国際協力事業団（JICA）

社会開発調査部報告書

サウディアラビア国気象環境保護局（MEPA）

サウディ・アラビア国
アラビア湾環境モニタリング計画調査
技術移転結果報告書

平成13年1月

千代田デイムス・アンド・ムーア株式会社

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要　約

本調査の主要な目的の一つは、サウディ・アラビア国がアラビア湾を対象として、沿岸域の水質環境のモニタリングを遂行してゆくことができるように、MEPA の沿岸域環境管理能力、モニタリング能力の増強を図ることであった。

この目的の達成のために、調査団は MEPA 側カウンターパート（C/P）に対して、調査期間を通じて技術移転を実施した。

技術移転項目は、フィールドモニタリング調査技術、水質／底質の化学分析技術、衛星画像解析技術等の分野について実施した。

また、セミナーやワークショップを通じて、沿岸域管理に関連すると考えられる公的機関、東部地区の主要企業、研究機関等に対し、本計画の内容、調査結果、将来的な沿岸域管理の必要性等について説明し、将来的なモニタリングシステム構築のための広報、啓発を図った。

技術移転は、調査団と MEPA C/P の間で協調的かつ効果的に行われた。技術移転項目はフィールドにおけるサンプリング技術、サンプル取扱い手法等の基本的事項からラボ整備・分析操作、モニタリング・データ解析手法、モニタリング計画の評価手法等を含む広範囲に及ぶものであり、モニタリング計画を実現、発展させてゆくための基礎技術が移転できたものと評価される。

実施された日サ両国の先駆的努力を確実に結実されるためには、今後も、水質モニタリング業務の継続を行うことで確実な知識の習得と技術者の育成を図って行く必要があるものと考えられる。また、これらの活動を成功裡に行うためには、専門家派遣等の手段による継続的な技術支援が不可欠である。

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添付資料

1．はじめに

1997 年 11 月に合意された日サ協力アジェンダに基づき、サウディアラビア国気象環境保護局(MEPA：Meteorology & Environmental Protection Administration)と国際協力事業団(JICA：Japan International Cooperation Agency)は 1999 年～2001 年にかけてアラビア湾環境モニタリング調査（本調査）を実施した。

本調査の主要な目的の一つは、サウディ・アラビア国がアラビア湾を対象として、沿岸域の水質環境のモニタリングを遂行してゆくことができるように、MEPA の沿岸域環境管理能力、モニタリング能力の増強を図ることである。

この目的の達成のために、調査団は MEPA 側カウンターパート（C/P）に対して、調査期間を通じて沿岸域水質モニタリングに関する技術の移転を実施してきた。

以下に、本調査において実施された技術移転の内容、方法、使用された教材等についてとりまとめ、その成果について報告する。

2．技術移転の概要

本調査で実施された技術移転の項目および対象者は次のとおりである。

(1) 技術移転項目

技術移転の主な対象項目を表 2.1 に示す。

表 2.1　技術移転の対象項目

分　野	項　目
モニタリング計画	・モニタリングデザイン手法 ・実施体制、ネットワーク構築 ・資機材の整備
フィールド調査	・調査資機材の取扱い ・試料のサンプリング ・流況等の把握
水質分析	・海水/底質の分析手法 ・機器/器具の操作、ラボ管理 ・精度管理手法
衛星画像解析	・画像データの解析 ・調査データとの比較
沿岸域管理計画	・モニタリングデータの解析 ・主要汚染源の把握 ・水質保全計画

(2) 技術移転対象者

技術移転はカウンターパート機関である MEPA のみならず、他の沿岸域管理に関連する機関についても対象として実施された。

MEPA 職員に対する技術移転について、その主な対象者（C/P）を表 2.2 に示す。

なお、各カウンターパートの履歴について添付資料Aとして添付した。

表 2.2 技術移転対象者

対象分野	名前および所属
水域管理計画	Mr. Hamadan S. Al-Ghamdi (MEPA 東部事務所所長)
水域管理計画	Mr. Aziz Al-Omary (MEPA 東部事務所 環境部局長)
水域管理計画	Mr. Mohammed Ali Al-Ghamdi (MEPA 東部事務所)
モニタリング計画 フィールド調査	Mr. Khaled Al-Rasheed (MEPA 東部事務所 環境部)
モニタリング計画 フィールド調査	Mr. Khalid Busbait (MEPA 東部事務所 環境部)
フィールド調査	Mr. Adel Qusti (MEPA 東部事務所)
水質分析	Mr. Qusai Bohlaiqah (MEPA 東部事務所)
水質分析	Mr. Hashim Al-Zawad(MEPA 東部事務所)
水質分析	Mr. Alam Nizami (MEPA 東部事務所)
水質分析	Mr. Jamal Kazim (MEPA)
水質分析	Mr. Najib S Raadan (MEPA)
水質分析	Mr. Yousef H Al-Hilal (MEPA 東部事務所)
機器メンテナンス	Mr. Ahamed Al-Dalouj (MEPA 東部事務所)
機器メンテナンス	Mr. Ghazi Al-Naimi (MEPA 東部事務所)
衛星画像解析	Mr. Mohammed A. Bukhari (MEPA 本部)

沿岸域管理に関連すると考えられる機関への技術移転については、以下に示す機関の参加を得た。

・公的機関

Coast Guard, Ministry of Industry, Ministry of Agriculture, Al-Jubail Municipality, Dammam Municipality, Civil Defense, Water and Sewerage Authority, Royal Commission 等

・東部地区の主要企業

SAFCO, SABCO, SECO, Qurrayah Power Plant, SWCC 等

・研究機関

King Fahd University of Petroleum & Minerals, King Faisal University 等

これら機関に対しては、本計画の内容、調査結果、将来的な沿岸域管理の必要性等についてワークショップ等を通じて説明し、将来的なモニタリングシステム構築のための広報、啓発を図った。

3．技術移転の方法

本調査における主な技術移転の内容と技術移転方法について表 3.1 に示す。

表 3.1　技術移転内容と方法

時　期	分　野	項　目	方　法
第 1 次現地調査 （1999年 3 月）	フィールド調査 水質分析	・調査計画の考え方 ・ラボ整備計画	説明・協議、 OJT 説明・協議、 OJT
第 2 次現地調査 （1999年6月～ 7 月）	フィールド調査	・調査地点の選定 ・サンプリング手法	レクチャー／協議 OJT
	水質分析	・ラボ施設の整備 ・調査計画の策定 ・既存設備による分析	レクチャー／協議、OJT OJT OJT
第 3 次現地調査 （1999年9月～11月）	フィールド調査	・調査計画の策定／準備 ・調査の実施 ・試料の取扱い ・資機材の整備	レクチャー、OJT レクチャー、OJT レクチャー、OJT レクチャー、OJT
	水質分析	・海水/底質の分析手法 ・機器/器具の操作 ・ラボ管理方法	レクチャー、OJT レクチャー、OJT レクチャー、OJT
	衛星画像解析	・ 衛星画像解析の適用	レクチャー
第 4 次現地調査 （2000年5月～ 7 月）	フィールド調査	・調査計画の策定／準備 ・調査の実施 ・試料の取扱い ・調査資機材の取扱い ・資機材の整備 ・ データ整理および解析	OJT OJT OJT OJT OJT、セミナー OJT、セミナー
	水質分析	・ 海水/底質の分析手法 ・ 機器/器具の操作 ・ 精度管理手法 ・データ管理、存	OJT、セミナー OJT OJT、セミナー OJT、セミナー
	衛星画像解析	・衛星画像解析の実施	レクチャー、OJT

技術移転においては On-the-job Training(OJT)を通じて実践的な技術の移転を図るとともに、レクチャー、ディスカッション、ワークショップ、セミナー等の Off-the-job

Training を実施することにより、モニタリング活動における理論的側面を補足した。

4．技術移転の内容

4.1 フィールド調査

フィールド調査では現場測定技術、サンプリング技術、サンプル取扱い手法等の基本的事項のみならず、モニタリング・データ解析手法、モニタリング計画の評価手法等を含めたモニタリングの実施に関連する一連の技術を移転し、サウディ・アラビア国側が将来にわたりモニタリング計画を実現、発展させてゆくための基礎構築を目指した。これらの技術移転は、主に2回にわたる試験的モニタリング実施水域（インテンシブ・スタディエリア）における水質モニタリング調査および試料分析を通して行った。

技術移転の実施に当たっては、1回目のモニタリング調査時に基礎的技術の指導を行い、2回目の調査時においては、C/P が主体となって調査業務を実施し、調査団はこれをサポートすることによって、技術移転成果を確認し、C/P の自立を促すように配慮した。また、調査期間を通じて指導時間（tutorials）を設け、モニタリングおよびサンプリング活動の理論について C/P の理解を促した。

フィールド調査において実施された主な技術移転の内容は次のようである。

- モニタリング計画の策定方法
- 対象域の事前調査方法
- フィールドワークにおける安全衛生計画
- モニタリング地点の配置方法
- 調査データの記録および保存
- 調査データの整理および解析
- 採取試料の取扱い（Chain-of-Custody Procedure）

フィールド調査にかかる技術移転において作成した書類および技術指導で使用した資料を添付資料Bに示す。

4.2 化学分析業務

化学分析業務についての技術移転は、分析室の整備およびモニタリング試料分析の実務について実施された。以下にその内容について述べる。

4.2.1 分析室の整備

技術移転の実施に先立ち、MEPA 東部事務所の化学分析室に JICA 供与機器を導入することで分析環境の整備を行った。

この分析室の整備経過においては、C/P と共に作業を行い、以下に示すような技術移転を行った。

- 導入機器設置のための室内整理/配置計画
- 分析室ユーティリティーの整備
- 分析操作の基礎（既存備品による）
- ラボ安全衛生規程の作成
- 分析器具、薬品管理の方法
- ラボ廃棄物の取扱い、処分方法

4.2.2 分析実務

機器導入後に行われた第２次および第３次現地調査時のモニタリング調査においては、採取試料について C/P とともに分析することで、TSS、TOC、TKN、NH3、T-P、クロロフィル、金属類（As、Cr、Hg、Mg、Cd、Co、Cu、Ni、Pb、Zn）、CN、油分、BTEX、フェノール、残留塩素、大腸菌群数等の各項目について分析方法の指導をおこなった。

また、以下のような化学分析に係る技術の移転を行った。

- 各機器設備の操作取扱いおよび管理
- 試料の取扱いおよび保存
- 各種分析方法の基礎理論
- 試料前処理方法ならびに定量操作
- 分析野帳の整備および保管
- 分析データの精度管理
- 分析結果報告書の作成
- 主要分析機器のメンテナンス方法

4.2.3 書類管理

ラボ整備および分析実務に必要な書類として以下のものを整備し、その意義および用途について技術移転を行った。

- 分析業務管理計画（Laboratory Management Plan）

- 試料受渡し管理票（Chain-of-custody Sheet）
- 分析項目別標準操作手順（分析フローシート）
- 主要機器の操作校正マニュアル
- ラボ安全衛生規程
- ラボ廃棄物取扱規定
- 分析機器/器具/薬品リスト
- 分析野帳/記録票
- 分析結果報告書

添付資料Cに上記書類の一部およびラボ業務日報を示す。

4.3 衛星画像解析

衛星画像解析についての技術移転は、第4次現地調査期間に MEPA 本部（Jeddah）においてC/Pを対象に実施された。

実施期間は2000年6月21日～7月13日である。

技術移転は調査対象域の水温、SS、クロロフィルの分布図作成を主体に行った。

以下に技術移転内容について示す。

- LANDSAT TM データ解析ソフトのワークステーションへの導入
- TM データの読込みおよび調整
- 水温分布にかかるデータ処理
- 懸濁物質（SS）分布にかかるデータ処理
- クロロフィルａの分布にかかるデータ処理
- 沿岸域利用状況にかかるデータ処理

添付資料Dに衛星画像解析にかかる業務日報を示す。

4.4 ワークショップ等

技術移転に関するワークショップは、MEPA と共同主催の形で調査期間中に3回実施した。ワークショップ参加者は、主に調査への協力機関および東部地区の主要企業、公的機関である。また、第4次現地調査期間においては MEPA C/P を対象とした小セミナーを行った。表3.2に、セミナー/ワークショップの開催実績を示す。

各セミナー/ワークショップにおいては、調査団側のみではなく MEPA 側からの発表・講演も行われた。また、各セッションの終わりには討議の場を設けられ、参加者との質疑応答が活発に行われた。

表 3.2　ワークショップ等の開催実績

時　期	内　容
第 2 次現地調査	ワークショップ（1999 年 7 月 7 日） ・本調査の紹介 ・モニタリング計画の考え方/MEPA の役割
第 3 次現地調査	ワークショップ（1999 年 11 月 17 日） ・衛星画像解析による環境状態の把握 ・現地モニタリングワークの成果 ・ラボ整備の状況および課題
第 4 次現地調査	小セミナー（Lunch Time Seminars） ・ラボ分析における留意点、精度管理手法 ・モニタリング計画の建て方、データ管理手法 ・モニタリングデータの統計解析手法 ・モニタリング機器の取扱い/整備 ・環境管理における組織的活動
第 5 次現地調査	ワークショップ（2000 年 11 月 13、14 日） ・本調査の実施内容および成果 ・アラビア湾沿岸域の水質現況 ・衛星画像解析による環境評価 ・水質モニタリングの段階的計画 ・ラボ整備の過程および今後の課題 ・期待される MEPA の環境管理体制

以下に各ワークショップおよびセミナーの内容について記載する。

4.4.1 第 1 回ワークショップ

第 1 回のワークショップは、第 2 次現地調査期間中の 1999 年 7 月 7 日に MEPA 会議室において実施された。

講演発表者は調査団および MEPA から 5 人を選定し、30 名以上の外部機関からの参加者を得て実施された。

参加者と発表者の間では、討議の時間を通して活発な質疑応答・意見交換がなされた。

第 1 回ワークショップのプログラム、参加者リスト、発表要旨および質疑応答概要を添付資料 E に示す。また、表 4.1 に第 1 回ワークショップの講演者および発表内容を示す。

表4.1　第1回ワークショップの講演内容

講演者	所属/担当	発表テーマ
島津康弘	調査団 団長	"Introduction of the work"
Mr. Aziz Al-Omari	MEPA 東部事務所 Chief of Environmental Division	"The Role of MEPA and the Management of Monitoring Program"
Dr. Robert Hilliard	調査団 水質モニタリング	"Design of Water Monitoring"
田中和雄	調査団 社会・経済・組織制度	"Socio-Economical Framework for the Project"
Mr. Khaled Al-Rasheed	MEPA 東部事務所	"Cooperation, coordinate with Coast Guard"

4.4.2 第2回ワークショップ

第2回のワークショップは、第3次現地調査期間中の 1999 年 11 月 17 日に MEPA 会議室において実施された。第1回と同様に多数の外部参加者を集めた。このワークショップの主題は調査の経過状況の報告とし、次のようなテーマを主体とした。

・衛星画像解析による対象域の環境状況
・現地モニタリングによる初期情報
・ラボ整備における課題

第2回ワークショップのプログラム、参加者リスト、発表要旨および質疑応答概要を添付資料Fに示す。また、表 4.2 に、第2回ワークショップの講演者および発表内容を示す。

表4.2　第2回ワークショップの講演内容

講演者	所属/担当	発表テーマ
島津康弘	調査団 団長	"Present Status of the Study -- Outline"
Mr. Aziz Al-Omari	MEPA 東部事務所 Chief of Environmental Division	"Requirements for Continuing the JICA/MEPA Project"
Dr. Krishna K. Mishra	調査団 衛星画像解析	"Environmental Condition Analyzed from Recent LANDSAT Images"
Mr. Khaled Busbait	MEPA 東部事務所	"Findings During Actual Monitoring Work"
佐藤 衛	調査団 機材整備計画	"Laboratory Set Up"

4.4.3 ランチタイムセミナー（Lunchtime Seminar）

第 4 次現地調査期間（2000 年5月～7月）を通じ、MEPA 会議室において7回の Lunchtime Seminar と称する小セミナーを開催した。これらのセミナーは昼休みに相当する時間を利用して、水質モニタリング業務に対する各 C/P への技術移転をより確実なものとすることを目的としたものである。

各セミナーのテーマは予め調査団と C/P の間で検討され、それぞれの側から本調査に関するトピックをテーマとして発表ならびに討議が行われた。

ランチタイム・セミナーで使用された資料および参加者リストを添付資料Gに示す。

また、表4.3に、各セミナーの概要を示す。

表 4 .3　Lunchtime Seminar の実績

実施日	発表者	テーマ	内容
2000.6.21	今枝良隆	Laboratory Practice (1)	Important Procedure on Chemical Analysis
2000.7.2	Mr. Khaled Al-Rasheed	Sampling Practice (2)	Documentation and Recording System
2000.7.8	Dr. Robert Hilliard	Interpretation of Results	Graphs and Statistics on Data Arrangement
2000.7.9	Mr. Khalid Busbait	Sampling Practice (1)	Objectives, Logistics and Planning of Monitoring
2000.7.12	池 知彦	MEPA Field Equipment	Calibration and Maintenance Procedure
2000.7.16	佐藤 衛	Laboratory Practice (2)	QA/QC – Preventing Contamination
2000.7.19	田中和雄	Performance Management	Position Duties and Responsibilities

4.4.4 第 3 回ワークショップ（技術移転セミナー）

本業務の総括発表の場としての第 3 回ワークショップは、第 5 次現地調査時の 2000 年 11 月 13～14 日に、Al-Khobar の Al-Gosaibi Hotel 会議室において実施された。当ワークショップの開会式には、日本大使およびサウディアラビア東部州副知事も臨席され、多くの関係機関、主要企業の参加があった。本ワークショップの主題は調査の成果報告ならびに水質モニタリング・水域管理計画にかかる将来ビジョンとし、調査団および MEPA からは表 4.4 に示すような講演発表を行った。

第 3 回ワークショップのプログラム、参加者リスト、発表要旨および質疑応答概要については添付資料 H に示した。

表 4.4　第３回ワークショップの講演内容

講演者	所属/担当	発表テーマ
第１日		
島津康弘	調査団 団長	"Outline of the Study"
Dr. Robert Hilliard	調査団 水質モニタリング	"Present Sea Water Quality Situation in the Area"
Mr. Khaled Al-Rasheed	MEPA 東部事務所	"Sampling Practice
Mr. Mohammed Bukhari	MEPA 本部	"MEPA's Ongoing GIS & RS Activities"
Dr. Krishna K. Mishra	調査団 衛星画像解析	"Seawater Quality Evaluated by Satellite Data Analyses"
第２日		
池 知彦	調査団 生態系	"Phased Approach to Future Seawater Monitoring"
Mr. Adel Qusti	MEPA 東部事務所	"Importance of the Extending Seawater Monitoring along all of the Eastern Coast"
大井裕之	調査団 水質分析	"Laboratory Preparation for Environmental Monitoring"
田中和雄	調査団 社会・経済・組織制度	"Strengthening MEPA's Capacity"
Mr. Hamdan Al-Ghamdi	MEPA 東部事務所 所長	"Present Situation and Future Consideration"

５．技術移転の成果

技術移転は、調査団と MEPA C/P の間で協調的かつ効果的に行われた。技術移転項目はフィールドにおけるサンプリング技術、サンプル取扱い手法等の基本的事項からラボ整備・分析操作、モニタリング・データ解析手法、モニタリング計画の評価手法等を含む広範囲に及ぶものであり、モニタリング計画を実現、発展させてゆくための基礎技術が移転できたものと評価される。

実施された日サ両国の先駆的努力を確実に結実されるためには、今後も、水質モニタリング業務の継続を行うことで確実な知識の習得と技術者の育成を図って行く必要があるものと考えられる。また、これらの活動を成功裡に行うためには、専門家派遣等の手段による継続的な技術支援が不可欠である。

以下に、各分野における技術移転の結果と課題の概要をとりまとめた。

5.1 フィールド調査

技術移転の結果、計画からサンプルのハンドリングに至る一連の作業については、MEPA が定点モニタリングを独自に実施できるだけの最低限の基本体制は確立されたものと評価される。今後これらの C/P を核として MEPA 内部での技術移転がなされること、および高度な技術の移転修得の機会を与えることが期待される。

5.2 水質分析業務

MEPA においては 1 名の分析員を除き（2000 年　12 月時点)、化学分野におけるバックグラウンドを有しておらず、今後ラボを適切に運営し、分析を実施して行く上で充分な体制が整ったとは言いがたい。調査団の強い Recommendation を受け、この問題に対応するために、MEPA は次年度より化学分析の素養がある分析要員 2 名の補充を行う予定である。

これら分析員に対しては MEPA 内部での技術移転がなされることが期待されるとともに、JICA からも専門員の派遣等によるフォローアップを継続し、分析室における技術／体制の確立を図ることが必要と考えられる。

5.3 衛星画像解析

当該分野においては、MEPA は既に基礎的な技術、経験および設備を有しており、技術移転は円滑に実施された。MEPA はアラビア湾沿岸域の主要陸域排出源や自然環境に関する GIS データベースを保有しており、今後は衛星画像解析結果とこれらの GIS データベースを利用したより高度な解析を実施できるようになることが期待される。

5.4 ワークショップ等

技術移転の結果を発表する機会であるワークショップにおいては、本業務の目的である技術移転の成果が確認された。また、参加者である環境関連の行政機関及び民間組織、大学研究機関からの注目度も高く、活発な意見交換がなされた。

これら行政組織、民間組織および大学研究機関等との情報交換は将来的に MEPA が沿岸域管理に関する環境行政の中心機関として機能する上での基礎となると評価される。

添付資料 A

カウンターパート履歴書

Hamdan Saleh Al-Ghamdi

P. O. Box-117, Dhahran Airport
Dhahran-31932, Saudi Arabia
Tel: (03) 8576260/8575732
Fax: (03) 8576752/8575304

Nationality : Saudi Date of Birth : May 03, 1952

Marital Status : Married

Work Experience

- Working as a Director of Ministry of Defense and Aviation, Meteorology and Environmental Protection Administration (MEPA) Eastern Province since 1998.
- Worked in MEPA Headquarters as a Director for Protection Controls and Services for Marine Environmental Department.

Education

1994 Aberdine University, Scotland U. K.
Environmental Assessment and Management

1981-1984 Western Michigan University, USA
Master Degree of Marine Biology

Aziz W. Al-Omari

P. O. Box-117, Dhahran Airport
Dhahran-31932, Saudi Arabia
Tel: (03) 8576260/8575732
Fax: (03) 8576752/8575304

Nationality : Saudi
Marital Status : Married

Qualification:

- Diploma in Marine Pollution Response from Bahrain in 1987.
- The Saudi Arabian Observer Course from United Kingdom of Great Britain and Northern Island in 1979.
- Two years Met. Observers Course from Civil Aviation Presidency, in 1978.

Experiences:

- Working as a Chief of the Environmental Division, at Meteorological Environmental Protection Administration (MEPA) Eastern Province since 1992.
- Involved in combating the Gulf Oil Spill in January 1991 as a senior airborne observer.
- Worked as the MEPA Air Surveillance Coordinator (Observer) for Gulf Oil Response Team in June 1991.
- Participated in MEMAC workshop on Prevention, Control and Response to Marine Pollution by Oil and the Regional Contingency Plan held at Kuwait on May 4-6, 1986.
- Participated in "Marine Pollution Prevention Control and Response" Seminar at Jeddah in 1987.

Training:

- Advanced training in oil spill observation and trajectory projections.
- Advanced training in equipment development and clean-up method.
- Participated in the training course on the Vaisaia Sounding System in 1981.
- Participated in "Oil Spill Response Training Program" sponsored by NOAA and MEPA at research planning, Inc. USA.

Letter of appreciation:

- Received appreciation letter of the outstanding performance through the Gulf Oil Spill from National Oceanic and Atmospheric Administration (NOAA), US department of commerce in 1991.
- Received appreciation letter as an observer on overflights during Desert Storm Operation from International Maritime Organization (IMO), London.

P.O.Box:20443,
Al-Khobar- 31952

Mobile 055826582 / Pager 19909096
E-mail: ksr@dmm.naseej.com

Khaled S. Al-Rasheed

Work Experience

1990- Present

Ministry of Defence (MEPA) , Dammam

Environmental Observer / Site Supervisor

- Supervision of the day to day activities of the cleanup operation on the Arabian Gulf Oil Spill.
- Air, land and sea surveillance operations .
- Operation and maintenance of oil spill equipment .
- Beach assessment with international organizations (IUCN , IMO).
- Oil Spill Response Team member, and monitoring of environmental pollution in the Eastern Province of Saudi Arabia.
- Involved in the sampling and preservation of solid, sludge and liquid samples for complete range of analyses.

Education / Training

1987 — Al-Thgba High School Al-Khobar
Graduated, High School Degree.

1987-1989 — King Fahad University of Petroleum and Minerals.
13 months, Mechanical Engineering.

1989-1990 — Leeds Polytechnic U.K.
Diploma in Environmental Monitoring.

16-20 April 1994 — MEPA / NOAA Jeddah
Workshop on marine pollution prevention, control and response.

14-18 January 1995 — Environment Protection Council Kwait
Course on response to marine oil spills accidents for supervisors/On-scene commander.

12/11/1995 to 06/12/1995 — Ports Authority Dammam
Course in Anti Marine Oil Pollution.

K. AL-RASHEED 1/2

13-17 January 1996 IMO / GACMAO Bhahrain
Course on response for Oil Spills for supervision/ On-scene commander.

Special Skills

- Computer data logging.
- Very good knowledge of networking and PC's repairs.
- Co-author of a paper on the effects of the 1990-1991 Gulf War on Saudi Arabian prawn stocks.

Honors

- 4 appreciation letters from MEPA in the completion of some environmental projects.
- An appreciation letter from SAUDI ARAMCO for good cooperation in the Medical waste cleanup project.

Personal data

Born in Dammam, Saudi Arabia, April 22nd 1970
Married with two children (4 & 1).
Health – Excellent.

K.AL-RASHEED 2/2

Name : Yousef H. AL-Helal

Birth : 13-11-1966

Nationality : SAUDI

Marital Status : Married

Address : P.O Box 117 DHAHRAN INT Air Port ,
Dhahran, 31932 , Saudi Arabia

Position : member of Air quality team 1990

Qualifications :
High school degree
One year study at Leeds polytechnic and received Diploma in instrumentation
Completed three months certificate of a course of instruction in the operation and maintenance 9800 series Ambient Analyzers from United States
Completed three months in the data entry &word processing at ASSEFR institute in SAUDI ARBIA

Name : Al-Zawad , Hashim H.
Birthday : 01-01-1967
Nationality : SAUDI
Marital Status : Married

Address : P.O Box 117 DHAHRAN INT Air Port , Dhahran, 31932 , Saudi Arabia

Position : Member of Oil Spill Response Team, Environmental Protection Section in Eastern Province.

Qualifications :

- High school – Qatif Secondary School
- 2 Years study of Medical science at King Saud University.
- A 12-week English course , Leeds Polytechnic – England
- Diploma in Environmental Monitoring (Noise Pollution Management) at Leeds Polytechnic – England.
- 4 weeks Computer training course at Institute of Public Administration – Dammam.
- 3-days Workshop on Oil Spill Trajectory Modeling by NOAA & MEMAC – Bahrain.

1/2

HASHIM AL SAWAD

EXPERIENCE :

- PARTICIPATED WITH CIVIL DEFENSE IN COMBATING TOXIC GASES DURING THE GULF WAR
- PARTICIPATION IN AIR QUALITY MEASURMENTS AT KHAFJI AS EFFECTED BY THE GULF OIL SPILL .
- CARRIED OUT ADMINISTRATION ISSUES FOR OIL SPILL RESPONSE TEAM DURING GULF OIL SPILL.
- PARTICIPATION OF SOME OF THE COASTAL SURVEILLANCE ALONG EASTERN PROVINCE COASTS.
- PARTICIPATION IN INTIATING OIL SPILL REPORTS.
- PARTICIPATION IN COASTAL SURVEILLANCE OF OIL SPILL RECOVERY CENTRE AT JUBAIL.
- FULL OPERATION OF COMPUTER USING WORD PROCCESSING (WORD PERFECT, ARAB WORD).
- CARRY OUT MEPA ADMINISTRATION ISSUES.

2/2

Khalid Hussain Busbait

P.O.Box - 117, Dhahran Airport
Dhahran - 31932, Saudi Arabia
Tel: (03) 8576260 / 8575732
Fax: (03) 8576752 / 8575304

Nationality	:	Saudi	Date of birth	:	August 12, 1967
Marital Status	:	Single			

Qualification:

- Wroking as an Environmental observer at Meteorology and Environmental Protection Administration (MEPA), since 1990.
- One year English course at King Fahd University of Petroleum and Minerals, Saudi Arabia, and two years in college of Engineering (Applied Mechanical Engineering), 1985 - 1988.
- English course at Leeds Polytechnic, England, 1989.
- Diploma in Environmental Monitoring from Leeds Polytechnic, 1990.
- Diploma in Oil Spill Response from Research Planning, Inc. USA, 1994.
- Certificate in Manufacturer's Operation and Maintenance Course.
- Training in GT 185 Oil Recovery System.
- Hazardous waste management course at KFUPM, 1998.

Experiences:

- Participated with MEPA in environmental studies in Dammam, KSA.
- Participated in the Gulf War Oil Spill recovery and pollution control.
- Participated with air, land and sea oil spill surveillance operations.
- Assisted in issuing oil spill reports.

Khalid. Bustat

- Participated with oil spill planning committee.
- Attendance in Scientific meeting regarding the oil spill held at research institute (RI), KFUPM, Dhahran.
- Supervised the protection made for facilities along Saudi shore (power plant, desalination) during Gulf Oil Spill.
- Participated with the Japanese delegation on mangrove clean-up in Gurmah Island.
- Supervised oil spill warehouse during Gulf oil spill.
- Participated in the scientific experiment for salt marshes clean-up.
- Issuing final reports for Saudi shore facilities.
- Participated with NCWCD in the turtle study in Kuran Island.
- Participated with the international organizations in the environmental assessments.
- Participated in the IMO's 62nd session in London (May 23-28, 1993).
- Participated with the oil spill beach clean-up after the Gulf War.
- Participated in the facilities for protection of tarballs.

RESUME

Name : Bo-Hulaiqah , Qusay M.
Birthday : 6-11-1964
Nationality : Saudi
Marital Status : Married
Address : P.O Box 117 DHAHRAN INT Air Port ,
Dhahran, 31932 , Saudi Arabia
Psition : Member of Oil Spill Response ,
Environmental Protection Section ,
Eastern Province

QUALIFICATIONS :

High school - King Khaled Secondary school , Hofuf

104 credit hours (Systems Engineering)
King Fahd University of
Petroleum & Minerals (KFUPM) ,
Dhahran

A 12-week English course ,
Leeds Polytechnic – England

Diploma in Environmental Monitoring
(Waste Disposal Management) –
England

A 120-hour (Levels 1,2 & 3) French courses
The French Saudi Center , Dammam

A 5-day Workshop on Marine Pollution Prevention, Control & Response organised by NOAA & MEPA at Jeddah

A 2-week training curse in Anti Oil Pollution by The saudi Ports Authority

A 2-day workshop on Utilization & Conservation of Water & Soil for Desert Greening by The Joint Saudi – Japanese (RI , KFUPM & PEC)

EXPERIENCE

A Certificate of Appreciation for contribution & efforts during Desert Shield & Desert Storm from King Abdulaziz Air Base

A Certificate of Appreciation for contribution & efforts during Arabian Gulf Oil Spill Clean Up from MEPA & BECHTEL

A local membership in Saudi Section of Air & Waste management Association (SAS – A & WMA)

Curriculum Vitae

MOHAMMED ALI M. AL GHAMDI

ADDRESS

P.O. BOX # 30220
AL KHOBAR 31952
SAUDI ARABIA
TEL. # 03 - 8576260
FAX # 03 - 8576752

DATE OF BIRTH : 06 JUNE 1966

EDUCATIONAL BACKGROUND

SECONDARY : AL KHOBAR SECONDARY SCHOOL, SAUDI ARABIA SCIENTIFIC SECTION IN 1985.

CERTIFICATE IN METEOROLOGICAL OBSERVER : THE UNIVERSITY OF WYOMING, WYO, USA. IN JUNE 20, 1989 TO DEC, 20, 1990.

UNDERGRADUATE COURSE IN ELECTRONICS : TECHNICAL TRAINING INSTITUTE, INTERNATIONAL AIRPORT, DHAHRAN, SAUDI ARABIA. FROM 1987 TO 1988.

CERTIFICATE IN ENGLISH :
INTERNATIONAL LANGUAGE CENTERS, SUSSEX, LONDON FROM MAY 05, 1987 TO JUNE 05, 1987.

TRAININGS

AL- KHALEEJ TRAINING & ELECTRONICS
INDUSTRIES, AL KHOBAR, SAUDI ARABIA

* BEGINNING FOXPRO 2.5 FOR WINDOWS - APRIL 02, 1996
* BEGINNING DBASE V FOR WINDOWS - MARCH 27, 1996
* INTERMEDIATE MS EXCEL 95 - MARCH 17, 1996
* BEGINNING MS EXCEL 95 - MARCH 12, 1996
* BEGINNING MS EXCEL 5.0 FOR WINDOWS - MARCH 12, 1996
* BEGINNING / INTERMEDIATE MS DOS 6.2 - MARCH 04, 1996
* INTERMEDIATE MS WORD6.0 FOR WINDOWS- JAN. 29, 1996
* BEGINNING MS WORD 6.0 FOR WINDOWS - JAN. 27, 1996
* BEGGING MICROSOFT WINDOWS 3.1 - JAN. 21, 1996

* COMPUTER MADE EASY - JAN. 15, 1996

AMERICAN EXPRESS, BAHRAIN

* GOLD & PERSONAL CARD TRAINING PROGRAM - FEB. 11, 1993

SAUDI BRITISH BANK, TRAINING CENTRE, DAMMAM, SAUDI ARABIA

* UNIT LETTER COURSE - MAR. 19 to 22, 1998

* BASIC BANKING COURSE - MAR. 05 to 10, 1988

CITY OF GUILDS OF LONDON INSTITUTE, LONDON

* TELECOMMUNICATIONS TECHNICIANS - PART 1 - DEC. 18, 1986

US EPA - SAUDI ARABIA ARSAD PROJECT

* PRINCIPLES OF ENVIRONMENTAL ENFORCEMENT AND COMPLIANCE

EMPLOYMENT RECORD

* MINISTRY OF DEFENSE & AVIATION - METEOROLOGY & ENVIRONMENTAL PROTECTION ADMINISTRATION (MEPA)

NATURE OF POSITION - METEOROLOGICAL OBSERVER, FROM 08 NOV. 1997 TO 01 OCT. 1999. AND FROM OCT. 02, 1999 TO UNTIL PRESENT AS ENVIRONMENTAL OBSERVER

*	COMPANY	:	AL-FALAK ELECTRONICS COMPUTERS AND SUPPLIES CO.
	NATURE OF BUSINESS	:	COMPUTER SUPPLIES AND ACCESSORIES
	ADDRESS	:	AL-KOHBAR, KSA
	INCLUSIVE DATES	:	FEB. 01, 1996 to NOV. 1997
	POSITION	:	ACCOUNTS RECEIVABLE CONTROLLER
	INCLUSIVE DATES	:	NOVEMBER 1995 TO JANUARY 31, 1996
	POSITION	:	ACCOUNTING
*	COMPANY	:	AHMED HAMAD AL GOSAIBI & BROS.
	NATURE OF BUSINESS	:	MONEY EXCHANGE
	ADDRESS	:	AL-KHOBAR, SAUDI ARABIA
	INCLUSIVE DATES	:	1992 TO 1993
	POSITION	:	MARKETING REPRESENTATIVE
*	COMPANY	:	SAUDI BRITISH BANK
	NATURE OF BUSINESS	:	BANK
	ADDRESS	:	TRAINING CENTRE, HEAD OFFICE IN DAMMAM, SAUDI ARABIA.
	INCLUSIVE DATES	:	MRCH 05, 1988 TO SEPTEMBER 05,1988
	POSITION	:	GOLD & PERSONAL CARD REPRSNTATVE

PERSONAL DATA

MARITAL STATUS	:	MARRIED
NATIONALITY	:	SAUDI
LANGUAGE	:	ARABIC, ENGLISH.
HOBBIES	:	TRAVELLING, READING, SWIMMING AND CAMPING.

Curriculum Vitae

ADEL M. KUSTI

ADDRESS

P.O. BOX # 1358 (MEPA Eastern Province)
21431 (MEPA Headquarters)
Tel : # 02-6512-321, ex 2625, 2616 (MEPA Headquarters)
055-542-156 (Mobile)
Date of Birth : 1958 (Makkah)

EDUCATION

Graduated from King Abdoul Aziz University of Jeddah in 1982 with B.sc. in Biology and M.sc. in Ecology (range land management) from Bangor University of U.K.,1990.

EXPERIENCE

1- From 1982 until now working in EPGD (Environmental Protection General Department), MEPA
2- 1983 working for Nerows Oil Spill clean-up
3- Charge in Vol 6, 7, 8, 9, 10 and 11 in fauna of Saudi Arabia
4- From 1993-1996 working of research programs into wild life
5- From 1996-1999 working in the ESON Programe (Environmental Support of the Nomads) with expert from Arizona University, USA

ALAM NIZAMI

MEPA, P.O. BOX - 117
Dhahran Airport, Dhahran - 31932, Saudi Arabia
Tel: (03) 857-5732/6260 (Off), (03) 8653665 (Res.)
Fax: (03) 857-6752

PERSONAL DATA

Address in India

Ekhlaque Manzil
Surat ganj, Madhubani - 847211
Bihar, India
Tel: 91 6276 22377

Date of birth	:	December 21, 1964
Nationality	:	Indian
Marital status	:	Married
Religion	:	Islam

PROFESSIONAL EXPERIENCE:

April 1994 to-date: **Meteorology & Environmental Protection Administration (MEPA), Dammam, Saudi Arabia.**

Working as a Chemist in MEPA project of Dyna Arabia Co. Ltd., since April 1997.

Worked as a Chemist in MEPA project of Saudi Amoudi Group Co. from April 1994 to April 1997.

Responsibilities include the following:

Management of the MEPA Environmental Laboratory equipped with State-of-Art instrumentation such as Gas Chromatograph, Atomic Absorption Spectrophotometer, Total Organic Carbon Analyzer, UV-VIS spectrophotometer, Oil Content Analyzer & various others to operate the laboratory according to MEPA Environmental Protection Standard for the analysis of industrial effluent/wastewater, ground water, municipal wastewater and etc.

Treatment and disposal evaluation of the various types of waste generated from industries and making waste disposal decisions for implementation.

Participated in the sampling program of seawater, sediment and clams with the representatives of UN laboratory at Monaco to carry out the ROPME Contamination Screening Project.

Evaluation and recommendation of analytical results of industrial effluent/waste on the basis of MEPA Environmental Protection Standard submitted to MEPA by various companies located in eastern region of Saudi Arabia.

Extensively involve in the project *"The Study on an Environmental Assessment and Monitoring of Arabian Gulf in the Kingdom of Saudi Arabia"* with Japan International Co-operation Agency (JICA).

Provided training to employees on wet chemistry analysis and the analytical instruments.

Nov. 23, 1996 - Dec. 06, 1996: Royal Commission, Yanbu, Saudi Arabia

Worked as a Chief Chemist in Royal Commission (RC) laboratory at Yanbu. In this period submitted a proposal to RC Quality Control Manager on the management of laboratory, implementation of QA/QC procedures, a complete range of analytical procedure for the analysis of industrial wastewater, ballast water, drinking water etc., and the distribution of work load according to the qualification of technicians.

Jan. 1990 - July 1993: KFUPM Dhahran, Saudi Arabia.

Worked as a Research Assistant in Chemistry department at KFUPM, Dhahran. Responsibilities include: graded course assignment, taught freshmen chemistry 101 & 102 labs., proctoring exams., assisted professors in research activities and participated in seminars and other meetings scheduled by department.

April 1991 to May 1992: Research Institute, KFUPM, Dhahran, KSA.

Samples of sediment, soil, fish, oyster and seawater were prepared as well as analyzed for metal analysis. Analysis were performed through the extensive use of Atomic Absorption Spectroscopy (AAS) and Inductively Coupled Argon Plasma (ICAP), on part time basis, in Water Resources and Environmental Division, Research Institute, KFUPM, Dhahran.

Worked on the following King Abdulaziz City for Science and Technology (KACST) Projects at KFUPM, Dhahran, KSA.

"Investigation of the size of industrial waste in the industrial city of Jubail" at Research Institute, KFUPM, Dhahran.

"Studies on used lubricating oil recovery and re-refining" in oil testing center, chemistry department KFUPM, Dhahran

"Stability characteristics of liquid fuels" in oil testing center, chemistry department.

Dec. 1988 - Dec 1989: Aligarh Muslim University (AMU), Aligarh, India

Worked as a Research Scholar in chemistry department at AMU, Aligarh. During research program, involved in the extraction and synthesis of naturally occurring alkaloids as well as flavonoids from plants by using column chromatography. The crystalline extracts were identified by chromatographic and spectroscopic methods.

ACADEMIC QUALIFICATIONS:

King Fahd University of Petroleum and Minerals (KFUPM), Dhahran, KSA.

Master of Science (MS) in chemistry, GPA = 3.50/4.00, July 1993.

Thesis Title: "Chemical Aspects of Thermal Instability in Jet Fuel from Saudi Arabian Crude Oils".

MS Thesis works include the following:

PONA (Paraffin, Olefin, Naphthene and aromatic) determination by Gas Chromatograph (GC) in aviation turbine fuels (Jet fuel).

Carbon, Hydrogen, Nitrogen and Oxygen analysis by elemental analyzer in jet fuel.

ASTM and IP methods were applied for the examination of sulphur, mercaptan sulphur, peroxide number, gum existent, copper strip test, silver corrosion test, flash point, smoke point and various other test in Jet fuel.

Investigation of the composition, structure and mechanism of gum/sediment formation in jet fuel during long term storage, by using elemental analyzer, Fourier Transform Infra Red (FTIR) and mass spectrometry (MS).

Application of nuclear magnetic resonance (NMR) spectroscopy to chemical characterization of jet fuels and various fuel blends containing varying amounts of paraffinic and aromatic constituent with the help of computer programming.

Aligarh Muslim University (AMU), Aligarh, India.

M.Sc. in Chemistry with first class, 73.2 % marks, August 1988.

B.Sc. (Chemistry, Botany & Zoology) with first class, June 1986.

Intermediate (physics, chemistry, biology, mathematics and English) with first class from L.N. Mithla University, Darbhanga, Bihar, India, 1982.

High School with first class from Bihar Education Board, Patna, Bihar, India, 1980.

Supervised students in Senior project CHEM. - 411 at KFUPM, Dhahran.

Fuel degradation study by doping of standard fuels with nitrogen and oxygen containing compound.

Nitrogen compounds in petroleum fraction.

PUBLICATIONS:

M.F. Ali, A. J. Hamdan and A. Nizami, "Chemical Aspects of Thermal Instability in Jet Fuel From Saudi Arabian Crude Oils", Preprints, Am. Chem. Soc., Div. Pet. Chem., 76-94, 1994.

M.F. Ali, A. Nizami and A J. Hamdan, "The role of heteroatoms on the instability of jet fuels", Fuel Science and Technology Int.'L. 13 (5), 655 - 679, 1995.

COMPUTER SKILL:

Worked on FORTSYS & WSCRIPT software available on IBM compatible AMDAHL 5850 mainframe at KFUPM, Dhahran.

Used extensively the Microsoft word, Microsoft Excel, Microsoft Access, Word Perfect, Lotus 123 and many other PC packages.

Well experienced in use of Microsoft packages on Macintosh Computer.

PROFESSIONAL AFFILIATION:

Member, American Chemical Society (ACS)

HONORS AND AWARDS:

Research Assistantship	:	Ministry of Higher Education, Saudi Arabia.
Merit Scholarship in M.Sc.	:	University Grants Commission, 1986 - 1988, India.
Stood 3rd in order of merit	:	M.Sc. examination, Dept. of chemistry, AMU, Aligarh, India.

Jamal Kazim

Objective JICA REQUERED

Experience

1995–2000 Working

Oil Spill Response center / MEPA , Jeddah

- Response for Oil Spill Incident.
- Combating Oil Spill .
- Writing Report .

1986–1995 Working

Lab Analyst at K . F . U . P . M , Dhahran

- Sampling Fish and Plankton from Arabian Gulf .
- Sorting for Fish larvae and Fish egg .
- Writing Report .

Education

1981–1985 k.A.A. University, Jeddah

- B.Sc. in Marine Science Collage.

Interests For computers, running, swimming, collecting shells .

Curriculum Vitae

AHMED IBRAHIM AL DALOUJ

Mailing Address

Post Box # 239
Al Khobar - 31952
Saudi Arabia
Tel. # 03-8900720

Date of Birth : 22 January 1958

Present Occupation : Meteorological Instruments Technician

Present Employee : Meteorology And Environmental Protection Administration

Date of Commencing : 10 September 1981

EDUCATIONS :

* High School in 1976
* High Diploma in Electronics - 10 August 1981
* Eight weeks Course in Introduction to Computers an Basic Language - 1983
* Eight weeks Course in Introduction to Cover Language
* Five weeks Course in Cobol Language - 1990
* Three weeks Course in Met. Communication System - 21 June 1990
* Two Months Course in Met. Computer System - 20 October 1993
* Two weeks Course in Enhance Training Capability - 1994

Scope of Work :

Nineteen Years working with Meteorological Instruments and Systems such as :

1. Wind Speed and Direction Transmitters
2. Wind Speed and Direction Indicators
3. Anemograph

4. Thermohydrograph
5. Barograph
6. Psychrometer
7. Rain Gauge
8. Rain Recorder
9. Ceilometer
10. Sun Shine Recorder
11. Sun Radiation Recorder
12. Manned Data Collection System
13. Automatic Weather Stations
14. Seimens - 100 Teleprinters
15. Trends -800 Teleprinters
16. Receive only Teleprinters
17. Time Plexer (Communication)
18. Commaster
19. Pesely Weather Radar 43S
20. RVR System Impulsphysik (Runway Visual Reading
21. IBM PC and Compatibiles Hardware and Software
22. Upper Air Cora Systems
23. Upper Air Micro Cora Systems
24. Upper Air Digi Cora Systems
25. ASOS (Automatic Surface Observation Systems)
26. IMS (Integrated Meteorological Systems)

添付資料 B

フィールド調査に係る
技術移転関連資料

Health & Safety Plan
Chain-of-Custody Sheet
Field Record Sheet
Field Team Tutorials

SIGNED

JICA/MEPA PROJECT – STAGE 4 FIELD WORK - JUNE/JULY 2000

HEALTH AND SAFETY PLAN FOR VESSEL AND SHORELINE WORK

Field Team:

MEPA	JICA
Khaled Al Rasheed	Robert Hilliard
Khalid Busbait	Ike Tomohiko
Adel Qutsi	Sakaguchi Kozo

Equipment:

Mobile Phone (K. Busbait)
VHF radio (vessel)
First Aid Kit
Two torches
Water-resistant sun screen lotion (+15)
Cooler box with ice, bottle water and cool drinks (1-2 L /person/day)
Lunch boxes

Protective Clothing:

Hat with brim
Sunglasses (polaroids with 100% UV protection are preferable)
Loose long sleeve shirt
Shorts and trousers
Boat shoes
Note: cotton clothes are much better than nylon or other artificial fibres

Vessel Work Safety Meeting:

A "Vessel Work Safety Meeting" will be held prior to departure, including:

- Familiarise main features of vessel.
- Confirm location and type of Vessel Emergency Equipment for crew and workers (location/use of life jackets, fire extinguishers, radio, flares, etc).
- Confirm emergency communication & transport for serious injury or illness.
- Confirm Vessel Emergency Plan for 'Man Overboard', Fire and Collision/Sinking.
- Team to explain to vessel crew the project work procedures and requirements.
- Anchoring and Engine/propeller 'switch off' routine if workers go in water.
- Confirm preferred Entry and Exit points on vessel
- Confirm no fishing by crew when workers are in the water.

Assessment of Potential Injuries and Precautionary Actions:

Injury/Accident	Risk	Precautionary Action
Sun burn	High	Maximise shade use; use sunscreen cream regularly.
Heat exhaustion	High	Drink water regularly; take more salt than usual amount at mealtimes.
Heat stroke	Medium	Work slowly; do not ignore early symptoms (dazzling light, dizziness, headache, hot dry itchy skin)
Sea sickness	Medium	Take 1-2 motion tablets at least 1 hour before start. Avoid engine exhaust and small internal spaces; Move to rear (less motion); lie down; sip water and eat some plain food (biscuits, bread, apple) between bouts of sickness,
Slips and falls/	High	Move carefully; wear boat shoes.
Cuts and abrasions.	High	Use First Aid Kit promptly to clean skin cuts.

Potential Injuries and Precautionary Actions:
(continued from Page 1)

Injury/Accident	Risk	Precautionary Action
Rough weather	Medium	Stop work and wear life jacket if sea gets very rough.
Man overboard	Low	Maintain continuous visual contact with person in water. Shout 'Man Overboard' and point clearly with arm.
Boat fire or sinking	Low	Follow Vessel Emergency Drill and commands of skipper.

Brief Snorkelling Inspection of Shallow Seafloor (< 3m):

Minimum dress: T-shirt, shorts, socks, mask, snorkel, fins for rapid inspections (<10 minutes). For longer or frequent inspections, use long trousers or overalls to prevent sunburn.

Preferred dress: Bootees, diving knife, gloves, and lycra diving suit.

Winter dress: Neoprene wet suit, hood and gloves, with 2-4 kg wet belt.

Procedure:

* Confirm anchor is holding the boat.
* Engine switched off (skipper to remove ignition key, if present).
* Check site safety (vessel traffic, current, wave, visibility, water temp, etc)
* Deploy the international Diving Flag (Code "A"; white/blue).
* If there is a strong water current, also deploy a 10 m safety line and float from the stern of boat.
* Emergency visual, audible and/or rope signals to be confirmed before snorkeller/s enter the water (eg. 'Recall to boat' and 'Help Me' signals).
* At least two persons, including skipper or deputy skipper, to remain on boat. Always one observer on deck with no other job to distract.
* The observer must be ready to enter the water for rescue (ie. wearing suitable clothes for immediate water entry, with his mask and fins placed in a convenient position for immediate use).
* No fishing from boat before or during snorkelling operation.
* Snorkellers must use the 'buddy' system - always remain in visual contact with each other and the boat.
* Snorkeller/s to be tethered by a rope line if there is a low water clarity (>1 m) or a strong current.
* Snorkellers not to touch corals or fish.
* Remain alert for jelly fish.

SCUBA DIVING IS NOT PERMITTED FOR MEPA/JICA PROJECT

Use of Vehicles for Shoreline Sites:

Only MEPA approved vehicles and Saudi national drivers will be used by field team members.

Emergency Plan for Serious Injury:

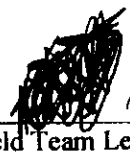
Offshore: Field team leader/deputy leader will coordinate with skipper for contacting nearest local hospital and MEPA (Dammam Office) for arranging appropriate transport.

Onshore: Field team leader/deputy leader will contact nearest local hospital and MEPA (Dammam Office), for arranging appropriate transport.

MEPA (Dammam) Office to immediately locate and inform JICA project team leader (or deputy leader if absent from Dammam).

CONFIRMATION OF H&S PLAN:

We have the read the above and agree to the requirements of the Health & Safety Plan:

NAME:	SIGNATURE:	DATE:
 Khaled S. Al Rasheed		10/6/2000
(Field Team Leader)		
 Bushart		10.6.00
(Deputy Field Team Leader)		
Rob Hilliard		10-6-00
Adel M. Kusti		10-6-00
Kozo Sakaguchi		10/6 00
Tomohiko Ike	T. Ike	10/6/00

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

No. Page : of

Date Sampled: 24-25/6/2000

Sampler: AC-RASHEED, Bustail, 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 / 16:30

Received at Laboratory by (Name) Alam Nizami

(Signature)

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

FIELD RECORD SHEET
MEPA/JICA PROJECT

Samplers name : Adil M Kusti

Site No.: H 2 **Location:**

GPS, DOP:	Latitude (N) : 26° 04.05	Longitude (E) : 50° 04' 95
Date 18/6/2001	Time 9.40	

Weather Condition

Weather	fine	Temperature (°C)	37.5	Cloudiness	0
Wind Direction	N/D	Wind Speed (m/s)	Calm	Wave height	< 0.1 m

Water Condition

Tide	middle low	Depth (m)	5.7
Current Direction	60	Current Speed (m/s)	

70 :9

Water Quality Surface

Temperature (°C)	30.7	Water Color	green
Salinity	59.09	Odor	N/D
pH	7.86	Sheen	N/D
DO (mg/l) 59-71.	3.08	Rubbish	
Turbidity (NTU)	6-6	Res. Cl (as Total)	0.15
Water Clarity (m)	5-7	Free	0.15

Bottom

30.16
60.55
7.91
64.51. 7.36
0.0

Sediment Quality

Sediment Color	—	Temperature (oC)	
Odor	—	ORP (mv)	
Texture	—		

Observations and Comments

FIELD TEAM TUTORIAL

Date: 2. July, 00
Title: Planning Sampling

(Planning with Navigation Charts and Satellite Position Fixing)

1) Sampling Site Selection

<Key Issues>

- 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

<Key Issues>

- Fluctuation of the Target contaminants
- Tides etc.

3) Number of Samples

<Key Issuess>

- Reliability
- Statistical analysis

4) Sample handling methods.

<Key Factors>

- Sample number check
- Storage
- Transport
- Delivery

Factors for selecting analysis method

1) Matrix of sample
2) Analysis parameter
3) Concentration of analyte, required detection limit
4) Number of sample
5) Equipment, apparatus
6) availability of chemicals
7) Budget/fund
8) experience of the method, skillful

ex. NH_3 in water sample

Method	equip	MDL (mg/l)	turnaround	cost
Titration	burette	5	medium	low
Phenate colorimetry	spectrometer	0.1	long	medium
Selective electrode	electrode	0.03	short	low
Flow injection analysis	FIA apparatus	0.002	short	high

Note: Reporting Detection Limit is not Method Detection Limit (MDL)

Factors for selecting outside laboratory

1) Reliability
2) Specialty
3) Cost
4) Location
5) Client focus, satisfactory response

Information needed to discuss with outside lab

1) Analysis parameter with matrix, sampling location
2) Number of sample/amount
3) Container with preservative
4) Minimum level for reporting
5) Analysis method
6) Time limit for reporting
7) Analysis request sheet (chain of custody sheet)

1) Matrix of sample:

wastewater, seawater, sediment, waste, air

2) Parameter, Analyte:

Physical: TSS, Salinity, Conductivity

Inorganic: N, P, Cyanide

Metals

Organic

Microbiological

3) Concentration of analyte:

minimum level for reporting comes from some standard or target value for research programs

4) Number of sample

5) Equipment, apparatus:

GC, AAS, SP

6)availability of chemicals

7) Budget: should be related sample amount

8) experience of the method, skillful

Ammonia analysis: distillation is needed to separate from interference; some metals

titration[1]: simple procedure but need skillful to find out the end point on titration, slow start sharp change

NH3 is collected into boric acid and then is titrated with HCl

colorimetry[2]: certain and easy to detect, need several chemicals and SP

indophenol-blue

electrode[3]: more easy than others, need sufficient care for the electrode; delicate

FIA equipment: principal is same as colorimetry, automatically, most sensitive

Turnaround: the time needed for analysis operation

Cost: initial and running, chemicals and labor cost

---

[1] A process by which a substance to be measured is combined with a reagent and quantitatively measurement. Ordinarily, this is accomplished by the controlled addition of a reagent of known concentration to a solution of the substance until reaction between the two is judged to be complete; the volume of reagent is then measured.

[2] The solutions of many compounds have characteristic colors. The intensity of such a color is proportional to the concentration of the compound. The spectrophotometer measures the intensity of visible light after passing through a sample.

[3] Use the gas-sensitive electrode, a type of ion-selective electrode, to measure the NH3 gas.

Detection limit for reporting

Precision of measurement; signal/noise ratio

Contamination on the method, blank measurement

Sensitivity of the equipment

Size/amount of the sample

Selecting for outside lab

1) Reliability: meet with lab manager, refer to their service specification, responsibility of work

2) Specialty: each lab has their strong/weak point

3) Cost: cost performance, cooperative to negotiate

4) Location: close to the sampling site or our office

5) Client focus, satisfactory response: do as what we want to do

Information needed to discuss with outside lab

1) Analyte with matrix, sampling location

2) Number of sample/amount

3) Container with preservative → sample management

Volume: suitable amount for each analysis method

Container: adequate container for each compound

Preservation:

to prevent the compound from changing caused by chemical, biological affection

changes caused by growth of microorganisms are greatly retarded by keeping the sample at low temperature (4°C ± 2°C) and dark

for Cyanide, to avoid forming HCN gas from the sample, alkalize the sample to a pH above 12

metal ions are subject to loss by adsorption or ion exchange with glass wall

to minimize precipitation and adsorption, acidified with nitric acid to a pH below 2

to fill the container, except for VOCs and DO, leave an air space approximately 1% of container volume to allow for thermal expansion during shipment

Holding time means maximum storage time recommended

4) Minimum level for reporting

5) Analysis method

6) Time limit for reporting

7) Analysis request sheet (chain of custody sheet)

添付資料 C

ラボ分析業務に係る
技術移転関連資料

Laboratory Management Plan
Health & Safety Plan
Inventory Sheet
List of Chemicals
List of Glassware/Apparatus
Instrument Operation Manuals
List of Analysis Methods
Sample Management Plan
COC Sheet
Reporting Forms
Waste Treatment/Disposal Plan
Daily Report of Laboratory Work
Data Sheets (example)

Laboratory Management Plan
(Fundamental Plan)

To establish a reliable laboratory for environmental monitoring of Arabian Gulf, it is recommended to implement the following measures.

(1) Organization

To carry out the sample analysis for continuous monitoring program, following staffs should be arranged by MEPA (these numbers depend on the monitoring plan). Specification and documentation of authority, responsibility and interrelation of all laboratory personnel are very important to assure the quality of chemical analysis. Existing laboratory staff shall be trainers for new laboratory person therefore they should be kept hired for more several years.

Sections	Number of personnel		Roles
	Experts	Assistants	
Laboratory Manager	1		Overall Management of the Laboratory, Analysis Planning, Data Management and Quality Control of Analytical Works
Wet Chemistry	1	(1)	TSS, NH3, TKN, T-P, CN, Phenol
Trace Metals	1	(1)	Metals
Organic Analysis	1	(1)	TOC, Oil & Grease, BTEX
Biochemical	1	(1)	Coliform, Chlorophyll

It is recommended to assign a pair of person for equipment maintenance.

(2) Education and Training System

To learn and maintain the up-to-date technologies for chemical analysis, laboratory management, and 'health & safety', MEPA should provide opportunities to attend the education and training programs to be held by proper organization (e.g. ROPME, RCJY, SWCC and JICA) to lab personnel. Lab manager should prepare the schedule of education and training of lab staff. Close relationships with other reliable laboratories and university are also important.

(3) Restrictions

An access of unauthorized persons to laboratory should be prohibited more strictly. The use of measurement instruments by not trained persons should also be prohibited. (refer to Laboratory Health & Safety Plan)

(4) Cleaning of Laboratory

Good system to keep the laboratory clean should be made to prevent or minimize the contamination. The use of detergent and cleaner that contain chemicals with adverse affects on the results of chemical analysis should be prevented. (refer to Laboratory Health & Safety Plan)

(5) Register of Equipment

The laboratory should provide the list of measurement instruments to perform the laboratory works correctively. The following information should be recorded in the list. (refer to Inventory Sheet)

(a) Name and ID number
(b) Date of purchase/installation
(c) Name of manufacturer
(d) Name of vendor
(e) Results of calibration
(f) Detail maintenance record
(g) History of any damage, malfunction, modification or repair

(6) Maintenance of Equipment

All equipment shall be properly maintained. Periodical maintenance shall be executed based on the maintenance manual supplied by manufacture. In case that instrument is broken or suspect result is obtained, the reason of the trouble (e.g. overloading or miss-operation) shall be clearly identified. At present, the following equipment needs periodical maintenance. (refer to Inventory Sheet)

Gas Chromatograph	Shimadzu GC 17A
Atomic Absorption Spectrometer	Varian spectra 220
TOC analyzer	Shimadzu TOC5000A
Spectrophotometer	Shimadzu UV1240
pH meter	Metrohm 744
Oil Contents meter	Horiba OCMA300
Autoclave	ALP Japan KI30S
Centrifuge	LIG
Water Purification	Milli-Q "Academic"
Balance	Sartorius

(7) Inventory system of chemicals and glassware/apparatus

Lists of chemicals, gases and other consumable goods should be provided. Since it takes long time to purchase some of them in Saudi Arabia, it is important to have an appropriate volume of inventory. Remaining volumes of them must be checked periodically, and required goods should be purchased prior to run out. The proper inventory control of glassware/apparatus is also essential to maintain continuous analysis work. (refer to List of Chemicals and Glassware/apparatus)

(8) Instrument operation manual

It is recommended to provide the instruction sheet on the use and operation of all instruments based on the operation manual of manufacture to perform the analysis works correctively. According to the operation manual or instruction sheet, every instrument must be calibrated periodically. (refer to Operational Manuals)

(9) Analysis Methods and Procedures

The laboratory should provide standard procedure for each analysis, and analysis must be made based on the standard procedure. The procedure of report making should be included in this standard procedure. The standard procedure should be prepared based on the authorized procedures including the following manuals.

"Methods for Chemical Analysis in Waters and Waste", US.EPA-600/4-79-020
"Standards Methods for the Analysis of Water and Wastewater", 20th edition
"Manual of Oceanographic Observations and Pollutant Analyses Methods" (MOOPAM), 3rd edition, ROPME

All standards, manuals and reference data relevant to the laboratory works shall be maintained up-to-date and readily available to the staff. (refer to List of Analysis Methods)

(10) Sample management

The laboratory shall establish appropriate manuals for sample management including sample handling, storage and identification system.

Proper sample containers, sample volumes, preservatives, and holding times are essential to provide reliable data. The laboratory shall provide the sample management plans by referring the manuals mentioned in above (9). (refer to Sample Management Plan)

(11) Sample custody

It is essential to ensure sample integrity from the time of sampling through analysis and final disposition. Chain-of-custody procedure is useful for routine control of sample flow. Prior to shipping samples, all documentation must be ready for proper chain of custody. Chain-of-custody record includes the information below: (refer to Chain-of-Custody Sheets)

- Sample description
- Sample type
- Sampling date and time
- Name of sampler
- Sample containers, preservatives

After receiving the samples, laboratory manager should put ID number on each sample to conduct analytical works smoothly.

(12) Reporting system

Test results carried out by the laboratory shall be reported accurately, clearly and objectively, in accordance with the standard procedure mentioned in the above (9). The results should include all information necessary for the interpretation of test results and all information required by the method used. The report shall include the following information: (refer to Analysis Report Forms)

- Title
- Name and address of laboratory
- Identification of the report
- Description of the test item (parameter)
- Date of sample received
- Date of performance of test
- Test method used
- Measurements, examinations and derived results
- Signature and title of the responsible person

The process of transforming raw analytical data into a finished report shall involve mathematical modeling of the standard calibration curves, statistical analysis of acquired data, calculations procedure by taking into account of dilution (or condensation) factor.

(13) Waste management procedure

The laboratory shall provide a waste management procedure for the prevention of environmental pollution to be caused by chemicals or organic solvents in the wastes. The laboratory shall stores the wastewater containing organic solvent, oil and heavy metals are stored in separate containers and entrust the waste treatment contractor. (refer to Waste Treatment/Disposal Procedure)

(14) Health and Safety procedure

The laboratory staff should make effort to protect their health and be safe from accident. The use of goggles and gloves are recommendable for the protection of eyes and hands, especially in case that strong acid or alkali is used. In case that organic solvent is used, operation should be done in the hood with draft. For the protection of body, work wear or laboratory coat should be used. (refer to Laboratory Health & Safety Plan)

(15) QA/QC procedure

Maintenance and evaluation of instrument efficiency

- Standard solution to be used for preparation of calibration curve
  - Standard solutions made by reliable laboratory or company must be purchased or they must be prepared in the laboratory based on the standard procedure.
  - Standard chemicals with high purity (analytical grade) must be used for the preparation of standard solution.
  - Standard solution should be stored properly.
  - The maximum holding time for each standard solution should be defined.
- Pretreatment/condensation
  - These procedures must be made based on the standard operation procedure.
- Adjustment of analytical equipment
  - Periodical calibration of measurement instruments is very important.

Evaluation of credibility for measurement result

- Detection limit
  - The laboratory must define detection limit of each parameter.
  - In case that result of analysis is smaller than detection limit, it must be reported as "less than detection limit (e.g. less than 0.1 ppm or '< 0.1 ppm')".

- Blank test
  - Blank test should be made as much as possible in parallel with sample analysis.
  - Whenever new reagent is used, blank test must be made.
  - When unexpected high concentration of some parameter is measured, blank test must be made.

- Repeat measurement
  - Analysis of duplicated samples or repeat analysis of same sample is useful for assessing precision of analysis.
  - When unexpected result of analysis is obtained, analysis of same sample should be done again. In this sense, enough amounts of sample for repeat measurement is recommendable.

- Check on sensitivity of measuring instruments
  - Calibration of measurement instruments should be made periodically.
  - If sensitivity of some instrument fluctuates widely, daily check of sensitivity is required.

- Spike and recovery test
  - In environmental analysis, process such as solvent extraction and distillation are widely used. Spike recovery test by adding known amount of substances (target of measurement) is useful for assessing an accuracy of the analysis.
  - This test is useful to assess the matrix effect.

- Cross-checking
  - Cross-checking with other expert analyst or reliable laboratories should be made periodically to check the precision of analysis.

Data control and evaluation

- Reliability of samples
  - Representative sample must be taken at sampling point.
  - In case that suspect result of analysis is obtained, re-sampling and analysis of it shall be made.

- Treatment of abnormal data and lack of data
  - In case that abnormal data is obtained, the reason of such result must be checked. If enough amount of same sample is available, it must be analyzed again.
  - If result of the second analysis is also abnormal (abnormally high), re-sampling should be made.
  - If analysis result of newly collected sample is abnormally high, the result must be reported to the general manager of MEPA. The general manager must inform the result to relevant organizations, and take appropriate measures to find the polluter.

- It is anticipated that no data is obtained due to accidents. MEPA should provide the standard procedure for such case.

- Recording of measurement operation
  - Results of analysis including raw data must be kept for an appropriate period (e.g. 5 years)
  - The result should be recorded on table and chart by sampling points and by parameters.

(16) Internal inspection

To secure the proper operation and management of the laboratory, a system to inspect the operation and management of laboratory should be provided. MEPA should nominate three persons in charge of inspection, and the nominated persons shall visit the laboratory periodically for observation and discussions with laboratory personnel. One or more of them should be a person with technical background of laboratory works. If such person is not available in MEPA, specialist in this field shall be hired from outside as a technical adviser. In case that some troubles are observed or informed, discussions between general manager of MEPA, inspectors and laboratory manager shall be held to solve the problems.

HEALTH & SAFETY PLAN

For Laboratory Works

In order to carry out the laboratory works in health and safety, lab staff should keep the following rules:

Tidiness

- Keep the laboratory clean and tidy. Before starting lab work, wipe your bench and equipment that will be used.
- Cleaning must be done by lab technician or qualified person. Janitors under the supervision of lab manager or lab technician, however, can do regular cleaning of floor and table.
- Do not leave obstructions in the passages.
- Do not leave dirty apparatus around the sink.
- When a job is finished, wash used glassware and dispose chemicals properly or arrange to store all chemicals – other than those in standard reagent bottles – and leave your bench empty.
- When a job is finished, do not leave dirty apparatus in the laboratory.

Self-protections

- Wear laboratory coat or work wear in laboratory to avoid staining or eroding your skin or clothes. For the same reason, shoes are needed in laboratory to protect your toe.
- Wear eye protection devices, such as goggles or safety glasses, when there is the slightest risk of splashes or flying particles reaching the eyes.
- Safety gloves and fume cupboard should be used at the time of handling toxic/dangerous substances.
- In anticipation of chemical splashes on your body or in your eyes, you must know where to find and how to operate the emergency shower and eyewash.

Sulfuric Acid and other corrosive liquids

- During the period of diluting concentrated acid, remember always to pour the acid slowly into cold water well stirred in an open basin beaker. **Never pour water into concentrated sulfuric acid.**
- Do not store acids and similar materials on high shelves or in a hot place.
- Wear eye protection and the appropriate protective clothes.

Forethought

- Before you start a new experiment, ask yourself or lab manager whether it is exactly the same as one that you have done. If there is anything new, there must be possibilities to happen unexpected issue.
- Do not alter the details of an installation without very carefully thinking out what the possible consequences may be caused.
- Manager should give enough information and precautions prior to order of new experiment or work.

Spillage

- Mop up at once when water or chemicals are spilled on the bench or floor.
- If the spillage contains any chemicals, ask lab manager how to treat it.
- If mercury is spilt it must be removed immediately, since mercury escape as vapor easily.
- In case of the spillage of large quantities of sulfuric acid or organic solvent, special adsorbent or absorbent can be used. Ask manager for treatment.

Waste materials

- Do not pour into the sinks large volume of solvent, heavy metals and inflammable liquids.
- Refer the procedure of waste treatment.

Labels

- See that bottles containing reagents are clearly labeled.
- Keep the adequate labels on sample containers.

Glassware

- Examine all glassware for defects before carrying out any experiments and washing.
- Do not carry a glassware (bottles, flask, etc.) by the cap or neck, since it may slip or break off.
- Make sure that any vessel you are going to carry is clean on the outside and your hands are dry and not oily.
- Do not rapidly heat or cool thick-walled or normal glass apparatus. They will crack under such treatment.

Electrical Circuit

- Ensure that all resistance, cables and terminal arrangements are capable of carrying the desired current without overheating.
- All switches, sockets and terminal connections must be made correctly and firmly.

- All high voltage electrical equipment should have good earth connections. The handling of such equipment should be avoided in wet conditions.
- When pull out the electrical plugs, do not pull the electrical cord, but plug itself.

Fume Chamber

- Do not carry out on the open bench experiments likely to result in the generation of poisonous or unpleasant vapor/fumes, but work in a fume chamber.
- Make sure that the ventilation system is in order before use.

Fire

- Each room should be provided with fire extinguishers.
- Know the locations of the fire extinguishers and how to operate them.
- Do not use water unless you know it is safe to do so, electricity turned off, no organic liquids involved, and no chemicals that react dangerously with water.

Notice

- All warning and danger notices should be posted appropriate locations.

Eating and Smoking

- Eating and smoking are strictly forbidden in laboratory.

First-aid

- When chemicals adhere to skin or reach eyes, wash with running water for at least 15 minutes. During washing, call the lab manager and get instructions.
- In any case of poisoning, summon first-aid and a doctor. Speedy action is essential in poisoning cases.
- In case of burn, cool the burned area with running water or ice chilled water for at least 15 minutes.

Inventory of Equipment

No. _____

Name of Equipment	Maker	Model/Type	Reference Number

Date of Purchase		Purchace Price	
Vendor (contact point)			

Specifications

Accessories

Instruction Guidebook	Keeping place

Inspection/Repair record

Details	Date	Signature

List of Chemicals (1/2)

	Chemicals	Unit	Q'ty	note	stock	Date
A	Acetic Acid	1 L	1	glacial		
	Acetone	2.5 L	1			
	Amidosulfuric Acid	100 g	1			
	Ammonium Amidosulphonate	100 g	1	sulfumic acid		
	Ammonium Chloride	1 kg	1			
	Ammonium Hydroxide	2.5 L	1	30%		
	Ammonium Iron(III) Sulfate-6H_2O	500 g	1			
	Ammonium Molybdate-4H_2O	250 g	1			
	Ammonium Sulfate	1 kg	1			
	4-Aminoantipyrine	25 g	1			
	APDC	25 g	1			
	Ascorbic Acid	100 g	1			
C	Chloramine T	1 kg	1			
	Chloroform (for spectrometry)	1 L	1			
	Copper Sulfate-5H_2O	1 kg	1			
D	2,6-Dimethyl-4-Heptanone	1 L	1			
	Dipotassium Hydrogen Phosphate	1 kg	1			
E	EDTA-2Na	1 kg	1			
	Ethanol	2.5 L	1			
F	Fluorobenzene	100 g	1			
H	Hydrochloric Acid	2.5 L	1	37%		
	Hydroxylamine Hydrochloride	100 g	1			
I	Iron(III) Sulfate-7H_2O	1 kg	1			
M	Magnesium Carbonate	500 g	1			
	Magnesium Oxide	250 g	1			
	Mercury(II) Sulfate	100 g	1			
	Metacresol Purple	5 g	1			
	Methanol	2.5 L	1			
	Methanol (GC grade)	1 L	8		2	
	Methyl Orange	100 g	1			
	3-methyl-1-phenyl-5-pyrazolone	25 g	1			
	MIBK	500 g	1			
N	N,N-Dimethyleformamide	500 ml	1			
	Nitric Acid	2.5 L	4			
P	o-Phenanthroline-H_2O	25 g	1			
	Perchloric Acid	2.5 L	1			
	Phenol	1 kg	1			
	Phenolphthalein	100 g	1			
	Phosphoric acid	2.5 L	1			
	Potassium Dichromate	1 kg	1			
	Potassium Dihydrogen Phosphate	500 g	1			
	Potassium Hexacyanoferrate(III)	500 g	1			

List of Chemicals (2/2)

	Chemicals	Unit	Q'ty	note	stock	Date
	Potassium Hydrogen Phthalate	500 g	1			
	Potassium Iodate	500 g	1			
	Potassium Iodide	1 kg	1			
	Potassium Permanganate	1 kg	1			
	Potassium Peroxodisulfate	500 g	1			
	Potassium Sulfate	1 kg	1			
	4-Pyridinecarboxylic Acid	100 g	1	Isonicotinic acid		
S	Silica Gel 60-200 mesh	500 g	2			
	Sodium borohydride (SBH)	100 g	1			
	Sodium Chloride	1 kg	1			
	Sodium Cyanide	5 g	1			
	Sodium Hydroxide	1 kg	3	97%		
	Sodium Hypochlorite	1 L	1			
	Sodium Pentacyanonitrosylferrate(III)-2H_2O	25 g	1			
	Sodium Peroxide	500 g	1			
	Sodium Sulfate	1 kg	1	anhydrous		
	Sodium Thiosulfate	500 g	1			
	Starch, soluble	500 g	1			
	Sulfamic Acid (for general use)	100 g	1			
	Sulfamic Acid (standard material)	500 g	8			
	Sulfuric Acid	2.5 L	4	95 - 98%		
T	Tartar Emetic (Antimony Potassium Tartrate)	5 g	1			
	Tin(II) chloride-2H_2O	100 g	1			
	Tri-n-octylamin	25 ml	1			
U	Urea	1 kg	1			
	Standard Chemicals					
	Buffer solution (pH = 4)	1 L	1			
	Buffer solution (pH = 7)	1 L	1			
	Buffer solution (pH = 9)	1 L	1			
	As standard solution	100 ml	2			
	Cd standard solution	100 ml	2			
	Co standard solution	100 ml	2			
	Cr standard solution	100 ml	2			
	Cu standard solution	100 ml	2			
	Hg standard solution	100 ml	2			
	Mg standard solution	500 ml	1			
	Ni standard solution	100 ml	2			
	Pb standard solution	100 ml	2			
	V standard solution	100 ml	2			
	Zn standard solution	500 ml	1			
	BTEX standard solution	1 ml	3	from Japan	2	

Glassware/Apparatus (1/2)

Date: _____

Material	Specification	Q'ty	Note
Glassware			
beaker, low form	250ml	10	
beaker, conical	150ml	20	
beaker, conical	250ml	30	
beaker, conical	500ml	10	
tall beaker	250ml	10	
Erlenmeyer flask	100ml	10	
Erlenmeyer flask	500ml, with stopper	10	
Erlenmeyer flask	100ml, with stopper	10	
volumetric flask	100ml	15	
volumetric flask	200ml	6	
volumetric flask	250ml	10	
volumetric flask	50ml	10	
evaporating dish	45ml	20	
measuring cylinder	100ml	10	
measuring cylinder	500ml, with stopper	6	
Kjeldahl flask	300ml	6	
centrifuge tube	15ml test tube with stopper	10	
separating funnel	spherical, 1000ml	6	
separating funnel	conical, 250ml	10	
separating funnel	conical, 500ml	10	
test tube	pyrex, 25ml with stopper	6	
test tube	pyrex, 50ml with stopper	15	
test tube	195ml, with stopper	10	
test tube	54ml, with stopper	30	
watch glass	80mm, dia.	20	
watch glass	200mm dia.	5	
digesting bottle	Duran, 100 ml	10	
reagent bottle	glass, 500ml	10	
Apparatus			
Bunsen burner	LPG	1	
LPG gas cylinder	25 lbs.	1	
tubing for burner	8mm bore, 10 m	1	
nickel crucible	25ml	40	
ignition crucible	12 ml	60	
crucible tongs	bow type	1	
filter paper	GF/B, 47 mm	100	
filter paper	GF/A, 125mm	100	
filter paper	Whatman No.40, 125mm	200	
funnel, glass	60 mm dia.	20	
glass cell for spectrophotometer	10 mm	4	
quarts cell	10 mm	4	
glass cell for spectrophotometer	50 mm	4	
quarts cell	50 mm	4	

Glassware/Apparatus (2/2)

material	specification	Q'ty	Note
micro syringe	1 μ l	2	
pippte filler	three valve	3	
pippte vulve	PVC, 15 ml	10	
agate mortar, with pestle	7cm dia.	1	
porcelain mortar, with pestle	100ml	5	
porcelain desiccator plate	190 mm	5	
vacuum filtration funnel (holder)	for 47mm membrane	1	
wash bottle	500 ml	12	
dropping bottle	60 ml	10	
burette clamp	for 11-14 dia rods	1	
stand clamp	holding 1-75 dia item	10	
retort stand base	200 x 125 mm	5	
steel rod	12.5 mm dia, 600 mm	5	
tweezzers	102mm	3	
weighing paper	4 x 14"	5	
PTFE stopcock burette	10 ml	1	
stainless funel	200mm dia.	2	
tray	ABS	5	
brush		10	
brush		10	
sieves, mesh size 10,20,40,60,80 &	100 mm dia, with brush	2	
Sampling Container			
glass bottle	1000 ml	60	
glass bottle	500 ml	60	
glass bottle	500 ml, wide mouth	60	
glass bottle	250ml, with PTFE liner cap	50	
polyethylene bottle	2000 ml	50	
polyethylene bottle	1000 ml	100	
polyethylene bottle	500 ml	100	
cooler box	Igleo, 50 liters	5	

Operational manual (Atomic Absorption Spectrometer)
Varian AA220

[Start up]
(1)check drain tank.
if it is almost full, dump solution into "metal waste tank".
(2)switch on AAS.
The switch locates on the left of the machine.
(3)switch on the exhaust system and air compressor.
The switch locates on the left sidewall.
(4)turn on the computer.
The switch locates on the center of computer.
(5)start up the control system.
Double click the icon "SpectrAA 220" in the display.
(6)click "work sheet".
"Load Worksheet" will be shown.
(7)click "New from".
"New Worksheet from Worksheet" will be shown.
(8)select proper worksheet, and click it and click "ok"
"Name Worksheet" will be shown.
(9)type name and click "ok"
in general date should be put in "Name"
(10)click "Select"
select elements and number of sample
black frame is selected (measured)
(11)click "Select"

[Optimization of measurement condition]
(1)click "Optimize"
"Optimize" will be shown.
(2)select element and click "ok"
"Flame Optimization" will be shown.
"Analysis checklist" will be shown.
Click "ok"
Wait until green bar will be shown.
(3)arrange the lamp position
set 2 knobs on the back of lamp holder in order to get highest intensity.
(green bar shows the intensity)
if intensity becomes over the range, click "Rescale".

(4)arrange the burner position

remove burner front cover

use name card, move burner to be set the burner slit will be just above the light pass.

put front cover back

(5)open gas cylinder

(6)turn on flame

push the flame switch, which is located just above the main switch.

(7)adjust the burner height

click "Optimize Signal"

for optimization, use proper solution that contains the measured element

move knob to get the highest intensity

white bar shows the signal.

(8)click "ok"

(9)click "Cancel"

(10)start measurement

click "start"

follow the direction of PC

(use MilliQ water for equipment zero)

(11)if there is more element(s)

confirm "prepare instrument zero" is shown

and click "Cancel"

(12)if different lamp is used for next element, turn off burner and go to (1), or go to (7)

[Print out the result]

(1)click "exit"

(2)click "Return to Main Index"

(3)click "Reports"

"Reports" will be shown.

(4)select worksheet

(5)click "Next"

(6)select element(s)

selected element(s) is shown in blue

(7)click "Next"

(8)click "Next"

(9)click "Print Report..."

"Print" will be shown.

(10)click "ok"

(11)click "Close"

main index will be shown.

[Shut down]

(1)at main index, click "Exit"

"confirm" will be shown.

(2)click "Yes"

(3)turn off main switch of AA

(4)turn off exhaust

(5)close gas cylinder valve

(6)shut down computer

Operational manual (Gas Chromatography)

Shimadzu GC 17A

[Start Up]

1. Air Compressor ON
2. after air pressure comes up (> 50 kPa), turn on GC-17A
3. CBM-101 ON, Computer ON
4. GC System ON
   1) [Main Menu] open
   2) [Real time analysis]
   3) [Method file] - load: BTEX.MET
   4) Helium gas open
   5) Click System ON
   6) Wait until setting temperature comes up (see GC monitor)
5. FID Ignition ON
   1) Hydrogen gas open
   2) Click Flame ignition
   3) Wait until the baseline settled

[Start an Analysis]

{using Sample Login}···for few samples or optimize the analytical conditions

{using Sample Schedule}···for many samples or using an auto sampler

1. select 'Sample Schedule' on 'Real Time Analysis'
2. input parameters directly or using 'Edit Parameters'

   Vial #
   Sample Name
   Sample ID
   IS (internal standard) Amount
   Sample Amount
   Dilution Factor
   Injection Volume
   # of Injection
   Data File

   (IS (internal standard) Amount, Sample Amount, Dilution Factor, Injection Volume) ─ controlled by Headspace sampler

   Type → input 'U' for unknown sample, 'S' for standard sample
   Method File → select by click the file from 'File' menu
3. Set the samples (vial bottles) in the headspace auto sampler – outside first
4. Start the Analysis – click 'RUN'

[Shut Down]

1) [Method file] - load: Shut.MET
2) Hydrogen gas shut
3) Wait until the temperature comes down (at least column temp. < 50°C)
4) Click System OFF
5) Helium and Air shut
6) Turn off Computer, CBM off, GC off

[Quantification]

{make a Calibration Curve}

1.Set the Method File

'Setup' – Data Processing Ch# – Quantitation

Calculated by	→ Area
Method	→ Internal Standard
Curve Fit Type	→ Least Square Method
Calibration Level	→ 3
Window/Band	→ Widow

2.Create ID Table

1) 'Load' existing Data File (chromatograph) for the same parameters
2) enter the component name, retention time and concentration of each peak
   - set Conc. in order of concentrations
   - fill in the internal standard in the row of ID No.1, Conc.→ 1

3.Set 'Sample Schedule' using the method file

- the Type of sample should be 'S' for standard sample
- samples which are set to Type 'U' are quantitated based on the calibration

4. Click 'RUN'

{using Post-Run Analysis}

1. Select "BATCH"
2. File – Load Data Files:

   select the data files for Calibration Curve and Sample Analysis Data

3. Batch Schedule – click Method Name
4. Data Processing – confirm or change the method
5. Click 'RUN' → print out

Daily operational manual

TOC-5000 (sea water measurement)

(start up)

1. open gas (zero-air) cylinder.
   confirm gas pressure (500 – 600KPa).
2. turn on main power switch (on the left side of machine).
   confirm carrier gas flow (150 ml/min.).
3. push "F1" (next).
   display will go to "MAIN MENU".
4. push "3" and "ENTER".
   display will go to "GENERAL CONDITIONS".
5. confirm next items.
   "TC CATALYST" is "1" (1=NORMAL).
   "SYRINGE SIZE" is "1" (1=250).
   "CELL LENGTH" is "1" (1=STD).
   "TOC OR SSM" is "1" (1=TOC).
   if some of these items are different, enter proper number and "ENTER".
6. change furnace condition.
   at "FURNACE ON/OFF", enter "1" (1=TOC) and "ENTER" to turn on furnace.
7. push "F2" (MAIN MENU).
   display will go to "MAIN MENU".
8. push "2" and "ENTER".
   display will go to "SAMPLE MEASUREMENT/CONDITIONS".
9. confirm "1st CAL CURVE #" and "NPOC" is "6", if not enter "6" and "ENTER".
10. confirm next items.
    "RANGE" of "NPOC" is "30".
    "INJ VOL" of "NPOC" is "50".
    "SPARGE TIME" of "NPOC" is "15".
    "NO OF INJECTS" is "2".
    "MAX NO OF INJ" is "3".
    if not, enter proper number and "ENTER".

leave equipment approx.30min., until the ready lamp will come on.

(sample measurement)

11. push "F1".

display will go to "MEASUREMENT START".

12. set sample.

13. push "START/STOP".

measurement will be implemented automatically.

14. confirm "COMPLETE" is blinking on the display.

15. if there is no more sample to be measured, go to 19.

16. change sample.

17. push "F1" (NEXT).

display will go to "SAMPLE MEASUREMENT/CONDITIONS".

18. repeat 11 To 15.

19. push "F2" (END).

display will go to "MAIN MENU".

(shut down)

1. enter "7" and "ENTER".

display will go to "STANDBY OPTIONS".

2. push "1".

3. push "F1".

confirm "WAIT 29 MIN TO TURN MAIN SWITCH OFF".

wait for 30 min.

4. confirm "TURN MAIN SWITCH OFF" is displayed.

5. turn off main power switch.

6. close gas (zero-air) cylinder.

Daily Operational Manual (TOC Analyzer)

TOC-5000 + **SSM-5000 (for Solid Sample)**

(start up)

1. open gas (zero-air) cylinder.
   confirm gas pressure (500 – 600KPa), **water level of drain vessel (outlet pipe)**
2. turn on main power switch of TOC-5000 (on the left side of machine)
   confirm carrier gas flow (150 ml/min.).
   turn on main power switch of SSM-5000 (on the right side of machine)
   confirm carrier gas pressure (2 kg/cm^2), flow (500 ml/min.)
3. push "F1" (next).
   display will go to "MAIN MENU".
4. push "3" and "ENTER".
   display will go to "GENERAL CONDITIONS".
5. confirm next items.
   "TC CATALYST" is "1" (1=NORMAL).
   "SYRINGE SIZE" is "1" (1=250).
   "UNIT OF CONC" is "1" (ppm), **is "5" (%)**
   "CELL LENGTH" is "1" (1=STD), **is "3" (w-short)**
   "TOC OR SSM" is "1" (1=TOC), **is "2" (SSM)**
   if some of these items are different, enter proper number and "ENTER".
6. change furnace condition.
   at "FURNACE ON/OFF", enter "1" (1=TOC) and "ENTER" to turn on furnace.
   enter "3" (TOC & SSM) ***or "4" (SSM)***
7. push "F2" (MAIN MENU).
   display will go to "MAIN MENU".
8. push "2" and "ENTER".
   display will go to "SAMPLE MEASUREMENT/CONDITIONS".

9.confirm "1st CAL CURVE #" and "NPOC" is "6", if not enter "6" and "ENTER".
   "1st CAL CURVE #", "TC" is "9" and "IC" is "10"

10. confirm next items.
    "RANGE" of "NPOC" is "30".
    "INJ VOL" of "NPOC" is "50".
    "SPARGE TIME" of "NPOC" is "15".
    "NO OF INJECTS" is "2".
    "MAX NO OF INJ" is "3".
    Enter "Sample Amount" in 'mg'
    if not, enter proper number and "ENTER".

leave equipment approx.30min., until the ready lamp will come on.

(sample measurement)

11. push "F1".
    display will go to "MEASUREMENT START".

12. set sample. **at first in TC port then IC port (add phosphoric acid)**
    open the sample port cover and place the sample boat in sample boat holder

13. push "START/STOP".
    Gently push the sample boat push rod from "Sample change" to "Measuring"

measurement will be implemented automatically.

14. confirm "COMPLETE" is blinking on the display.
    TC: pull sample port to "Cooling" wait 30 sec. then move to "Sample change"
    IC: pull sample port to "Sample change"

15. if there is no more sample to be measured, go to 19.

16. change sample.

17. push "F1" (NEXT).
    display will go to "SAMPLE MEASUREMENT/CONDITIONS".

18. repeat 11 To 15.

19. push "F2" (END).
    display will go to "MAIN MENU".

(shut down)

1. enter "7" and "ENTER".
    display will go to "STANDBY OPTIONS".

2. push "1".

3. push "F1".
    confirm "WAIT 29 MIN TO TURN MAIN SWITCH OFF".

    wait for 30 min.

4. confirm "TURN MAIN SWITCH OFF" is displayed.

5. turn off main power switch.

6. close gas (zero-air) cylinder.

List of Analysis Method

June, 2000

Analysis Parameter	Method Number.		Note
	pre-treatment	measurement	
Water Analysis			
Residual Chlorine	4500-Cl G		using portable meter
TOC	5310 B		Shimadzu TOC5000A
TSS	2540 D		
NH_3	4500-NH_3 B	4500-NH_3 F	
TKN	4500-N_{org} B	4500-NH_3 F	except Ammonia removal
Total Phosphorus	4500-P B	4500-P E	
Cyanogen	4500-CN C	4500-CN E	
Magnesium	3111 B		
Phenols	EPA 420.1		
Oil & Grease	EPA 413.2 (Oil contents meter)		Horiba OCMA300
TPH	EPA 418.1 (Oil contents meter)		Horiba OCMA300
BTEX	Head space-GC/FID		
Chlorophyll	10200 H		
Total Coliform	9222 B		Milliflex
Sediment Analysis			
Ignition Loss	2540 B	2540 E	Loss of Ignition @ 550 °C
TOC	Moopam IV.4		
Cr, Cd, Pb, Zn, Cu, Co, Ni, V	EPA 3050 B	Flame AAS	
Hg	EPA 3050 B	Cold vapor AAS	
As	EPA 7471 A	Hydride generation AAS	
TPH	EPA 3550 B	Oil contents meter	Horiba OCMA300
BTEX	EPA 5021	Head space-GC/FID	

Sample Management Plan

Analysis Item	Container	Volume (ml)	Q'ty	Preservation	Holding Time
Water Sample					
Total Suspended Solid	Plastic bottle	1000	1	Cool, 4 °C	48 hours
COD, TOC, Ammonia, Total Kjeidahl Nitrogen, Total Phosphorus	Plastic bottle	2000	1	Cool, 4 °C H_2SO_4, pH<2	28 days
Cyanogen	Plastic bottle	1000	1	Cool, 4 °C NaOH, pH>12	14 days
Metals	Plastic bottle	500	2	HNO_3, pH<2	28 days (Hg) 6 months (others)
Phenols	Glass bottle	500	2	Cool, 4 °C H_2SO_4, pH<2	28 days
Oil & Grease	Glass bottle	1000	1	Cool, 4 °C HCl, pH<2	28 days
TPH	Glass bottle	1000	1	Cool, 4 °C HCl, pH<2	28 days
BTEX (Benzen, Toluene, Etylbenzen, Xylene)	Glass bottle PTFE liner cap	250	1	fill up to the brim Cool, 4 °C HCl, pH<2	14 days
Chlorophyll	Plastic bottle	1000	1	Cool, 4 °C	filtrate - immediately 28 days (frozen filter)
Total Coliform	Whirl-pak Bag (sterile)	125	1	Cool, 4 °C	6 hours
Chlorinated Hydrocarbons	Glass bottle	1000	2	Cool, 4 °C	14 days
Sediment Sample					
Ignition Loss, TOC, Metals	Whirl-pak Bag		1	Cool, 4 °C (freeze)	
BTEX, TPH, *PCBs*	Glass bottle (wide mouth)	500	1	Cool, 4 °C	

Chain-of-Custody Sheet (Water Samples)

No. Page : of

Date Sampled:

Sampler:

Remarks:

No.	Sample ID	Time Sampled	Type of Sample	Bottle Type	Volume (ml)	Q'ty	Residual Chroline	TSS	COD/TOC	NH_3 (Ammonia)	TKN (Kjeldahl Nitrogen)	T-P (Total Phosphorus)	CN (Cyanogen)	Mg (Magnesium)	Hg (Mercury)	As (Asenic)	Cr (Chromium)	Other Metals (Cd,Co,Cu,Ni,Pb,Zn)	Phenol	Oil & Grease	BTEX	TPH	Chlorophyll	Total Coliform	Chlorinated Hydrocarbons	Notes

Analysis Parameter

Supplied to Laboratory by : (Name)

(Signature)

(Date/Time)

Received at Laboratory by : (Name)

(Signature)

(Date/Time)

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

No. Page : of

Date Sampled:

Sampler:

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
			Sediment (SD), Soil (SL), Biota (B)	Glass (G), Plastic (P), Whirl pack (W)			Analysis Parameter												

Supplied to Laboratory by : (Name)

(Signature)

(Date/Time)

Received at Laboratory by : (Name)

(Signature)

(Date/Time)

MEPA Eastern Province, Environmental Laboratory

LABORATORY ANALYSIS REPORT

Date: **Report No.**

Sample Site :
Type of Sample : **Sediment**
Sample ID# :
Sampled by :

Sampled :
Received :
Completed :
QA/QC ID# :

Analytical Results

Parameter	Method	Unit	Result	DLR	Note
Loss on Ignition	SM 2540 B	%		0.1	
TOC	MOOPAM IV.4	%		0.1	
Cadmium	EPA 3050 B	mg/kg		1	
Cobalt	EPA 3050 B	mg/kg		5	
Copper	EPA 3050 B	mg/kg		5	
Lead	EPA 3050 B	mg/kg		20	
Nickel	EPA 3050 B	mg/kg		10	
Zinc	EPA 3050 B	mg/kg		1	
Chromium	EPA 3050 B	mg/kg		10	
Mercury	EPA 3050 B	mg/kg		0.05	
Arsenic	EPA 7471 A	mg/kg		0.1	
Vanadium	EPA 3050 B	mg/kg		10	
TPH	EPA 3550 B	mg/kg		5	
Benzene	EPA 5021	mg/kg		0.1	
Toluene	EPA 5021	mg/kg		0.1	
Ethylbenzene	EPA 5021	mg/kg		0.1	
Xylene	EPA 5021	mg/kg		0.1	

DLR: Detection Limit for Reporting ND: Not Detected at the DLR
SM: Standard Methods for the Analysis of Water and Wastewater
MOOPAM: Manual of Oceanographic Observations and Pollutant Analysis Methods, ROPME
EPA: U.S. Environmental Protection Agency

MEPA Environmental

Laboratory Director

Meteorology and Environmental Protection Administration
Eastern Province
Tel: 03-857-6260
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MEPA Eastern Province, Environmental Laboratory

LABORATORY ANALYSIS REPORT

Date: **Report No.**

Sample Site :
Type of Sample : **Seawater**
Sample ID# :
Sampled by :

Sampled :
Received :
Completed :
QA/QC ID# :

Analytical Results

Parameter	Method	Unit	Result	DLR	Note
TSS	SM 2540 D	mg/L		1	
TOC	SM 5310 B	mg/L		1	
TKN	SM 4500-N_{org} B	mg/L		0.1	
NH_3	SM 4500-NH_3 B, F	mg/L		0.1	
Total Phosphorus	SM 4500-P B, E	mg/L		0.01	
Cyanogen	SM 4500-CN C, E	mg/L		0.005	
Magnesium	SM 3111 B	g/L		0.1	
Cadmium	SM 3111 C	mg/L		0.01	
Cobalt	SM 3111 C	mg/L		0.05	
Copper	SM 3111 C	mg/L		0.05	
Lead	SM 3111 C	mg/L		0.1	
Nickel	SM 3111 C	mg/L		0.05	
Zinc	SM 3111 C	mg/L		0.01	
Chromium	SM 3111 C	mg/L		0.1	
Mercury	SM 3111 C	mg/L		0.005	
Arsenic	SM 3111 C	mg/L		0.01	
Phenols	EPA 420.1	mg/L		0.005	
Oil & Grease	EPA 413.2	mg/L		0.2	
TPH	EPA 418.1	mg/L		0.2	
Benzene	Headspace-GC/FID	mg/L		0.01	
Toluene	Headspace-GC/FID	mg/L		0.01	
Ethylbenzene	Headspace-GC/FID	mg/L		0.01	
Xylene	Headspace-GC/FID	mg/L		0.01	
Chlorophyll a	SM 10200 H	ug/L		0.1	
Total Coliform	SM 9222 B	pcs/100ml		10	

DLR: Detection Limit for Reporting ND: Not Detected at the DLR
SM: Standard Methods for the Analysis of Water and Wastewater
EPA: U.S. Environmental Protection Agency

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QUALITY CONTROL REPORT

Date: **QA/QC ID No.** _____

Inorganic QC Report

Parameter	Method	Unit	Blank Test		Duplicate Test			RecoveryTest		
			Result	Note	Conc.	RPD (%)	Note	Conc.	% Recovery	Note

SM: Standard Methods for the Analysis of Water and Wastewater

EPA: U.S. Environmental Protection Agency

RPD: Relative Percent Difference; RPD [%] = $|C_1-C_2|/(C_1+C_2)*100$

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