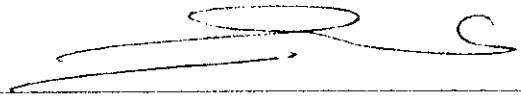
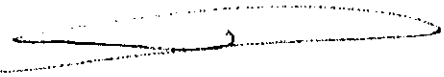
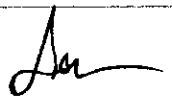
Lunch Time Seminar (2)

Date: 2, July, 00
Title: Sampling Practice - 1 (Documentation and Recording System)
Speaker: Khaled Al Rasheed

Attendance

Name	Signature
Adel M. Kusti	
Yousef Al-Helal	
Qussai M. Bohlegah	Qussai M.
HIROYUKI OHI	H.O
Kozo Sakaguchi	
Alam Nizami	

FIELD TEAM TUTORIAL

Date: 2. July, 00

Title: Planning with Navigation Charts and Satellite Position Fixing

Planning Sampling

1) Sampling Site Selection

- Sensitivity/Detectability for Target contaminants
- Environmental conditions/Geographical features
- Accessibility/Convenience
- Unchangeability etc.

---→Navigation Charts, Aerial photography/Satellite Image, Site inspection

2) Sampling time, frequency and period

- Fluctuation of the Target contaminants
- Tides etc.

3) Number of Samples

- Reliability
- Statistical analysis

4) Sample handling methods.

- Sample number check
- Storage
- Transport
- Delivery

Chain-of-Custody Sheet (Sediment/Soil and Biota Samples)

No. Page : of

Date Sampled: 24-25/6/2000

Sampler: AC-RASHEED, Burbail, Kusti

Remarks:

No.	Sample ID	Time Sampled	Type of Sample	Bottle Type	Volume (mL)	Q'ty	Particle Size	Ignition Loss	COD/TOC	Hg (Mercury)	As (Asenic)	Cr (Chromium)	V (Vanadium)	Other Metals (Cd,Co,Cu,Ni,Pb,Zn)	BTEX	TPH	PCBs	Plankton, Biota	Notes
	J1	12:00	SD	W	350	1	✓	✓	✓	✓	✓	✓	✓						
	J1	12:00	SD	W	125	1	✓												
	J1	12:00	SD	G	350	1									✓	✓			
	J1	12:00	B	W	125	1												✓	
	J2	14:30	SD	W	350	1					✓	✓	✓						
	J2	14:30	SD	W	125	1	✓												
	J2	14:30	SD	G	350	2									✓				1 for Beeah
	J4	15:20	B	W	125	1												✓	
	J80	8:00	SD	W	350	1					✓		✓						
	J80	8:00	SD	W	125	1	✓												
	J80	8:00	SD	G	350	2									✓	✓			1 for Beeah
	DD20	17:30	SD	G	350	1										✓			
	DD20	17:30	SD	W	350	1				✓	✓	✓	✓						
	DD20	17:30	SD	W	125	1	✓												

Supplied to Laboratory by : (Name) AC-RASHEED

(Signature)

(Date/Time) 26/6/2000 / 10:30

Received at Laboratory by (Name) Alam Nizami

(Signature)

(Date/Time) 26/6/2000 11:10

Reshead 7/2

FIELD RECORD SHEET

MEPA/JICA PROJECT

Samplers name :

Site No.: J80 **Location:**

GPS, DOP:	Latitude (N): 27 05 11	Longitude (E): 4940.36

Date	6/25/00	Time	5:50

Weather Condition

Weather	fine	Temperature (°C)	35	Cloudiness	0
Wind Direction	335	Wind Speed (m/s)	3-4	Wave height	<0.1

Water Condition

Tide		Depth (m)	-6.9 — ice L
Current Direction	—	Current Speed (m/s)	—

bottom **Water Quality** surface

29.86	Temperature (°C)	29.93	Water Color	pale green	
42.3	Salinity	42.25	Odor	no.	→ Ice
7.17	pH	8.00	Sheen	no	
1.56 (43.9)	DO (mg/l)	2.75 (46.9)	Rubbish	no.	
0.7	Turbidity (NTU)	0.0	Res. Cl (as Total)	0.06	
	Water Clarity (m)	6.0		0.12	

Sediment Quality

Sediment Color	dk gray	Temperature (oC)	30.2
Odor	H2S	ORP (mv)	-27
Texture	sandy		

Observations and Comments

5:54 Ice.

Lunch Time Seminar (3)

Date: 8, July, 00
Title: Interpretation and Presentation of Results (Graphs and Statistics)
Speaker: Robert Hilliard, Adel Qusti

Attendance

Name	Signature
Alam Nizami	
Khalid Busbait	
Khaled S. Al-Rasheed	
AZIZ ALomair	
Adel M. KUSTI	
Rob Hilliard	
Y. SHIMAZU	
K. TANAKA	
T. Ike	
Yousef Al-Helal	
Qusai M. Bohlaigah	
Yozo Sakaguchi	
HIROYUKI OHZ	
JAMAL KAZIM	

DESIGNING AND INTERPRETING MONITORING PROGRAMS

1 "KNOW YOUR CONTAMINANTS"

A good environmental monitor and field sampler needs to understand the different types of 'contaminant' that occur in the marine environment, especially their sources, their characteristics and typical behaviour.

Without this knowledge, no one can develop a reasonable ability to plan a sampling program, or interpret its results. But what exactly is a contaminant? We already have a working definition at MEPA:

"Something that should not be there..."

but we should also add: ***"...above its expected and/or essentially benign concentration"***

There are two main types of contaminant:

A) **'Artificial' (Man-Made) Compounds**. For example - PCBs, DDT, dioxins, other OCLs including amines and many herbicides/insecticides (part of "POPs"), organo-phosphates, plutonium, uranium-235, cobalt-90, tributyl-tin (TBT), plastic co-polymers, poly-silicanes, etc. There are over 200,000 listed artificial chemicals in the world.

B) **Naturally-Occuring Compounds**; but which are present in water, sediment or inside biota at unusually high levels (that is - at levels which produce either **toxic** or **biostimulating** effects). For example:

- **aromatic hydrocarbons** (from oil and refined oil products, low-temperature burning of organic material, smoke, etc. Includes the heavy molecular weight *polycyclic aromatic hydrocarbons* (PAH; part of "POPs") - as well as the light and volatile 1-3 ring BTEX compounds (benzene, toluene, ethylene, xylene and their derivatives)

- **metals** (eg. barium, iron, magnesium, manganese) and **heavy metals** (eg. cadmium, cobalt, copper, chromium, lead, mercury, nickel, tin, vanadium, zinc, etc), and metalloids (eg. arsenic, selenium). At **low concentrations** many of these metals are also **essential nutrients** (needed to sustain normal healthy growth and reproduction in plants or animals (eg. copper, zinc, selenium and even arsenic....).

- **biostimulants** (= organic food for bacteria, and "fertilisers" for algae and plants). For example, almost all soluble molecules containing **nitrate (NO3), nitrite (NO2), ammonia (NH3/NH4), phosphate (PO3) and even silicate (SO3) are powerful fertilisers** - and stimulate unwanted and rapid algae growth. This process includes increase in number and severity of toxic planktonic 'red tides' of dinoflagellates or cyanobacteria, plus also stimulate the growth of both native or introduced 'choking weeds and plants' (which can rapidly cover the floor of coastal lagoons and smother seagrass beds; for example: *Chaetomorpha*, *Cladophora*, *Caulerpa*, water hyacinth, introduced reeds and grasses). 'Food' for bacteria includes any **organic (=carbon-based) molecules** containing carbohydrates (sugars, starches and cellulose), proteins (collagen, muscle fibres), plant oils and animals fats, etc. At warm temperatures (>20°C) **all of these can be quickly used by bacteria for their respiration, rapid growth and division** (the bacteria multiply - use more oxygen, release more carbon dioxide and so cause de-oxygenation events, fish kills, etc)

- **Halides** (chlorine, flourine, bromine, iodine - all are toxic at low concentrations, but can occur naturally - especially in volcanic gases....)

- **pH changers**: Many acids (HCL, H_2SO_4, HNO_3) do occur naturally (volcanic gases) - but they are usually associated with chemical spills from ships and road tankers..... Spills of caustic soda (alkali - NaOH) are also not uncommon - but usually this impact is very temporary if sufficient water is present for adequate dilution....

2 "*CONTAMINATED*" AND "*POLLUTED*" WATER - IS THERE A DIFFERENCE?

There is a difference!

For 'clean' water, this can be called '*pristine*' or '*near-pristine*' if all measured contaminants are below all 'screening' and 'alert' values in the international/national guidelines and standards for the PROTECTION OF AQUATIC ECOSYSTEMS; eg. Class A in Japan).

PROTECTION OF AQUATIC ECOSYSTEMS is the highest standard applied by nations and many international conventions - it is generally higher than the standards set for human drinking water, cattle drinking water, crop irrigation, fishing activities, fish farming, and prawn or mollusc aquaculture.

For samples of sea water taken from offshore areas of the semi-enclosed Gulf where there has been no recent oil spill, '***near pristine***' is the more accurate term (because of the long history of oil spills and regular tanker discharges - both illegal and legal - across the majority of its waterways).

Where water or sediment is found to contain **one or more contaminants** at levels above their '*screening*' or '*alert*' value, then they are **contaminated.** So is it *slightly* or *moderately* contaminated? This depends on how close or how far the contaminant/s are above the alert value, plus the number of such contaminants.

When water or sediment is found to contain **one or more contaminants** at levels above their respective '*maximum permissible*' values set by the internationa/national guidelines and standards, then it is said to be **polluted** . Whether it is *moderately* or *grossly* polluted also depends on how close or how far the contaminant/s are above the maximum permissible value, plus the number of such contaminants.

From 'best' to 'worst' can be summarised as follows:

Pristine --> Near Pristine --> Slightly contaminated --> Moderately contaminated -->

'Grossly contaminated' (**not used**) = Slightly polluted (**not used**) = Moderately polluted --> Grossly polluted.

3 SOURCES OF CONTAMINANTS:

When designing a sampling program and interpreting the results for any site or region, it is important to have a good understanding of all possible sources of the contaminants that (a) may be expected (predicted) to be present, or (b) are discovered by chance!

For sources of plastics, litter, rubbish: (= 'gross pollution' / 'large items')	Fishing boats, recreational boats, ships, port workers, beach visitors, illegal dumpers, wind-blown debris from landfill tips, etc.
For sources of radioactive materials:	Medical/hospital equipment; scientific equipment; military equipment; Research and Medical Isotope Reactors, Nuclear Power Stations, Nuclear Fuel Reprocessing Facilities, Nuclear Powered ships and submarines; atmospheric fall-out from nuclear accidents (Chernobyl) and weapons testing.

For the other contaminants, we should start to complete the Table on the next page.

Using the following symbols, we should spend no more than 30 minutes on the following table:

++	=	important or biggest source
+	=	minor source
?	=	potential source
??	=	a possible but very uncommon source
empty space	=	unlikely or typically very minor source

Contaminant	Artificial Compounds					Metals		Heavy Metals	Metalloids	Biostimulants	Organic
Source	PCBs	Dioxins	OCLs	HC/PAHs	TBT	Ba	Mg	(Cd,Cu,Pb,Vn,Zn)	(As, Ga Se)	(NO_3, NH_3, PO_4)	'food"
Cargo Vessels											
Oil Tankers											
Oil Terminals											
Oil/gas prodn fields											
Ship Repair and Maintenance yards											
Boating marinas											
Fishing harbours											
Smoke											
Dumping											
Coastal Landfill											
Reclamation wks											
Sewage plants											
G-Water Septics											
Urban drains											
Urban/Road dust											
Factory dust											
Factory outfalls											
Power stations											
Desalinatn plants											

NOTES / COMMENTS:

4 BASIC STATISTICS FOR SAMPLING PROGRAMS"

4.1 Why Take Replicate Samples and Use Statistics?

To overcome the problem of inaccurate results due to **natural variation** in the field (**sampling error**) and also due to **measurement error** (caused by the variations when repeating laboratory procedures, or the systematic contamination of a measuring instrument).

4.2 What are causes of sampling/laboratory contamination? (already discussed in Sato-san's Seminar)

4.3 What are the Causes of Natural Variation? (to discuss and note here):

4.4 What is the Value of 'Pooling' Samples?

To reduce the number of field sample replicates that need to be taken.

So **how does pooling work**? Pooling reduces the amount of natural variation present in each field sample

4.5 What is True Replication and False Replication (Pseudo-Replication) - in the use of Statistics? To discuss...

4.6 The Basic Statistics that must be Understood by all Monitoring Designers/Intepreters

Understand the difference between **Precision** and **Accuracy**. Read introductory texts to statistics to help you understand and remember what is the difference, and when/when not to use the following:

Mean (average) versus **Median**
Parametric tests versus **Non-Parametric tests**
Standard Deviation versus **Coefficient of Variation** versus **Standard Error**
Degree of Significance (p<0.05) and **Confidence Limits**
The importance and meaning of **'Testing the Null Hypothesis'** by Statistical Tests
Statistical Power and its associated **'Type I'** and **'Type II'** errors
Cost effectiveness of **Analysis of Variance** for **'Before-After/Control-Impact' [BACI] designs.**

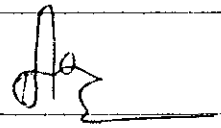
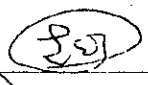
It is necessary only to understand these terms and their use - there is no need to become an 'expert'!

THE GOLDEN RULE: ***"IF QUANTITATIVE DATA AND STATISTICAL RESULTS ARE REQUIRED, ALWAYS CONSULT WITH A PROFESSIONAL STATISTICIAN WHEN DESIGNING YOUR SAMPLING PROGRAM!*** ***[so find one at a University and become friends!]***

Lunch Time Seminar (4)

Date: 9, July, 00
Title: Sampling Practice (Objectives, Logistics and Planning)
Speaker: Khalid Busbait

Attendance

Name	Signature
ALAM KIZAMI	
SATO	
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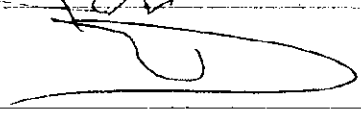
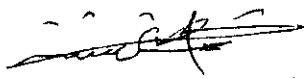
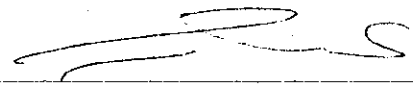
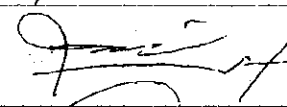
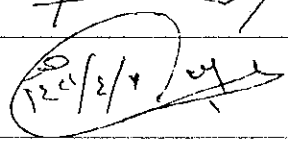
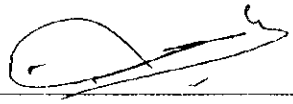
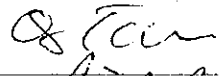
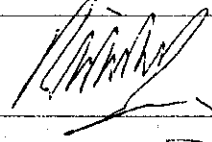
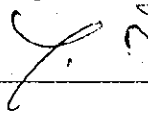
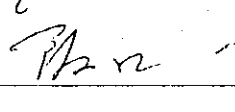
Yousef AL-Helal	
Ousai M. Bohlaigah	
Adel M. Kusti	
Khaled S. Al-Rasheed	
AZIZ W. ALOmair	
Khalid Buskait	
KAZUTAKE TANAKA	
R-Hizumi	
Y. SHIMAZU	
Kozo Sakaguchi	

July 9, 2000
Khalid Busbait

Sampling Practice

Objectives, logistics and planning

- **Introduction**:

To examine the coastal seawater quality and the causes of water quality degradation along the Arabian Gulf you would need to consider the following things:

1. Monitoring Design:

Choosing the area of study
Identifying the sampling locations
Identifying the purpose of choosing those locations
Setting the kind of samples needed (Water, Sediment and Plankton) and the parameters for each location

2. Instrument Management

3. Data and Sample Analysis

What MEPA needs to run a good Water Quality Monitoring Program

1. One of MEPA requirement for each Facility activities is to make an Environmental Impact Assessment, so we can suggest to add one more requirement which is Water Quality Monitoring Program for each individual facility, for example, Desalination Plant, Power Plant and sewage system discharge.
2. Collect all the program reports from the facilities each year to come up with one complete report to give more details of the situation of water quality.

PRESENTING AND INTERPRETING RESULTS -

TABLES, GRAPHS, FIGURES AND PHOTOS

Introduction: To make reports that are useful for your boss and MEPA, it is important to present the data and, more importantly their meaning and implications, in a clear and easy-to-follow way. Good use of Tables, Graphs, Figures and Photographs helps you achieve this. If you learn how to use Excel and a simple paint/draw program such as Paint Shop Pro (PSP), you can achieve this goal effectively and easily.

1. **Site Location Figure**: Always include a location diagram. Take the study area from a navigation chart is the best way to make the 'foundation' of your figure (charts are the most accurate). Use the enlargement facility of the photocopier to make the study area occupy most of the page (or scan this part of chart to make a .jpg file, and add your sites by using a simple computer application such as PSP).

2. **Table/s of Data:** Always include the site number, location, date and time. List the sites in a geographical order. Never have a blank cell - this reduces readability and adds to confusion:- "*why is it empty?*"; So cells in table where data are missing or lost should contain special character (eg. 'ns' = not sampled; 'na' = not analysed, etc). Cells with planned (deliberate) 'no result' should contain a simple '-'.

   Provide footnote/s for any important feature that had affected one or more of the results (eg. tidal condition or wind prevented the measurement, or altered the normal quality or expected features of the sample) .

   For laboratory analysis data, show the results of any duplicate tests (splits) and also the percentage recoveries if 'spikes' had been used.

3. **Table/s of Results**: Tables of results help summarise the data, and are made for the following reasons:

   (i) to show 'standardised' or 'normalised' results. For example, metals in sediment samples can be normalised to the finer fractions of sediment particle size (particles less than <0.2 mm diameter); organic compounds in sediments can be normalised to 1% organic carbon content);

   (ii) to compare the results with international or national guidelines and criteria;

   (iii) to compare the raw and/or standardised results with those from previous surveys of same sites; and/or

   (iv) to compare results with those from surveys in the same or similar regions;

3. **Plots/Graphs**: Use these to show the **trends** in your results over time or over distance (2D Histograms Scatter Plots and Line Plots can show one parameter over time or space; 3D plots to show more than one parameter over time or space).

   Follow the correct protocol when joining points together (difference in meaning between solid lines and dashed lines).

   Use the Excel computer program - it has a wide range of easy to use graphing features in its 'Chart' module. It also allows you to show any correlation between results, and can give you the regression and the goodness of fit. For complicated trends, you can plot the values onto the same base diagram you made for Location Diagram.

4. **Photographs:** *"One picture = one thousand words"*; use a photograph not only to provide interest but to demonstrate a key feature of the study. Photos can be used to show: (a) the main activity under investigation - such as the outfall or fishing harbour; (b) the conditions at a typical sampling site; (c) unusual conditions at a surprising sampling site; (d) the new or important field equipment that was used; or (e) how the sampling method was undertaken.

5. **General Tips:**

Use colour **only** to help highlight a trend or a difference. Do not use colour only to make a figure look 'pretty'.

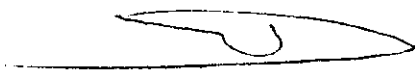
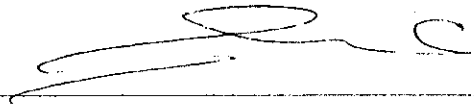
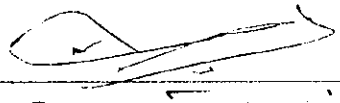
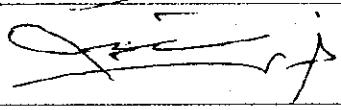
Always give a **title,** and **always** show the **units of measurement** and the **site code** or **dates** on the graph axes. Every graph or figure must be able to 'stand alone' - so if your boss or someone else makes a photocopy of the figure, it shows enough information to make clear what is going on and what it means.

5. **Statistics**: Use of graphs to present the statistical results of quantitative data analysis (means, standard errors, confidence limits, multi-variate data, etc) will be addressed separately in the tutorial scheduled for Field Team.

Lunch Time Seminar (5)

Date: 12, July, 00
Title: MEPA Field Equipment (Calibration and Maintenance)
Speaker: Tomohiko Ike

Attendance

Name	Signature
Yousef Al-Helal	
Adel M. Kusti	
Khaled H. Buskait	
Khaled S. Al-Rasheed	
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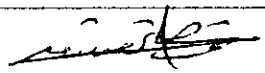
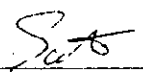
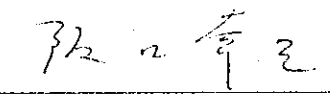
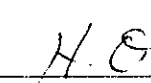
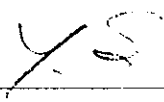
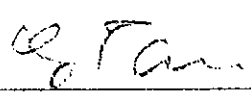
Qusai M. Bohlaigah	
SATO	
K. Sakaguchi	
HIROYUKI OHI	
I. SHIMAZU	
K. Tamaka	

MEPA Field Equipment
(Calibration and Maintenance)

1. Introduction

Maintenance and Calibration of the field equipment is basic and easy but one of the most important issue on the monitoring activity. Especially in KSA, where the maintenance work is more important than in other countries because of the following environmental factors. These are distinctive in KSA and can cause a rapid deterioration of the materials of the field equipment.

- Strong Sunlight (ultraviolet rays)
- High Temperature
- High Humidity
- High Salinity of seawater
- Dust and Sand

2. General matters

2.1 Qualified Staff

Without adequate management of maintenance and protection, all equipment is easily damaged. Thus, only qualified persons who have adequate knowledge for the equipment should manage maintenance and calibration works. Only under the supervision of the qualified person, can labor maintain and/or clean the equipment.

2.2 Maintenance

The frequency of maintenance depends mainly on the kinds of equipment and/or the frequency of their usage.

However, all equipment should be checked and maintained regularly, especially routine maintenance and calibration during the period of field surveys.

One of the most important issues on the field equipment maintenance is to keep all equipment clean, tidy and calibrated.

Equipment cleanness is an essential factor in ensuring that samples remain contaminant-free. All sampling devices must be cleaned and/or washed with fresh water before and after each sampling trip, and stored in new plastic bags or in clean boxes.

2.2 Calibration

Calibration should be conducted before the survey and it is better to calibrate again after one week and/or after the survey to check the instrument worked correctly in the field. Also, calibrations should be carried out at the time of installation and/or after repairing.

In general, "Zero" solutions and "Range" (Span) solution are usually used for the calibration of the water quality measurement instrument.
A "Zero" solution is the standard solution used to fix the zero (or basic) point of the instrument.
A "Range" (Span) solution is used to fix the slope ,range, or scale value of the instrument.
The accuracy of the concentration of these solutions is important to carry out the calibration correctly, so these solutions should be stored fresh and properly (check "use-by" date and store according to label instructions).

Calibration should be conducted under clean and tidy conditions to avoid contamination, and always use fresh standards. Do not let anyone tamper with the solutions.

All glassware and/or tools that are used for the calibration also should be kept clean.
The temperature of the Standard solution should be kept stable during the calibration. Generally, provide sufficient time for thermal stabilization on the standards. To reduce the time for stabilization, try to keep all calibration standards and instrument stored at the same temperature for at least 2 hours before the beginning of the calibration.
Standard solutions will contaminate with exposure to air so they should be kept in a container with an airtight lid when not in use.

2.3 Equipment Storage

Equipment should be stored in cool, shady and dry conditions after cleaning and/or washing.

If equipment is not used for a long time,

- For some metal parts such as spring, bolts, shackle etc, wipe each part with clean cloth and spray a small amount of "Moisture prevention liquid rust (= corrosion inhibitor such as WD40/CRC)" to prevent the.
- Remove the batteries from equipment. ----They can leak and corrode terminals.

3. MEPA Field Equipment

Field monitoring equipment held in the Eastern Province is listed in Table 1.

Table 1 Field Monitoring Equipment List

Equipment	Specification	Q'ty
Sampling Equipment		
Van Dorn Water sampler	rubber band closing type, 6 & 10 litter	3
Eckman grab sediment sampler	chrome plated; 0.04 m^2 gape	3
Van Veen grab sediment sampler	stainless steel; 0.12 m^2 gape	1
Soil samplers	polycarbonate tube corer + cap	10
Plankton net	NXX-13 mesh size	2
Sampling buckets and bins	Assorted, 40 litre	4
Stainless scoops and sterile spatulas	Assorted pkts	6
Stainless Trays	Various	4
Plastic Trays	Various	2
Field Instruments		
Water current meter	electromagnetic, 0 - 250 cm/s	1
Hydrolab portable multi-probe meter	Temp, pH, DO, cond/salinity, turbidity	1
Portable ORP meter	Redox measurement	1
Secchi plate	dia. 30cm white plate, rope 30m	2
Sounding lead	lead weight 3.2 kg, rope 30m	1
Portable GPS	Battery powered non-DGPS	2
Other		
Tool Box		1
First Aid Kit		1
Cooler Boxes	65 litre	5

4. Maintenance and Calibration of each Equipment

4.1 Van Dorn Water sampler

a. Description

The Van Dorn water sampler is used to collect water samples from a depth of more than 2 meters. The sampler is composed of rubber strings and lids, stainless steel parts and high density polyethylene tube. Sampling carried out by the dropping of the "messenger" along the rope to close the Rubber lids with the power of the rubber strings.

b. Maintenance

Wash the sampler with fresh tap water before and after the survey to fully remove salt and dirt. When sampling for trace substances, the sampler should be rinsed two or three times with distilled water after washing with tap water.

The Messenger also should be thoroughly washed and checked after the survey. After that, spray with "Moisture prevention liquid" to the moving parts of the messenger.

The sampler should be stored in the open position to prevent moisture being trapped. Possible deterioration of the rubber parts and corrosion of the steel parts (including the messenger) should be checked periodically.

4.2 Eckman grab sediment sampler

a. Description

The Eckman grab sediment sampler is generally used for sampling of sediments in shallow water area (<10m). The sampler has spring-tensioned, scoop-like jaws on the bottom and is made from stainless steel (Figure 2).

The sampling is carried out by dropping of the "messenger" along the rope to close the jaws with the tension of the spring.

b. Maintenance

Wash the sampler with fresh water before and after the survey.

Spray the "Moisture prevention liquid" to the moving parts of the sampler when not in use.

The "Messenger" also should be washed and checked after the survey. After that, spray with "Moisture prevention liquid" to the moving parts of the messenger.

The corrosion on the steel parts (including the messenger) should be checked.

4.3 Van Veen grab sediment sampler

a. Description

The Van Veen grab sediment sampler is generally used for the sampling sediments from deep water areas (>10m). This sampler is also suited to the collection of hard bottom material such as sand, gravel, and firm clay.

The sampler is made of stainless steel and consists of a pair of jaws and arms plus a stainless steel closing chain (Figure.3).

The jaws are held open by a trigger. Upon impact with the sediment, the trigger is released and

the jaws are closed by the tension of the rope, which acts on the closing chain.
The arms must be strongly tightened, with the "T" key in the hole. Otherwise the lock mechanism cannot be used.

b. Maintenance

Wash the sampler with fresh water before and after the survey.
Spray with the "Moisture prevention liquid" to the moving parts of the sampler when not in use.
The corrosion on the steel parts (including the messenger) should be checked for periodically.

4.4 Soil sampler

a. Description

The Soil sampler comprises a polycarbonate tube plus 2 silicon end caps.
The sampler is used to collect core samples and/or to collect the surface samples of exposed intertidal sediments.

b. Maintenance

Wash the tubes and caps with fresh water before and after the survey.
For sampling trace substances, the sampler should be first washed using a laboratory detergent. After that, dip into 5% HCl (Analas Grade) for one night and then rinse three times with distilled water.
For trace substances, a new sampler should be used from each site.

4.5 Plankton net

a. Description

The small plankton net is used for plankton sampling where only qualitative data or a large biomass is needed for analysis of plankton populations.
The plankton net comprises a tow line, nylon mesh "bolting" cloth, tap and plastic collecting cylinder (Figure 4).

b. Maintenance

Hang the net and wash by hosing down with lots of the tap water after the survey.
The collecting cylinder and tap should be detached from the net and washed separately.
Check regularly for corrosion of tap and other metal parts. Use a "Moisture prevention liquid" spray to prevent corrosion.

4.6 Water current meter

a. Description

The Portable electromagnetic water current meter has no moving external parts and is used for the real-time monitoring of current speed and direction. The portable current meter comprises a Sensor Sonde, Display Unit and cable (Figure 5).

Power can be supplied by AC 100 or by self-contained rechargeable battery inside the display unit.

b. Maintenance

Check and recharge the Battery before and after the survey, or weekly if the survey period is long.

After the survey, the current speed sensor and connecting cable should be rinsed in fresh water first. Then carefully rinse away with cleanser any oil or the like from the surface of the parts of the Sensor and cable.

For the Display Unit, wipe by the soft cloth with fresh water and remove the salt. Pay particular attention to the cable connectors. Make sure they are clean and spray a "Moisture prevention liquid" before storage.

When the instrument is not used for long time of period, the Battery voltage may drop. In this case, follow the battery rejuvenation procedure described in the manual.

c. Calibration

This meter is factory-calibrated so only a zero point adjustment (for confirmation) is needed.

The Zero Point Adjustment can be done by turning the Zero-Adjust Trimmer when the sensor is submerged in completely still water (for example – in a large sink or large bucket).

4.7 Hydrolab DS4 portable multi-probe meter

a. Description

The Hydrolab portable multi-probe meter is used to spot measure pH, temperature, DO, turbidity and Salinity at the surface and at depth..

This meter has both internal battery (9.5V inside the meter) and an external 12V rechargeable battery pack.

b. Maintenance

General

Check and recharge the internal and external batteries before the survey.

For temporary storage, fill the sensor cup with clean tap water (don't use the distilled water) and

screw the cup on the multi probe. For lonf term storage (>month) follow instruction manual (= Store upright with only 3cm of the water in the cup).

Lay the cable coils of at least 15cm in diameter at the bottom of the container.

pH sensor

The pH glass electrode should be gently cleaned when it is obviously coated with oil, sediment or biological growth. Slow response or non-reproducible measurements are signs that the electrode has become dirty or is scratched. Carefully clean the pH glass electrode using a clean, soft cloth with methanol to remove the film from the surface of the electrode. **Never** put methanol in the cup (this will destroy the DO probe!).

DO sensor

DO sensor maintenance is usually required when calibration becomes impossible or when the membrane covering the cell becomes wrinkled, bubbled, torn, dirty, or otherwise damaged. The membrane of the sensor should be replaced according to the procedure described in the Manual.

After replacing the membrane, allow it to soak overnight in the tap water before calibration.

Never use methanol or other solvent to wash the membrane. Use a gentle spray of distilled water only.

Temperature, Salinity sensor

The temperature sensor and salinity sensor does not require any special maintenance, except to keep clan and check for possible corrosion. **Do not** spray with "Moisture prevention liquid"---This will badly affect the pH and DO probe.

Turbidity sensor

Turbidity sensor maintenance is required when any of the lenses have a visible coating of dirt.

Rinse sensor with distilled water directed at the lenses to remove any large caked deposits and loose residue. Use soft lint cloth with methanol to remove any additional residue such as sand or grit. Be very careful not to scratch the lenses.

Wet the cloth with methanol. Wipe the lenses and be careful not to touch DO probe. Rinse the sensor and lenses with distilled water again, then dry.

b. Calibration

pH sensor

Calibration for pH is achieved by pouring a standard solution into the sensor cup. Then allow time for the solution to stabilize, and check/adjust the value of the standard according to the manual instructions.

Generally, calibrate "Zero point" with the "zero" standard solution (pH 7.) first.

Then calibrate the "Slope" with a "slope" standard solution (pH4 and/or pH9).

The pH value of the slope standard solution used for the calibration should be better to close the value that of the anticipated samples that will be measured in the field survey.
PH9 is best for sea water monitoring programs.

DO sensor

The basic procedure of Dissolved oxygen (DO) calibration is similar to that of pH sensor.
Pore the standard solution into the calibration cup. Then enter the calibration value after stabilize the value. First add sodium sulphite to sensor cup (2g), then fill to brik with distilled water and screw onto probe. Make sure there is minimum air bubble. Wait until DO reading has reached 0% saturation (10-15 minutes). If not stabilized, wait again. If stabilized above 0%, adjust zero according to Scout panel display (or computer link-refer manual). Then thoroughly wash cup and total probes with fresh water to remove every trace of $Na_2(SO_3)$. Then use air (or shake) to get 100% saturation check.

Temperature, Salinity sensor

Temperature and salinity does not require any calibration. These sensors are factory-calibrated.

Turbidity sensor

Turbidity sensor calibration must be done in a vessel with **at least a 2 inch** clearance between the vessel wall and the sensor's face. Prepare the zero (distilled water) and slope standards. The slope standard would be close to the expected NTU value of the deployment site (20 or 50 NTU is good).

4.8 Portable ORP meter

a. Description

The portable ORP meter and probe is used to measure the Oxidation Reduction Potential of the sediment. This is a measure of the ability of the sediment to remove oxygen from the water. Using the lower the value (-mV)---the bigger the capacity to remove oxygen.

b. Maintenance

After the survey, the ORP probe should be rinsed in fresh water.
For the Display Unit, wipe by the soft cloth with fresh water to remove the salt and dirt.
When the meter is not used for long time of period, the batteries should be removed.

c. Calibration

The portable ORP meter does not require any calibration. The probe is factory-calibrated.

4.9 Secchi plate

a. Description

The Secchi plate is a white and black plastic plate (30cm diameter). The plate used to measure water Clarity (by metres depth from surface).

b. Maintenance

Wash the plate with fresh water after the survey. Regulary check the connections to the tapeline and lead weight for corrosion. All shackle connections should be washed in tap water, dried and sprayed with a "Moisture prevention liquid" before storage.

4.10 Portable GPS

a. Description

The Portable GPS unit is used for navigating and taking position of the sampling site.
The default setting is WGS84—but many spheroids are available for selsction, according to the chart that is used.

b. Maintenance

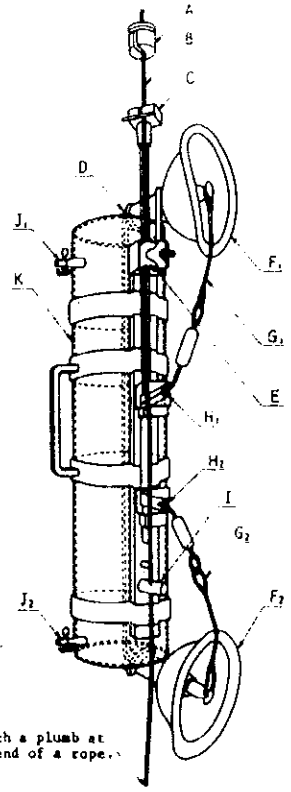
Wipe by the soft cloth with fresh water and remove the salt.
When the GPS is not used the long time of period, the batteries should be removed.
The GPS unit is particularly sensitive to heat because of the microprocessor chip and the color LCD crystal display. This unit must be protected from sunshine always.

5. Record Keeping

When any equipment is installed, used, repaired, maintained or calibrated, details of these works should be recorded. A record sheet should be prepared for each piece of equipment and kept at MEPA by the person responsible for managing all field equipment..
The Manager of equipment should check these records periodically and confirm that the works are being implemented properly. Examples of the recording sheet are attached.

Fig 1

Example of Vandorn water sampler



A: Messenger

B: Rope (or wire) for suspending

C: Messenger receiver

D: Rubber string

E: Fastening metal for rope

F_1, F_2: Rubber lid

G_1, G_2: Wire for rubber lid

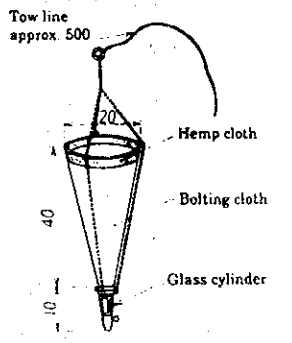
H_1, H_2: Fixing metal of wire for rubber lid

I: Fixing place of rope

J_1, J_2: Soft polyvinyl chloride tube with a pinch cock for taking out sample

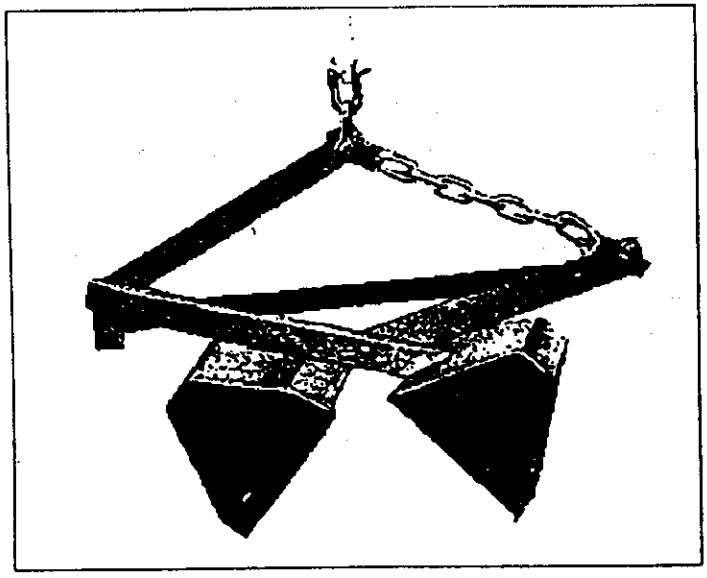
K: synthetic resin-made cylinder

Unit : cm



Example of plankton net

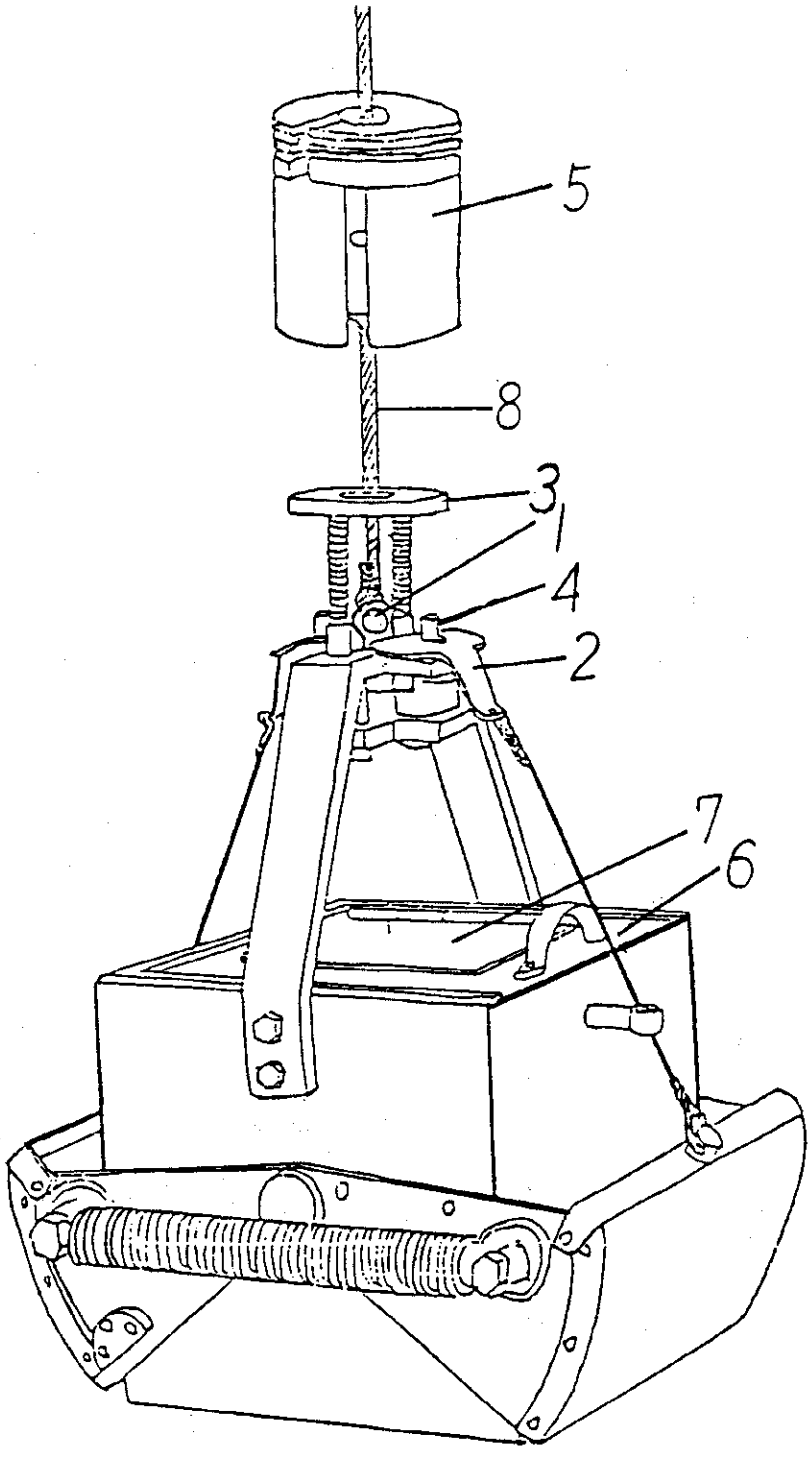
Fig 4



Van Veen Grab

Fig 3

Fig2. EKMAN-BERGE DREDGE



Name of Parts	
No.1	Hook for rope
No.2	Suspention metal fitting
No.3	Messenger receiver
No.4	Latch
No.5	Messenger 1 Kg
No.6	Top lid
No.7	Door
No.8	Rope

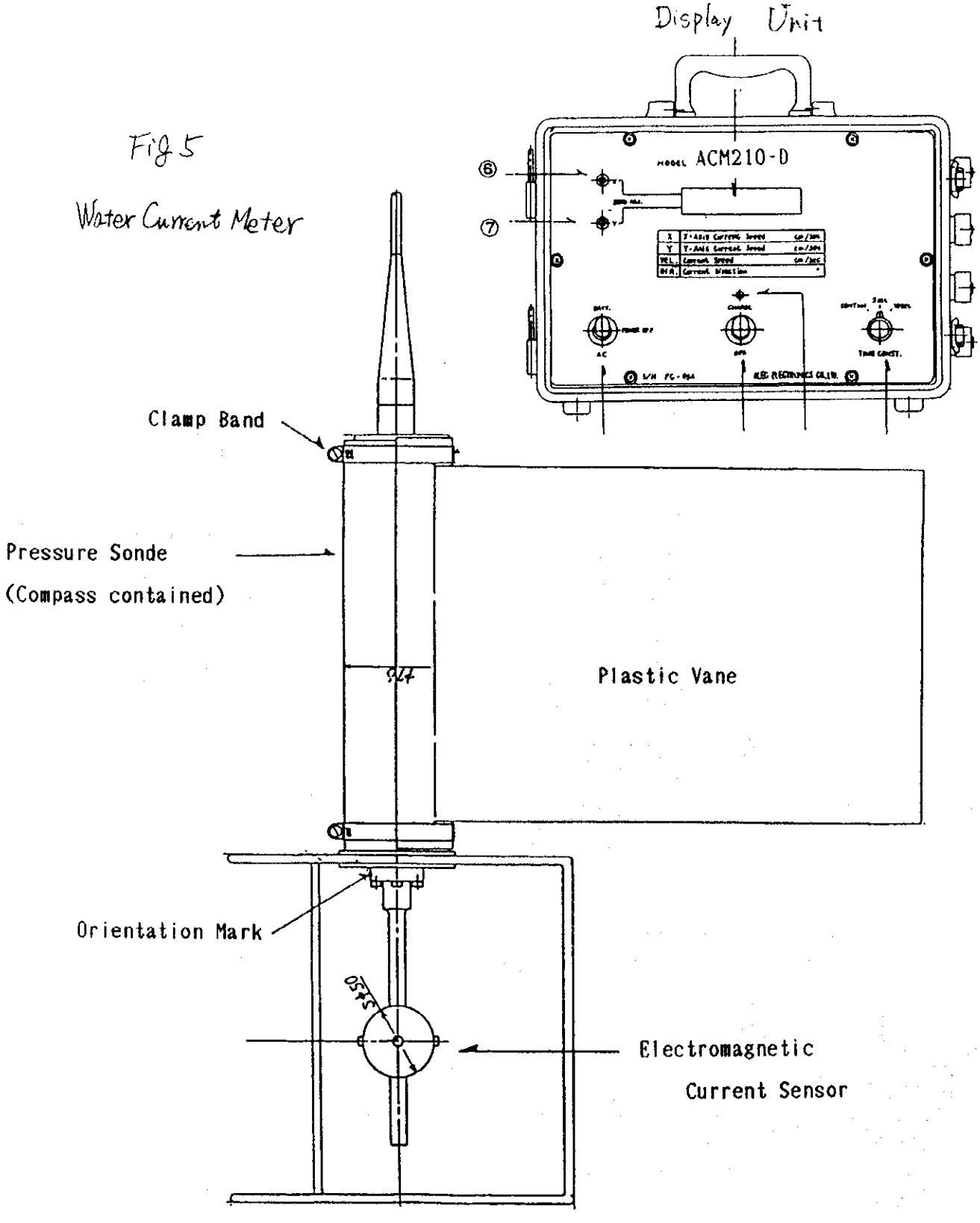
Material: Brass

Sampling area: 15 x 15 cm
20 x 20 cm

Accessories: Messenger
Wooden Case

Fig 5

Water Current Meter



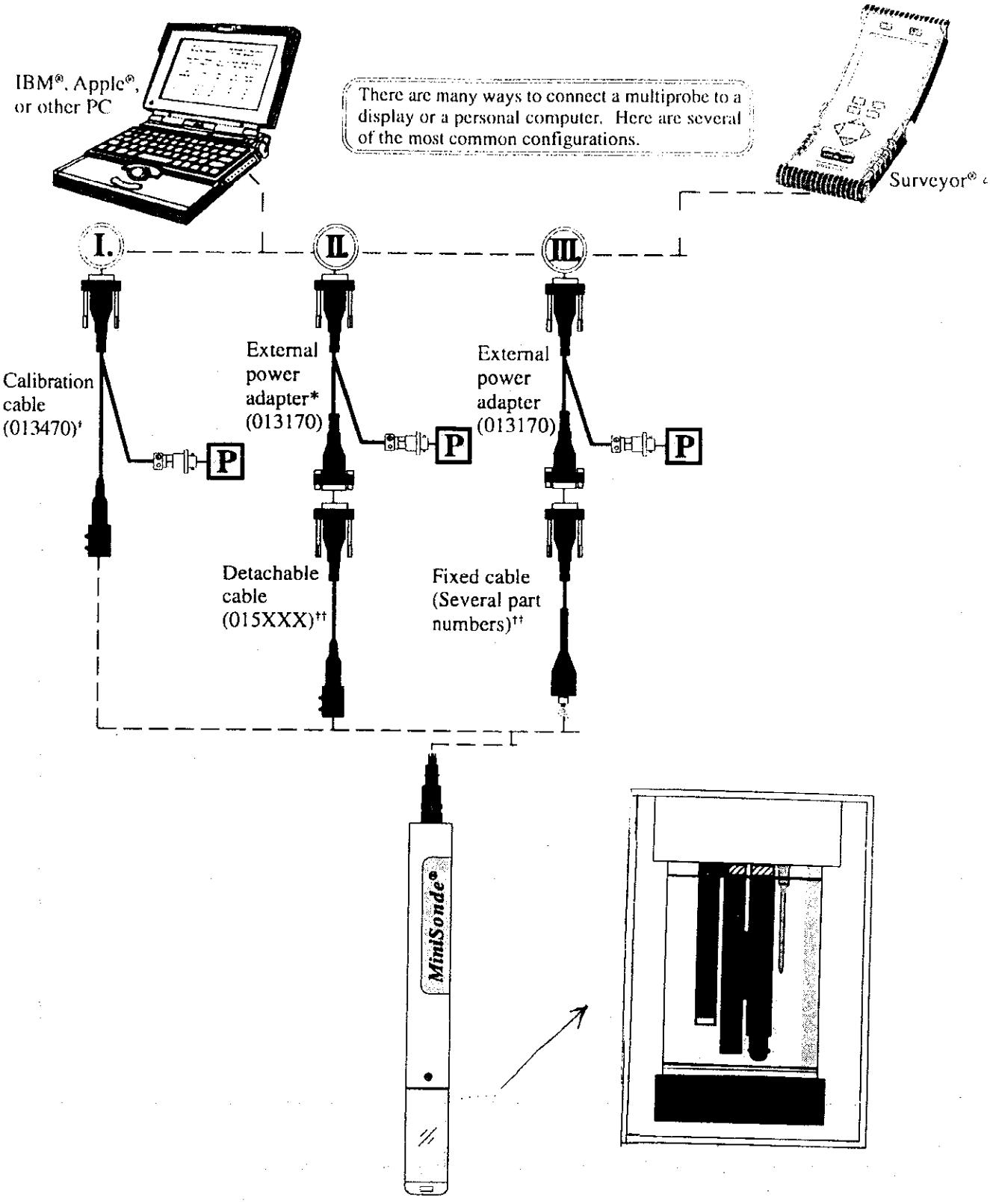


Fig 6. Hydrolab multi-probe meter

Maintainance Record Sheet

Equipment Name	
Manufacturer/Model No.	
MEPA's Control No.	
Maitainance Date	
Maintainance Person/Company	
Responsible person (Signature)	

Detail content of Maintainance

Maintained Items	Eqauipment Condition	Description
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		

<Legend for Equipment Condition >
G: Good CA: Calibrated/Adjusted PC: Parts Changed R: Repaired NR:Need to Repair

Calibration Record Sheet (pH)

Date	Person	Calibration Results with Standard Solutions						Remarks
		pH7		pH4		pH9		
		Before	After	Before	After	Before	After	

Equipment Repair Record Sheet

Equipment Name	
Manufacturer/Model No.	
MEPA's Control No.	
Repaired Date	
Repaired Person/Company	
Responsible person (Signature)	
Symtoms and Cause	
Repaired Matters/Parts (detail extent of repairs)	
Results of Repair	
Other Remarks	

Lunch Time Seminar (6)

Date: 16, July, 00
Title: Laboratory Practice (2)
Speaker: Mamoru Sato

Attendance

Name	Signature
[illegible]	
Khaled S. Al-Rasheed	
Aziz W. ALomair	
Adel M. Kusti	
K. Tanaka	
Y. SHIMAZU	
Alam Nizami	
Qusai M. Bohlaiqah	
Yousef Al-Helal	
Tomohiko Ishe	
HIROYUKI OHI	
KRISHNA KUMAR MISHRA	
K. Sakaguchi	
Kunio Arai	
R. Hiromoto	

[1] Contamination

What is the contamination?

Where dose it come from?

Example of the contamination

How to prevent the contamination

[2] QA/QC

Spike test (recovery test)

Duplicate analysis (sample)

Standard (reference) sample

Blank test

[3] Precision and Accuracy

Result of analysis, which is controlled by the statistical rules

What is the precision?

What is the accuracy?

How to know the true value?

Errors, which scientists always struggle with

Lunch Time Seminar (7)

Date: 19, July, 00
Title: Performance Management (Position Duties and Responsiilities)
Speaker: Kazutake Tanaka

Attendance

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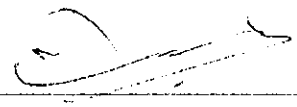
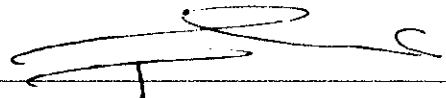
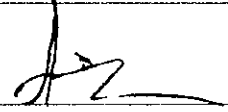
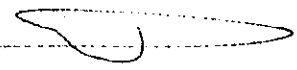
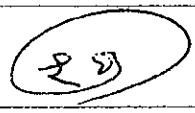
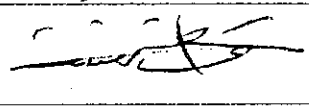
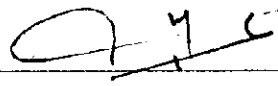
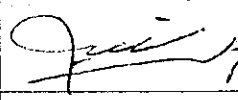
Khalid Busbait	
Adel M. Kusti	
Alam Nizami	
yousef AL-Helal	
SATO	
Qusai M. Boldaiyaka	
AZIZ ALOMARI	
Khaled S Al. Rasheed	
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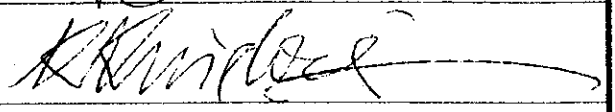
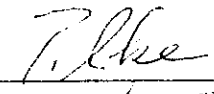
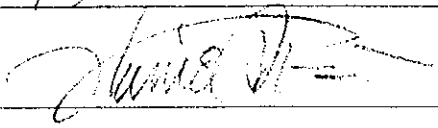
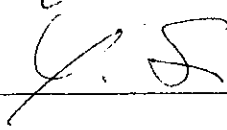
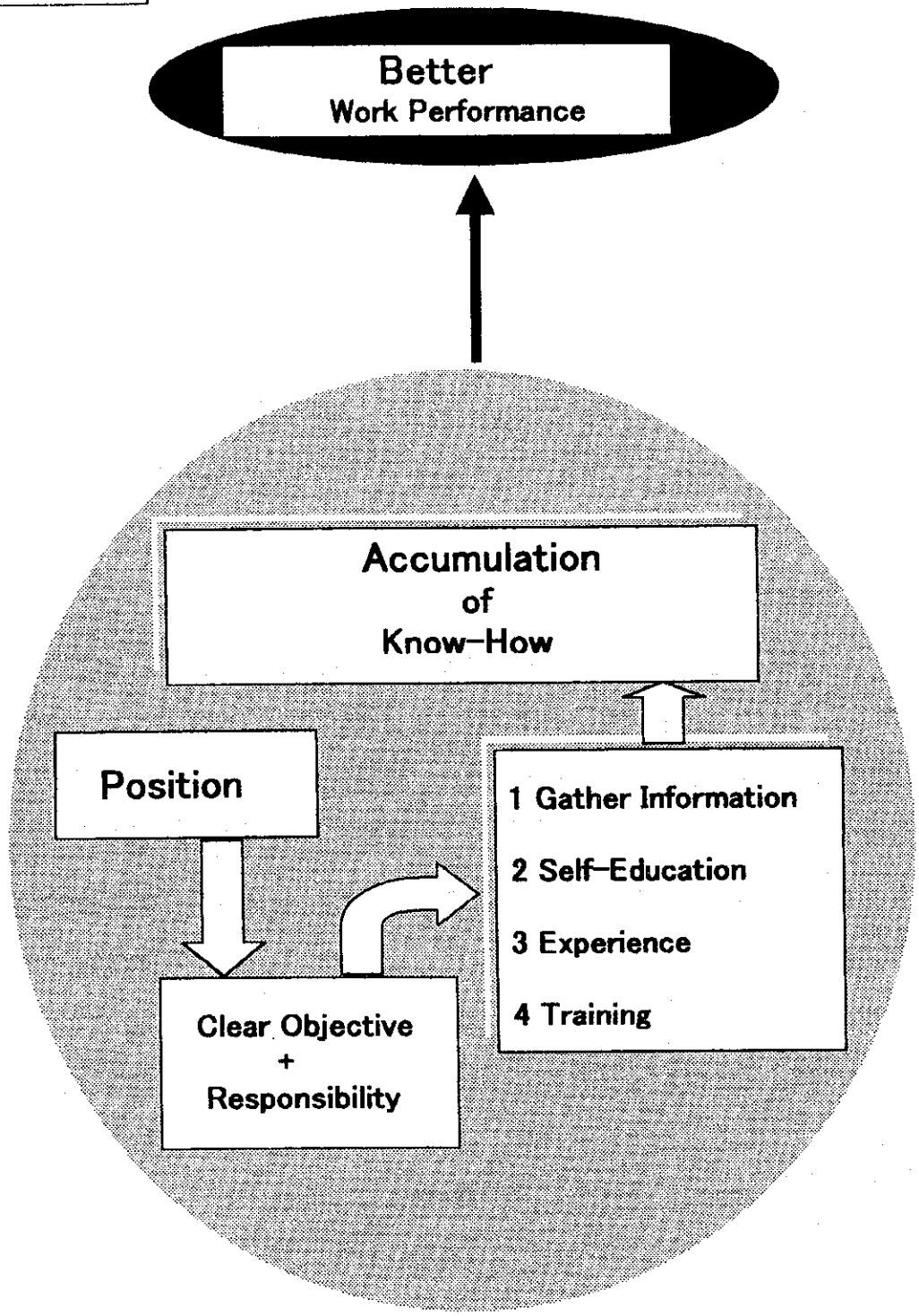
KRISHNA KUMAR MISHRA	
Tomchiko Ike	
Kunio Arai	
Y. SHIMAZU	

BY K.Tanaka


Better
Work Performance
Accumulation
of
Know-How
Position
1 Gather Information
2 Self-Education
3 Experience
4 Training
Clear Objective
+
Responsibility

ATTACHMENT

Position Description and Responsibility

Position Description (sample)

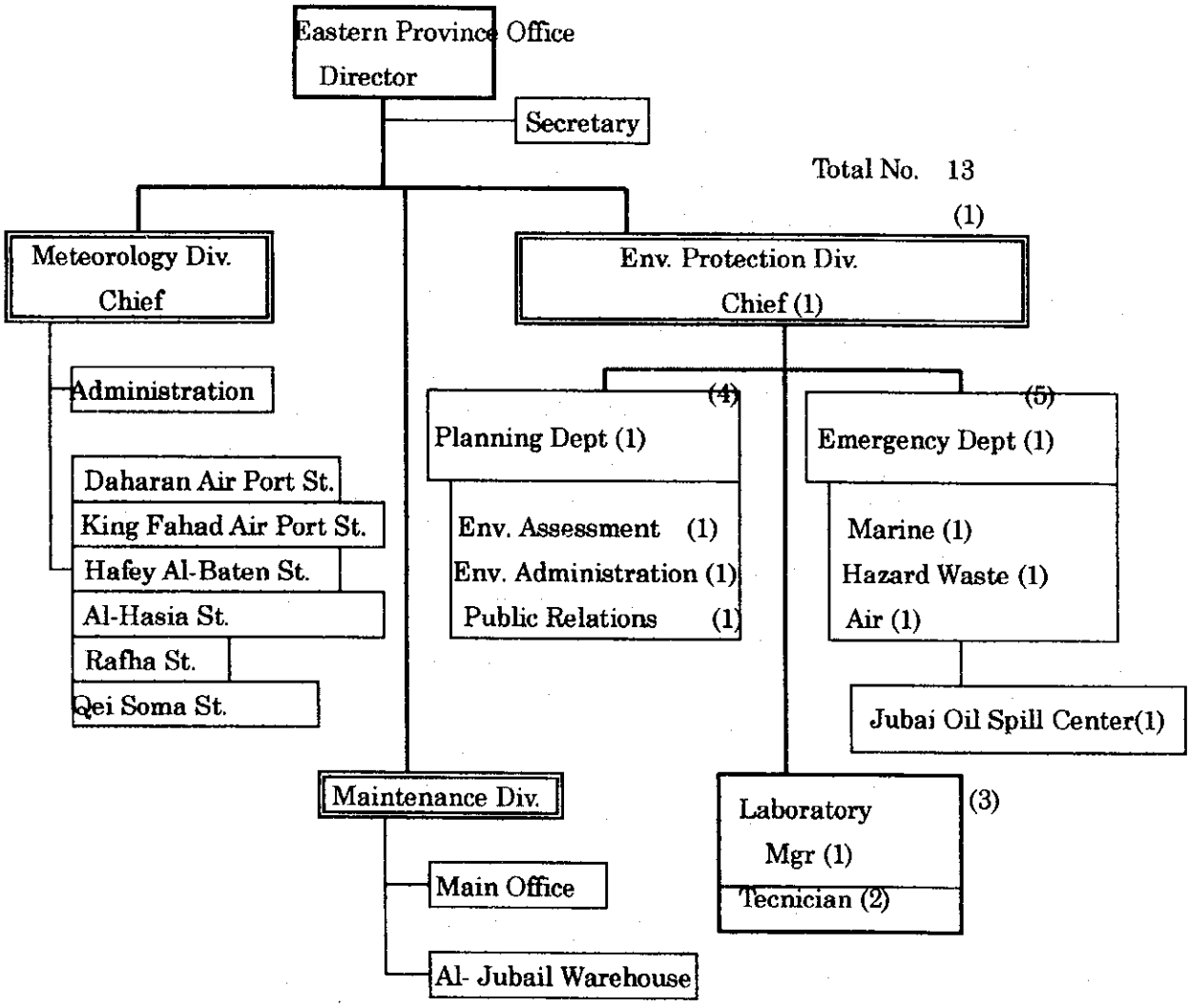
Name	Khalid Al-Rasheed
Department	Environment Protection Division -Marine Control Group
Title	Sea Water Quality Control Supervisor
Report to	Aziz Al-Omary
Supervise	A,B,C
Objective	Assist Manager in Gulf Sea Water Quality Protection
Responsibility	1. Plan an annual schedule for the group's activities 2. Plan better methods or system to protect sea water quality from pollution. 3. Design and update work-flow charts and procedures for efficient work for the group. 4. Gather as much information as possible of the environment related data including from international sources. 5. Keep updated the data of the Gulf water quality 6. Coordinate with persons in charge of Sewage Department, Fishery Department, Coast Guard and other public Departments for environment protection of the Gulf 7. Plan sea water monitoring program and schedule. 8. Lead monitoring work at sites. 9. Evaluate the result of monitoring in comparison with accumulated data, after receiving the analytical result at lab. 10. Prepare a warning letter to an organization which imperils the sea water condition. 11. Guide, train and help subordinates for better group work. 12.Perform other duties than the above to be given by his manager

Appendix E-1

Recommendation on Organization Structure

Of MEPA Eastern Province

July, 2000



Notes: 1.Recommendation is only on Environment Protection Division.

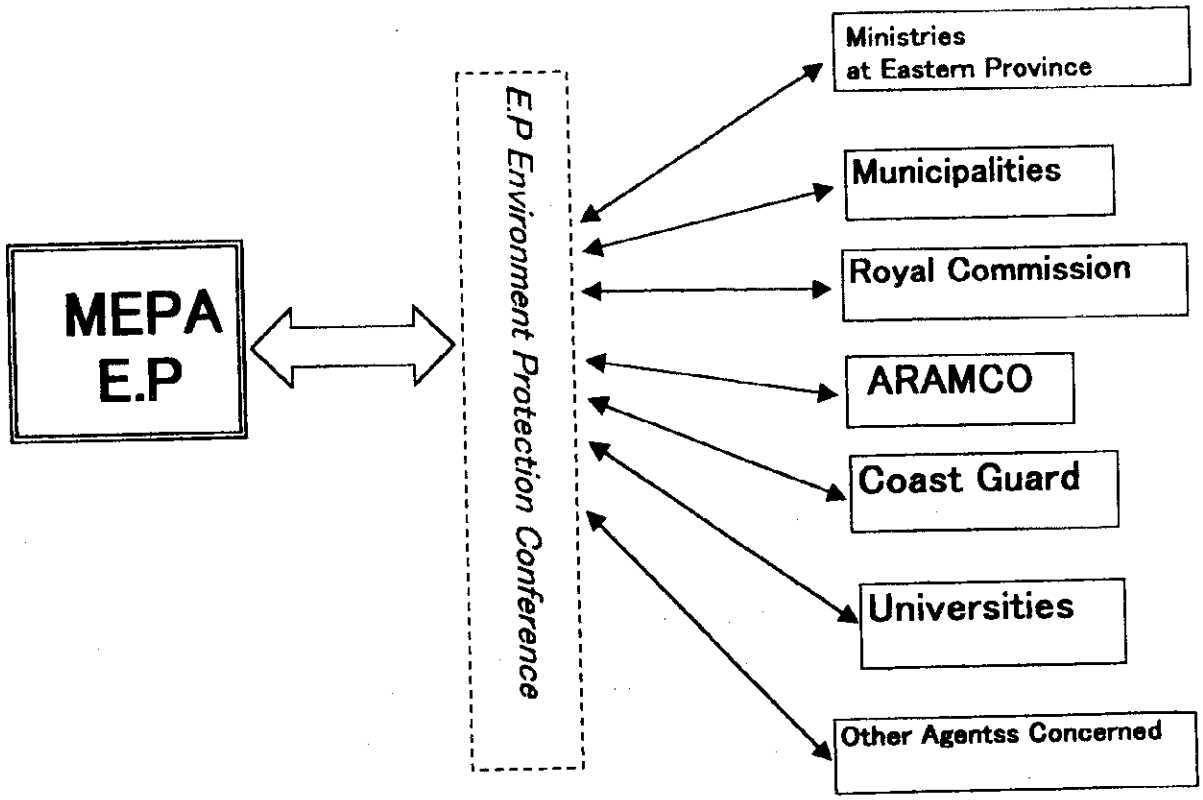
2.The figure in bracket ( ) shows the minimum required staff number.

3. Depending upon the requirement or emergency case, the assigned personnel should be flexible in helping each other by the order of the Chief.

Appendix E-2

Environment Management

(1) Relation with Public (governmental) organizations



Role of MEPA

1)Summon the Conference

2) Coordinate the Agents

3) Accumulation of Data

4)Guide for better E. Mangement

Topics to discuss

1) General Affairs for Environment Management

2) Dumping of Pollutants

3) Waste Water/Solid Waste

4) Dredging

5) Land Reclamation

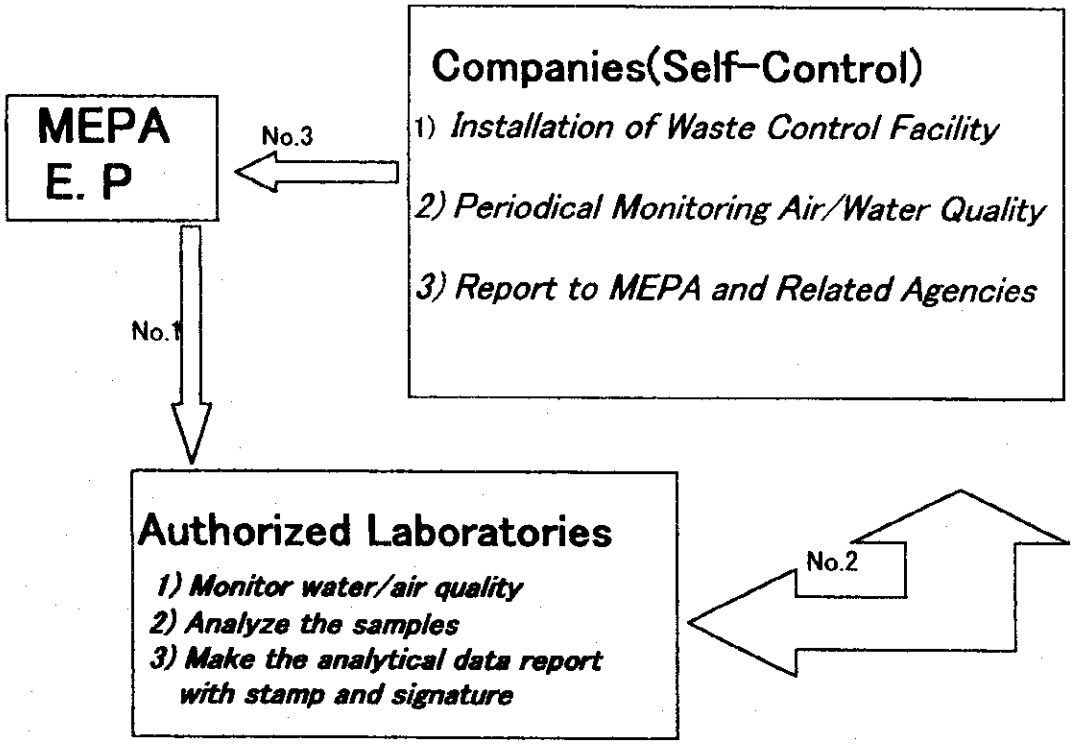
6) Large Scale Development

7) Define the Scope of Work among the Agents

Appendix E-3

Environment Management

(2) Relation with Industrial Companies/Factories



Notes:

No.1 MEPA encourages Saudi laboratories/institutes for monitoring and analytical work for air/water quality, and authorize them, under a certain condition, to undertake such work for an official report.

No.2 The individual company requests an authorized laboratory/institute to monitor, check and confirm the data on the report to be sent to MEPA and other Authorities.

No.3 The companies/factories are instructed to establish a self-control anti-pollution system and report periodically to MEPA including the related Agencies of the monitoring result which is confirmed and stamped by the said laboratory/institute.

Appendix E –4

Environment Management

(3) Example of Action Plan

Step	Major Action	Period
1st Step	**Demonstration of MEPA Presence** -Visit various agencies and factories -Issue questionnaires to the above -Interview with the above -Publicize about MEPA	Jan. 2001 ~ Jun. 2001
2nd Step	**Establishment of Collaboration with Agencies** -Creation of Environment Management Conference (EMC) -Clarification of Scope of Responsibilities -Exchange of Views for Environment Protection Management	Jul.. 2001 ~ Dec. 2001
3rd Step	**Establishment of Relationship with Major Industrial Companies** -Enlightening them for Environment Protection -Self-control system of Anti-Pollution by Individual Companies -Creation of Authorized Laboratories -Reporting System of Companies	Jan. 2002 ~ Jun. 2002
4th Step	**Establishment of MEPA as Data Center** -Collect All Information and Data in Eastern Province -Monitor Environment Status -Issue Periodical Report about Status	Jul. 2002 ~ Dec. 2002
5th Step	**Reinforcement of MEPA for Anti-Pollution Activities** -Actual Investigation into Industrial Sites -Warning Letter to Faulty Facilities -Order of Factory Closure	Jan. 2003 ~ Dec. 2003

↓

Plenary Function of MEPA Eastern Province

Note: 1) The period (time table) can be adjusted.

2) "1st step to 6th step" shows the focal points of MEPA E.P activities.

3) At the 5th step, "Order of Factory Closure" will need reinforcement of laws and strong relationship with the relative agencies.

Appendix H

Documents of Workshop III

Workshop Program
Resume of Presentation
Q & A Summary

JICA

Meteorology & Environmental Protection Administration (MEPA)
With the Cooperation of
Japan International Cooperation Agency (JICA)

مصلحة الأرصاد وحماية البيئة
بالتعاون مع
الوكالة اليابانية للتعاون الدولي

ورشة العمل الخاصة
بدراسة جودة ومراقبة مياه الخليج العربي
Work Shop of
Sea Water quality & monitoring of Arabian Gulf

برنامج حفل الافتتاح
Opening Ceremony Program

Monday 13/11/2000 الاثنين ١٧/٨/١٤٢١هـ

The Holy Qur'an	9.00	٩,٠٠	القرآن الكريم
Welcome Speech by MEPA president	9.05	٩,٠٥	كلمة معالي رئيس عام مصلحة الأرصاد وحماية البيئة أمين عام اللجنة الوزارية للبيئة
H.R.H. Prince Saud Bin Naif Bin Abdulaziz Deputy Governor of E.P.	9.15	٩,١٥	كلمة راعي الحفل صاحب السمو الملكي الأمير سعود بن نايف بن عبد العزيز
Japan Ambassador to Saudi Arabia	9.25	٩,٢٥	كلمة السفير الياباني لدى المملكة العربية السعودية
Mr. Kuniaki NAGATA JICA Representative	9.35	٩,٣٥	كلمة السيد/ كونياكي ناقاتا ممثل الوكالة اليابانية للتعاون الدولي
Mr. Yasuhiro SHIMAZU Head of JICA study team	9.45	٩,٤٥	كلمة السيد/ ياسوهيرو شيمازو رئيس فريق الدراسة الياباني
End of the ceremony	9.50	٩,٥٠	نهاية حفل الافتتاح

MEPA/JICA PROJECT

Sea Water Monitoring and Management Program

Under The Patronage of His Royal Highness
Saud Bin Naif Bin Abdulaziz
Deputy Governor, Eastern Province

Workshop

According to the agreement between JICA (Japan International Cooperation Agency) and MEPA (Meteorology and Environmental Protection Administration), the workshop will be held during 13 – 14 November 2000

Your presence and contribution to the discussion will be greatly appreciated, since this workshop is a full presentation of the project and its results.

PROGRAM

The Study on Environmental Assessment and Monitoring of Arabian Gulf in the Kingdom of Saudi Arabia
- Full Presentation and Discussion –

Al-Ghosaibi Hotel, Conference Room
Al-Khobar

Schedule

Day 1 (November 13, 2000)

Session 1 Opening

08:45	Registration	
09:00	Recitation of Holy Quran	
09:05	Dr. Nizar I. Tawfiq (MEPA President)	Welcome Speech
09:15	Deputy Governor of Eastern Province	
09:25	Mr. Shotaro Oshima (Japan ambassador to Saudi Arabia)	Welcome Speech
09:35	Mr. Kuniaki Nagata (JICA Representative)	Role of JICA
09:45	Mr. Yasuhiro Shimazu (Head of JICA Study Team)	Cooperation of Study
09:50	Break	
	Special Speaker	
10:30	Effective Environmental Management in Arabian Gulf	Mr. Masahiro Ohta (JICA Advisor)

Session 2 Scientific Findings

10:50	Mr. Yasuhiro Shimazu (Head of JICA Study Team)	Outline of Study
11:00	Present Sea Water Quality Situation in the Study Area	Dr. Robert Hilliard (JICA Team)
11:15	Sampling Practices	Mr. Khaled S. Al-Rasheed (MEPA)
11:30	Prayer Time	
12:00	MEPA's ongoing GIS & RS Activities	Mr. Mohammed Bukhari (MEPA)
12:10	Sea Water Quality Evaluated by Satellite Data Analyses	Dr. Krishna Mishra (JICA Team)
12:25	Discussion	
13:00	Lunch Sponsored by JICA	All participants are invited

Day 2 (November 14, 2000)

Session 3 MEPA's Role

09:00	Phased Approach to Future Sea Water Monitoring	Mr. Tomohiko Ike (JICA Team)
09:20	Importance of the Extending Seawater Monitoring along all of the Eastern Coast of Saudi Arabia	Mr. Adil Qusti (MEPA)
09:35	Laboratory Preparation for Environmental Monitoring	Mr. Hiroyoki Ohi (JICA Team)
09:50	Precautionary measures in the Environmental Analysis	Mr. Jamal Kazim
10:00	Break	
10:20	Aspect of Chemical Pollution in the Arabian Gulf	Dr. Abdul Rahman Al-Arfaj (MEPA)
10:35	Strengthening MEPA's Capability	Mr. Kazutake Tanaka (JICA Team)
10:55	Present Situation and Future Consideration	Mr. Hamdan Al-Ghamdi (MEPA)
11:30	Prayer Time	
12:00	Discussion	
13:00	Summarization and Conclusion	Mr. Aziz Al-Omari (MEPA)
13:15	Closing Speech	Dr. Nizar Ibrahim Tawfiq (MEPA President)

JICA/MEPA Workshop III

"Outline of the Study"

Yasuhiro Shimazu

Workshop

November 13, 2000

Outline of the Study

by

Yasuhiro SHIMAZU

JICA Study Team

JAPANESE GOVERNMENT

J I CA
(Japan International Cooperation Agency)

Chiyoda-Dames & Moore Co., Ltd.

Dames & Moore
PASCO International

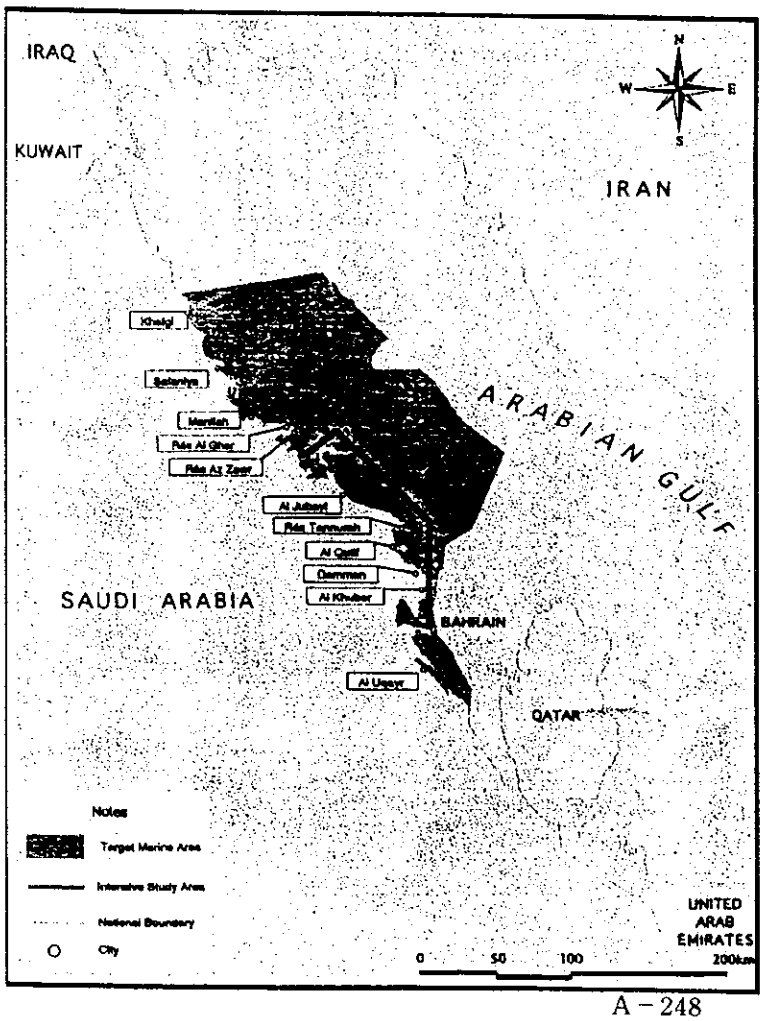
Study Team
(11 members)

OBJECTIVES

1) Investigate Water Quality & Cause of Degradation

2) Help Develop a Comprehensive Monitoring Program

3) Strengthen MEPA's Capability



Target Area

&

Intensive Study Area

Schedule

(1999)

March	Planning of the Project
June-July	Field Pre-survey
	Monitoring Plan
	Workshop
Sept - Nov	Installation of Equipment
	1st Sampling & Analysis
	Data Analysis
	Workshop

(2000)

June-July	2nd Sampling & Analysis
	Data Analysis
Nov	Evaluation
	Final Report
	Workshop

CHALLENGES IN THE FUTURE

1) Laboratory Management

2) Water Monitoring

Specific Site

Periodical

JICA/MEPA Workshop III

"Present Seawater Quality Situation in the Study Area"

Robert Hilliard

PRESENT WATER QUALITY SITUATION

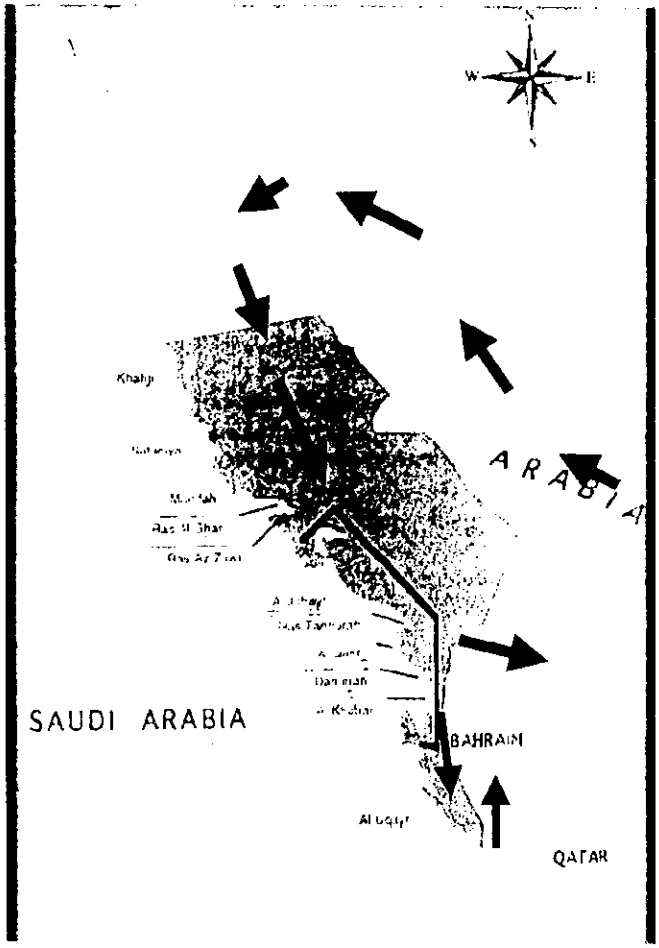
Results from the Baseline Monitoring Surveys of the Intensive Study Area

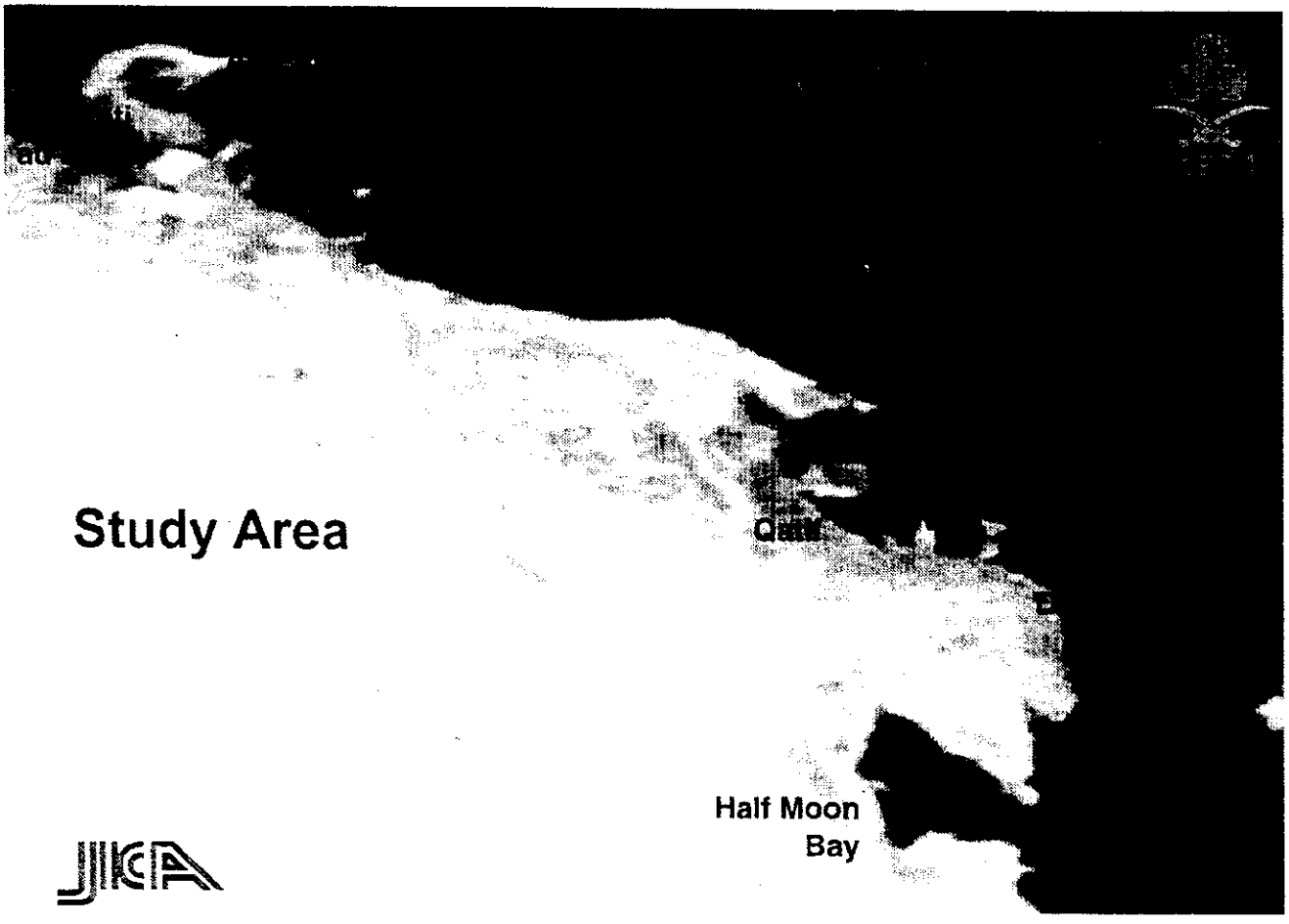
Dr Robert Hilliard,
MEPA-JICA Study Team

OBJECTIVES OF THE BASELINE SURVEYS:

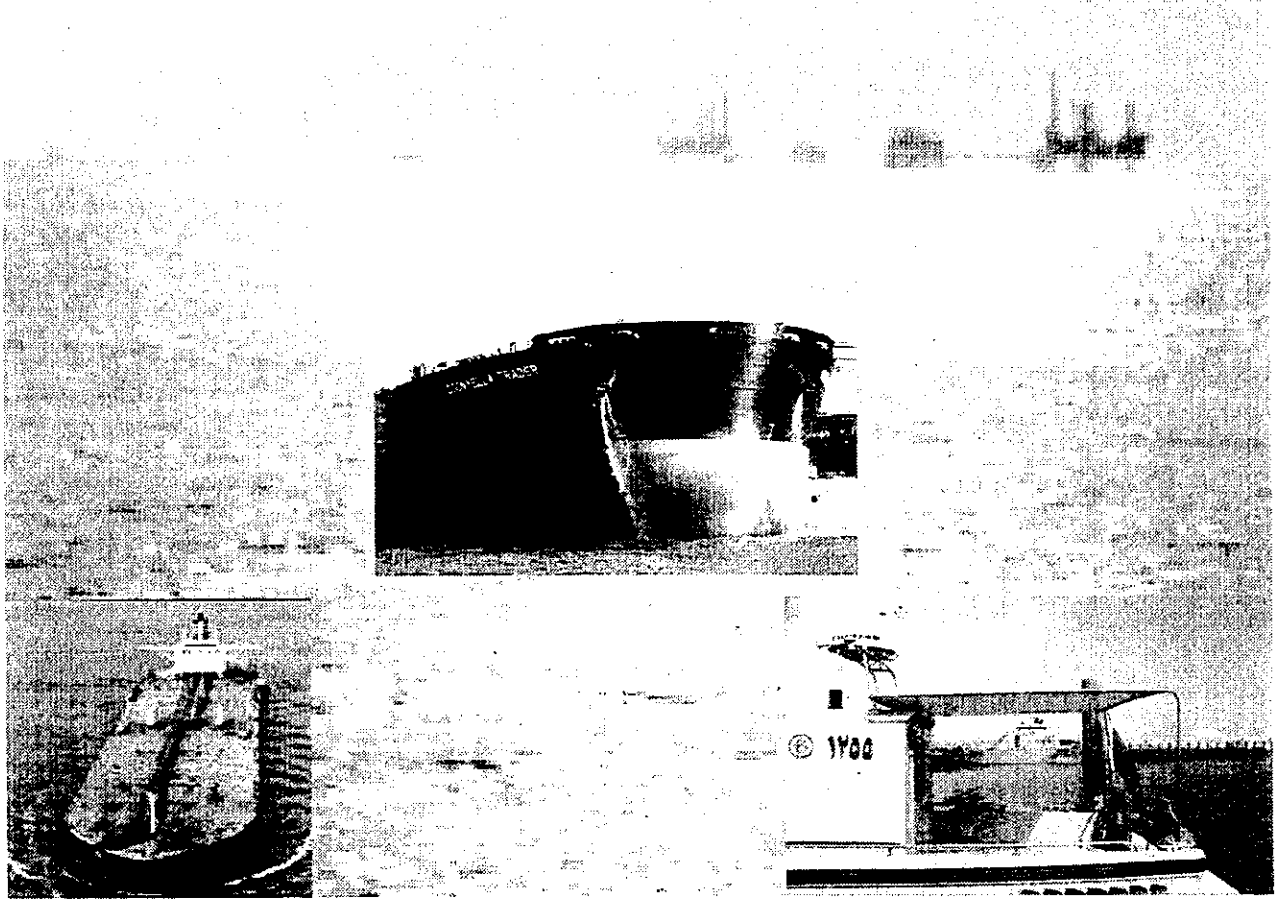
- To facilitate the Technology-Transfer Project by providing practical, 'hands-on' training.
- To examine Coastal Seawater Quality and identify causes of Water Quality Degradation.
- To help MEPA develop a more integrated, comprehensive and appropriate Water Quality Monitoring Program.

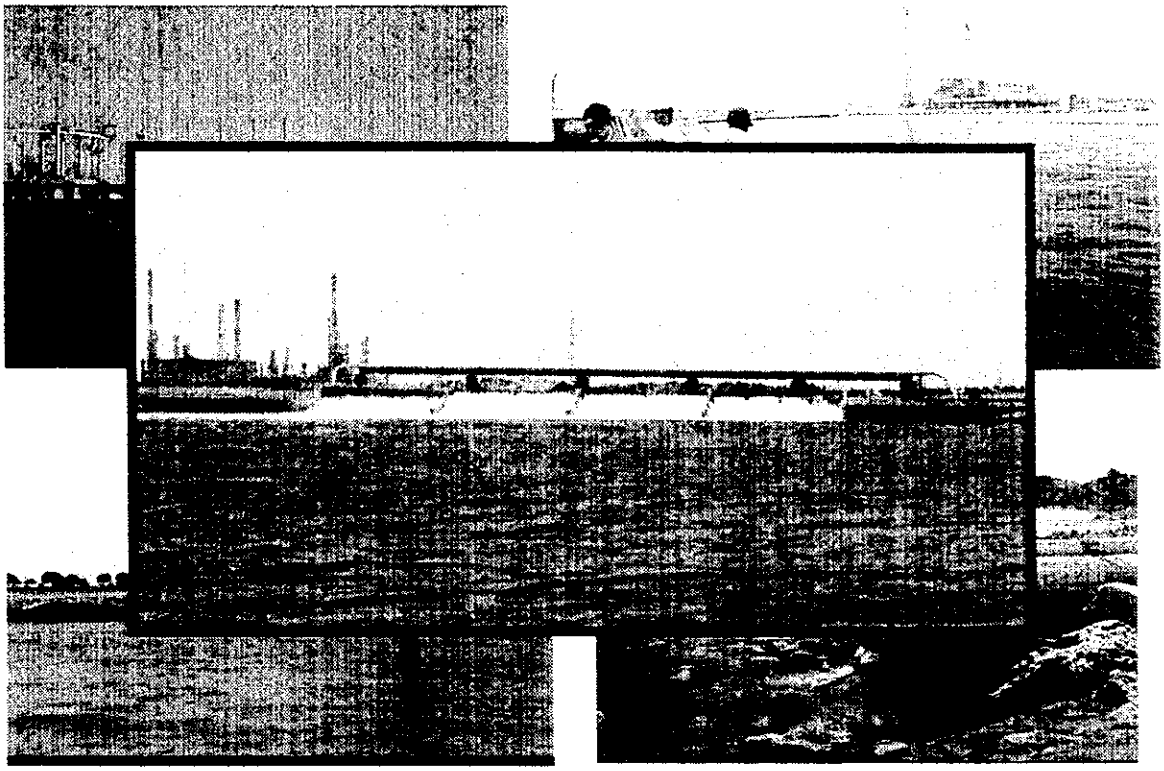
Water Circulation in the Gulf





Study Area





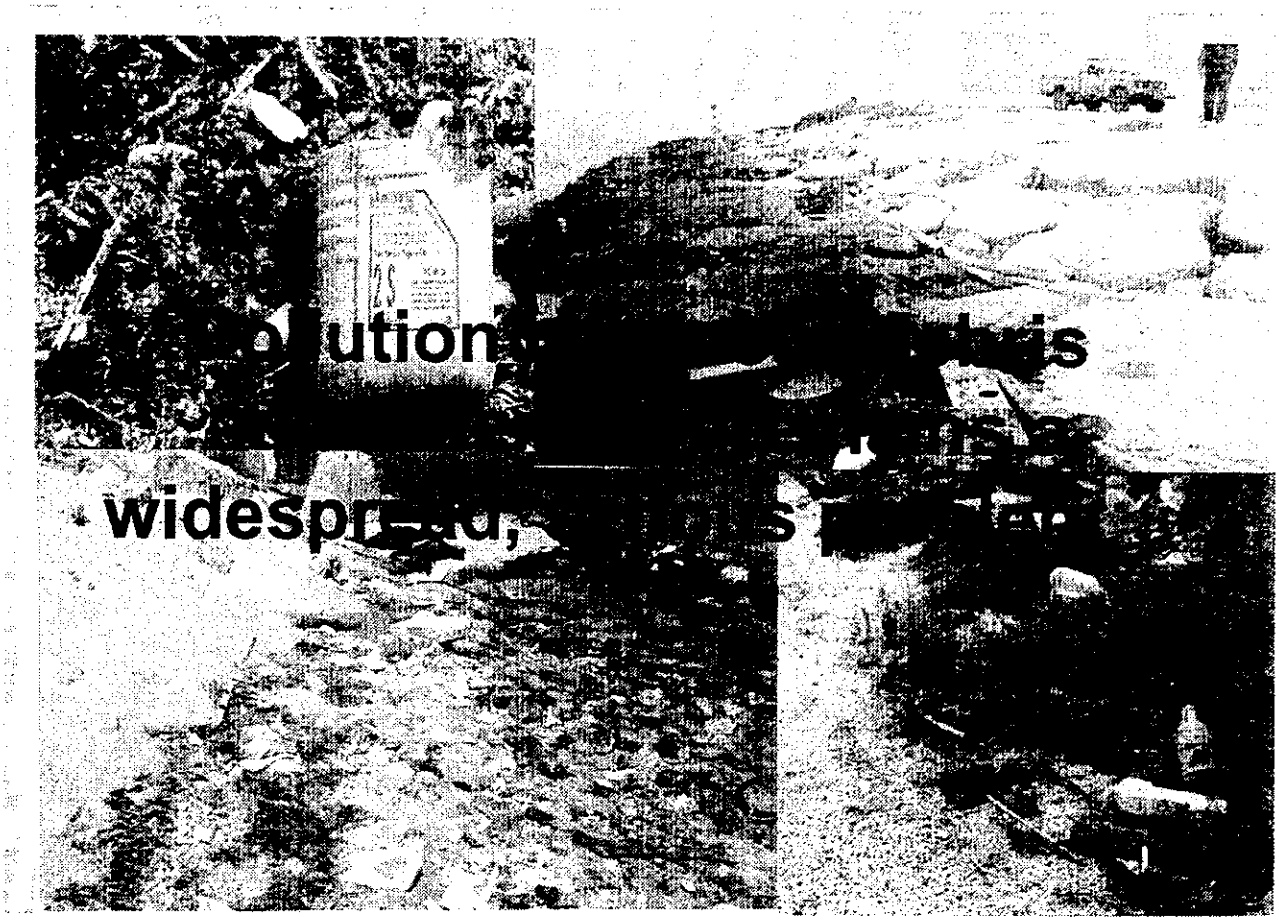
Numbers of regions, sites, field records samples, parameters and analyses per survey

Regions	Sites	Field Data Records	Parameters Analysed	No. of Lab Analyses
6	34	544	33	353

RECORDED FIELD WATER PARAMETERS									
GPS & Met Data	°C	pH	DO	Sal.	Free Cl	Clarity	Current Flow	Current Directn	Sediment Descriptn
34	34	34	34	34	34	34	22	22	24

LABORATORY WATER ANALYSES									
Plankton	TDS	TSS	Total KN	Total P	NH4	Chlor. A	TOC/ COD	Mg^{++}	As
28	9	21	20	20	12	15	16	5	8
Cr	Hg	8 other metals	CN	Oil + Grease	TPH	BTEX	Phenol	Resid. Cl	Total Coliform
8	5	11	4	9	4	3	3	8	9

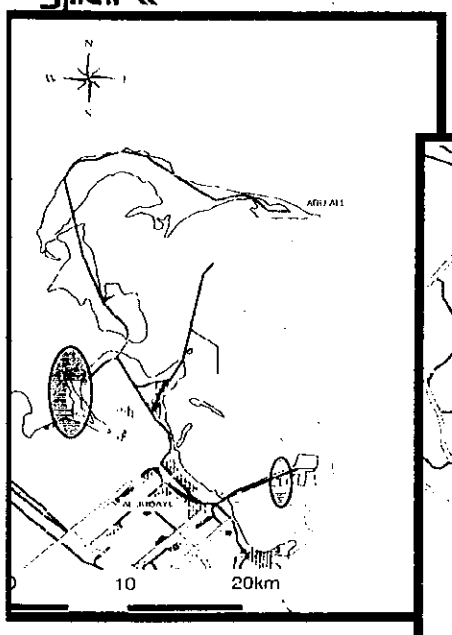
LABORATORY SEDIMENT ANALYSES									
PSA	Ign. Loss	TOC	As	Cr	Hg	Vn	8 other metals	TPH	BTEX
21	13	16	14	16	5	10	22	13	5

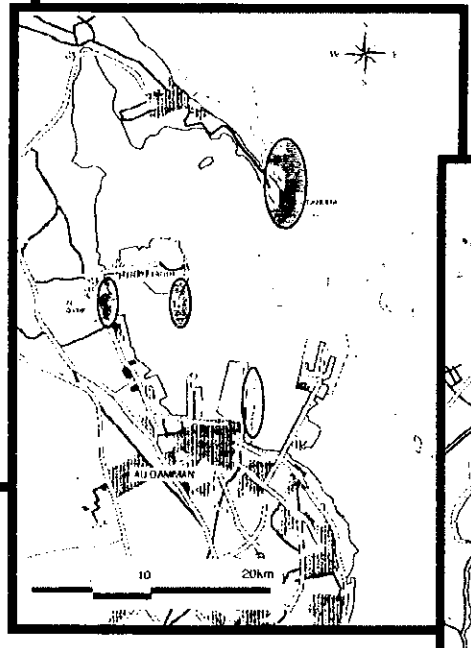


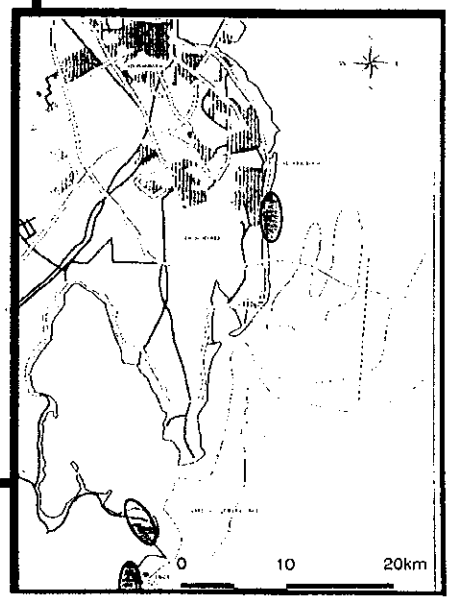
JICA

MEPA

Oil Contamination Summary







= on water

= in sediments