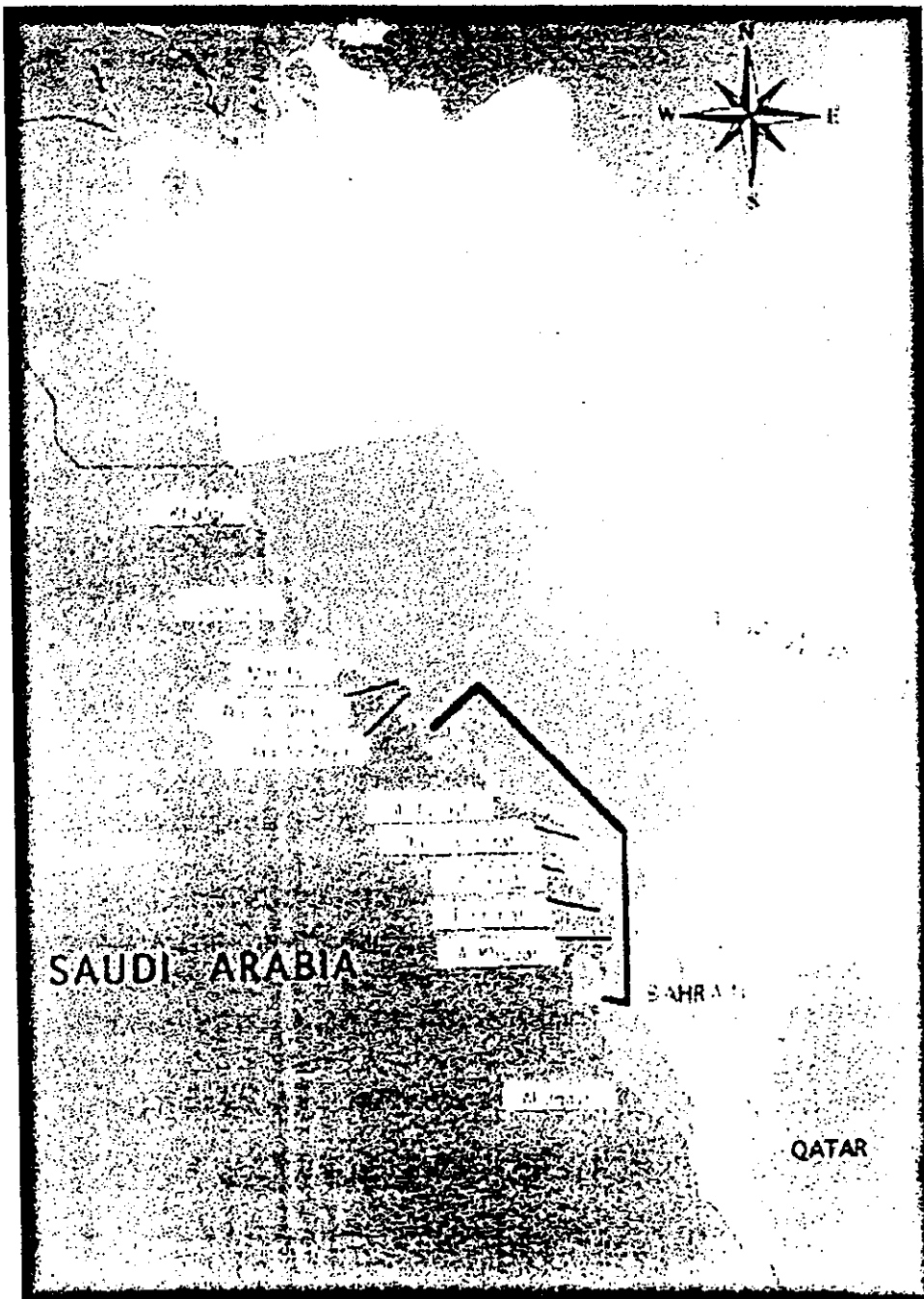


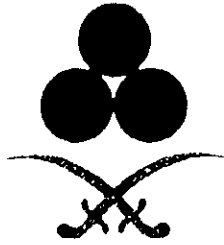
Study Area

- Intensive Study Area
- Target Marine Area



July 7, 1999
Workshop

Design of Water Monitoring by Dr. Robert Hilliard



Meteorological and Environmental
Protection Agency



JICA

F-22

Environmental Assessment and Water Quality
Monitoring Program Workshop

DESIGNING THE MARINE MONITORING PROGRAM

THE PROBLEM:

Sampling programs to detect human environmental disturbance and impacts are often poorly conceived, illogical, badly designed and impossible to interpret.

Poor and illogical field sampling makes irrelevant all of the subsequent analyses that are undertaken carefully in the laboratory, often at great expense.

Unless logical and scientifically sound sampling designs are used by monitoring programs, our understanding of the environment and man's impacts will remain unclear and our management ineffective.

Problems in marine monitoring programs are usually caused by:

lack of clear-cut questions, hypotheses or tests about the relationship between the managed activities and the variables being monitored.

poor recognition/understanding of natural processes or other human activities affecting the monitored variables.

lack of adequate controls or background samples.

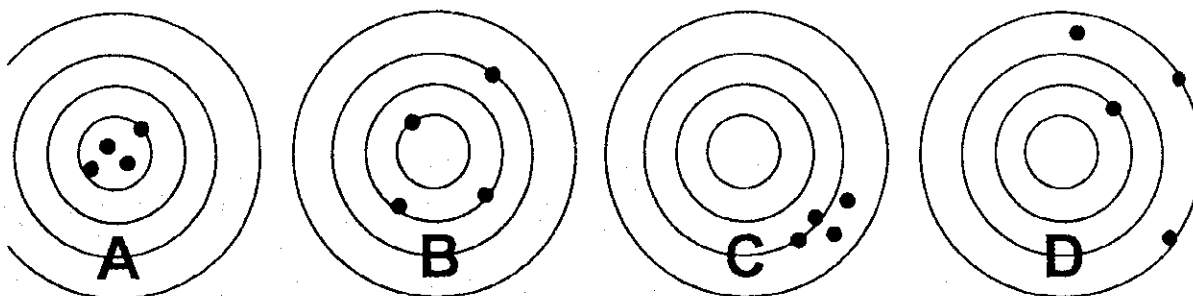
lack of replication over distance, time and method, which prevents meaningful interpretation of the data because:

(a) no results to show the real-world mean and range due to natural variations over distance and time;

(b) no results to show size of errors caused by sampling and measurement methods.

a lack of appropriate statistical tests and statistical analysis.

PRECISION VERSUS ACCURACY



The 'target range' analogy shows the difference between precision and accuracy. Bullet holes in Target A show high accuracy ('on target') and precision (small spread), whilst Target B represents good accuracy but low precision (wide spread). The bullet holes in Target C show low accuracy and high precision, and the bullet holes in D show low accuracy and low precision.

PROCESSES AND DISTURBANCES CAUSING SPATIAL AND TEMPORAL VARIATIONS ALONG THE GULF COAST

PHYSICAL EVENTS

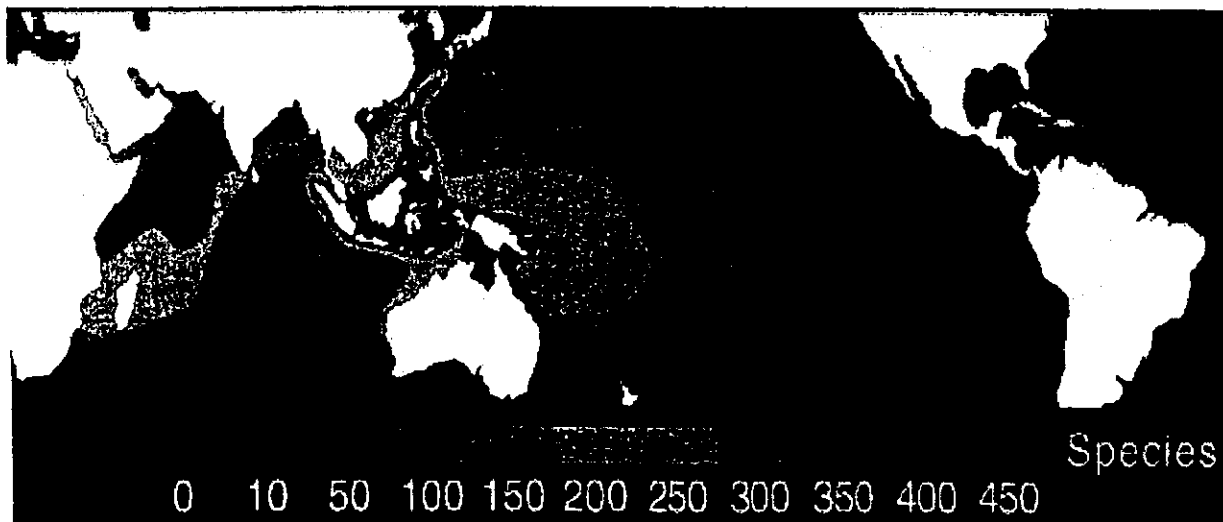
El Niños Storms Frontal events (upwellings) Dust storm inputs
seasonal winds Episodic rainfall (run-off/seepage) Unusual low or high tides
Extreme temperatures (low/high) Extreme Salinities (low/high)

BIOLOGICAL EVENTS

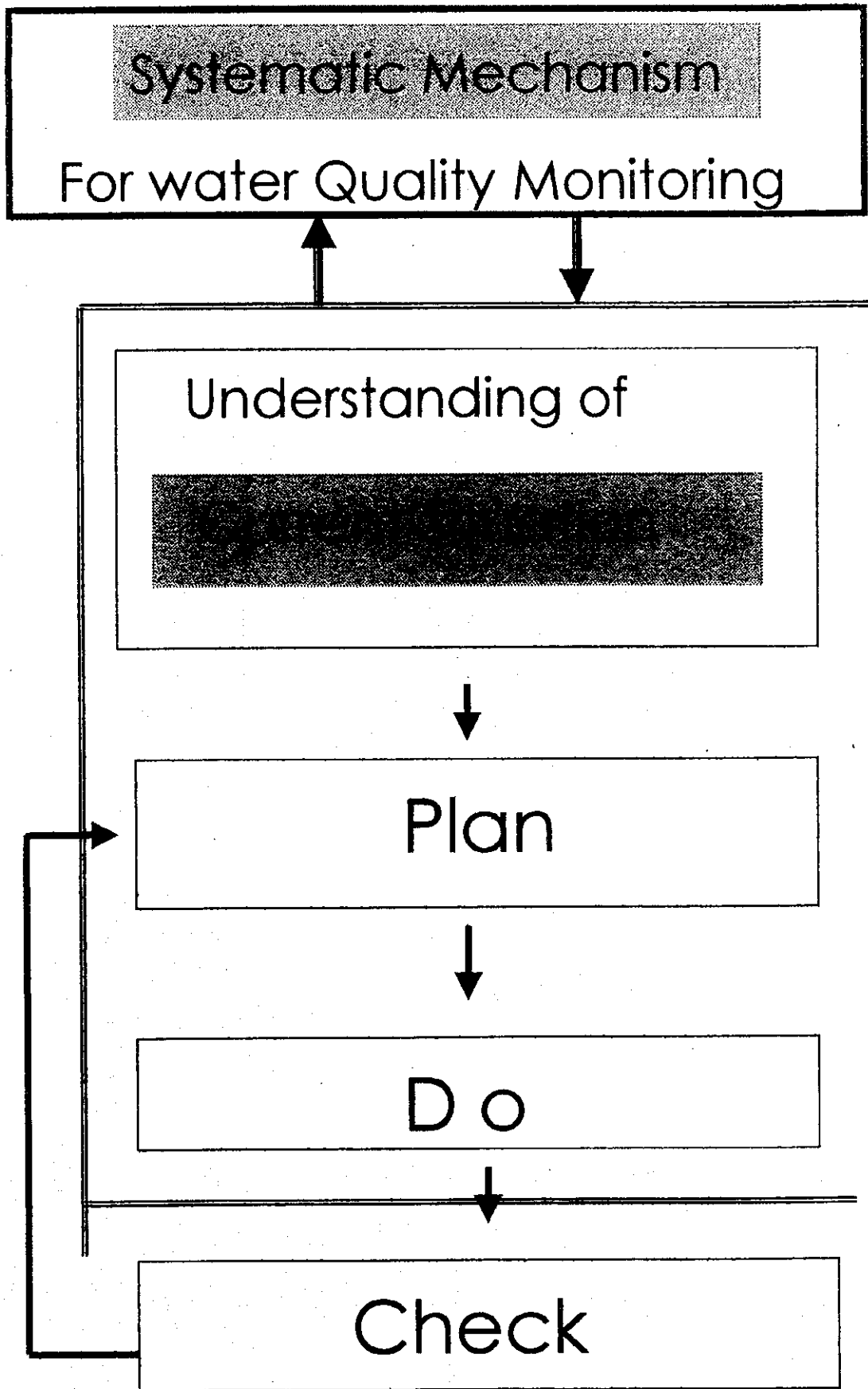
Natural Blooms Mass Spawnings Recruitment/Settlement success variation
Predator 'invasions' Competition (resources/space) Diseases/Parasites

HUMAN ACTIVITIES

Greenhouse Climate change Commercial fishing/trawling Waste Outfalls
Offshore oil/gas fields (pipelines, discharges, spills) Atmospheric inputs (PAHs)
Marinas, harbours and load-out terminals (spills, discharges, rubbish, wastes)
Urban coastal run-off/seepage Recreational boating/fishing (rubbish, litter)
Shipping (discharges, spills, non-native species introduction)
Dredging, Land reclamation, Corniche developments (modify shorelines)

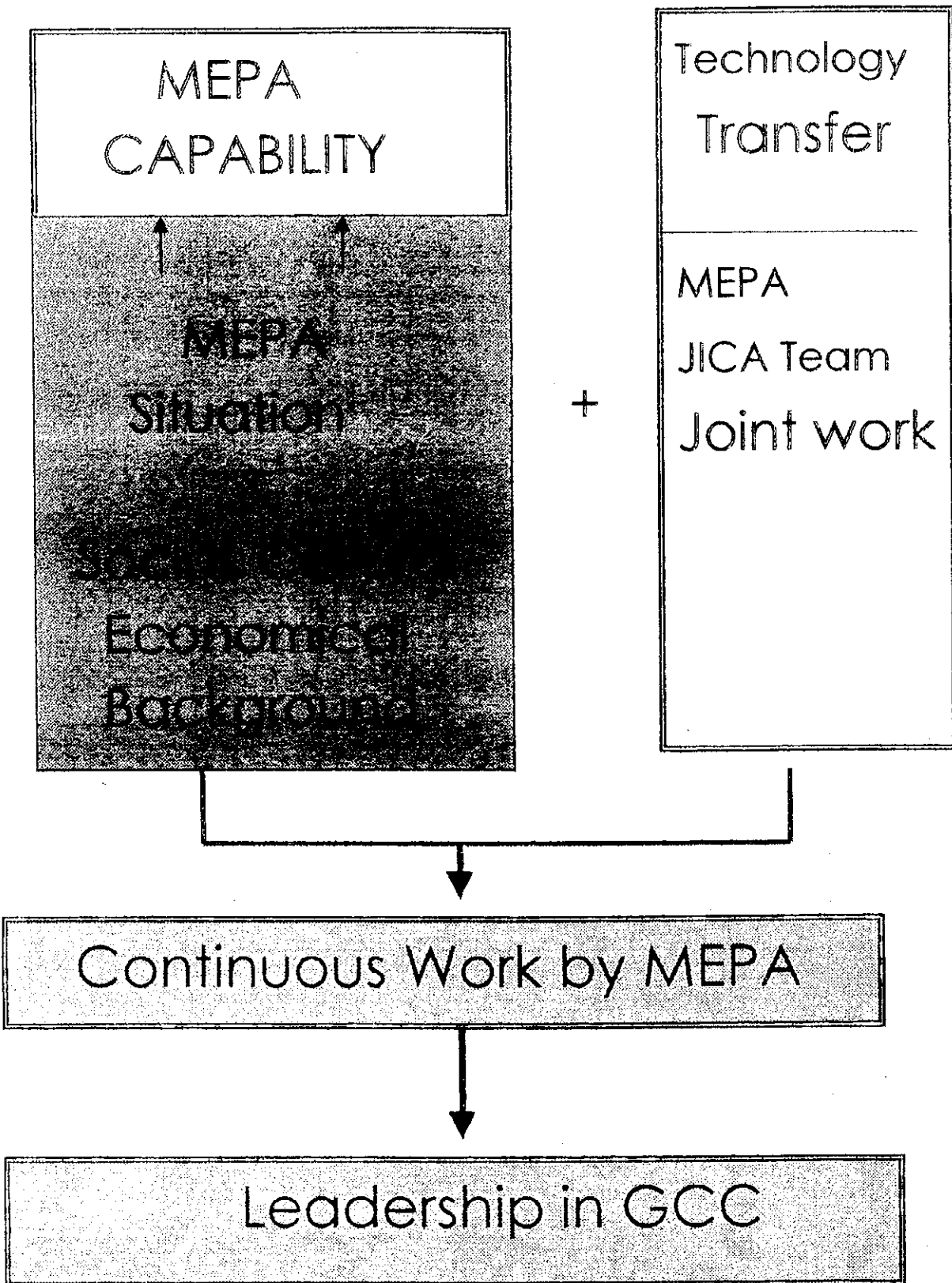


(reproduced with permission from JC Veron)

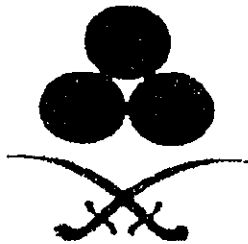


Socio-Economical Framework for the Project.

By Kaz. Tana ka



THE STUDY ON AN ENVIRONMENTAL ASSESSMENT AND MONITORING OF ARABIAN GULF IN SAUDI ARABIA



Khaled S. Al-Rasheed

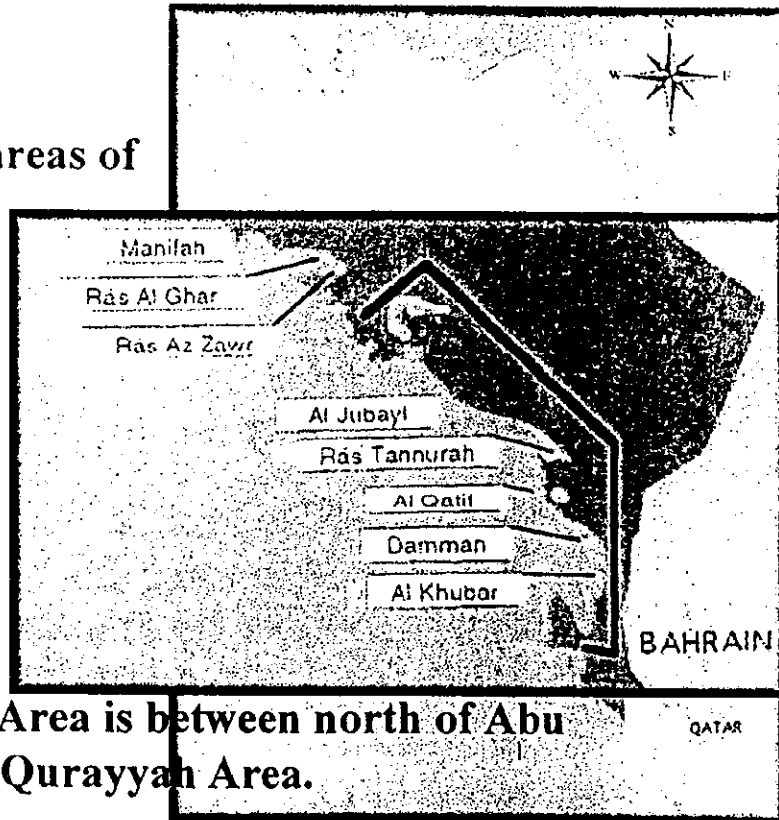


Objectives of the Study

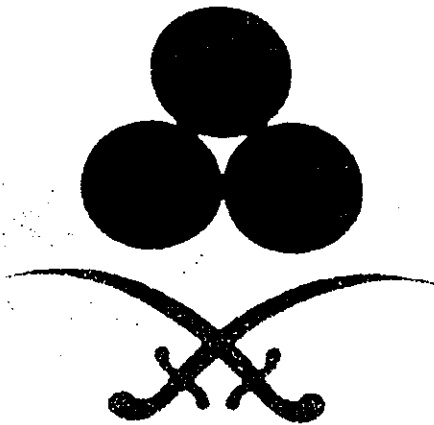
- Examine sea water quality and Identify causes of water quality degradation along the Arabian Gulf.
- Review the existing sea water quality monitoring activities conducted by MEPA and by other parties.
- Strengthen MEPA's capacity through technology transfer to counterpart personnel during the Study.

Area of the Study

- The sea and coastal areas of the Arabian Gulf.



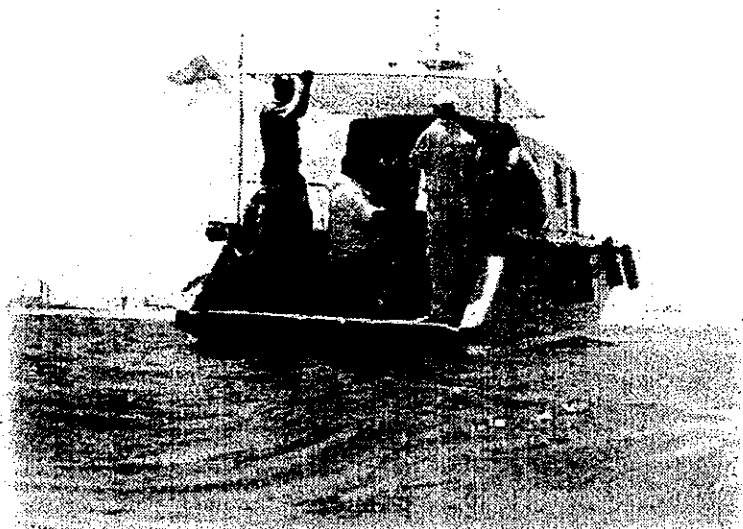
- The Intensive Study Area is between north of Abu Ali Island and Ras Al-Qurayyah Area.



Coast Guard Role in The Study

Why Coast Guard?

- History of MEPA/Coast Guard strong cooperation.
- Can reach every area (e.g. Sensitive intake/out falls).
- Local experience and knowledge.
- Range of vessels along coast.
- Availability of offshore and shallow water vessel.
- Excellent Radio communications for safety.

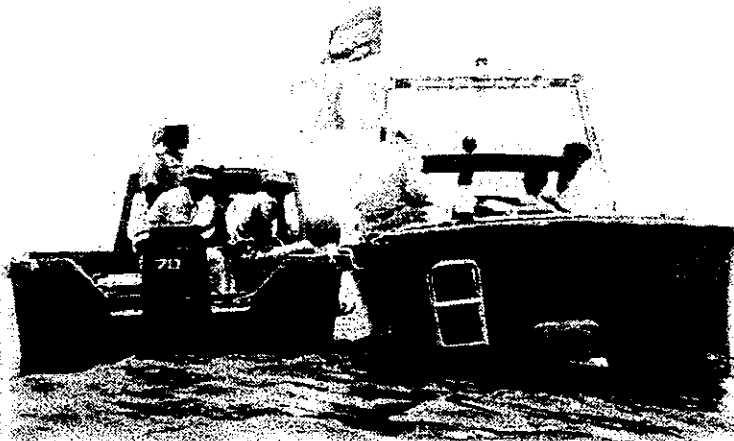


Convenient vessel with a shaded space





A big one for far away points



Two vessels needed in shallow water





Personal Protection from the SUN is needed

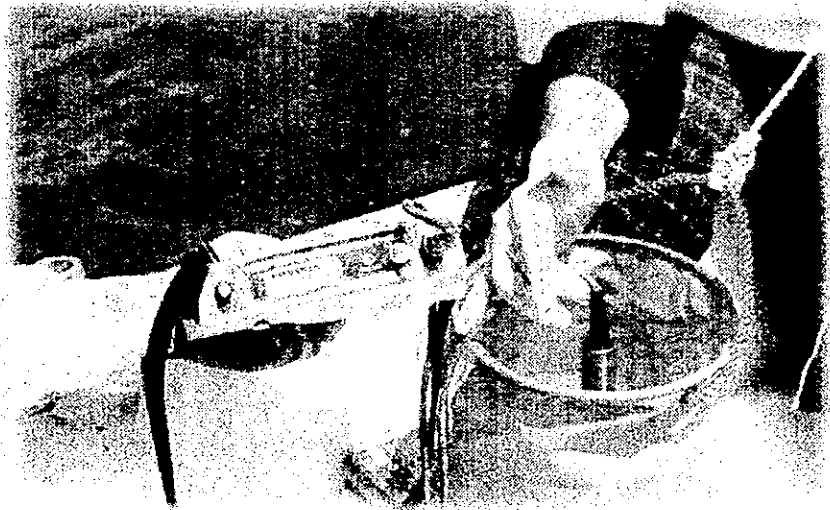


SPEED is No Problem



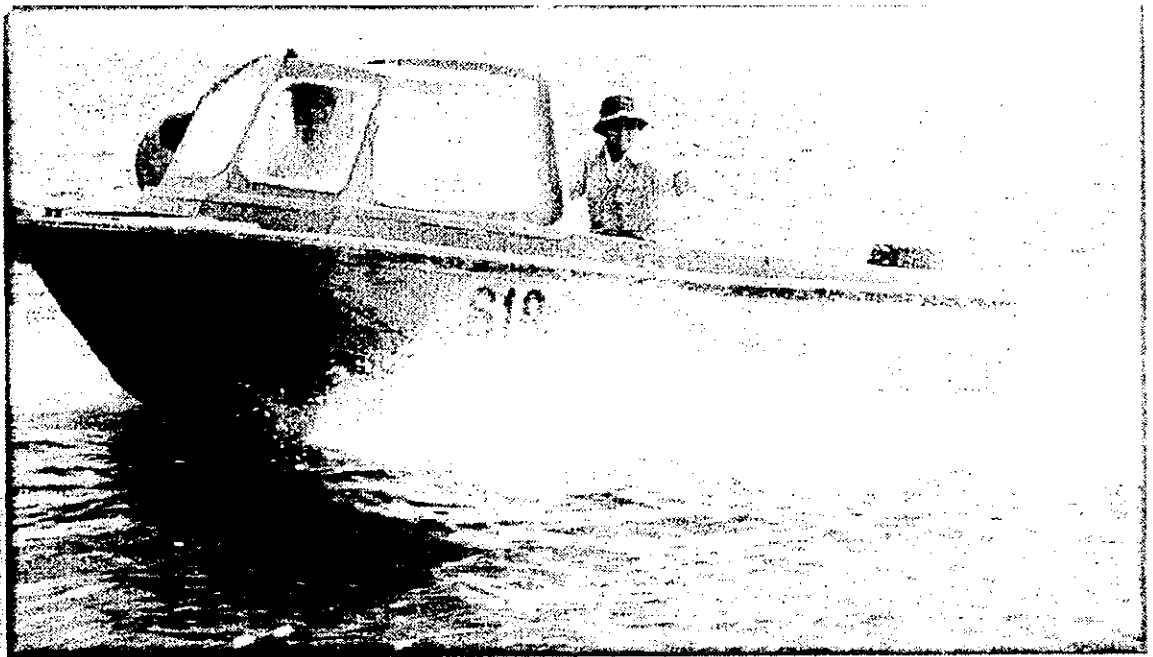


Working Time

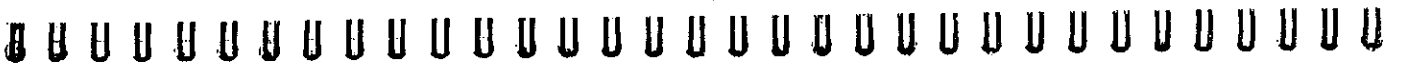


Sampling on Spot



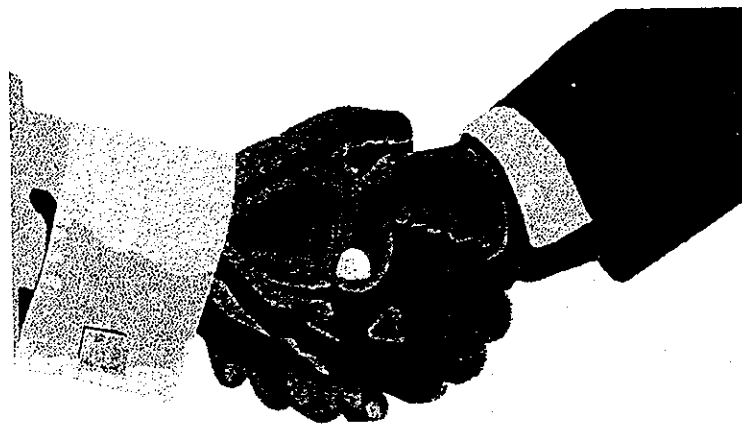
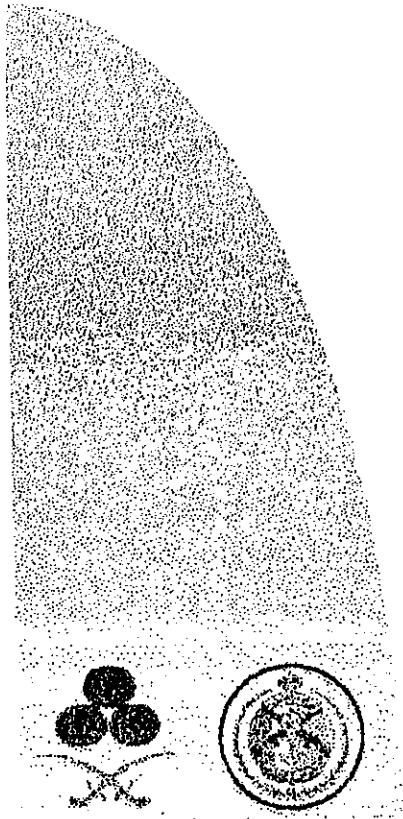


Work is accomplished



Home Safe





Thank You

Question & Answer Summary

MEPA Workshop dated July 7, 1999

The following questions answers were exchanged between MEPA/JICA Team at Discussion]Session.

- Q1. Is the project team going to do only monitoring work?
Management and engineering solution should be most important.
A1. Your comment is quite right, but this project is not intended to work out solution.
- Q2. I think you will pay much care and attention to the samples while transporting them.
A2 .Yes, we do laboratory test two times for one-spot-water in two bottles so that handling of bottles is very complicated.
- Q3. What are criteria or standards applicable to sampling?
A3. We will refer to standards of K.S.A and other countries for comparison. The standard is going to be internationally unified.
- Q4. Why not use mass-media to publicize MEPA aim and program?
A4. Jeddah Head Office started such activity, but here there is budget problem.
- Q5. Are Japanese water quality standards too strict?
A5. Saudi Standards are rather strict, but enforcement is much weaker than Japan. Anyhow we do not intend to apply Japanese standards or others, because the standards are irrelevant with the project, just for reference and comparison use.
- Q6. How will you be coordinating with Royal Commission?
A6. We have already got in touch with R/C. The data they have collected will be informed to the project team. We like to avoid duplication of work.
- Q7. Tell us the timing of sampling regime, and reason.

- A7. We do monitoring in Oct./Nov.(Autumn) and Jun./Jul.(Summer).
During winter, the water is cool, when stress becomes weak.
- Q8. What type of contaminants will you be examining?
A8. Many types.
 - Q9. What previous data will be used?
A9. We intend to refer to ROPME's, ARAMCO's etc.,
 - Q10. Is the gulf water safe for people?
A10. There is no evidence at moment it is not safe.
 - Q11. Does MEPA have preservation power?
A11. It has to cooperate with Municipality and other government department. As for enforcement of dumping, MEPA can not do it (manpower problem), but it can go to Governor to stop persistent offenders.
 - Q12. Please tell us QA/QC.
A12. We refer to American methods, but we can not reach the level of ISO9001 within 2 years.
 - Q13. What is the basis of JICA effort/funding to the Kingdom.
A13. We do not think that JICA is ready to afford additional, considerable amount of money for this project.
 - Q14. Who handle problems of land-filling and dredging?
A14. Municipality will handle permission, depending upon coastal zone management policy.
 - Q15. Is Socio-Economist only collecting data/information.
A15. At this stage, we need information, but at a later stage, we will make some recommendation based on the information.

Appendix F

Documents of Workshop II

Workshop Program

List of Participants

Resume of Presentation

Q & A Summary



Appendix L (1) Workshop Program

الرقم :
التاريخ :
المرفقات :
الموضوع :

MEPA/JICA PROJECT
Marine Monitoring and Management of the Gulf Coastal Waters
SECOND WORKSHOP
November 17, 1999

Introduction

According to the agreement between JICA (Japan International Cooperation Agency) and MEPA (Meteorology and Environmental Protection Administration), the second workshop will be held on at Dammam MEPA office.

Your presence and contribution to the project discussion will be greatly welcomed and appreciated.

Program

- 1 Title
Environmental Assessment and Water Quality Monitoring Program in the Arabian Gulf - Present Status of the Study
- 2 Location
Office of Eastern Province, Post Box # 117, Dhahran -31932
Phone 03-857-6260, Fax 03-857-6752
- 3 Date/Time
November 17, 1999 / 08:30 AM
- 4 Chairman
Dr. Abdul Rahman Al-Arfaj and Mr. Aziz Al-Omari
- 5 Schedule

0830 to 0840	Dr. Hamdan Al-Ghamdi (MEPA)	Welcome Speech
0840 to 0850	Mr. Yasuhiro Shimazu (JICA)	Present Status of the Study - Outline
0850 to 0920	Mr. Aziz Al-Omari (MEPA)	Requirements for Continuing the JICA/MEPA Project
0930 to 0950	Dr. Mishra Krishna K. (JICA)	Environmental Condition Analyzed from recent LANDSAT Images
0950 to 1010	Mr. Khaled Busbait (MEPA)	Findings During Actual Monitoring Work
1010 to 1030	Mr. Qusai Bohlaiqah (MEPA)	Laboratory Set-up
1030 to 1050		Coffee Break
1050 to 1140		Panel Discussion
1140 to 1150	Mr. Chairman	Summarization
1150 to 1200	Dr. Hamdan Al-Ghamdi or Representative of JICA's Riyadh Office	Closing Speech
- 6 Pray Time 1200 to 1230
- 7 Buffet Party 1230 to 1430

All participants in the workshop are invited to the party.
During the party, the installed laboratory equipment will be exhibited.

KINGDOM OF SAUDI ARABIA

Ministry of Defence & Aviation
Meteorology & Environmental
Protection Administration (MEPA)
Eastern Province



المملكة العربية السعودية
وزارة الدفاع والطيران
مصلحة الارصاد وحماية البيئة
المنطقة الشرقية

الرقم:

التاريخ:

المرفقات:

الموضوع:

" Environmental Assessment and Water Quality Monitoring Program in the Arabian Gulf "

MEPA - JICA

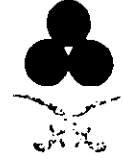
Second Workshop - November 17, 1999

The list of participants.

1. Ali Aldulaijan
SAFCO
2. Ahmed S. A. Al-Badrani
SAFCO/IBB
3. Manaa Abuslalarir Manaa Al-Qerni
Civil Defence
4. Tariq Abdal Hadi Al-Qerni
Civil Defence
5. Said Ali Mohammed Al-Qerni
Civil Defence
6. Fahni H. Al-Waskeer
SAFCO
7. Tariq S. Al-Essa
SAFCO
8. Mohammed Abdullah Al-Saif
SAFCO
9. Khalid Adi Al-Shamri
Civil Defence
10. Habib Ali Al-Garni
Civil Defence - Industrial & Safety

KINGDOM OF SAUDI ARABIA

Ministry of Defence & Aviation
Meteorology & Environmental
Protection Administration (MEPA)
Eastern Province



المملكة العربية السعودية
وزارة الدفاع والطيران
مصلحة الارصاد وحماية البيئة
المنطقة الشرقية

الرقم:

التاريخ:

الموضوع:

المرفقات:

11. Dr. Abdul Salam A. Al-Shuail
Dammam - Municipality
Meat and food staff observation
12. Assad M. Alothman
Civil - Fire & Safety
13. Kahleen Abdul Zez Al-Samary
Civil Defence - Safety officer
14. Ihah Al-Sharkawi
JICA - Senior Program Manager
Riyadh
15. Masahiro Tsubaki
JICA - Embassy of Japan
Program Development officer
Riyadh
16. Saad I. Al-Inaizi
National Environmental Preservation Co.
17. Nabil I. A. Fita
Ministry of Agriculture - F.R.C.
18. Dr. Khaled Al-Abdulkader
Saudi Aramco - Environmental Specialist
19. Ron Williams
Saudi Aramco - Sr.Env. Specialist
20. Dr. Ali Al-Dakhil - Allah
KFUPM - Assistant Professor
21. Khalifa A. Al-Saad
Dammam - Municipality
Food Inspector
22. Dhaifallah Ali Al-Shamari
Arabian Oil Co. Ltd.
Supervisor Env. Prat. Sector

KINGDOM OF SAUDI ARABIA

Ministry of Defence & Aviation
Meteorology & Environmental
Protection Administration (MEPA)
Eastern Province



المملكة العربية السعودية
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مصلحة الارصاد وحماية البيئة
المنطقة الشرقية

..... الرقم:

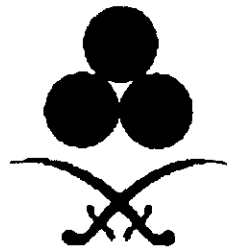
..... التاريخ:

..... المرفقات:

..... الموضوع:

23. Hamad Raheel Al-Anazi
A.O.C - Inspector
24. Rashid Mubarak Al-Othaibi
Civil Defence - Al-Khobar
25. Dr. Mohammed O. Saeed
Research & Development Center
Saline water Conversion Corporation
26. Dr. Ahmed M. Al-Hassan
SWCC - Chemist Research
27. Richard Hunter Smith
Royal Commission - Jubail
28. Brian Meadows
R.C. / R.G.M.E.
29. Saleh Al-Jandal
W.S.D. - Sanitary Division
30. Ibrahim A. Al-Wayel
Water Authority
31. Saleh Al-Buthi
S.W.C.C.
32. Ibrahim A. Al-Tisan
S.W.C.C.
33. Ali Abrurab Rasoul Al-Hamza
Research and Development Center
S.W.C.C.

**Environmental Assessment
and
Water Quality Program
in**



Second Workshop

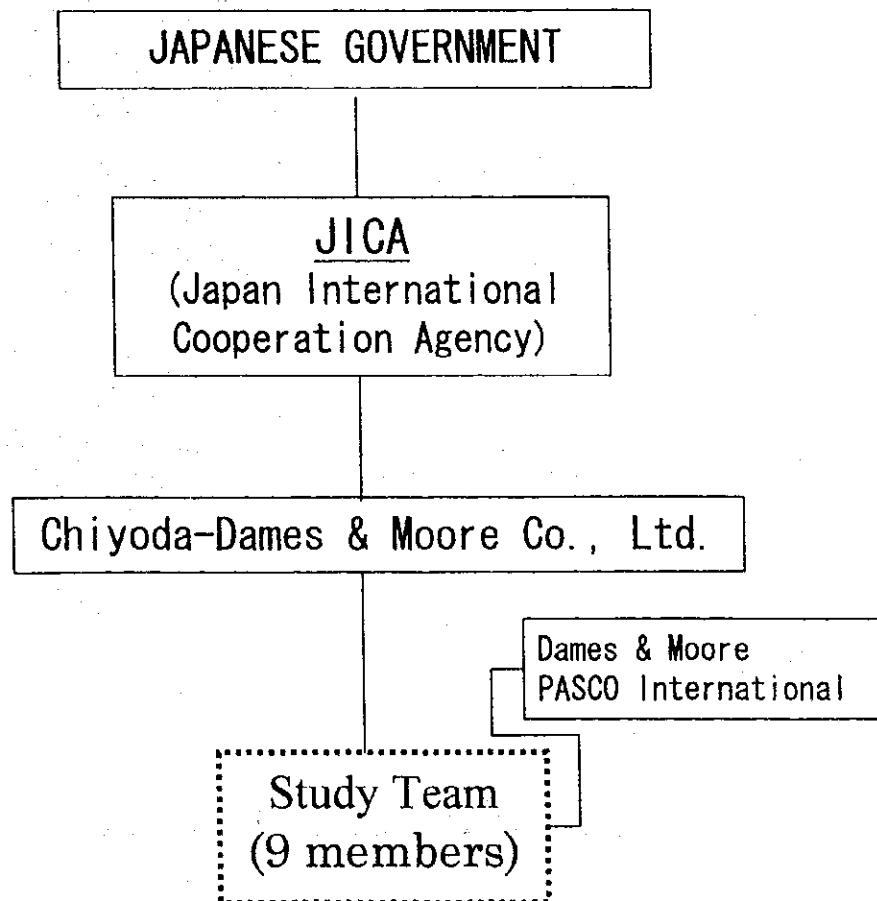
17 November 1988

MEPA & JICA

Present Status of the Study - Outline

by

Y. SHIMAZU



OBJECTIVES

- 1) Investigate Water Quality and Cause of Degradation
- 2) Help Develop a Comprehensive Monitoring Program
- 3) Strengthen MEPA's Capability

Target Area and Intensive Study Area



(1999)

March

Planning of the Project

June-July

Field Pre-survey

Monitoring Plan

Workshop

Sept - Nov

Installation of Equipment

1st Sampling and Analysis

Data Analysis

Workshop

(2000)

June-July

2nd Sampling and Analysis

Data Analysis

Sept

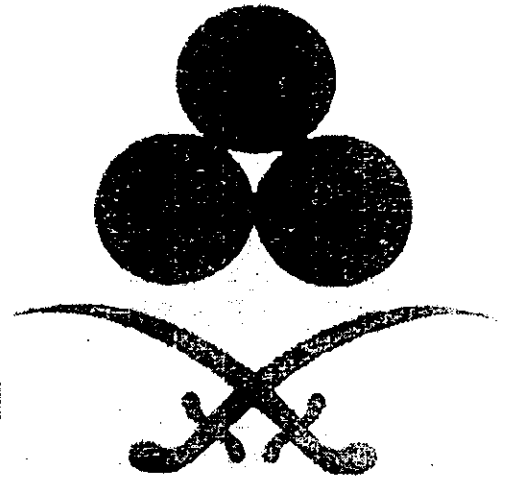
Evaluation

Final Report

Seminar

MEPA

JICA



PROJECT

PROJECT REQUIREMENTS

Aziz Al-Omari

PROJECT GOAL:

***“ENHANCE MEPA’S
CAPACITY TO MONITOR
AND MANAGE THE GULF
COASTAL WATERS”***

PROJECT STRATEGY:

- **CONDUCT A TECHNOLOGY TRANSFER AND TRAINING PROGRAM AT MEPA EASTERN PROVINCE (DAMMAM OFFICE)**
- **UNDERTAKE A COLLABORATIVE STUDY OF THE INTENSIVE USE ZONE (ABU-ALI TO AL QURAYAH)**

PROJECT OBJECTIVES:

- **UPGRADE MEPA'S LABORATORY AT DAMMAM OFFICE**
- **UPGRADE MEPA'S FIELD SAMPLING AND MONITORING EQUIPMENT**
- **TRAIN MEPA PERSONNEL IN MARINE ENVIRONMENTAL MONITORING AND ANALYSIS TECHNIQUES BY A PRACTICAL 'HANDS-ON' APPROACH**

PROJECT TASKS:

- 1 REVIEW EXISTING CAPACITIES AND EQUIPMENT AT MEPA DAMMAM.**
- 2 SELECT, PURCHASE AND INSTALL LABORATORY & FIELD EQUIPMENT.**
- 3 IMPLEMENT A COASTAL WATERS STUDY (INCLUDING SATELLITE REMOTE SENSING) FOR:**
 - (A) TRAINING PURPOSES, and**
 - (B) INVESTIGATING PRESENT SITUATION.**

PROGRESS TO DATE:

- Existing MEPA capacities and coastal water monitoring capabilities reviewed (Stages 1-2);
- Laboratory and field equipment selected and ordered from KSA & overseas suppliers (Stage 2);
- Investigative Study of Coastal Waters designed and trialled by a small pilot program (Stages 1-2);
- Equipment items delivered and installed (Stage 3);
- Commissioning of new laboratory procedures and analyses (Stage 3);
- Study of Coastal Waters implemented, including remote sensing by LANDSAT (Stage 3).

FUTURE TASKS

- Review and identify MEPA's precise role and responsibilities within the range of existing KSA policies and regulations for protecting Gulf coastal water quality and natural marine resources.
- Conduct further training on field, laboratory and satellite data analysis procedures and techniques to achieve an adequate level of technology transfer.
- Collaborate with key outside organisations to continue the Study.

PROJECT REQUIREMENTS

- Increase the number of pre-qualified MEPA personnel at Eastern Province to achieve effective laboratory training and technology transfer.
- Continue developing the close working relationship with Coastguard for use of its vessels for field work.
- Collaborate with the following key agencies for the Investigative Study of Coastal Water Quality:
(next slide...)

REQUIREMENTS (continued)

- Collaborate with the following key agencies:
 - Royal Commission of Jubail
 - King Faisal University
 - Research Development Centre - SWCC
 - Municipalities and Sewage Treatment Authorities
 - KFUPM Research Institute
 - Ministry of Agriculture Research Centres
 - Ministry of Petroleum
 - NCWCD
 - Private Sector

**THE STUDY ON AN ENVIRONMENTAL ASSESSMENT AND MONITORING
OF ARABIAN GULF IN THE KINGDOM OF SAUDI ARABIA**



**Environmental Condition Analyzed from
Recent LANDSAT Images**

by, Dr. Krishna Kumar MISHRA, JICA TEAM

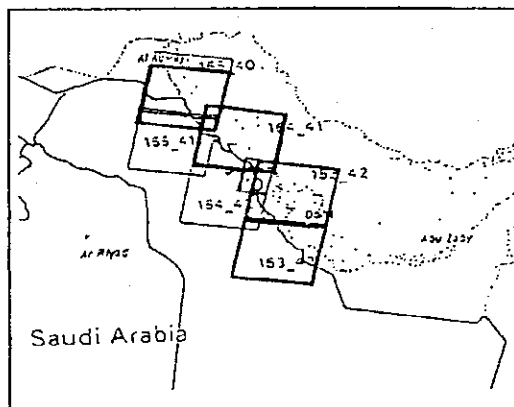
Environmental Condition Analyzed from Recent LANDSAT Images

Dr. Krishna Kumar MISHRA

Member, JICA Team

Abstract

The multispectral satellite data have the inherent properties of being able to provide synoptic observations with high observational density over relatively large areas. Satellite images have shown great potential for monitoring coastal environment. This project utilized the LANDSAT Thematic Mapper (TM) data to cover the Arabian Gulf, coastal region, of the Kingdom of Saudi Arabia (KSA) and analyzed the situation of the sea-pollution.



The utilized TM data were, Path/Row: 165/040-041 - Jan 20 1999, 164/041 - Dec 12 1998, 164/042 - Dec 12 1998, 163/042 - Dec 21 1998, 163/043 - Nov 03 1998. The TM data were analyzed for the preparation of mosaicked False Color Composite Image.

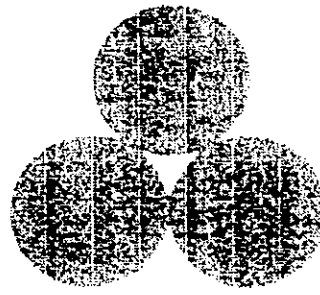
Also distribution maps at 1:500,000 scale were prepared for the distribution of suspended solids, chlorophyll *a* and oil pollution. These maps show variations for suspended solids, chlorophyll *a* and possible oily surface water micro-layers, and can be referenced for assessment and monitoring purposes.

Marine and coastal processes are complex, interrelated systems, and remote sensing data may not always provide sufficient information for the efficient monitoring purposes. In general amounts of *in situ* measurements are necessary to enhance and facilitate the interpretation of the synoptic remote sensing imagery. Further analysis with additional objectives, e.g., coral reef, sea surface temperature and seashore vegetation mapping are proposed for the fourth stage of this Project.

Note: The numbers of animated Slides shown were 48 through PowerPoint Presentation.

MEPA

JICA



PROJECT

FIELD MONITORING WORK

Khalid Busbait

OUTLINE OF FIELD WORK

- **FIELD MONITORING DESIGN**
- **FIELD INSTRUMENT MANAGEMENT**
- **COLLECTION OF WATER & SEDIMENT SAMPLES**
- **FIELD DATA RECORDS**
- **DATA ANALYSIS & INTERPRETATION**

OBJECTIVES OF THE STUDY OF INTENSIVE USE ZONE

- TO FACILITATE THE TECHNOLOGY TRANSFER AND TRAINING PROGRAM
- TO EXAMINE COASTAL SEAWATER QUALITY AND THE CAUSES OF WATER QUALITY DEGRADATION ALONG THE ARABIAN GULF
- TO REVIEW EXISTING WATER QUALITY MONITORING ACTIVITIES BY MEPA AND OTHER PARTIES
- TO HELP DEVELOP A MORE INTEGRATED, COMPREHENSIVE AND APPROPRIATE COASTAL WATER QUALITY MONITORING PROGRAM

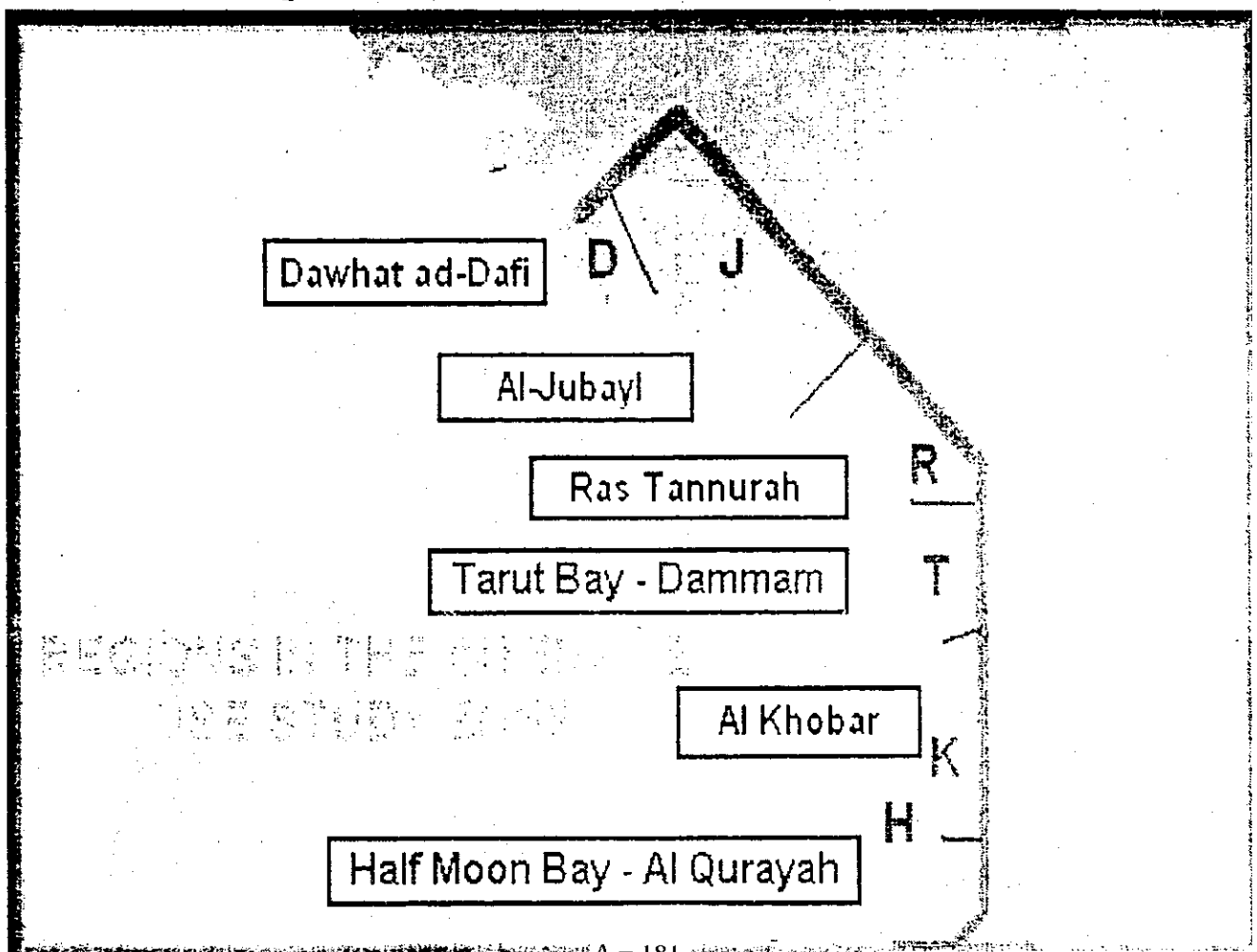
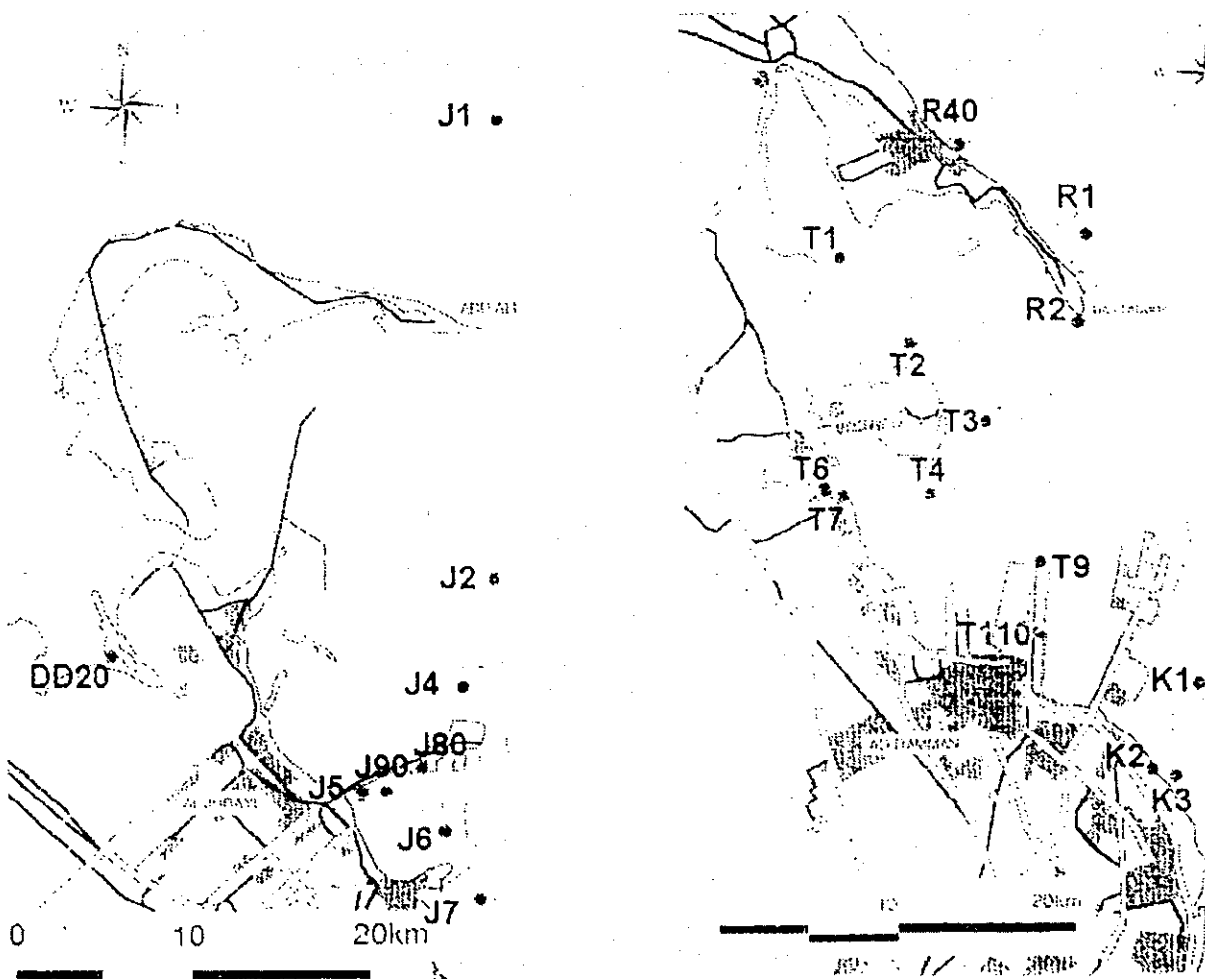
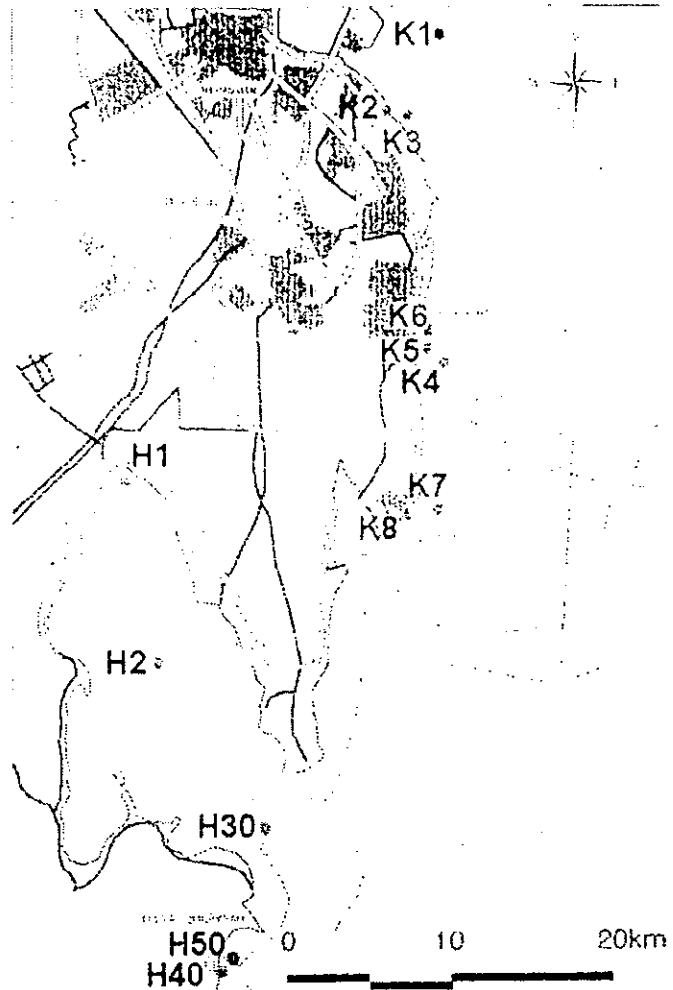


TABLE OF SAMPLING SITES FOR STAGE 3*

No.	Site	Region	Site Name	Latitude	Longitude	Purpose	Site Description
1	BD20	Dubi District	Umrah Island	-	-	Oil pollution zone and mangrove rehabilitation	W of Umrah Island, mangroves recovered from 1991 spill
2	J1	Jubail	Abul Ali North	27° 23.4'	49° 44.0'	Regional Water quality Background - Entry Level	Regional baseline 5 km N of Abu Ali (25 m depth). Strong south current
3	J2	Jubail	Dem Oil Field	27° 16.8'	49° 42.1'	Offshore oil field	South Dem oil field (30 m depth). Sediment collected by drilling
4	J4	Jubail	North Jubail	27° 07.6'	49° 41.1'	Water Quality Background (Jubail Port Entry Level)	1.5 km north of Jubail port (5 m deep)
5	J5	Jubail	Jubail Shared Outfall	27° 07.8'	49° 38.2'	Water quality of shared industrial outfall	Shared outfall (2 m deep). High temperature (30°C), blue green algae
6	J7	Jubail	South Jubail	27° 04.0'	49° 42.2'	Zone J Water quality Background (dist. Level)	2.5 km S of Jubail port (7 m deep). For pollutants flow through
7	J6	Jubail	Jubail Harbour	27° 02.8'	49° 41.0'	Assess WQ in harbour	General mixing zone of Jubail port
8	J80	Jubail	Jubail Is. Harbour	27° 01.9'	49° 40.1'	Workboat harbour water & sediment studies	Small boat moorings in Jubail port (5 m deep). Renovation and maintenance
9	J81	Jubail	Sea Jubail Outfall	27° 03.8'	49° 37.0'	Optimal Water quality in the outer mixing zone	Above same as No. 8. Sediment conditions may be better
10	R1	Ras Lan	Sea Island Terminal	26° 59.9'	50° 12.0'	Zone K Background Water quality	Deep water area (20-25 m). Water flows through this area to Lami
11	R2	Ras Lan	Gas Terminal Spt	26° 57.0'	50° 11.0'	To assess of pollution levels in sediments	The site is a shallow water area where tar bars are present in sands
12	R40	Ras Lan	Refinery Outfall	-	-	Water and sediment quality near refinery outfall	Water depth about 2 m. Seagrass beds present in area
13	T1	Tamr Bay	North Tamr Bay	-	-	To assess water & sediment quality	Shallow zone with urban inputs of nutrients and waste
14	T2	Tamr Bay	Tamr - 2m	26° 56.8'	50° 05.0'	Assess affect of diffuse residential GW discharges	1.5 km north of SIP on Tamr Bay (2 m deep). Nutrient levels look high
15	T3	Tamr Bay	Tamr - 1m	-	-	Zone I Water Quality Background (central area)	East of Tamr 1. Seagrass in relatively clear water depth 2-3 m
16	T4	Tamr Bay	Tamr - Dam	26° 51.5'	50° 04.5'	Assess water & sediment quality in fishing harbour	Fishery (2-3 m deep) affected by sponges cleaning and maintenance
17	T6	Tamr Bay	Qait-Anak dam drain	26° 51.2'	50° 02.3'	Assess WQ at mouth of major urban drainage	Dam from Qait SIP which enters Tamr Bay
18	T7	Tamr Bay	Qait-Anak dam mouth	26° 51.2'	50° 02.3'	Assess effect of dam on nearby mangrove	Mangrove habitat to the south side of Qait dam
19	T9	Dammam	Entrance of Fish Harbour	-	-	QGHal entrance	Harbour - fish boat maintenance, lay-ups and repairs (2-4 m deep)
20	T10	Dammam	Middle Fishing Harbour	26° 27.5'	50° 08.0'	To determine extent of chronic pollution	Narrow harbour (2-5 m deep). WQs found in previous years
21	K1	Khobar	Dammam South	26° 22.3'	50° 15.0'	Zone K Water Quality Background (Entry Level)	5 km west of Kaskas (depth 15 m). Clam high seagrass present
22	K2	Khobar	SAPCO outfall	26° 21.0'	50° 11.0'	To assess water quality of a fertilizer plant outfall	Close by SAPCO outfall
23	K3	Khobar	SAPCO - 2m	26° 21.0'	50° 11.0'	Assess WQ in zone of influence of outfall	200 m off shore from SAPCO outfall. Sediment samples etc.
24	K4	Khobar	Khobar Central	26° 20.0'	50° 13.2'	Zone K Water Quality Background	2 km north of Khobar SIP. Water depth about 5 m
25	K5	Khobar	Khobar SIP outfall	26° 19.0'	50° 13.2'	Assess WQ in the SIP outfall mixing zone	At Khobar SIP outfall. Depth 5 m. Water clarity low
26	K6	Khobar	Khobar South	26° 18.0'	50° 15.2'	To assess water quality south of SIP mixing zone	South of mixed Khobar SIP mixing zone
27	K7	Khobar	Desalination Plant Intake	26° 16.5'	50° 13.5'	Zone K WQ Background (Southern Area)	2 km South of SIP outfall. Water depth about 5 m
28	K8	Khobar	Desalination Outfall	26° 15.8'	50° 13.0'	Assess effect of desalination plant discharge	Close to the desalination plant intake. Water depth about 4 m
29	H1	Half Moon	Half Moon Bay - North	26° 10.0'	50° 02.0'	Water Quality and Circulation Profile (North)	Inner part of Halfmoon bay. High salinity (35). Water depth about 1-2 m
30	H2	Half Moon	Half Moon Bay - mid	26° 09.0'	50° 05.0'	WQ and circulation profile (Central)	Center of Halfmoon Bay. Water depth about 5 m
31	H30	Half Moon	Half Moon Bay - South	26° 09.0'	50° 10.0'	WQ and Circulation Profile (Entrance)	Mouth of the Halfmoon Bay. Open water
32	H40	Quryah	Power Station Intake	-	-	Water Quality Background	Accessible by car
33	H50	Quryah	Power Station Outfall	-	-	Check WQ near powerhouse mixing zone	Accessible by car





ORIGINAL SCHEDULE OF SITE SAMPLING WORK FOR STAGE 3 (OCT-NOV 1999)

Date	Region	Transport	Sampling stations	Comment	Tide times and heights (m)
Saturday 16-Oct	KHOBAR	Cars only	K2	4WD	0816 / 1.7; 1431 / 0.5; 2101 / 1.8
Sunday 17-Oct	TARUT	Cars only	T1, T0	4WD	0856 / 1.6; 1521 / 0.6; 2156 / 1.7
Monday 18-Oct	TARUT	Qatif Marina	T4	Coast Guard	0417 / 1.0; 0951 / 1.6; 1628 / 0.8
Tuesday 19-Oct	RAS TANURA	Ras Tanura	R2	Coast Guard	0554 / 1.1; 1112 / 1.5; 1751 / 0.8
Wednesday 20-Oct				Helipin Lab.	0720 / 1.0; 1247 / 1.6; 1909 / 0.7
Thursday 21-Oct					0821 / 0.9; 1359 / 1.7; 2013 / 0.7
Friday 22-Oct					0905 / 0.8; 1452 / 1.9; 2105 / 0.6
Saturday 23-Oct	TARUT	Dammam Port	T110	Coast Guard	0326 / 2.0; 0942 / 0.6; 1537 / 2.0
Sunday 24-Oct			(K2)	Helipin Lab.	0404 / 2.1; 1017 / 0.5; 1619 / 2.2
Monday 25-Oct	KHOBAR	Khobar Marina	K4	Coast Guard	0440 / 2.1; 1051 / 0.3; 1701 / 2.3
Tuesday 26-Oct	HALF MOON	HM Marina	H1	Coast Guard	0517 / 2.1; 1127 / 0.2; 1743 / 2.3
Wednesday 27-Oct	HALF MOON	Cars only	H50	Coast Guard	0556 / 2.1; 1205 / 0.2; 1827 / 2.3
Thursday 28-Oct					
Friday 29-Oct					0719 / 2.0; 1332 / 0.2; 2004 / 2.2
Saturday 30-Oct	JUBAIL	Cars only	Pack gear, drive to Jubail, meet Coastguard	Travel by Car	0755 / 1.4; 1427 / 0.3; 2107 / 1.8
Sunday 31-Oct	JUBAIL	Jubail Port	J1	Coast Guard	0849 / 1.3; 1527 / 0.4; 2210 / 1.7
Monday 1-Nov	JUBAIL	Jubail Port	J7	Coast Guard	0349 / 0.8; 1060 / 1.2; 1640 / 0.5
Tuesday 2-Nov	DAFI DAHMAT	Dafi Marina	DD20	Coast Guard	0624 / 0.2; 1136 / 1.2; 1804 / 0.5
Wednesday 3-Nov				Helipin Lab.	0745 / 0.7; 1316 / 1.3; 1928 / 0.5

LIST OF MEPA-JICA FIELD EQUIPMENT - OCTOBER 1999

Equipment	Specification	Qty
Sampling Equipment		
Water sampler (Van Dorn 6 litre)	rubber band closing type, 6 litre	1
Water sampler (Van Dorn 10 litre)	rubber band closing type, 10 litre	1
Messengers for water sampler	chrome-brass	3
Eckman grab sediment sampler	chrome plated, 0.04 m ² gape	1
Van Veen grab sediment sampler	stainless steel, 0.12 m ² gape	1
Soil samplers	polycarbonate tube corer + cap	10
Plankton nets	XXX-13 mesh size	2
Sampling buckets and bins	Assorted, 40 litre	4
Assorted ropes	50 m, 25 m, 15 m	4
Stainless scoops and sterile spatulas	Assorted pkts	6
Stainless Trays	Various	4
Plastic Trays	Various	2
Shackles	stainless steel	4
Cable Ties	Narrow	100
Field Instruments		
Water current meter	Electromagnetic, 0 - 250 cm/s	1
Hydrolab portable multi-probe meter	Temp, pH, DO, conductivity, turbidity	1
Portable ORP meter	Redox measurement	1
Secchi plate	dia. 30cm white plate, rope 30m	2
Sounding lead	3.2 kg, rope 30m	1
Pocket colorimeter for Residual chlorine	Electronic with powder	1
Glass Thermometer	0-50 °C	2
Portable GPS	Battery powered non-DGPS	2
KCH Datascope	Compass and range finder	1
Wind Speedometer	Silva pocket type	2
Preservatives and Containers		
Crushed water ice	20 kg	26
Whirl Pak sterile polythene bags	L (115x22cm) : 13 (Yellow), 13 (White)	26
	M (115x22cm) : 21 (Yellow)	21
	S (7.5x18.5cm) : 55 (White)	55
Ziploc resealing bags	L (22x33cm) : 10	10
	M (12x22.5cm) : 15	15
Cooler Boxes (55 litre & 120 litre)	Assorted sizes	5
Formalin	1 litre bottle of 10% Solution	1

Equipment	Specification
Field Record Items	
Field Record and COC Sheets	Printed White paper - assorted forms
Canon land camera with films	Films 36 x 10 packs
Disposable underwater cameras	Plastic type
Waterproof Labels	Assorted
Diver's board with pens	Magnetic self-cleaning
Waterproof marker pens, pencils & tape	Various
Miscellaneous	
Adhesive Tapes	Various
Razor blades	Packets of ss blades
Trash bags	Various
Disposable sterile polyethylene gloves	Box of latex disposable type
Kimwipes	Box
Replacement batteries	Various
Swab board tooth	Packet of various brand tooth
Distilled water in wash bottle	Various sizes
Health, Safety & Diving Equipment	
Spray jackets, hats, sun glasses	personal items
Protective cotton gloves	packet
Field First Aid Kit	
Sunprotection lotion	bottles
Fins, snorkel and masks	personal sets

1999-10/16

**FIELD RECORD SHEET
MEPA/JICA PROJECT**

Samples name _____

Site No: R1 Location: _____
 GPS: Lat: _____ Longitude: 101 54 22 East, 13 08 00 N
 Date: 8 Nov 99 Time: 12:35

Weather Condition
 Weather: Clear Temperature (°C): 27 Cloudiness: 0
 Wind Direction: 030/91 Wind Speed (m/s): 1 Wave height: <1

Water Condition
 Tide: _____ Depth (m): 2.0-2.5
 Current Direction: SE Current Speed (m/s): 0.6-0.8

5 m depth

Water Quality			
Temperature (°C)	<u>27.65</u>	Water color	<u>Dark green</u>
Salinity	<u>31.1</u>	Disk	<u>1.0</u>
pH	<u>8.20</u>	DO (mg/l)	<u>6.0</u>
DO (mg/l)	<u>5.02</u>	Turbid	<u>0.0</u>
Trichloroethylene	<u>0.07</u>	DO (mg/l)	<u>6.07</u>
Residual Chlorine	<u>0.07</u>	DO (mg/l)	<u>6.07</u>

Sediment Quality
 Sediment color: off white Temperature (°C): 27.5
 pH: 8.20 ORP (mv): 150
 Texture: _____

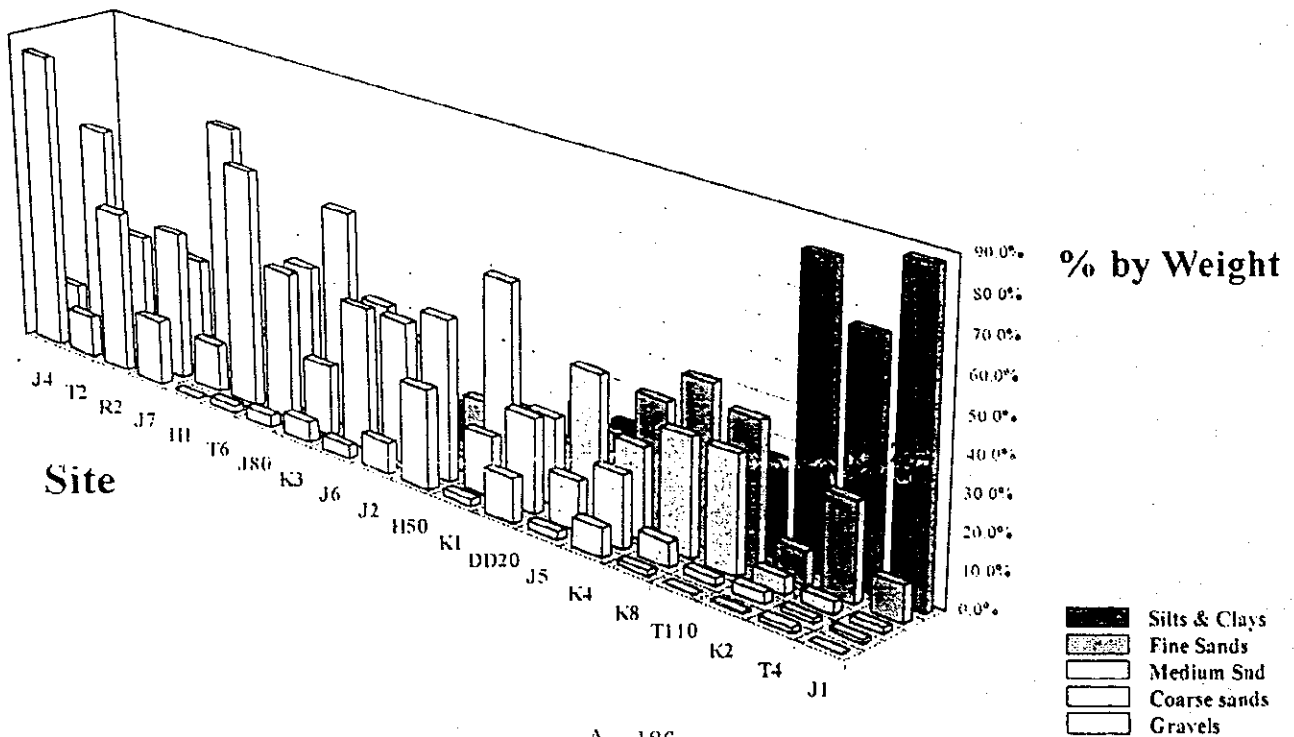
Observation and Comments

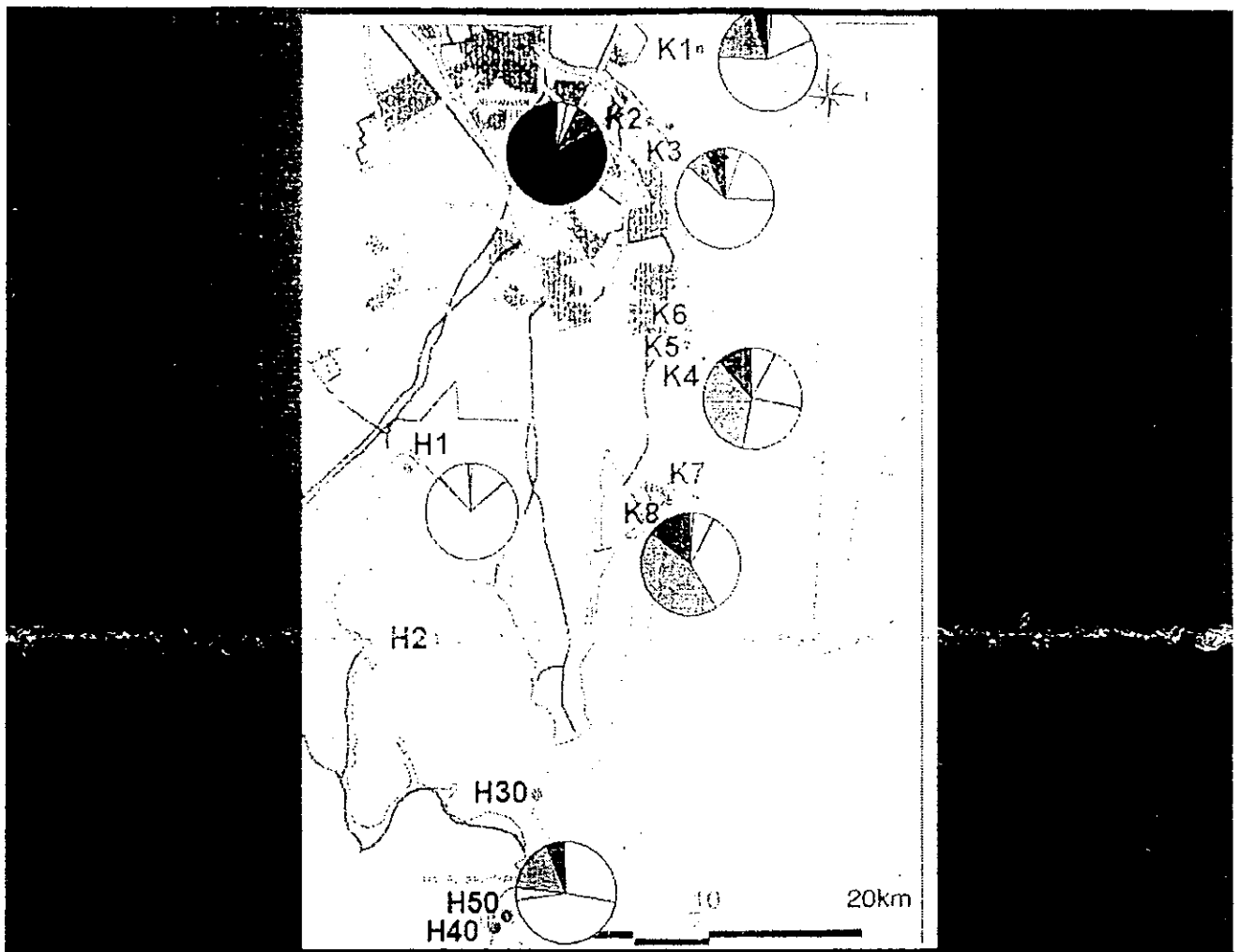
under, shell with very small tubes.





SEDIMENT COMPOSITION

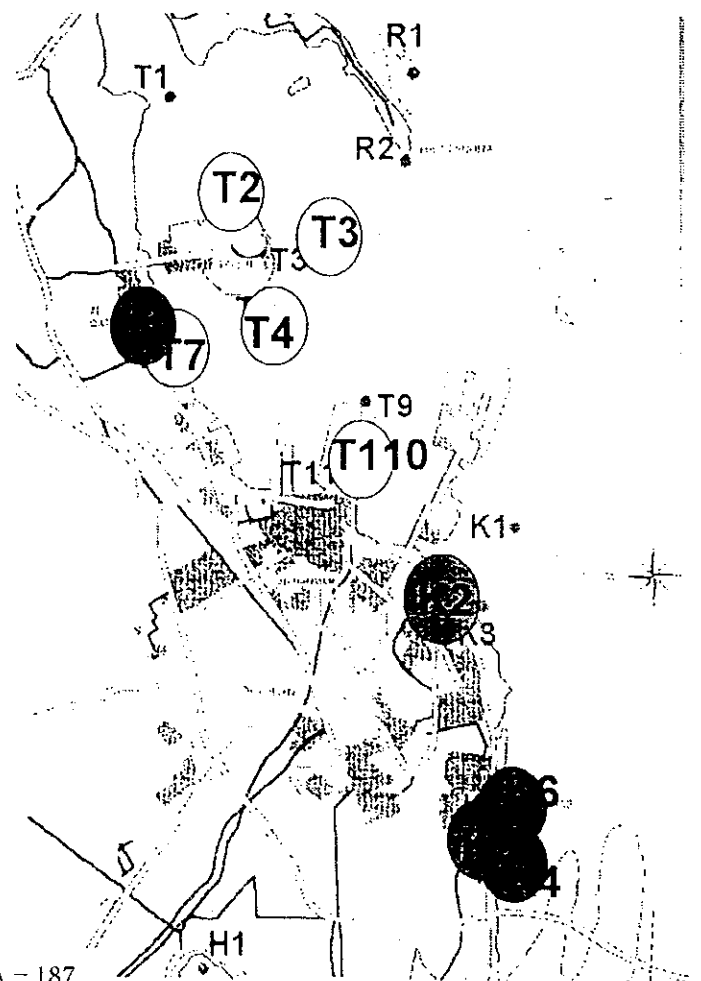




PRELIMINARY BACTERIA RESULTS

- <2,500 cfu
- >5,000 cfu
- >10,000 cfu
- >20,000 cfu

24-48 hr incubation
with M-ENDO
at 35°C, pH 7.2



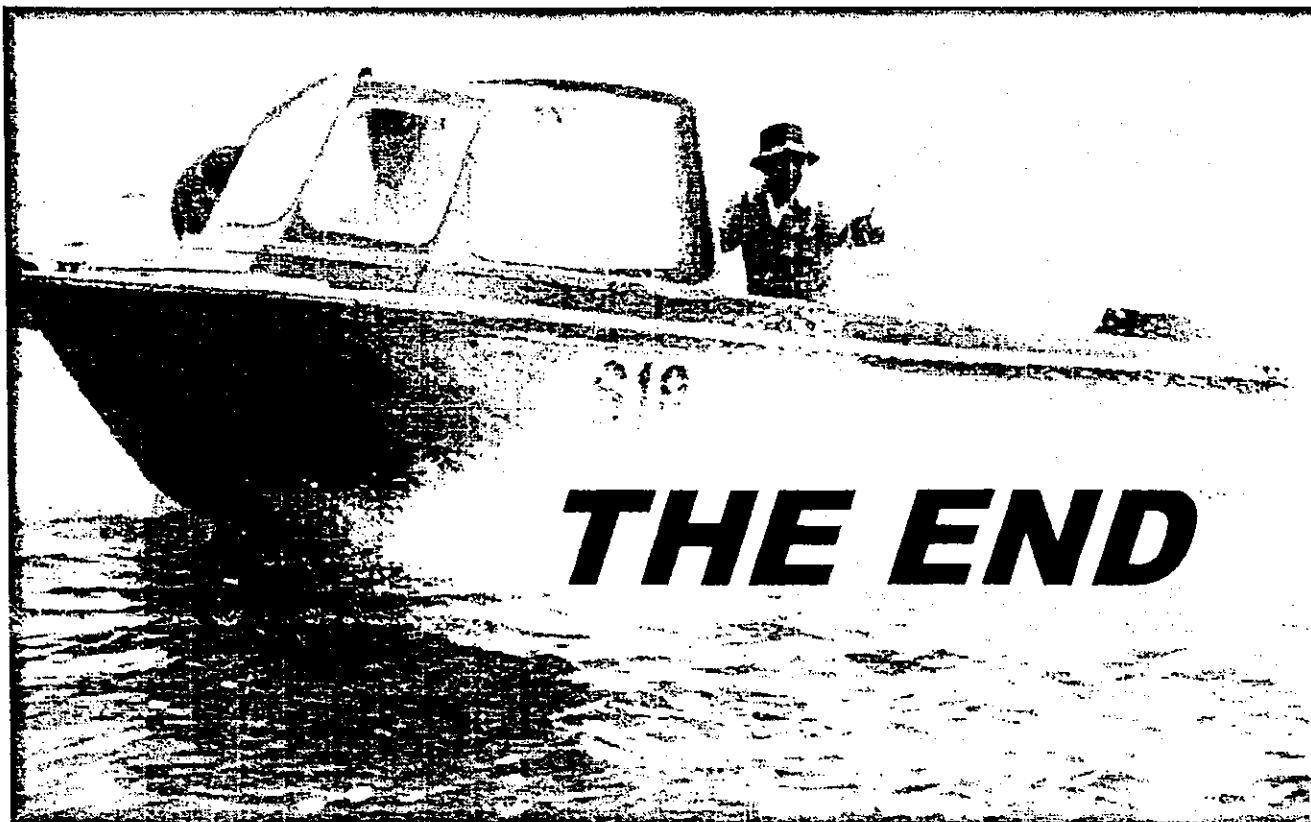
NUMBER OF REGIONS, SITES, SAMPLES, FIELD PARAMETERS AND LABORATORY ANALYSES IN STAGE 3

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		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



Replacement of Speaker

Because of the sudden unexpected happening to Mr. Qusai Bohlaiah, Staff of Environment Section of MEPA Eastern Province, Mr. Aziz Al-Omari, Chief of Environment Section of MEPA Eastern Province presented the summary of various matters about the Laboratory Set-up including equipment installation.

According to the sudden request by the chairman after the presentation by Mr. Al-Omari, Mr. Mamoru Sato of JICA Study Team presented the issues he concerned.

Next few pages show his important items of presentation.

Laboratory Set Up

Mr. Mamoru SATO
JICA Project Team

Purpose

- ❖ Strengthen MEPA's ability of field monitoring
- ❖ Monitor the seawater and sediment quality of Eastern Province
- ❖ Improve the basic ability to manage laboratory

Analysis Items in This Study

- ✧ Metals (include As and Hg)
- ✧ BTEX
- ✧ Nitrogen
- ✧ TOC
- ✧ Coliform
- ✧ Others

Major Equipment Introduced

- ✧ Gas Chromatography (GC-FID)
- ✧ Atomic Absorption Spectrometer (AAS)
- ✧ Total Organic Carbon meter (TOC)
- ✧ Distillation apparatus
- ✧ Spectrophotometer
- ✧ Oil Content Meter

Laboratory Management

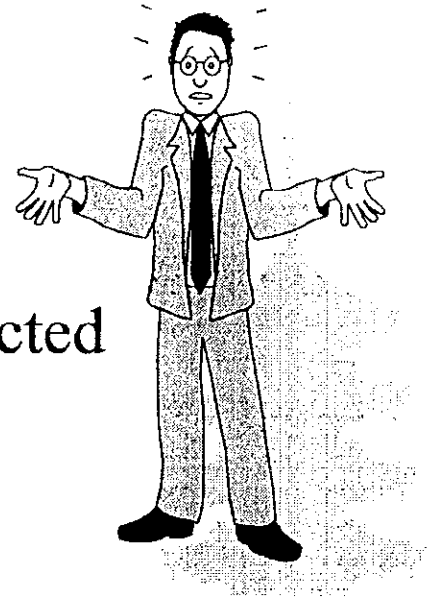
- ❖ Analysis method
- ❖ Quality Control
- ❖ Health and Safety
- ❖ Equipment maintenance
- ❖ Education

Documents for Management

- ❖ Analysis Procedures
- ❖ Health and Safety Plan
- ❖ Equipment Maintenance Procedure
- ❖ Daily Operational Manual of Equipment

Difficulties during Laboratory Set Up

- ❖ Purchase of the Laboratory
Equipment and Chemicals (delivery)
- ❖ Personnel of MEPA
- ❖ Utilities of Laboratory
- ❖ National Standard Method
- ❖ Characteristics of the Collected
Sample



Present Conditions and Future Plans

- ❖ Sample Analysis
- ❖ Preparation of the
Documents
- ❖ Personnel
(management,
specialist)
- ❖ Future image of the
laboratory
- ❖ Resources

Thank you for your Attention

Chiyoda Dames and Moore



Appendix L (4) Question & Answer Summary

MEPA/JICA PROJECT Marine Monitoring and Management of the Gulf Coastal Waters SECOND WORKSHOP November 17, 1999

Panel Discussion

1. *Q: When did Project start on Satellite Analysis? KFUPM is willing to extend cooperation for satellite data analysis in particular reference to the oil spill system.*
A (Mishra): The analysis was started at the start of 3rd stage. Due to lack of the opportunity the visit to KFUPM could not take place but hope to cooperate during 4th stage.
2. *Q: Land based sources were reviewed or not?*
A (Hamdan): Many components to Study on regional and national level, including cooperation with many other agencies apart from JICA were considered.
3. *Q: What is the public opinion on oil spill? Positive news required because public is very negative.*
A (Aziz): Study will focus on many sources not only on the oil spill.
4. *Q: What does the meaning of National Standard stands for?*
A (Sato): Japan has National Standard but it seems KSA does not have National Standard Methods.
(Hamdan): ROPME (Monaco Laboratory Agreement, UNESCO) exists and it will be provided to the Team.
5. *Q: Will laboratory be available after June 2000 for the use by the Ministry of Agriculture (Fisheries)?*
A (Hamdan): MEPA, as a focal point, is ready to cooperate with all agencies – both Government Department and Private Sector. Long term outlook is very important.
6. *Q: What kinds of results you getting to indicate which activities are of most concern?*
A (Robert): It is too early to say but ad-hoc coastal development is an issue; as is sewage discharge.
(Aziz): It is only Team's observation. Till now no conclusion, we are evaluating needs and more further information.

7. *Comment: Concrete recommendation should not be mentioned at this stage. We are not in a stage to tell, recommendation should be done after examining the results.*
8. *Comment: Our fishes are examined and 100% healthy. Fishes are good and edible without any worry.*
A (Hamdan): The Team concentrated only on Field-work. No recommendation is going to be done at this stage.
9. *Q: Was the image 3-Dimensional? How oil spill will be monitored if occurred within 16 days (no TM coverage)?*
A (Mishra): There was no 3-D image shown during the presentation. As far as oil spill is concerned there are other satellites available for monitoring purposes. RADARSAT can be used for oil spills.
10. *Aziz: Please visit the laboratory. The release of the results is authorized only to MEPA. THANKS.*

Appendix G

Documents of Lanchtime Seminar

List of Participants
Resume of Speech

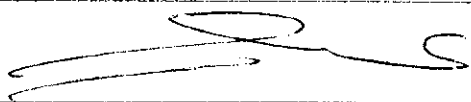
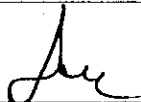
Lunch Time Seminar (1)

Date: 21, June, 00

Title: Laboratory Practice - 1 (Important Procedures)

Speaker: Yoshitaka Imaeda

Attendance

Name	Signature
Adel M. Kusti	
Yousef Al-Helal	
Qusni M. Bohliyah	Qusni M.
HIROYUKI CHI	N.O.
KOZO Sakaguchi	Kozu Sakaguchi
Abm Nizami	

Laboratory Practice (1) - Important Procedure -

1. **Introduction:** Importance of Environmental Analysis
2. **Some Chemicals are harmful:** Protect your health by yourself
3. **Matrix (sample) is complex:** Why environmental analysis is complicated
4. **Concentration is low:** Prevention of contamination is very important
5. **Units of Measurement:** Meaning of ppm and ppb
6. **Significant Figure:** 1 is not equal to 1.0
7. **Sample Preservation**
8. **Chain of Custody Procedure:** Prevention of Mistakes
9. **Errors in Analysis**
10. **Precision and Accuracy**
11. **Standard and Calibration**
12. **Sensitivity**
13. **Detection Limit**
14. **Linear dynamic range**
15. **On the Job Training**

Contamination Control

Environmental measurement processes are prone to contamination problems. Analytes in many environmental samples are present at trace levels and contamination can be a significant source of error.

Potential sources of sample contamination

Sample collection

- Equipment
- sample handling
- sample preservative
- sample container
- ambient contamination

Sample transport and storage

- sample container
- cross contamination from other samples or reagents

Sample preparation

- sample handling
- dilutions
- glassware
- ambient contamination

Sample analysis

- instrument carry-over
- reagents
- glassware and apparatus

Table F-2 Sample Containers, Preservatives and Holding Times

Analysis Parameter	Container	Volume (ml)	Preservation	Holding Time
Total Suspended Solid	Plastic	1000	Cool, 4°C	48hrs
Residual Chlorine	Plastic	1001	Cool, 4°C	Immediately
COD / TOC Ammonia, Total Kjeidahl Nitrogen Total Phosphorus	Plastic	2000	Cool, 4°C	48hrs
Cyanogen	Plastic	500	Cool, 4°C add NaOH, pH>12	14days
Metals	Plastic	500	add HNO ₃ , pH<2	28days (Hg) 6 months (others)
Phenols	Glass	500	Cool, 4°C add N ₂ SO ₄ , pH<2	28days
Oil & Grease, TPH	Glass	1000	Cool, 4°C add HCl, pH<2	28days
BTEX (Benzen, Toluene, Etylbenzen, Xylene)	Glass with teflon liner cap	250	Cool, 4°C add HCl, pH<2	14days
Chloropyll	Plastic	1000	Cool, 4°C	Immediately to filtrate 28days (Frozen)
Total Coliform	Plastic (sterilized)	100	Cool, 4°C	24hours

Chain-of-Custody Procedures

It is essential to insure sample integrity from collection to data reporting. This includes the ability to trace possession and handling of sample from the time of collection through analysis and final disposition. This process is referred as chain of custody.

The following procedures summarize the major aspects of chain of custody.

Sample labels

Use labels for each sample to prevent sample misidentification. Gummed paper labels or tags generally are adequate.

The following information should be included at least: sample identification number, name of collector, date and time of collection, place of collection, and sample preservative.

Sample seals

Use sample seals to detect unauthorized tampering with samples up to the time of analysis.

Attach seal in such way that it is necessary to break it to open the sample container. Affix seal to container before sample leaves custody of sampling personnel.

Field log book

Record all information pertinent to a field survey or sampling in a bound log book.

As a minimum, include the following in the log book: purpose of sampling, location of sampling point, name and address of field contact, type of sample and method of preservation

Chain-of-Custody record

Fill out a chain-of-custody record to accompany each sample or group of samples.

The record includes the following information: sample number, signature of collector, date and time of collection, sample type, signatures of persons in the chain of possession, and inclusive dates of possession.

Sample analysis request sheet

The sample analysis request sheet accompanies samples to the laboratory. The collector completes the field portion of the sheet that includes most of the information noted in the log

Sample delivery to the laboratory

Deliver samples to laboratory as soon as practicable after collection. Insure that samples are accompanied by a completed COC record and a sample analysis request sheet.

Receipt and logging of sample

In the laboratory, the sample custodian inspects the condition of the sample, reconciles label information against the COC record, logs sample in the laboratory log book, and store it in a secured storage room until it is assigned to an analyst.

Assignment of sample for analysis

Once sample is in the laboratory, the supervisor or analyst is responsible for its care and

Chain-of-Custody Sheet (Water Samples)

Date Sampled: <u>17 Oct</u>							Remarks:																			
Sampler:							Surface Seawater (SS), Bottom Seawater (BS), Waste Water (WW)	Residual Chlorine	TSS	COD/TOC	NH ₃ (Ammonia)	TKN (Kjeldahl Nitrogen)	T-P (Total Phosphorus)	CN (Cyanogen)	Mg (Magnesium)	Hg (Mercury)	As (Arsenic)	Cr (Chromium)	Other Metals (Cd, Co, Cu, Ni, Pb, Zn)	Phenol	Oil & Grease	BTEX	TPH	Chlorophyll	Total Coliform	Chlorinated Hydrocarbons
No.	Sample ID	Time Sampled	Type of Sample	Bottle Type	Volume (ml)	Qty	Analysis Parameter																	Notes		
	T120	12:35	SS	P	1000	1	✓																			
	T120	12:35	SS	PA	2000	1	✓	✓	✓	✓																
	T120	12:35	SS	PA	500	1							✓	✓	✓	✓	✓									
	T120		SS	W	125	2																				
	T6	14:50	WW	P	1600	1	✓																			
	T6	14:50	WW	P	1000	1																				
	T6	14:50	WW	PA	2000	1	✓	✓	✓	✓																
	T6	14:50	WW	PA	500	1							✓	✓	✓	✓	✓									
	T6	14:50	WW	W	125	2																				including spare
	T120	12:35	SS	P	1000	1																				
	T7	16:15	SS	P	1000	1	✓																			
	T7	16:15	SS	P	1000	1																				
	T7	16:15	SS	PA	2000	1	✓	✓	✓	✓																
	T7	16:15	SS	W	125	2																				

A-202

Extra including spare

including spare

Supplied to Laboratory by :

(Name) Hashim AL-Zawad

Received at Laboratory by :

(Name) HIROYUKI OHI

(Signature) [Signature]

(Signature) H. Ohi

(Date/Time) 17 Oct 99

(Date/Time) 18 Oct 99, 9:20