13	0.1	0.1	0.1	0.1	0.1
Sulphide	5	5	5	5	5	5	2.5	2.5	1.5	1	1	0.5
Total residual chlorine	1	1	1	1	1	1	1	1	1	1	1	1
Total nitrogen	100	100	80	80	80	80	50	50	50	50	50	50
Total phosphorus	10	10	8	8	8	8	5	5	5	5	5	5
Surfactants (total)	30	20	20	20	15	15	15	15	15	15	15	15
E. coli (count/100 ml)	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000

"marine waters" means all waters below the high water mark within the boundary of the North Western Water Control Zone;

"other inland waters" means inland waters other than those in the Tuen Mun (A), Tuen Mun (B) and Tuen Mun (C) Subzones;

"Secondary Contact Recreation Subzone" means an area delineated as such on the Map, except where the area is more specifically designated as a bathing beach;

"Tuen Mun (A) Subzone" means that part of the catchment of the Tuen Mun River which is delineated and marked TM(A) on the Map;

"Tuen Mun (B) Subzone" means that part of the catchment of the Tuen Mun River which is delineated and marked TM(B) on the Map;

"Tuen Mun (C) Subzone" means that part of the catchment of the Tuen Mun River which is delineated and marked TM(C) on the Map;

"Water Gathering Ground Subzone" means an area delineated as such on the Map.

SCHEDULE [s. 1]

	Water Quality Objective	Part or Parts of Zone
A.	AESTHETIC APPEARANCE	
	(a) Waste discharges shall cause no objectionable odours or discolouration of the water.	Whole zone
	(b) Tarry residues, floating wood, articles made of glass, plastic, rubber or of any other substances should be absent.	Whole zone

(c)	Mineral oil should not be visible on the surface. Surfactants should not give rise to a lasting foam.	Whole zone
(d)	There should be no recognisable sewage-derived debris.	Whole zone
(e)	Floating, submerged and semi-submerged objects of a size likely to interfere with the free movement of vessels, or cause damage to vessels, should be absent.	Whole zone
(f)	Waste discharges shall not cause the water to contain substances which settle to form objectionable deposits.	Whole zone

BACTERIA

(a)	The level of Escherichia coli should not exceed 610 per 100 mL, calculated as the geometric mean of all samples collected in a calendar year.	Secondary Contact Recreation Subzones

(b)	The level of Escherichia coli should be less than 1 per 100 mL, calculated as the running median of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days.	Tuen Mun (A) and Tuen Mun (B) Subzones and Water Gathering Ground Subzones
(c)	The level of Escherichia coli should not exceed 1 000 per 100 mL, calculated as the running median of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days.	Tuen Mun (C) Subzone and other inland waters
(d)	The level of Escherichia coli should not exceed 180 per 100 mL, calculated as the geometric mean of all samples collected from March to October inclusive. Samples should be taken at least 3 times in one calendar month at intervals of between 3 and 14 days.	Bathing Beach Subzones

COLOUR

(a)	Waste discharges shall not cause the colour of water to exceed 30 Hazen units.	Tuen Mun (A) and Tuen Mun (B) Subzones and Water Gathering Ground Subzones

(b)	Waste discharges shall not cause the colour of water to exceed 50 Hazen units.	Tuen Mun (C) Subzone and other inland waters

D. DISSOLVED OXYGEN

(a)	Waste discharges shall not cause the level of dissolved oxygen to fall below 4 mg per litre for 90% of the sampling occasions during the whole year; values should be calculated as water column average (arithmetic mean of at least 3 measurements at 1 m below surface, mid-depth and 1 m above seabed). In addition, the concentration of dissolved oxygen should not be less than 2 mg per litre within 2 m of the seabed for 90% of the sampling occasions during the whole year.	Marine waters
(b)	Waste discharges shall not cause the level of dissolved oxygen to be less than 4 mg per litre.	Tuen Mun (A), Tuen Mun (B) and Tuen Mun (C) Subzones, Water Gathering Ground Subzones and other inland waters

E. pH

(a)	The pH of the water should be within the range of 6.5-8.5 units. In addition, waste discharges shall not cause the natural pH range to be extended by more than 0.2 unit.	Marine waters excepting Bathing Beach Subzones
(b)	Waste discharges shall not cause the pH of the water to exceed the range of 6.5-8.5 units.	Tuen Mun (A), Tuen Mun (B) and Tuen Mun (C) Subzones and Water Gathering Ground Subzones
(c)	The pH of the water should be within the range of 6.0-9.0 units.	Other inland waters
(d)	The pH of the water should be within the range of 6.0-9.0 units for 95% of samples collected during the whole year. In addition, waste discharges shall not cause the natural pH range to be extended by more than 0.5 unit.	Bathing Beach Subzones

F. TEMPERATURE

Waste discharges shall not cause the natural daily temperature range to change by more than 2.0°C.	Whole zone

G.	SALINITY	
	Waste discharges shall not cause the natural ambient salinity level to change by more than 10%.	Whole zone
H.	SUSPENDED SOLIDS	
	(a) Waste discharges shall neither cause the natural ambient level to be raised by more than 30% nor give rise to accumulation of suspended solids which may adversely affect aquatic communities.	Marine waters
	(b) Waste discharges shall not cause the annual median of suspended solids to exceed 20 mg per litre.	Tuen Mun (A), Tuen Mun (B) and Tuen Mun (C) Subzones and Water Gathering Ground Subzones
	(c) Waste discharges shall not cause the annual median of suspended solids to exceed 25 mg per litre.	Other inland waters
I.	AMMONIA	
	The un-ionized ammoniacal nitrogen level should not be more than 0.021 mg per litre, calculated as the annual average (arithmetic mean).	Whole zone

J. NUTRIENTS

(a)	Nutrients shall not be present in quantities sufficient to cause excessive or nuisance growth of algae or other aquatic plants.	Marine waters
(b)	Without limiting the generality of objective (a) above, the level of inorganic nitrogen should not exceed 0.3 mg per litre, expressed as annual water column average (arithmetic mean of at least 3 measurements at 1 m below surface, mid-depth and 1 m above seabed).	Castle Peak Bay Subzone
(c)	Without limiting the generality of objective (a) above, the level of inorganic nitrogen should not exceed 0.5 mg per litre, expressed as annual water column average (arithmetic mean of at least 3 measurements at 1 m below surface, mid-depth and 1 m above seabed).	Marine waters excepting Castle Peak Bay Subzone

K. 5-DAY BIOCHEMICAL OXYGEN DEMAND

(a)	Waste discharges shall not cause the 5-day biochemical oxygen demand to exceed 3 mg per litre.	Tuen Mun (A), Tuen Mun (B) and Tuen Mun (C) Subzones and Water Gathering Ground Subzones

(b)	Waste discharges shall not cause the 5-day biochemical oxygen demand to exceed 5 mg per litre.	Other inland waters

L. CHEMICAL OXYGEN DEMAND

(a)	Waste discharges shall not cause the chemical oxygen demand to exceed 15 mg per litre.	Tuen Mun (A), Tuen Mun (B) and Tuen Mun (C) Subzones and Water Gathering Ground Subzones
(b)	Waste discharges shall not cause the chemical oxygen demand to exceed 30 mg per litre.	Other inland waters

M. TOXINS

(a)	Waste discharges shall not cause the toxins in water to attain such levels as to produce significant toxic, carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms, with due regard to biologically cumulative effects in food chains and to toxicant interactions with each other.	Whole zone
(b)	Waste discharges shall not cause a risk to any beneficial use of the aquatic environment.	Whole zone

N. PHENOL

Phenols shall not be present in such quantities as to produce a specific odour, or in concentration greater than 0.05 mg per litre as C_6H_5OH. — Bathing Beach Subzones

O. TURBIDITY

Waste discharges shall not reduce light transmission substantially from the normal level. — Bathing Beach Subzones

Secretary for Planning, Environment and Lands.

25 February 1992.

Explanatory Note

This Statement sets out the established water quality objectives of the various parts of the North Western Water Control Zone.

FORM A

For Official Use
Code No.
WPCO/ / /

GOVERNMENT OF HONG KONG

WATER POLLUTION CONTROL ORDINANCE
(Chapter 358)

Application for a licence/
Application for renewal/variation of a licence

North West **Water Control Zone.**

SECTION A. The Applicant.

A1. All applicants must complete this section.

Your name in English Hong Kong United Dockyards

Your name in Chinese

Your identity card number, *OR*, if the applicant is a firm,
your business registration number 03763057-000-01-93-0

Your correspondence address Tytl 108 R. P. SAI TSO WAN ROAD
TSING YI ISLAND N.T.
HONG KONG

Your telephone number 2431 2828

In what capacity are you making this application? Production Servicer Manager
(for example, "owner", "occupier", "manager", "director", "agent")

A2. Complete this section if the application is for commercial, industrial or institutional premises (including premises occupied by more than one household unit whether rented as holiday accommodation or otherwise), or a domestic sewage treatment plant.

Name of the enterprise Hong Kong United Dockyards Ltd

Registered address As above

Name of the manager M. T. Wong

Manager's identity card number D447463 (6)

Manager's business telephone number 2431 2880

SECTION B. The Effluent.

B1. All applicants must complete this section.

Give the name and full address of the premises from which the discharge or deposit is made.

Floating Dock, "United", near Yam O Wan
Natn Lantau Island

On what date did or will the discharge or deposit begin ? Early April

B2. Applicants with toilet, bathroom or kitchen wastewater must complete this section.

(1) Where does toilet wastewater discharge to (please tick) ?

(*a*) Septic tank ☐

(*b*) Other treatment facilities [X]

(*c*) Communal sewer or drain for the carriage of foul water ☐

(*d*) Elsewhere, for example, a watercourse ☐

(If (*b*) or (*d*), please specify Hamworthy Super Trident, Sewage Treatment Unit

State the location of the facility in relation to the premises within the floating dock, location shown on drawing 1 attached. Treated effluent is discharged to sea.

(2) Where do the kitchen and bathroom wastewaters discharge to (please tick) ?

(*a*) Septic tank ☐

(*b*) Other treatment facilities [X]

(*c*) Communal sewer or drain for the carriage of foul water ☐

(*d*) Elsewhere, for example, a watercourse ☐

(If (*b*) or (*d*), please specify Sewage treatment Unit)

State the location of the facility in relation to the premises Refer to drawing 1

B3. Complete this section if the application is for commercial, industrial or institutional premises.

(1) State —

(*a*) the industry, trade, business or other work carried on at the premises

Ship Repair, Maintenance and Inspection Work

(*b*) the number of staff 200

(*c*) the number of working hours per day 8

(*d*) the number of working days per week 6

If fluctuation in any of the above is expected, please elaborate Number of people working on the dock may be less depending on the actual works required to be carried out

(2) If the business is manufacturing, state —

(*a*) what is made N/A

(*b*) the raw materials used From washwater and bilge from ships

(*c*) any streams of wastewater produced

(*d*) water account number(s)

(*e*) the information shown in the last received water bill(s) as —

(i) the billing period

(ii) the water consumption (in cubic metres)

(*f*) the information shown in the next-but-last received water bill(s) as —

(i) the billing period

(ii) the water consumption (in cubic metres)

B4. If the application is for discharges from domestic premises, omit this section.

(1) What is the maximum daily flow rate of the discharge(s) or deposit(s) ? From Sewage treatment plant<400L/day; Washwater Max 250000L

Besides tap water, any other sources of water used ? yes

If yes, please specify (for example, well, stream or recycled water) occasionally sea water

and its total daily consumption Variable; Max 450 tonnes per ship

(2) If the effluent is treated before it leaves your premises show by ticking the boxes what treatment processes are used —

Screening	[X]	Temperature control	[ ]
Settlement	[X]	Biological treatment	[ ]
Chemical precipitation	[ ]	what kind ? Aeration	
Ion exchange	[ ]	Other process	[ ]
pH adjustment	[ ]	what kind ? Disinfection (Chlorination)	

Provide a layout plan and schematic diagram of the treatment plant if one is available.

(3) Where does the effluent discharge to ? sea

(for example surface water drain, foul sewer, treatment plant, river, stream or sea); draw a sketch plan of the discharge in section C. Please Refer to additional information

SECTION C. Plan.

If the application is for discharges from domestic premises, omit this section. If the application is other than for discharges from domestic premises, draw or attach in this section a sketch plan showing the following details —

(1) the location of the premises;
(2) the location of the discharge points;
(3) the places where samples of the effluent may be taken.

Please Refer to additional information and attached drawings.

SECTION D. Renewal or Variation. N/A

Complete this section if you are applying to vary or renew an existing licence.

(1) Existing licence number _____

(2) Date licence expires _____

If the application is for a variation of conditions, state the variation sought and the reasons for it —

_____

_____

_____

_____

SECTION E. Declaration.

All applicants must complete this section.

I hereby certify that the particulars provided in this form are, to the best of my knowledge and belief, correct.

Signed _____
(Applicant)

Date _____

NOTE: 1. Please use a separate sheet of paper where the space provided in the form is not sufficient.

2. The information given in this application, and the result of the application, will be recorded in a register open for public inspection. If an applicant wishes to withhold certain information from public notification, a separate application under section 43 of the Ordinance will be required.

3. The issue of a licence is subject to payment of a prescribed fee, details of which are provided in a leaflet attached to this application form. A demand note for the fee, specifying the date by which it should be paid, will be sent to the applicant. A licence will not be issued unless the fee is paid by the due date.

Warning: Regulation 17 of the Water Pollution Control (General) Regulations makes it an offence punishable with a maximum fine of $10,000 for a person in completing the form to knowingly or recklessly make a statement or give an estimate which is incorrect in a material particular or knowingly omit a material particular.

Appendix 8

Good Housekeeping Rules for Dockyards

APPENDIX 8

GOOD HOUSEKEEPING IN DOCKYARDS (AFTER VROM, 1988)

General:
Containers have to be placed within the docks for collection of the remainders of the paints used, thinners, oil, chemicals and empty paint tins.
The management and the administration for the afore-mentioned containers have to be carried out by one responsible person, who also replaces filled-up containers for empty ones.
The responsible person has to inspect the dock floor before out-docking.
All sink holes and water drains have to be closed during painting, cleaning and (sand) blasting.
Cleaning:
anchors have to be released from bilge blocks;
anchors and chains have to be laid down in such a way that a part from the dockfloor (as little as possible) is covered;
all superfluous obstacles and materials have to be removed from the dockfloor in time.
Water cleaning:
It is recommended that the pressure of the power wash nozzles be monitored and adjusted to minimise the removal of the paint film during cleaning operations.
Sand or gritblasting:
Alternatives to gritblasting can include cavitating high pressure water jets and high energy beams;
Since the spent grit (including old paint) is for the most part settable in dry dock areas, it can be vacuumed up for proper disposal;
Blasting residues have to be collected as good as possible and disposed of in a proper way. Recommended means for pre-include plastic film lining of the dry dock area prior to painting, and clean up by vacuum and wash-down prior to re-flooding the drydock.
Painting:
overspray has to be minimized by e.g. an optimal distance between spraying nozzle and object, a very small spraying angle and the use of a lance;
the amount of paint tins to be opened has to be geared to the amount of paint to be used. Paint tins shall be opened only if absolutely necessary;
all used paint tins have to be emptied as far as possible. The remainder of the paints can be applied to the sheeting of the ship, sent with the ship or dumped in the aforementioned containers;
purging of spraying pistols, paint hoses and nozzles have to be carried out in the afore-mentioned containers and not on the dockfloor or docksides;
spilling of the paint has to be cleaned up immediately and the spilling has to be reported.
Waste material:
all paint rests, spent grit, brushes and cleaning rags have to be collected and dumped into the afore-mentioned containers before out-docking.

Appendix 9

HUD's Operational Procedure for the Testing and Examination of Lifting Appliances and Lifting Gear

OPERATING PROCEDURE

Procedure No. : HUD-MAR-002

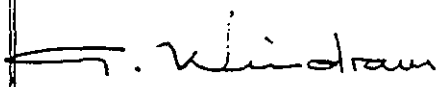
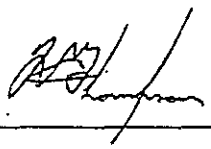
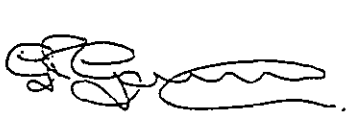
Procedure Title : TESTING AND EXAMINATION OF LIFTING APPLIANCES AND LIFTING GEAR

Revision No. : 0

CONTROL STAMP

THE STAMP IS IN RED FOR A

CONTROLLED COPY

PREPARED BY	VERIFIED BY	AUTHORIZED FOR ISSUE
SIGNATURE 	SIGNATURE 	SIGNATURE 
NAME G. WINDRAM	NAME J.A. THOMPSON	NAME G.R. GOUGH
POSITION MARINE MANAGER	POSITION ADMINISTRATION MANAGER	POSITION MANAGING DIRECTOR
DATE 2.12.94	DATE 2/12/94	DATE 2-12-94.

HUD

OPERATING PROCEDURE

REVISION HISTORY

PROCEDURE TITLE : TESTING AND EXAMINATION OF LIFTING APPLIANCES AND LIFTING GEAR

PROCEDURE NO. HUD-MAR-002

REVISION NO.	CLAUSE NO.	PAGE NO.	DETAILS:
0	ALL	ALL	INITIAL RELEASE
	ISSUE DATE: 1.12.94		
	CLAUSE NO.	PAGE NO.	DETAILS:
	ISSUE DATE:		
	CLAUSE NO.	PAGE NO.	DETAILS:
	ISSUE DATE:		
	CLAUSE NO.	PAGE NO.	DETAILS:
	ISSUE DATE:		
	CLAUSE NO.	PAGE NO.	DETAILS:
	ISSUE DATE:		

CONTENTS

1.0 PURPOSE

The purpose of this procedure is to describe responsibilities, methods and documentation required in the testing and examination of lifting appliances and lifting gears to comply with Hong Kong Government Legislation and to fulfill the safety requirement of the company.

2.0 SCOPE

This procedure is applicable to lifting appliances and lifting gear which are owned and operated by the company.

3.0 REFERENCES

HUD-MAR-003 "Care and Maintenance of Lifting Gear".

4.0 DEFINITIONS

4.1 Lifting Appliances

A winch, pulley block, chain block or air hoist used for raising or lowering, and a fixed or rail mounted tower crane, mobile crane, workshop overhead crane, radial arm, and also any part of such appliance.

4.2 Lifting Gear

A chain sling, rope sling, wire sling, synthetic material sling, ring or similar gear, and a link, hook, plate clamp, shackle, swivel or eyebolt and portable lifting beam, spreader, personnel basket, etc. For the purpose of this procedure Lifting Gear does not include staging and its accessories.

4.3 Competent Examiner

A person who is a Registered Professional Engineer and is by reason of his qualifications, training and experience, competent to carry out the test and examination.

4.4 Competent Person

A person who is by reason of his training and practical experience, competent to perform the duty.

4.5 Maintenance Team

Personnel assigned by the Plant Manager, Docking Services Manager, and the Electrical Manager, who by reason of their training and practical experience are competent to carry out maintenance and testing of lifting appliances.

4.6 Limit Switch

Electrical or mechanical components which may be installed on lifting appliances to prevent overloading, over-hoisting of lifting hook, etc.

4.7 Maintained

Maintained in an efficient state, in efficient working order and good repair.

4.8 Repair

Includes renewal, alteration or addition.

4.9 Safe Working Load (SWL)

The Safe Working Load is the load for which the lifting appliance or lifting gear is designed and is approved to support and as specified in the current certificate of test and thorough examination delivered in the prescribed form by a Competent Examiner in respect of that lifting appliance or lifting gear.

4.10 Proof Load

The Proof Load is the test load to which a component or an assembled unit is subjected as required by prevailing regulations and/or to satisfactorily verify the suitable condition of the appliance or gear.

4.11 Thorough Examination

A visual examination, carried out as carefully as the conditions permit in order to arrive at a reliable conclusion as to the safety of the parts examined, and if necessary for the purpose the visual examination shall be supplemented by other means such as a hammer test and, parts of the lifting appliance or lifting gear shall be dismantled. Thorough Examinations of lifting appliances and lifting gears shall be conducted by a **Competent Examiner.**

4.12 Inspection

A visual inspection to determine that the part is in good order and is fit for safe use for the purpose intended. Inspections of Lifting Appliances and Lifting Gear shall be conducted by a nominated **Competent Person.**

5.0 RESPONSIBILITIES

5.1 Plant Manager

The Plant Manager is responsible for ensuring that all lifting appliances are properly maintained. The Plant Manager is also responsible for coordinating the testing and thorough examination of all lifting appliances and lifting gear including when necessary the appointment of a competent examiner and maintaining proper records and certification of the results of the tests and examinations.

5.2 Electrical Manager

The Electrical Manager is responsible for coordinating electrical maintenance, checking of electrical components of all lifting appliances and cooperating with Plant personnel to carry out testing.

5.3 Departmental Managers

Departmental Managers are responsible for ensuring that all lifting appliances and lifting gear under the control of their departments are properly maintained and that all inspections, examinations and tests are carried out as and when required and to ensure that department records are maintained.

5.4 Docking Services Manager

The Docking Services Manager is responsible for provision of Competent Persons (Ship Riggers) to conduct and assist the testing, inspection and maintenance activities as required.

5.5 Safety Officers

Safety Officers shall randomly audit the scheduled testing and examination activity of lifting appliances and lifting gear and to ensure that the testing procedure fulfills the safety requirement. Safety Officers are authorized to stop any activity which may be prejudicial to safety.

5.6 Maintenance Team

The Maintenance Team is responsible for carrying out maintenance, examination and testing of all lifting appliances and lifting gear as directed and preparing proper record of same.

5.7 Competent Examiners

The Competent Examiners are required to carry out the **thorough examination** and **testing** of lifting appliances and lifting gears and to report the results in the approved form.

5.8 Competent Persons

The Competent Persons are required to carry out the **inspection** of lifting appliances and lifting gear and to report the results in the approved form.

6.0 ACTIONS FOR TESTING, EXAMINATION AND INSPECTION

6.1 Frequency and Execution

6.1.1 Lifting Appliances

6.1.1.1 Before first use, a Lifting Appliance shall be tested and thoroughly examined by a Competent Examiner in the manner prescribed and a certificate in the approved form in which the Competent Examiner has made a statement to the effect that it is in safe working order has been obtained.

6.1.1.2 All floating dock cranes, travelling quay cranes and the fixed tower crane, all mobile cranes and workshop overhead cranes in use along with the Automatic Safe Load Indicators installed on these cranes shall be thoroughly examined and load tested once in every twelve(12) months. All limit switches for these cranes shall be thoroughly examined and tested once in every six(6) months.

6.1.1.3 All air hoists, radial arms and associated electric hoists and chain blocks in use shall be thoroughly examined once in every twelve(12) months.

The examinations and tests of the appliances described above shall be conducted in some cases by the manufacturer of the appliance as in the case of item 6.1.1.1 or by the Dockyard's Maintenance Team and a Competent Examiner appointed by the Plant Manager and the results reported on Forms 3, 4 or 5 as appropriate. (For those lifting appliances identified under item 6.1.1.3 and which are used solely on ***marine works*** *then it would not be necessary to appoint a third party Competent Examiner to witness the examination and testing.)*

6.1.1.4 If any Lifting Appliance which has been thoroughly examined or tested and thoroughly examined but has since undergone substantial repair or failure, it is not to be used unless it has been further tested and thoroughly examined by a Competent Examiner and a certificate in the approved form has been obtained.

6.1.1.5 All floating dock cranes, travelling quay cranes, mobile cranes, workshop overhead cranes and the fixed tower crane shall be **inspected** by the crane operator weekly and a declaration on Form 1 shall be made to the effect that the appliance is in safe working order.

6.1.1.6 All air hoists, radial arms and associated electric hoists and chain blocks shall be inspected by a Competent Person before use on each occasion.

6.1.2 Lifting Gear

6.1.2.1 Before first use, a chain, rope, or lifting gear (except a fibre rope or fibre-rope sling) shall be tested and thoroughly examined by a competent examiner in the manner prescribed and a certificate in the approved form in which the competent examiner has made a statement to the effect that it is in safe working order has been obtained.

6.1.2.2 All lifting gear in use shall be thoroughly examined at intervals not exceeding six(6) months. This interval should be less where deemed necessary in the light of service conditions.

6.1.2.3 For any Lifting Gear which has been thoroughly examined or tested and thoroughly examined but has since undergone repair or failure, it is not to be used unless it has been further tested and thoroughly examined by a Competent Examiner and a certificate in the approved form has been obtained.

*The examinations and tests of the Lifting Gear described above shall be conducted in some cases by the manufacturer of the lifting gear as in the case of new equipment under item 6.1.2.1 or by the dockyard's Maintenance Team and a Competent Examiner appointed by the Plant Manager and the results reported on Forms 6 or 7 as appropriate. (For the Lifting Gear identified under item 6.1.2.2 and which are used solely on **marine works** then the examinations and tests may be conducted by the Maintenance Team and/or nominated Competent Persons and the results reported on the Register of Lifting Gear.)*

6.1.2.4 All lifting gear shall be **inspected** by a Competent Person before use on each occasion.

6.1.3 Post Test Examination

6.1.3.1 All lifting appliances (including its accessories) and lifting gear shall be thoroughly examined after load test so as to ensure that no part of the lifting appliances or lifting gear has been damaged during the test.

6.1.4 Disposal of Condemned Crane Wire Rope and Lifting Gear

6.1.4.1 All crane wire ropes and lifting gear which have been condemned as unsafe shall be physically destroyed prior to depositing in scrap bins.

6.2 Anchoring and Ballasting of Cranes

6.2.1 All of the devices used for the anchoring or ballasting of a crane are to be thoroughly examined by a competent examiner on each occasion before the crane is erected.

6.2.2 After each erection of a crane, and after each removal of a crane to a new location, or any adjustment to any component member of a crane (being a removal or adjustment which involves changes in the arrangements for anchoring or ballasting the crane), before it is taken into use, the crane is to be tested by a competent examiner, by the imposition either —

(a) of a load of 25% above the maximum load to be lifted by the crane as erected, at the positions where there is a maximum pull on each anchorage; or

(b) of a lesser load arranged to provide an equivalent test of the anchorage or ballasting arrangements.

A certificate of the examination and test from the competent examiner in the approved form (Form 2) in which the competent examiner has made a statement to the effect that the crane is in safe working order is to be obtained.

6.2.3 If the competent examiner making the test under paragraph 6.2.2 considers that the maximum load which may safely be lifted by that crane as erected is less than the safe working load of the crane he shall specify the new maximum load in his certificate and in which case, the new maximum load shall be the modified safe working load. Where a maximum load has been specified a loading diagram —

(a) appropriate to the stability of the crane as at the time of the test (taking into account, in the case of a crane mounted on wheels, the conditions of the track), and

(b) indicating the modified safe working load, which is deemed to be the safe working load of the crane as erected.

to be affixed in a position where it can readily be seen by the crane driver.

6.3 Marking of Safe Working Load

6.3.1 Lifting Appliances

6.3.1.1 A crane or lifting appliance shall be marked with safe working load and means of identification.

6.3.1.2 A crane (including a crane with a derrick jib) with variable operation radius shall be marked with safe working load at various radius of the jib, trolley or crab. In the case of a crane with a derricking jib, the maximum permissible radius at which the jib may be worked shall also be marked.

6.3.1.3 Jib or derrick cranes shall have an accurate load chart and radius indicator visible to the driver, showing radius of jib, trolley or crab at any time and safe working load for that radius.

6.3.1.4 Safe working load of lifting appliances shall not be exceeded, except when test of such appliances is being done by competent examiners.

6.3.2 Lifting Gear

6.3.2.1 Lifting gear shall be marked with safe working load and means of identification.

6.3.2.2 Lifting gear shall be marked with a colour code identifying the validity of the item. The colour code shall be changed every six months to coincide with the scheduled intervals for the thorough examination of all lifting gear.

6.4 Test Specification

6.4.1 Lifting Appliances

6.4.1.1 All lifting appliances shall be tested with a proof load which shall exceed the safe working load as follows:

(i) if the safe working load is less than 20 tonnes, the proof load shall exceed the safe working load by at least 25 percent;

(ii) if the safe working load is 20 tonnes but not more than 50 tonnes, the proof load shall exceed the safe working load by at least 5 tonnes;

(iii) if the safe working load is more than 50 tonnes, the proof load shall exceed the safe working load by at least 10 percent.

6.4.1.2 The proof load shall be hoisted and then swung as far as is practicable first in one direction and then in the other.

6.4.1.3 Where a crane with a jib which has a variable vertical operating radius is to be tested, the test shall be carried out by applying a proof load in accordance with section 6.3.1.1 at both the maximum radius and minimum radius of the jib.

6.4.1.4 Where in testing a hydraulic crane it is, because of the limitation of pressure, impossible to hoist a load which exceeds the safe working load by 25 percent, it is sufficient compliance with this paragraph if the crane has the greatest possible load applied to it.

6.4.2 Lifting Gear

6.4.2.1 Every item of lifting gear shall be tested with a proof load in accordance with the following provisions:

(i) if the item is a chain sling, wire sling, rope sling, ring, hook, shackle, or swivel, the proof load shall be at least twice the safe working load;

(ii) if the item is a single sheave pulley block, the proof load shall be at least 4 times the safe working load;

(iii) if the item is a multiple sheave pulley block with a safe working load of up to and including 20 tonnes, the proof load shall be at least twice the safe working load;

(iv) if the item is a multiple sheave pulley block with a safe working load of more than 20 tonnes but not more than 40 tonnes, the proof load shall exceed the safe working load by at least 20 tonnes;

(v) if the item is a multiple sheave pulley block with a safe working load of more than 40 tonnes, the proof load shall be at least 1-1/2 times the safe working load.

6.4.2.2 Where any new wire or synthetic rope is supplied, makers certificate is to be provided, and the safe working load shall not exceed 20 percent of the breaking load of the sample tested.

6.5 Notification of Action

6.5.1 Lifting Appliances

6.5.1.1 The Plant Manager shall nominate a staff member to maintain the register of lifting appliance for all departments.

6.5.1.2 The Plant Manager shall notify the concerned department in writing at least two weeks prior to the due date of test and examination to be undertaken on registered lifting appliances. Such notification shall include:

(i) asset number and/or identification marks;
(ii) type of test and examination;
(iii) safe working load;
(iv) location;
(v) due date;
(vi) additional instructions (if any).

The original notification shall be directed to the concerned departmental manager and one copy each shall be distributed to:

(i) Docking Services Manager,
(ii) Electrical Manager,
(iii) Safety Officer,
(iv) Master Record (Plant Department).

6.5.1.3 It is the responsibility of the Department Manager to notify the Plant Manager of any changes, additions or deletions of Lifting Appliances on the Department's Register of Lifting Appliances.

6.5.1.4 Each Departmental Manager shall nominate competent person(s) in the department to carry out **inspection** of lifting appliances under the control of the department as and when required.

6.5.2 Lifting Gear

6.5.2.1 Each Departmental Manager shall nominate a staff member in the department to maintain the register of lifting gear under the control of the department.

6.5.2.2 The holder of the register shall notify the Plant Manager and the Departmental Manager at least two weeks prior to the due date of the examination to be undertaken on the registered lifting gear. Such notification shall include:

(i) identification mark of the lifting gear,
(ii) due date;
(iii) additional instruction, if any (e.g. item to be re-tested).

6.5.2.3 Each Departmental Manager shall nominate competent person(s) in the department to carry out **inspection** of lifting gear under the control of the department as and when required.

6.6 Records

6.6.1 Lifting Appliances

6.6.1.1 A Master Record, which includes a Master Asset Register of all lifting appliances and all the test and examination records/certification, shall be kept by Plant department, and a copy of the Master Record shall be retained by Safety department and the individual department holding items of lifting appliance.

6.6.1.2 The Master Record shall be updated by Plant department following completion of test and examination. Originals of the test and examination certificate shall be kept in the Master Record and a copy shall be issued to Safety department for record.

6.6.1.3 Marking/re-painting of new test date after testing shall be arranged by Plant Department.

6.6.1.4 The records of weekly inspections of lifting appliances defined under 6.1.1.3 shall be kept by Plant Department.

6.6.2 Lifting Gear

6.6.2.1 A register listing all the lifting gear under the control of the department and the due date for examination shall be kept in each department. A copy of the register shall be retained by Plant Department and Safety Department.

6.6.2.2 The register shall be kept and updated by the holder of the register.

7.0 DOCUMENTATION

7.1 HUD Forms - Register of Lifting Appliances
- Register of Lifting Gears

7.2 Factories and Industrial Undertakings Regulations

- Form 1 : Reports of Results of Weekly Inspections of Lifting Appliances
- Form 2 : Certificate of Test and Thorough Examination of Anchoring or Ballasting of Cranes
- Form 3 : Certificate of Test and Thorough Examination of Crane, Crabs and Winches
- Form 4 : Certificate of Test and Thorough Examination of Lifting Appliances (Except Cranes, Crabs and Winches)
- Form 5 : Lifting Appliances Certificate of Results of Thorough Examinations in the Preceding Twelve Months
- Form 6 : Certificate of Test and Thorough Examination of Chains, Ropes and Lifting Gear
- Form 7 : Chains, Ropes and Lifting Gear Certificate of Results of Thorough Examinations in the Preceding Six Months

Hongkong United Dockyards Ltd.

Issue Date 2/12/94

Lifting Appliances
(MASTER LIST)

Location (Asset No.)	Mark No.	Description	Size	SWL (Tonne)	Test Load (Tonne)	Date of First Use (dd/mm/yy)	Date of Last Exam. (dd/mm/yy)	Due Date For Exam. (dd/mm/yy)
Dept.	Supplies c.c. 282							
92725	EL4462	Hyd. Crane	HIAB AEU350	2	2.5	15/4/90	19/5/94	18/5/95
92729	GB9016	Hyd. Crane	FASSI F4	4	5	1/8/80	1/10/94	30/9/95
16267		Block	El. Chain Block 1 tonne	1	1.25	12/8/94	12/8/94	11/8/95

SAMPLE ONLY

Hongkong United Dockyards Ltd.

Issue Date 2/12/94

Lifting Gear

(MASTER LIST)

Location (Asset No.)	Mark No.	Description	Size	SWL (Tonne)	Test Load (Tonne)	Date of First Use (dd/mm/yy)	Date of Last Exam. (dd/mm/yy)	Due Date For Exam. (dd/mm/yy)
Dept.	Plant c.c. 263							
	L97	Shackle	43 body 49 pin	25	50	31/1/94	21/11/94	20/5/95
	RS9	Shackle	45 mm body 49 mm dia. pin	25	50	31/1/94	31/1/94	30/7/94
	RW163	Wire Sling	24 mm dia 8.28 Mtr.	7.5	15	31/1/94	21/11/94	20/5/95

SAMPLE ONLY

Name of owner
物 主 姓 名 .....
.....
.....

Address of installation
裝置地址 .....
.....
.....

FORM 1
表格一

[reg 7A.]
〔規例第七A條〕

Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

REPORTS OF RESULTS OF WEEKLY INSPECTIONS OF LIFTING APPLIANCES

Form approved by the Commissioner for Labour for the purposes of regulation 7A of the Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

工廠及工業經營(起重機械及裝置)規例

起重機械之每週一次檢查結果報告

本表格乃由勞工處處長就工廠及工業經營(起重機械及裝置)規例第七A條之需要而認可

Description of lifting appliance and means of identification 起重機械說明及識別標誌 (1)	Date of inspection 檢查日期 (2)	Result of inspection (including all working gear and anchoring or fixing plant or gear, and where required the automatic safe load indicator and derricking interlock) State whether in safe working order 檢查結果 (包括所有起重裝置及緊繫或固定設置或裝置，在需要時並包括自動安全負重指示器及人字起重機聯鎖裝置)是否操作時是否安全 (3)	Signature and designation of person who made the inspection 檢查者簽署及職階 (4)

SAMPLE ONLY

Any competent examiner or competent person who delivers to an owner a certificate or makes a report which is to his knowledge false as to a material particular shall be guilty of an offence and shall be liable on conviction to a fine of $200,000 and to imprisonment for 12 months.

任何有資格檢驗員或有資格人員，向物主呈交之證明書或報告，明知其內容屬虛偽者，即屬違例，一經定罪後，有被處罰款二十萬元及監禁十二個月之虞。

Name of owner
物主姓名 .....

.....

.....

Address of installation
裝置地址 .....

.....

.....

FORM 2
表格二

Reg 7E(2) & (3)
(規例第七E條第(二)及第(三)款)

Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

CERTIFICATE OF TEST AND THOROUGH EXAMINATION OF ANCHORING OR BALLASTING OF CRANES

Form approved by the Commissioner for Labour for the purposes of regulation 7E(2) & (3) of the Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

工廠及工業經營(起重機械及裝置)規例

起重機緊繫或壓載調整之試驗結果證明書

本表格乃由勞工處處長就工廠及工業經營(起重機械及裝置)規例第七E條第(二)及第(三)款之需要而認可

Description of crane and means of identification 起重機說明及識別標誌 (1)	Test applied 試驗方法 (2)			Safe working loads as ballasted 經壓載調整之安全操作負重額 (3)	Result of test Enter details of repairs required or defects If none enter "In safe working condition" 試驗結果 註明所需進行之修理或毛病之詳情。如無不要，則註明"效能良好，使用安全"。 (4)
	Load imposed (tonnes) 負重(以公噸為單位)	Radius of jib (metres) 機臂半徑(以米為單位)	Anchorage tested 緊繫試驗	Load (tonnes) 負重額(以公噸為單位)	

SAMPLE ONLY

I hereby certify that the anchoring and ballasting of the crane described in this certificate was tested and thoroughly examined on ..... and that the above particulars are correct.
茲證明本證明書所指之起重機緊繫或壓載調整於 年 月 日試驗及詳細檢驗，且上述各項均屬確實無訛。

Signature of Registered Professional Engineer .....
註冊專業工程師簽署

Qualification .....
註冊資格

Date of certificate .....
簽發日期

Discipline .....
註冊界別

Any competent examiner or competent person who delivers to an owner a certificate or makes a report which is to his knowledge false as to a material particular shall be guilty of an offence and shall be liable on conviction to a fine of $200,000 and to imprisonment for 12 months.
任何有資格檢驗員或有資格人員，如向物主呈交之證明書或報告，明知其內容屬虛構者，即屬違例，一經定罪後，有機會罰款二十萬元及監禁十二個月之罪。

FORM 3
表格三

[reg. 5(3)&(5).
(規例第五條第(三)
及第(五)款]

Certificate No. .....
證明書編號

CERTIFICATE OF TEST AND THOROUGH EXAMINATION OF CRANE, CRABS AND WINCHES

Form approved by the Commissioner for Labour for the purposes of regulation 5(3)&(5) of the Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

工廠及工業經營(起重機械及裝置)規例

起重機、起重滑車及絞車之試驗及詳細檢驗結果證明書

本表格乃由勞工處處長就工廠及工業經營(起重機械及裝置)規例第五例(三)及第(五)款之需要而認可

1. Name and address of owner of the appliance. 一、機械物主姓名及地址		
2. Name and address of maker of the appliance. 二、機械製造廠名稱及地址		
3. Type of appliance and nature of power (e.g. Scotch derrick-manual; tower derrick-electric; rail mounted tower-electric). 三、機械類別及所使用之動力(例如：蘇格蘭式人字起重機——人力；塔式人字起重機——電力；架設軌道之塔式起重機——電力)		
4. Date of manufacture of the appliance. 四、該機械製造日期		
5. Identification number 五、識別編號	(*a*) Maker's serial number. (甲) 製造廠編號	
	(*b*) Owner's distinguishing mark or number (if any). (乙) 物主之識別標誌編號(如有此標誌或編號者)	

SAMPLE ONLY

6. Safe working load or loads. In the case of a crane with a variable operating radius (including a crane with a derricking jib or with interchangeable jibs of different lengths) the safe working load at various radii of the jib, jibs, trolley or crab must be given: test loads at various radii should be given in column (3) and in the case of a safe working load which has been calculated without the application of a test load "NIL" should be entered in that column. 六、安全操作負重額 如該起重機係有仲縮性之操作半徑者(包括裝有人字鐵臂或有不同長度之鐵臂可供調換之起重機)，則須列明鐵臂、絞輪或起重滑車在使用各種半徑操作時之安全負重額。試驗各種半徑時所用之負重量應填於第(3)欄內，如安全操作負重額並非經過負重試驗而屬計算者，則應在該欄內填「無」字。	(1) Length of jib (metres) 鐵臂長度(以米為單位)	(2) Radius (metres) 半徑(以米為單位)	(3) Test load (tonnes) 試驗時所用負重量(以公噸為單位)	(4) Safe Working load (tonnes) 安全操作負重額(以公噸為單位)
7. In the case of a crane with a derricking jib or jibs the maximum radius at which the jib or jibs may be worked (in metres). 七、如該起重機係裝有人字鐵臂者，則註明該鐵臂伸至最長時之半徑(以米為單位)。				
8. Defects noted and alterations or repairs required before appliance is put into service. If none enter "None" and state whether in safe working order. 八、註明所發現之毛病及起重機於使用前所需作之修改或修理。如無不妥，則填「無」字並註明操作時是否安全。				
9. In the case of a crane, state whether the automatic safe load indicator is in good working order. 九、如該機械為起重機，註明該機之自動安全負重指示器操作時是否安全。				

SAMPLE ONLY

I hereby certify that on ..... 19..... the appliance described in this certificate was tested and
茲證明本人曾於一九　　年　　月　　日依照第一附表之規定試驗及詳細檢驗
thoroughly examined by me in accordance with the First Schedule and that the above particulars are correct.
本證明書所指之機械，其上述各項均屬確實無訛。

Signature of Registered Professional Engineer .....
註冊專業工程師簽署

Qualification .....
註冊資格

Discipline .....
註冊界別

Name and address of person, company or association by whom the person conducting the test and examination is employed.
進行此項試驗之人士、公司或機構之姓名或名稱及地址

.....

.....

.....

Date of certificate .....
簽發日期

Any competent examiner or competent person who delivers to an owner a certificate or makes a report which is to his knowledge false as to a material particular shall be guilty of an offence and shall be liable on conviction to a fine of $200,000 and to imprisonment for 12 months.
任何有資格檢驗員或有資格人員，如向物主呈交之證明書或報告，明知其內容屬虛假者，則屬違例；一經定罪後，有被處罰款二十萬元及監禁十二個月之虞。

SAMPLE ONLY

FORM 4 [reg. 5(2)&(4).]

表格四 [規例第五條第(二)及第(四)款]

Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

CERTIFICATE OF TEST AND THOROUGH EXAMINATION OF LIFTING APPLIANCES (EXCEPT CRANES, CRABS AND WINCHES)

Form approved by the Commissioner for Labour for the purposes of regulation 5(2)&(4) of the Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

工廠及工業經營(起重機械及裝置)規例

起重機械(起重機、起重滑車及絞車除外)之試驗及詳細檢驗結果證明書

本表格乃由勞工處處長就工廠及工業經營(起重機械及裝置)規例第五條第(二)及第(四)款之需要而認可

Name of owner and address of installation
物主姓名及裝置地址

Description of appliance(s), type and distinguishing mark 該機械之說明、類別及識別標誌	Test load applied (tonnes) 試驗時所使用之負重量(以公噸為單位)	Safe working load (tonnes) 安全操作負重額(以公噸為單位)	Defects noted, alterations or repairs required. If none, enter "None" and state whether in safe working order. 註明所發現之毛病及所需之修改或修理。 如無不妥，則填「無」字並註明操作時是否安全

SAMPLE ONLY

I hereby certify that on ..... 19..... the appliances described in this certificate was tested and thoroughly examined by me in accordance with the First Schedule and that the above particulars are correct.

茲證明本人曾於一九　　年　　月　　日依照第一附表之規定試驗及詳細檢驗本證明書所指之機械，且上述各項均屬確實無訛。

Signature of Registered Professional Engineer .....
註冊專業工程師簽署

Qualification .....
註冊資格

Discipline .....
註冊界別

Person or firm by whom person conducting the test and examination is employed .....
進行該項試驗及檢驗之人士或商號

Date of certificate .....
簽發日期

SAMPLE ONLY

Any competent examiner or competent person who delivers to an owner a certificate or makes a report which is to his knowledge false as to a material particular shall be guilty of an offence and shall be liable on conviction to a fine of $200,000 and to imprisonment for 12 months.
任何有資格檢驗員或有資格人員，如向物主呈交之證明書或報告，明知其內容屬虛構者，則屬違例，一經定罪後，有被處罰款二十萬元及監禁十二個月之虞。

Name of owner
物主姓名 .....
.....
.....
Address of installation
裝置地址 .....
.....
.....

FORM 5
表格五

[reg. 5(1)]
〔規例第五條第(--)款〕

Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

LIFTING APPLIANCES CERTIFICATE OF RESULTS OF THOROUGH EXAMINATIONS IN THE PRECEDING TWELVE MONTHS

Form approved by the Commissioner for Labour for the purposes of regulation 5(1) of the Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

工廠及工業經營(起重機械及裝置)規例

起重機械在過往十二個月內進行之詳細檢驗結果證明書

本表格乃由勞工處處長就工廠及工業經營(起重機械及裝置)規例第五條第(一)款之需要而認可

Description of appliance, e.g. type, Identification marks, maximum safe working load, etc. 該機械之說明，例如：類別、識別標誌、安全操作最高負重額等 (1)	Date of examination 檢驗日期 (2)	Result of examination Enter details of repairs required or defects. If none enter "None" and state whether in safe working order. 檢查結果，註明所需進行之修理或毛病之詳情。如無不妥，則填"無"字並註明操作時是否安全 (3)

SAMPLE ONLY

I hereby certify that the appliances described in this certificate was thoroughly examined on ..... and that the above particulars are correct.
茲證明本證明書所指之起重機械於 年 月 日詳細檢驗，其上述各項均屬確實無訛。

Signature of Registered Professional Engineer .....
註冊專業工程師簽署

Qualification .....
註冊資格

Date of certificate .....
簽發日期

Discipline .....
註冊界別

Any competent examiner or competent person who delivers to an owner a certificate or makes a report which is to his knowledge false as to a material particular shall be guilty of an offence and shall be liable on conviction to a fine of $200,000 and to imprisonment for 12 months.
任何有資格檢驗員或有資格人員，如向物主呈交之證明書或報告，明知其內容屬虛偽者，即屬違例；一經定罪後，有被處罰款二十萬元及監禁十二個月之虞。

FORM 6 [reg. 18(1)(*d*).]

表格六 〔規例第十八條第(一)款第(丁)段〕

Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

CERTIFICATE OF TEST AND THOROUGH EXAMINATION OF CHAINS, ROPES AND LIFTING GEAR

Form approved by the Commissioner for Labour for the purposes of regulation 18(1)(d) of the Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

工廠及工業經營(起重機械及裝置)規例

鐵鏈、纜索及起重裝置之試驗及詳細檢驗結果證明書

本表格乃由勞工處處長就工廠及工業經營(起重機械及裝置)規例第十八條第(一)款第(丁)段之需要而認可

Name of the owner and address of installation of the chain, rope or lifting gear tested and examined.

接受試驗及檢驗之鐵鏈、纜索或起重裝置之物主姓名及裝置地址

Description of chain, rope or lifting gear tested and distinguishing marks 接受試驗之鐵鏈、纜索或起重裝置之說明及識別標誌	Test load applied (tonnes) 試驗時所使用之負重量(以公噸為單位)	Safe working load (tonnes) 安全操作負重額(以公噸為單位)	Defects noted If none enter "None" and state whether in safe working order. 註明所發現之毛病如無不妥，則填"無"字並註明操作時是否安全

SAMPLE ONLY

I hereby certify that on ..... 19 ..... the gear described in this certificate wes tested and thoroughly

茲證明本證明書所指之起重裝置於一九　　年　　月　　日業經依照

examined by me in accordance with the First Schedule and that the above particulars are correct.

第一附表之規定試驗及詳細檢驗，且上述各項均屬確實無訛。

Signature of Registered Professional Engineer .....

註冊專業工程師簽署

Qualification .....

註冊資格

Discipline .....

註冊界別

Person or firm by whom the person conducting the test and examination is employed
僱人執行此項試驗及檢驗之人士或商號 } .....
.....
.....

Date of certificate .....
簽 發 日 期

Any competent examiner or competent person who delivers to an owner a certificate or makes a report which is to his knowledge false as to a material particular shall be guilty of an offence and shall be liable on conviction to a fine of $200,000 and to imprisonment for 12 months.
任何有資格檢驗員或有資格人員，如向物主呈交之證明書或報告，據知其內容屬虛構者，則屬違例；一經定罪後，有被處罰款二十萬元及監禁十二個月之虞。

SAMPLE ONLY

Name of owner
物主姓名 .....
.....
.....

Address of installation
裝置地址 .....
.....
.....

FORM 7
表格七

[reg. 18(1)(e)]
〔規例第十八條第(一)款第(戊)段〕

Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

CHAINS, ROPES AND LIFTING GEAR CERTIFICATE OF RESULTS OF THOROUGH EXAMINATIONS IN THE PRECEDING SIX MONTHS

Form approved by the Commissioner for Labour for the purposes of regulation 18(1)(e) of the Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

工廠及工業經營(起重機械及裝置)規例

關於鐵鏈、纜索及起重裝置 在過往六個月內進行之詳細檢驗結果證明書

本表格乃由勞工處處長就工廠及工業經營(起重機械及裝置)規例第十八條第(一)款第(戊)段之需要而認可

Description of chain, rope or gear e.g. type, size and identification mark 鐵鏈、纜索及起重裝置之說明， 例如：類別、尺寸及識別標誌 (1)	Date of examination 檢驗日期 (2)	Safe working load (tonnes) 安全操作負重額 (以公噸為單位) (3)	Result of examination Enter details of repairs required or defects. If none enter "None" and state whether in safe working order. 檢驗結果，註明所需進行之修理或毛病之詳情 如無不妥，則填「無」字並註明操作時是否安全 (4)

SAMPLE ONLY

ereby certify that gear described in this certificate was thoroughly examined on ..... and that the above particulars are correct.
證明本證明書所指之起重裝置於一九 年 月 日詳細檢驗，且上述各項均屬確實無訛。

nature of Registered Professional Engineer .....
冊專業工程師簽署

Qualification .....
註冊資格

te of certificate .....
發出日期

Discipline .....
註冊界別

y competent examiner or competent person who delivers to an owner a certificate or makes a report which is to his knowledge false as to a material particular shall be lty of an offence and shall be liable on conviction to a fine of $200,000 and to imprisonment for 12 months.
可有資格檢驗員或有資格人員，如向物主呈交之證明書或報告，明知其內容屬虛偽者，即屬違例；一經定罪後，有權處罰款二十萬元及監禁十二個月之虞。

EIA FOR A 40,000 TON LIFTING CAPACITY FLOATING DOCK

YAM O WAN, NORTH LANTAU

ADDENDEM

Section 5.2 - Sensitive Receivers
Figure 4.5 should read Figure 5.1

Section 5.3 - Background Noise and Potential Noise Impacts
The last sentence of Page 5-1 should read, "Combined predicted noise levels of the existing and new HUD docks at the two NSR would range from 36 - 45 dB(A)."

The first paragraph of page 5-2 should read, "The calculations also show that the introduction of the new HUD dock will increase the existing docks noise levels at Tsing Chau Tsai and Luk King Tsuen respectively by 0.4dB(A) and 1.8 dB(A)."

Section 6.3.2 - Sewage Effluent
The discharge from the sewage treatment plant will meet the standards set out in table 10(b) of the Technical Memorandum (attached as Appendix 7, EIA Report).

The maximum volume of sewage effluent discharge is likely to be 4000 litres per day based on 200 people using the unit during one day. The treatment unit is however capable of treating a maximum volume of 17,500 litres per day. A sampling point is indicated in Figure 6.1

Chlorine use will be monitored on a daily basis to determine the efficiency of the sewage treatment unit. The installation of a residual chlorine sensor is not, therefore, considered necessary.

Section 6.3.3 - Discharge of toxicants

It is anticipated that the maximum rate of discharge will be within the >200 and < 400 m^3/day category of Table 10(b) of the Technical Memorandum (appendix 7). The effluent will meet the requirements of Table 10(b) of the TM. The effluent is, however, expected to contain TBTs when a ship treated with TBTs is under repair or maintenance. The environmental monitoring and audit programme will, therefore, focus on TBTs in order that the environmental impact of this toxicant can be monitored.

Different methods to reduce TBT discharge in the washwaters discharged from United will be tested as part of the on going work to develop good housekeeping procedures on the dock. Various methods will be used to filter the washwaters and these will include filters over the drainage ports and use of sandbags. Other methods will be determined through on going research to be undertaken by HUD.

Section 8.1.2

An environmental monitoring and audit manual will be produced containing a detailed monitoring programme to be undertaken during the first two years of operation of the United dock. This will be submitted to EPD in late June, 1995.

AXIS
Environmental

AXIS Environmental Consultants Ltd.