ANNEX

ANNEX I

プラントのモジュール工法

(An Alternate to Conventional Site Erected Plant)

1. GENERAL

石油や化学など，各種の process plant は近年頓に複雑化し，使用機器・資材も高級化するにつれて，plant 建設にも高度な技術が要求されるようになってきた。又これらの process plant を建設するには，土木・建築工事のみならず機器据付・配管・電気・計装・保温保冷・塗装など，いろいろな工事が現場で有機的な統制の下に遂行されなければならない。このためには数多くの熟練作業員が必要であり，更にそれら作業員の仕事を助ける近代的な建設機器資材が不可欠となってきた。

しかし最近のプラント建設現場の多くではこれらの熟練作業者及び建設機材が常に timely に入手出来るとは限らず，かりに出来たとしても悪い気象・労働条件等で，予想以上の苛酷な労働を強いられることが少なくない。従って，工事の品質も作業員の熟練度や現場の環境条件によって大巾に左右され，またこれが今迄は当然のことと考えられていた。

しかし建設技術も他の科学技術の進歩と共に急速に発達しつつある。つまり工事上の品質の不確実さをより少くするために，plant 建設にも大巾に shop prefabrication の技術が取り入れられるようになった。これは当初は主として配管工事に限られていたが，最近では陸海上に於ける輸送技術の顕著な発達もあり，この輸送手段の許される範囲内で極力装置としての形まで組立て，それを建設現場に搬入する事によって現地工事の単純化を図るようになった。この種の工事手法を一般に modular plant construction technique と呼んでいる。つまり，plant の大部分の assembly を plant site とは全く別の場所にある設備が充実し，施工管理もゆき届いた，又気象条件にもあまり左右されない module fabrication yard で行い，近代化された建設機械をフルに活用することにより工事上の品質の完璧さを期待出来る状態になった。

ここではこの新工法がどのようなものであるかその概要を紹介しよう。

1.1 Modular Plant Construction Technique

この新工法は，先進工業国の数多くの会社で開発されており，細かい所では各社各様にその考え方に違いはあるが，共通した考え方は，次の 7 steps によって構成されている。

(a) Engineering

(b) Procurement and / or fabrication of equipment and materials

(c) Module fabrication and loading - out

(d) Ocean transportation

(e) Civil and other works before module arrival

(f) Unloding, inland transportation and module erection works

(g) Interconnecting modules and other remaining works

以下各 step 毎に従来工法との相異点を pick－up しながら新工法についての説明を行なってゆくこととする。

1) Engineering

Engineering としては殆んど従来工法の場合と変りはない。 従って，この新工法が採用されたために特別に compact design をしなければならないところはなく，plant の安全性運転のし易さ，maintenance のし易さ等が損われることはない。もしそのようなことがあるとすれば経済的要因等別の原因から来るもので原則的には module 工法とは無関係である。

Engineering に於ける従来工法の場合との最も大きな変更点は各機器，配管，structure 等の design に於て海上輸送中の動揺に耐えるように配慮しなければならないことである。

2) Procurement and／or fabrication of equipment and materials

この作業も殆んど従来工法の時と変りはない。唯一の相異点は大部分の機器資材が直接 plant site に送られず，一度 module fabrication yard に送られるという点である。

module 工法の特徴の一つとして project schedule の短縮が考えられる。そのための key factor は使用機材を予定通りに module fabrication yard に納入することであり，その意味から機材の調達が module fabrication yard の近隣で行なわれることが好ましい。 又調達が同一国内で行われれば梱包費等の節減が期待出来る。

3) module fabrication and loading－out

module 工法を採用した時，最も大きく変るのがこの3)，4)，6)の部分である。即ち先づ殆んどの機材が厳密な工程管理の下で module fabrication yard に集められ，充分な品質管理の下に保管される。module の fabrication は近代設備の整った工場内で船舶や海洋構造物等と同様の厳しい施工管理の下で遂行される。完成された module は，海上輸送用 barge 又は特殊 RO／RO 船に搭載され船体に完全に固定される。

4) Ocean transportation

近年 offshore 油田の開発がさかんになりこの影響から，超重量物の海上輸送技術も急足に進歩し，今後もより便利な新型の特殊運搬船が続々と出現するものと思われる。現状では120 $^{mL}\times30^{mB}$ の ocean－going barge が最も一般的なものと考えられ，その海上輸送中の動揺対策，海水飛沫対策等については各社はそれぞれで充分な検討を行っているようである。

5) Civil and other works before module arrival

module が plant site に着く前に，現地側にて module unloading 用 jetty，site 迄の輸

送道路及びmodule付のための基礎工事を含む土木工事，underground piping，power cable敷設工事等が遂行されなければならないが，module 部分の基礎の形状が変る以外は従来工法の時と余り変らない。

6) Unloading，inland transportation and module erection works

moduleは予め準備されたunloading用jettyでLift－on／Lift－off又はRoll－on／Roll－off operationでunloadingされる。その後重量物輸送用carrier（一般にdollyと呼ばれている）で所定の基礎近傍迄輸送し，Lifting or Jacking operationにより基礎上に据付けられる。

3)，4)，6)の一連の作業が新工法の特徴であり，細部に於ては各社毎に細かい工夫がこらされているようである。3)，4)，6)の各作業の流れがFig.A－1 and 2に示されており，unloadingの詳細がFig.A－3 and 4 に示されている。

7) Interconnecting modules and other remaining works

moduleが据付けられるとこれらのmodule の間をつなぐ諸工事が行われ，総合テストを経て"Mechanical Completion"となる。

1.2 Basic Conditions and Advantages of Modularization

module 工法が成功するための条件として次の事項が考えられる。すなわち，

(a) plant siteが海岸線に近く船舶のaccessし易い所であること。

(b) 現地にてconstruction laborを充分に集めることが困難で他国より呼び寄せなければならず，そのために特別のcampを設営しなければならないような所であること。

(c) plant siteの気象・労働条件が比較的悪いこと。

このような条件に適したprojectに対しては従来工法に比較して次のようなadvantages が期待出来る。

(a) 高 品 質

(b) 建設コストの低減（0～30％）

(c) 工期の短縮（0～20％）

このようにコストと工期については，それぞれのcaseによってかなりの開きがある。従って実施に当っては，事前に充分な調査を行い，有利性を確認の上，実施することが好ましい。

2 オマーン製油所におけるモジュール工法採用の可能性

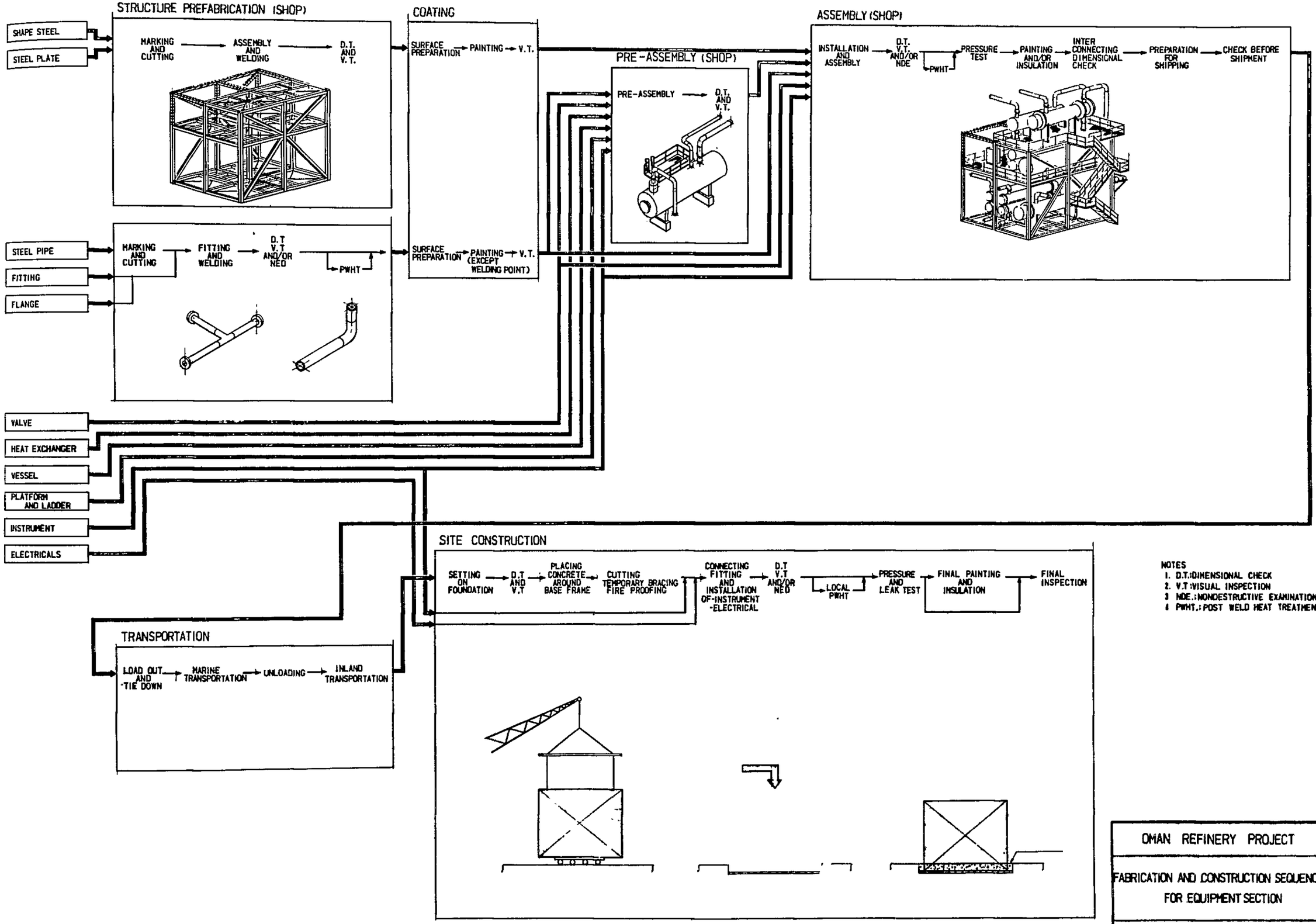
Oman refineryのsite条件に関しては，本文第5章に詳述されているが，この限りでは何れ

のcandidate sitesも前項で述べたmodule工法を実施する上で好ましいと考えられる条件が全て充されている。従って，このrefineryの建設には，module 工法が適しているといえるかもしれない。

しかしmodule工法が効果的に適用出来るのは，process unit部分とutilities unit部分であり，tank yardや建家の部分については，一般に現地で工事をすることが多い。

Oman refinery建設に際し，module 工法を適用するときの最大の留意点はunloadingの場所及び方法であり，また inland transportationの方法であろう。Port Quaboos の使用も絶対に不可能とはいえないが，module工法をより一層効果的にするためには，両candidate sites共その接する海岸に直接$120^{m\,L} \times 30^{m\,B}$ draft 4m程度のocean-going barge が係留しうるtemporary jettyを作るのがよい。

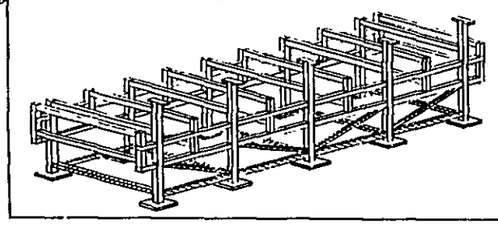
幸い何れのsitesも海岸が余り遠浅ではないので，dredgingも比較的容易と考えられる。又その費用も最悪の場合として所定の水深の所までjettyを海中に突き出すことを考えても，US$ 1.5 million程度であろう。又全てのmodulesは2 bargesで運搬出来るものと考えられるのでMina al Fahal siteの場合でも，沖合の船舶の航行，停泊に対して殆んど支障ないものと思われる。


STRUCTURE PREFABRICATION (SHOP)
SHAPE STEEL
STEEL PLATE
MARKING AND CUTTING
ASSEMBLY AND WELDING
D.T. AND V.T.
STEEL PIPE
FITTING
FLANGE
MARKING AND CUTTING
FITTING AND WELDING
D.T V.T AND/OR NDE
PWHT
COATING
SURFACE PREPARATION
PAINTING
V.T.
SURFACE PREPARATION
PAINTING (EXCEPT WELDING POINT)
V.T.
PRE-ASSEMBLY (SHOP)
PRE-ASSEMBLY
D.T. AND V.T.
ASSEMBLY (SHOP)
INSTALLATION AND ASSEMBLY
D.T. V.T. AND/OR NDE
PWHT
PRESSURE TEST
PAINTING AND/OR INSULATION
INTER CONNECTING DIMENSIONAL CHECK
PREPARATION FOR SHIPPING
CHECK BEFORE SHIPMENT
VALVE
HEAT EXCHANGER
VESSEL
PLATFORM AND LADDER
INSTRUMENT
ELECTRICALS
SITE CONSTRUCTION
SETTING ON FOUNDATION
D.T AND V.T
PLACING CONCRETE AROUND BASE FRAME
CUTTING TEMPORARY BRACING FIRE PROOFING
CONNECTING FITTING AND INSTALLATION OF-INSTRUMENT -ELECTRICAL
D.T V.T AND/OR NDE
LOCAL PWHT
PRESSURE AND LEAK TEST
FINAL PAINTING AND INSULATION
FINAL INSPECTION
TRANSPORTATION
LOAD OUT AND TIE DOWN
MARINE TRANSPORTATION
UNLOADING
INLAND TRANSPORTATION
NOTES
1. D.T.:DIMENSIONAL CHECK
2. V.T:VISUAL INSPECTION
3 NDE.:NONDESTRUCTIVE EXAMINATION
4 PWHT.:POST WELD HEAT TREATMENT
OMAN REFINERY PROJECT
FABRICATION AND CONSTRUCTION SEQUENCE FOR EQUIPMENT SECTION
FIG. A-1

PIPE BRIDGE PREFABRICATION (SHOP)

SHAPE STEEL
STEEL PLATE

MARKING AND CUTTING → ASSEMBLY AND WELDING → D.T. AND V.T.

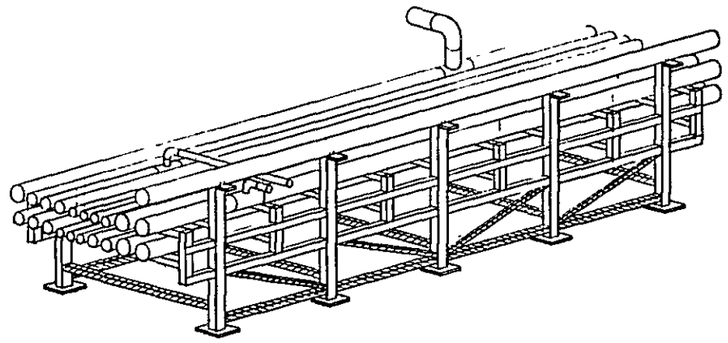


COATING

SURFACE PREPARATION → PAINTING → V.T.

ASSEMBLY (SHOP)

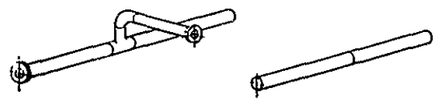
INSTALLATION AND ASSEMBLY → D.T. V.T. AND/OR NDE → PWHT → PRESSURE TEST → PAINTING AND/OR INSULATION → V.T. → PREPARATION FOR SHIPPING → CHECK BEFORE SHIPMENT



PIPING PREFABRICATION (SHOP)

STEEL PIPE
FITTING
FLANGE

MARKING AND CUTTING → FITTING AND WELDING → D.T. V.T. AND/OR NDE → PWHT



SURFACE PREPARATON → PAINTING (EXCEPT WELDING POINT) → V.T.

VALVE
INSTRUMENT
ELECTRICALS

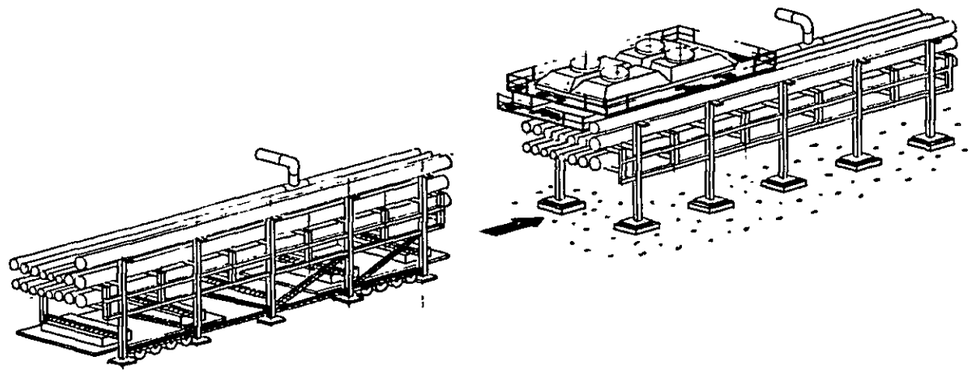
TRANSPORTATION

LOAD OUT AND TIE DOWN → MARINE TRANSPORTATION → UNLOADING → INLAND TRANSPORTATION

AIR COOLED HEAT EXCHANGER

SITE CONSTRUCTION

SETTING ON FOUNDATION → D.T. AND V.T. → CONNECTING PIPING AND INSTALLATION OF -INSTRUMENTS -ELECTRICAL -OTHER EQUIPMENT → D.T. V.T. AND/OR NDE → LOCAL PWHT → PRESSURE TEST AND LEAK TEST → FINAL PAINTING INSULATION AND FIRE PROOFING → FINAL INSPECTION



NOTE

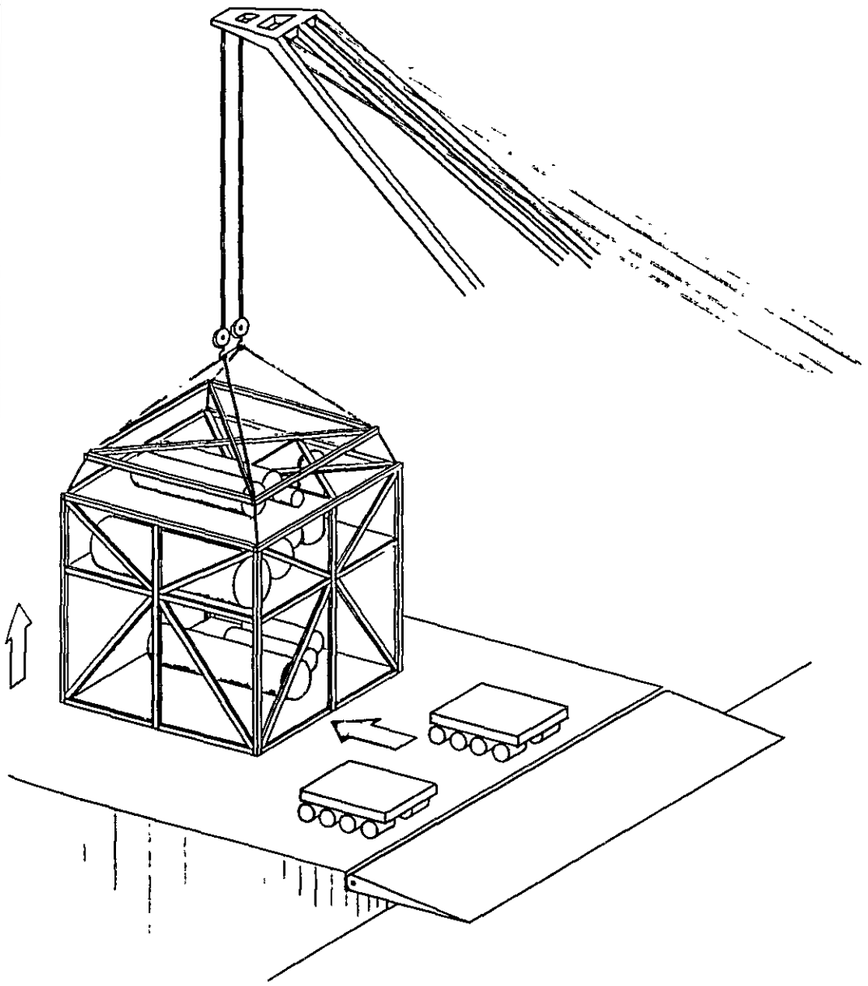
1. D.T.: DIMENSIONAL CHECK
2. V.T.: VISUAL INSPECTION
3. NDE:NON-DESTRUCTIVE EXAMINATION
4. PWHT: POSTWELD HEAT TREATMENT

OMAN REFINERY PROJECT

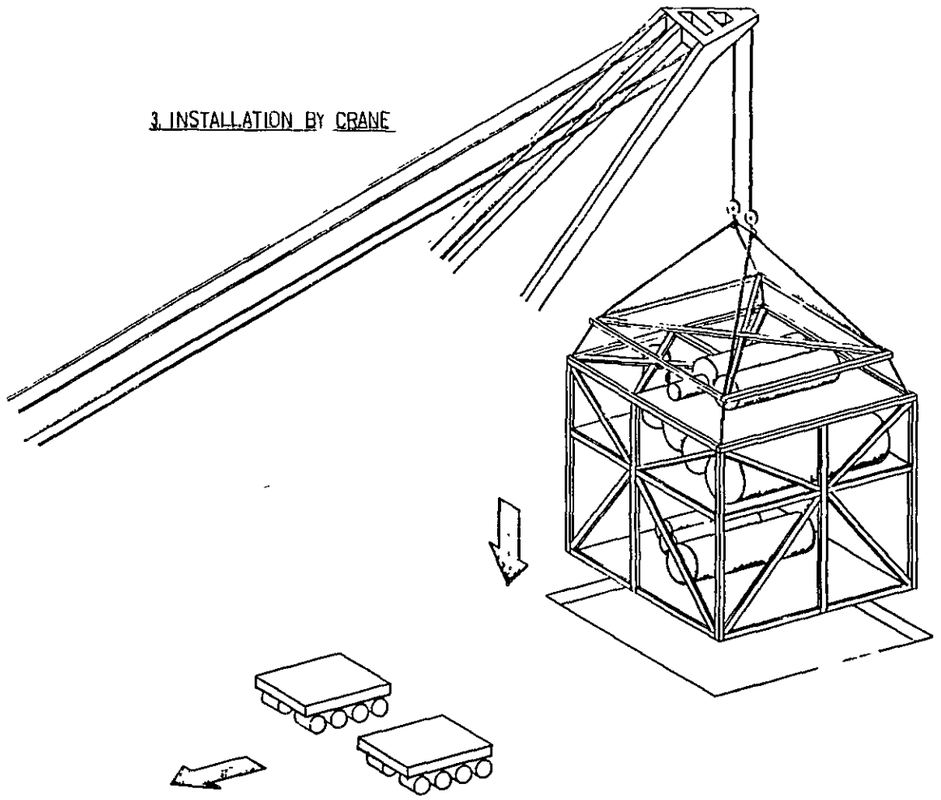
FABRICATION AND CONSTRUTION SEQUENCE FOR PIPE BRIDGE SECTION

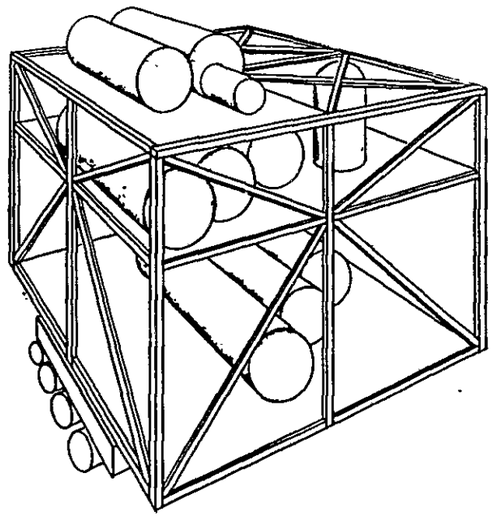
FIG. A-2

1. LOADOUT BY CRANE



3. INSTALLATION BY CRANE



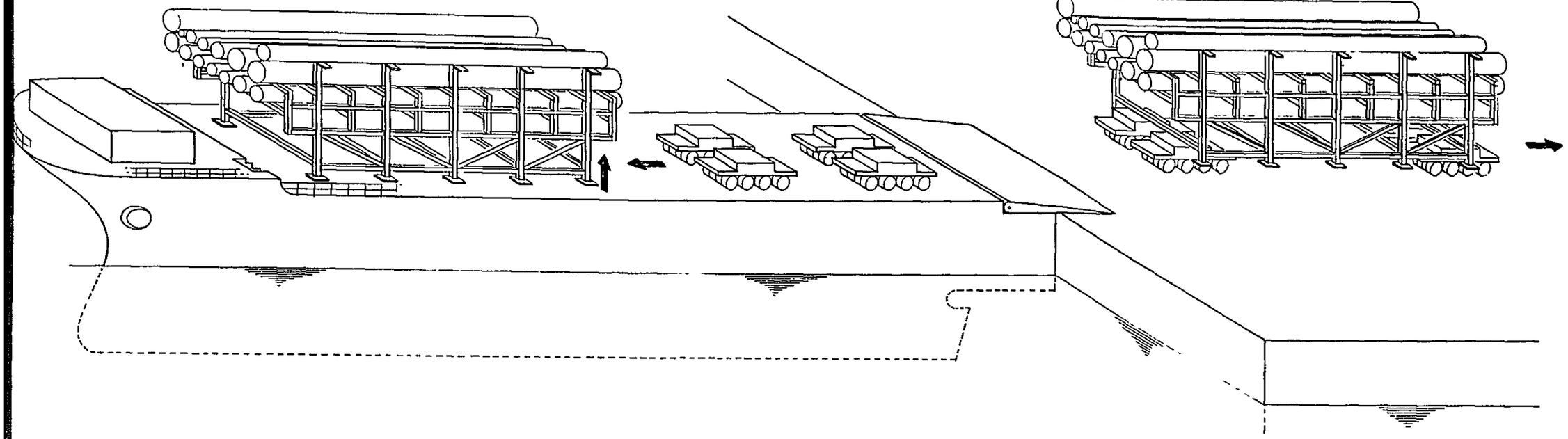


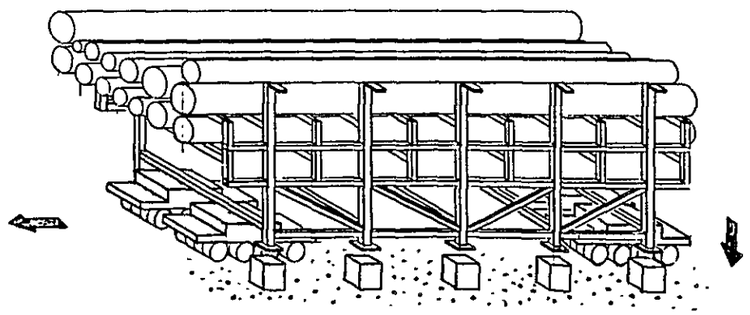
2. TRANSPORTATION BY DOLLY

OMAN REFINERY PROJECT
INLAND TRANSPORTATION AND INSTALLATION PIPE BRIDGE SECTION
FIG. A-3

1. LOAD-OUT BY DOLLY

2 TRANSPORTATION BY DOLLY





3. IN PRINCIPLE. THE LOADING, UNLOADING AND INSTALLATION WILL BE PERFORMED BY MEANS OF PLATFORM TRAILERS U-SING THEIR JACK-UP FUNCTIONS AND NO CRANE WILL BE USED.

OMAN REFINERY PROJECT
INLAND TRANSPORTATION AND INSTALLATION PIPE BRIDGE SECTION
FIG. A-4

ANNEX II TABLE A-1 PROJECTED FINANCIAL STATEMENTS (40,000 BPSD/P)

INCOME STATEMENT — OMAN REF.F/S (40MBPSD/REFORMER/P)

(22 MAY 79) PART 1 UNIT : MM R.O

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
SALES REVENUE										
FOR DOMESTIC				43.8	48.2	50.6	51.0	51.4	51.8	52.1
FOR EXPORT				20.7	23.9	25.4	25.1	24.7	24.4	24.1
SUB TOTAL				64.6	72.1	76.0	76.0	76.1	76.2	76.2
DIRECT PRODUCTION COST										
RAW MATERIAL COST				58.2	65.0	68.5	68.5	68.5	68.5	68.5
OPERATING LABOR COST				0.9	0.9	0.9	0.9	0.9	0.9	0.9
UTILITY COST				0.8	0.9	0.9	0.9	1.0	1.0	1.0
OTHERS				1.1	1.1	1.1	1.1	1.1	1.1	1.1
SUB TOTAL				60.9	67.9	71.4	71.4	71.4	71.4	71.4
DEPRECIATION & ALLOWANCE				2.2	2.2	2.2	2.2	2.2	2.2	2.2
GENERAL EXPENSE				1.0	1.0	1.0	1.0	1.0	1.0	1.0
FINANCING COST				1.2	1.4	1.3	1.2	0.9	0.7	0.4
TOTAL PRODUCTION COST				65.3	72.5	75.9	75.8	75.6	75.4	75.1
INCOME BEFORE TAX				-0.7	-0.4	0.1	0.3	0.5	0.8	1.1
INCOME TAX										
NET INCOME				-0.7	-0.4	0.1	0.3	0.5	0.8	1.1
DIVIDEND										
RETAINED EARNINGS				-0.7	-0.4	0.1	0.3	0.5	0.6	1.1
CUM RETAINED EARNINGS				-0.7	-1.0	-1.0	-0.7	-0.2	0.7	1.8

— continued —

INCOME STATEMENT

OMAN REF.F/S (40MBPSD/REFORMER/P)

(22 MAY 79)

PART 2 UNIT : MM R.O

	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
SALES REVENUE									
FOR DOMESTIC	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	768.3
FOR EXPORT	23.9	23.8	23.8	23.8	23.8	23.8	23.8	23.8	358.9
SUB TOTAL	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	1127.2
DIRECT PRODUCTION COST									
RAW MATERIAL COST	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	1013.2
OPERATING LABOR COST	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	13.4
UTILITY COST	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	14.4
OTHERS	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	16.4
SUB TOTAL	71.4	71.4	71.4	71.4	71.4	71.4	71.4	71.4	1057.4
DEPRECIATION & ALLOWANCE	2.2	2.2	2.2						22.5
GENERAL EXPENSE	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	14.5
FINANCING COST	0.3	0.1							7.6
TOTAL PRODUCTION COST	75.0	74.8	74.7	72.4	72.4	72.4	72.4	72.4	1101.9
INCOME BEFORE TAX	1.3	1.4	1.6	3.8	3.8	3.8	3.8	3.8	25.3
INCOME TAX									
NET INCOME	1.3	1.4	1.6	3.8	3.8	3.8	3.8	3.8	25.3
DIVIDEND									
RETAINED EARNINGS	1.3	1.4	1.6	3.8	3.8	3.8	3.8	3.8	25.3
CUM RETAINED EARNINGS	3.1	4.5	6.1	9.9	13.8	17.6	21.4	25.3	

FUNDS OUTLOOK

OMAN REF.F/S (40M8PSD/REFORMER/P)

(22 MAY 79)

PART 1 UNIT : MM R.O

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
CASH GENERATION										
NET_INCOME				-0.7	-0.4	0.1	0.3	0.5	0.8	1.1
ADD BACK DEPRECIATION				2.2	2.2	2.2	2.2	2.2	2.2	2.2
CASH FROM OPERATION				1.6	1.9	2.3	2.5	2.8	3.1	3.4
EQUITY	1.3	5.6	2.0							
LONG TERM LOAN	2.0	8.5	5.0	0.5						
SHORT TERM LOAN				1.9	0.5	-0.1	-0.5	-0.8	-1.0	
CAPITAL FUND	3.3	14.1	7.0	2.4	0.5	-0.1	-0.5	-0.8	-1.0	
TOTAL_CASH AVAILABLE	3.3	14.1	7.0	4.0	2.4	2.2	2.0	2.0	2.1	3.4
CASH REQUIREMENT										
PLANT COST	3.3	14.1	7.0	0.5						
INC WORKING CAPITAL				3.5	0.4	0.2				
REPAYMENT L.T LOAN					2.0	2.0	2.0	2.0	2.0	2.0
PAYMENT OF DIVIDEND										
TOTAL CASH REQUIREMENT	3.3	14.1	7.0	4.0	2.4	2.2	2.0	2.0	2.0	2.0
CASH SURPLUS									0.1	1.4
CUM CASH SURPLUS									0.1	1.4

— continued —

FUNDS OUTLOOK

OMAN REF.F/S (40MBPSD/REFORMER/P)

(22 MAY 79)

PART 2 UNIT : MM R.O

	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
CASH GENERATION									
NET INCOME	1.3	1.4	1.6	3.8	3.8	3.8	3.8	3.8	25.3
ADD BACK DEPRECIATION	2.2	2.2	2.2						22.5
CASH FROM OPERATION	3.5	3.7	3.8	3.8	3.8	3.8	3.8	3.8	47.7
EQUITY									9.0
LONG TERM LOAN									16.0
SHORT TERM LOAN									
CAPITAL FUND									25.0
TOTAL CASH AVAILABLE	3.5	3.7	3.8	3.8	3.8	3.8	3.8	3.8	72.7
CASH REQUIREMENT									
PLANT COST									25.0
INC WORKING CAPITAL								-4.1	
REPAYMENT L.T LOAN	2.0	2.0							16.0
PAYMENT OF DIVIDEND									
TOTAL CASH REQUIREMENT	2.0	2.0						-4.1	40.9
CASH SURPLUS	1.5	1.7	3.8	3.8	3.8	3.8	3.8	7.9	31.8
CUM CASH SURPLUS	3.0	4.7	8.5	12.3	16.2	20.0	23.8	31.8	

CASH FLOW ANALYSIS — OMAN REF.F/S (40MBPSD/REFORMER/P)

(22 MAY 79) — PART I — UNIT : MM R.O

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
CAPITAL INVESTMENT	3.3	14.1	7.0	4.0						
INCOME BEF TAX				-0.7	-0.4	0.1	0.3	0.5	0.8	1.1
DEPRECIATION				2.2	2.2	2.2	2.2	2.2	2.2	2.2
INTEREST				1.2	1.4	1.3	1.2	0.9	0.7	0.4
CASH FLOW	-3.3	-14.1	-7.0	-1.3	3.3	3.6	3.7	3.7	3.8	3.8
DISCOUNT RATE	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
DISCOUNTED CASH FLOW	-3.1	-12.8	-6.1	-1.1	2.6	2.7	2.6	2.5	2.4	2.3
ACC DCF	-3.1	-15.9	-22.0	-23.1	-20.5	-17.8	-15.2	-12.7	-10.2	-7.9
INT RATE OF RETURN	8.52	8.52	8.52	8.52	8.52	8.52	8.52	8.52	8.52	8.52

— continued —

CASH FLOW ANALYSIS — OMAN REF.F/S (40MBPSD/REFORMER/P)

(22 MAY 79) PART 2 UNIT : MM R.O

	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
CAPITAL INVESTMENT									28.5
INCOME BEF TAX	1.3	1.4	1.6	3.8	3.8	3.8	3.8	3.8	25.3
DEPRECIATION	2.2	2.2	2.2						22.5
INTEREST	0.3	0.1							7.6
CASH FLOW	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	26.9
DISCOUNT RATE	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	
DISCOUNTED CASH FLOW	2.2	2.1	2.0	1.9	1.8	1.8	1.7	1.6	7.3
ACC DCF	-5.6	-3.5	-1.5	0.5	2.3	4.1	5.7	7.3	
INT RATE OF RETURN	8.52	8.52	8.52	8.52	8.52	8.52	8.52	8.52	

BALANCE SHEET — OMAN REF.F/S (40MBPSD/REFORMER/P)

(22 MAY 79) — PART 1 — UNIT : MM R.D

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
ASSETS										
CURRENT ASSETS										
OPERATING CASH				0.5	0.5	0.5	0.5	0.5	0.5	0.5
RECEIVABLES				5.2	5.8	6.1	6.1	6.1	6.1	6.1
INVENTORIES				2.7	3.0	3.2	3.2	3.2	3.2	3.2
SUB TOTAL				8.4	9.3	9.8	9.8	9.8	9.8	9.8
CUM SURPLUS CASH									0.1	1.4
FIXED ASSETS										
PLANT & EQUIPMENT	3.3	17.4	24.4	25.0	25.0	25.0	25.0	25.0	25.0	25.0
LESS ACCUM. DEPRE.				2.2	4.5	6.7	9.0	11.2	13.5	15.7
NET FIXED ASSETS	3.3	17.4	24.4	22.7	20.5	18.2	16.0	13.7	11.5	9.2
TOTAL ASSETS	3.3	17.4	24.4	31.1	29.8	28.0	25.8	23.5	21.4	20.5
LIABILITIES										
CURRENT LIABILITIES										
PAYABLES				4.9	5.4	5.7	5.7	5.7	5.7	5.7
SHORT TERM LOAN				1.9	2.4	2.3	1.8	1.0		
SUB TOTAL				6.8	7.8	8.0	7.5	6.7	5.7	5.7
LONG TERM LIABILITIES	2.0	10.5	15.4	16.0	14.0	12.0	10.0	8.0	6.0	4.0
EQUITY										
PAID UP CAPITAL	1.3	6.9	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
CUM. RETAINED EARNIGS				-0.7	-1.0	-1.0	-0.7	-0.2	0.7	1.8
SUB TOTAL	1.3	6.9	9.0	8.3	8.0	8.0	8.3	8.8	9.7	10.8
TOT. EQUITY & LIABIL.	3.3	17.4	24.4	31.1	29.8	28.0	25.8	23.5	21.4	20.5

– continued –

BALANCE SHEET — OMAN REF.F/S (40MBPSD/REFORMER/P)

(22 MAY 79) — PART 2 — UNIT : MM R.O

	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
ASSETS									
CURRENT ASSETS									
OPERATING CASH	0.5	0.5	0.5	0.5	0.5	0.5	0.5		
RECEIVABLES	6.1	6.1	6.1	6.1	6.1	6.1	6.1		
INVENTORIES	3.2	3.2	3.2	3.2	3.2	3.2	3.2		
SUB TOTAL	9.8	9.8	9.8	9.8	9.8	9.8	9.8		
CUM SURPLUS CASH	3.0	4.7	8.5	12.3	16.2	20.0	23.8	31.8	
FIXED ASSETS									
PLANT & EQUIPMENT	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
LESS ACCUM. DEPRE.	18.0	20.2	22.5	22.5	22.5	22.5	22.5	22.5	
NET FIXED ASSETS	7.0	4.7	2.5	2.5	2.5	2.5	2.5	2.5	
TOTAL ASSETS	19.8	19.2	20.8	24.6	28.5	32.3	36.1	34.3	
LIABILITIES									
CURRENT LIABILITIES									
PAYABLES	5.7	5.7	5.7	5.7	5.7	5.7	5.7		
SHORT TERM LOAN									
SUB TOTAL	5.7	5.7	5.7	5.7	5.7	5.7	5.7		
LONG TERM LIABILITIES	2.0								
EQUITY									
PAID UP CAPITAL	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	
CUM. RETAINED EARNIGS	3.1	4.5	6.1	9.9	13.8	17.6	21.4	25.3	
SUB TOTAL	12.1	13.5	15.1	18.9	22.8	26.6	30.4	34.3	
TOT. EQUITY & LIABIL.	19.8	19.2	20.8	24.6	28.5	32.3	36.1	34.3	

TABLE A-2 PROJECTED FINANCIAL STATEMENTS (40,000 BPSD/S)

INCOME STATEMENT — OMAN REF.F/S (40MBPSD/REFORMER/S)

(22 MAY 79) — PART 1 — UNIT : MM R.O

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
SALES REVENUE										
FOR DOMESTIC				43.8	48.2	50.6	51.0	51.4	51.8	52.1
FOR EXPORT				20.7	23.9	25.4	25.1	24.7	24.4	24.1
SUB TOTAL				64.6	72.1	76.0	76.0	76.1	76.2	76.2
DIRECT PRODUCTION COST										
RAW MATERIAL COST				58.2	65.0	68.5	68.5	68.5	68.5	68.5
OPERATING LABOR COST				0.9	0.9	0.9	0.9	0.9	0.9	0.9
UTILITY COST				0.5	0.6	0.6	0.6	0.7	0.7	0.7
OTHERS				1.2	1.2	1.2	1.2	1.2	1.2	1.2
SUB TOTAL				60.8	67.7	71.2	71.2	71.2	71.3	71.3
DEPRECIATION & ALLOWANCE				2.4	2.4	2.4	2.4	2.4	2.4	2.4
GENERAL EXPENSE				1.0	1.0	1.0	1.0	1.0	1.0	1.0
FINANCING COST				1.2	1.5	1.4	1.2	1.0	0.8	0.5
TOTAL PRODUCTION COST				65.5	72.7	76.1	75.9	75.7	75.5	75.3
INCOME BEFORE TAX				-0.9	-0.5	-0.1	0.1	0.4	0.7	0.9
INCOME TAX										
NET INCOME				-0.9	-0.5	-0.1	0.1	0.4	0.7	0.9
DIVIDEND										
RETAINED EARNINGS				-0.9	-0.5	-0.1	0.1	0.4	0.7	0.9
CUM RETAINED EARNINGS				-0.9	-1.4	-1.5	-1.4	-1.0	-0.4	0.6

— continued —

INCOME STATEMENT

OMAN REF.F/S (40MBPSD/REFORMER/S)

(22 MAY 79)

PART 2 UNIT : MM R.O

	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
SALES REVENUE									
FOR DOMESTIC	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	768.3
FOR EXPORT	23.9	23.8	23.8	23.8	23.8	23.8	23.8	23.8	358.9
SUB TOTAL	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	1127.2
DIRECT PRODUCTION COST									
RAW MATERIAL COST	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	1013.2
OPERATING LABOR COST	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	14.1
UTILITY COST	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	9.8
OTHERS	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	17.7
SUB TOTAL	71.3	71.3	71.3	71.3	71.3	71.3	71.3	71.3	1054.8
DEPRECIATION & ALLOWANCE	2.4	2.4	2.4						24.4
GENERAL EXPENSE	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	15.5
FINANCING COST	0.3	0.2							8.2
TOTAL PRODUCTION COST	75.1	74.9	74.7	72.3	72.3	72.3	72.3	72.3	1102.9
INCOME BEFORE TAX	1.2	1.4	1.5	3.9	3.9	3.9	3.9	3.9	24.4
INCOME TAX									
NET INCOME	1.2	1.4	1.5	3.9	3.9	3.9	3.9	3.9	24.4
DIVIDEND									
RETAINED EARNINGS	1.2	1.4	1.5	3.9	3.9	3.9	3.9	3.9	24.4
CUM RETAINED EARNINGS	1.7	3.1	4.6	8.6	12.5	16.5	20.4	24.4	

FUNDS OUTLOOK

OMAN REF.F/S (40MBPSD/REFORMER/S)

(22 MAY 79)

PART 1 UNIT : MM R.O

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
CASH GENERATION										
NET_INCOME				-0.9	-0.5	-0.1	0.1	0.4	0.7	0.9
ADD BACK DEPRECIATION				2.4	2.4	2.4	2.4	2.4	2.4	2.4
CASH FROM OPERATION				1.5	1.9	2.3	2.5	2.8	3.1	3.4
EQUITY	1.4	6.3	2.3							
LONG TERM LOAN	2.1	9.2	5.3	0.5						
SHORT TERM LOAN				1.9	0.6		-0.4	-0.7	-0.9	-0.5
CAPITAL FUND	3.6	15.4	7.6	2.4	0.6		-0.4	-0.7	-0.9	-0.5
TOTAL CASH AVAILABLE	3.6	15.4	7.6	4.0	2.5	2.3	2.1	2.1	2.1	2.9
CASH REQUIREMENT										
PLANT COST	3.6	15.4	7.6	0.5						
INC WORKING CAPITAL				3.5	0.4	0.2				
REPAYMENT L.T LOAN					2.1	2.1	2.1	2.1	2.1	2.1
PAYMENT OF DIVIDEND										
TOTAL CASH REQUIREMENT	3.6	15.4	7.6	4.0	2.5	2.3	2.1	2.1	2.1	2.1
CASH SURPLUS										0.7
CUM CASH SURPLUS										0.7

— continued —

FUNDS OUTLOOK

OMAN REF.F/S (40MBPSD/REFORMER/S)

(22 MAY 79)

PART 2 UNIT : MM R.O

	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
CASH GENERATION									
NET_INCOME	1.2	1.4	1.5	3.9	3.9	3.9	3.9	3.9	24.4
ADD BACK DEPRECIATION	2.4	2.4	2.4						24.4
CASH FROM OPERATION	3.6	3.8	3.9	3.9	3.9	3.9	3.9	3.9	48.7
EQUITY									10.0
LONG TERM LOAN									17.1
SHORT TERM LOAN									
CAPITAL FUND									27.1
TOTAL CASH AVAILABLE	3.6	3.8	3.9	3.9	3.9	3.9	3.9	3.9	75.8
CASH REQUIREMENT									
PLANT COST									27.1
INC WORKING CAPITAL								-4.1	
REPAYMENT L.T LOAN	2.1	2.1							17.1
PAYMENT OF DIVIDEND									
TOTAL CASH REQUIREMENT	2.1	2.1						-4.1	44.2
CASH SURPLUS	1.5	1.7	3.9	3.9	3.9	3.9	3.9	8.0	31.6
CUM CASH SURPLUS	2.2	3.9	7.8	11.8	15.7	19.7	23.6	31.6	

CASH FLOW ANALYSIS

OMAN REF.F/S (40MBPSD/REFORMER/S)

(22 MAY 79)

PART 1 UNIT : MM R.O

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
CAPITAL INVESTMENT	3.6	15.4	7.6	4.0						
INCOME BEF TAX				-0.9	-0.5	-0.1	0.1	0.4	0.7	0.9
DEPRECIATION				2.4	2.4	2.4	2.4	2.4	2.4	2.4
INTEREST				1.2	1.5	1.4	1.2	1.0	0.8	0.5
CASH FLOW	-3.6	-15.4	-7.6	-1.2	3.4	3.7	3.8	3.8	3.9	3.9
DISCOUNT RATE	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
DISCOUNTED CASH FLOW	-3.4	-14.0	-6.5	-1.0	2.7	2.8	2.7	2.6	2.5	2.4
ACC DCF	-3.4	-17.4	-23.9	-24.9	-22.3	-19.5	-16.8	-14.2	-11.7	-9.3
INT RATE OF RETURN	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89

– continued –

CASH FLOW ANALYSIS

OMAN REF.F/S (40MBPSD/REFORMER/S)

(22 MAY 79)

PART 2 UNIT : MM R.O

	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
CAPITAL INVESTMENT									30.6
INCOME BEF TAX	1.2	1.4	1.5	3.9	3.9	3.9	3.9	3.9	24.4
DEPRECIATION	2.4	2.4	2.4						24.4
INTEREST	0.3	0.2							8.2
CASH FLOW	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	26.4
DISCCUNT RATE	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	
DISCOUNTED CASH FLOW	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	6.4
ACC DCF	-7.0	-4.8	-2.7	-0.7	1.2	3.0	4.8	6.4	
INT RATE OF RETURN	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89	

BALANCE SHEET

OMAN REF.F/S (40MBPSD/REFORMER/S)

(22 MAY 79)

PART 1 UNIT : MM R.O

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
ASSETS										
CURRENT ASSETS										
OPERATING CASH				0.4	0.5	0.5	0.5	0.5	0.5	0.5
RECEIVABLES				5.2	5.8	6.1	6.1	6.1	6.1	6.1
INVENTORIES				2.7	3.0	3.2	3.2	3.2	3.2	3.2
SUB TOTAL				8.3	9.3	9.7	9.7	9.8	9.8	9.8
CUM SURPLUS CASH										0.7
FIXED ASSETS										
PLANT & EQUIPMENT	3.6	19.0	26.6	27.1	27.1	27.1	27.1	27.1	27.1	27.1
LESS ACCUM. DEPRE.				2.4	4.9	7.3	9.8	12.2	14.6	17.1
NET FIXED ASSETS	3.6	19.0	26.6	24.7	22.2	19.8	17.3	14.9	12.5	10.0
TOTAL ASSETS	3.6	19.0	26.6	33.0	31.5	29.5	27.1	24.7	22.2	20.5
LIABILITIES										
CURRENT LIABILITIES										
PAYABLES				4.9	5.4	5.7	5.7	5.7	5.7	5.7
SHORT TERM LOAN				1.9	2.5	2.5	2.1	1.4	0.5	
SUB TOTAL				6.8	7.9	8.2	7.8	7.1	6.2	5.7
LONG TERM LIABILITIES	2.1	11.3	16.6	17.1	15.0	12.8	10.7	8.5	6.4	4.3
EQUITY										
PAID UP CAPITAL	1.4	7.7	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
CUM. RETAINED EARNIGS				-0.9	-1.4	-1.5	-1.4	-1.0	-0.4	0.6
SUB TOTAL	1.4	7.7	10.0	9.1	8.6	8.5	8.6	9.0	9.6	10.6
TOT. EQUITY & LIABIL.	3.6	19.0	26.6	33.0	31.5	29.5	27.1	24.7	22.2	20.5

— continued —

BALANCE SHEET

OMAN REF.F/S (40MBPSD/REFORMER/S)

(22 MAY 79)

PART 2 UNIT : MM R.O

	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
ASSETS									
CURRENT ASSETS									
OPERATING CASH	0.5	0.5	0.5	0.5	0.5	0.5	0.5		
RECEIVABLES	6.1	6.1	6.1	6.1	6.1	6.1	6.1		
INVENTORIES	3.2	3.2	3.2	3.2	3.2	3.2	3.2		
SUB TOTAL	9.8	9.8	9.8	9.8	9.8	9.8	9.8		
CUM SURPLUS CASH	2.2	3.9	7.8	11.8	15.7	19.7	23.6	31.6	
FIXED ASSETS									
PLANT & EQUIPMENT	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1	
LESS ACCUM. DEPRE.	19.5	21.9	24.4	24.4	24.4	24.4	24.4	24.4	
NET FIXED ASSETS	7.6	5.1	2.7	2.7	2.7	2.7	2.7	2.7	
TOTAL ASSETS	19.6	18.8	20.3	24.3	28.2	32.2	36.1	34.4	
LIABILITIES									
CURRENT LIABILITIES									
PAYABLES	5.7	5.7	5.7	5.7	5.7	5.7	5.7		
SHORT TERM LOAN									
SUB TOTAL	5.7	5.7	5.7	5.7	5.7	5.7	5.7		
LONG TERM LIABILITIES	2.1								
EQUITY									
PAID UP CAPITAL	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
CUM. RETAINED EARNIGS	1.7	3.1	4.6	8.6	12.5	16.5	20.4	24.4	
SUB TOTAL	11.7	13.1	14.6	18.6	22.5	26.5	30.4	34.4	
TOT. EQUITY.& LIABIL.	19.6	18.8	20.3	24.3	28.2	32.2	36.1	34.4	

TABLE A-3 PROJECTED FINANCIAL STATEMENTS (20,000 BPSD/P)

INCOME STATEMENT — OMAN REF.F/S (20MBPSD/REFORMER/P)

(22 MAY 79) PART 1 UNIT : MM R.J

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
SALES REVENUE										
FOR DOMESTIC				21.2	23.7	25.0	25.0	25.1	25.1	25.1
FOR EXPORT				11.2	12.5	13.2	13.2	13.2	13.2	13.2
SUB TOTAL				32.4	36.2	38.1	38.2	38.2	38.2	38.2
DIRECT PRODUCTION COST										
RAW MATERIAL COST				29.1	32.5	34.2	34.2	34.2	34.2	34.2
OPERATING LABOR COST				0.9	0.9	0.9	0.9	0.9	0.9	0.9
UTILITY COST				0.5	0.5	0.6	0.6	0.6	0.6	0.6
OTHERS				0.7	0.7	0.7	0.7	0.7	0.7	0.7
SUB TOTAL				31.1	34.6	36.4	36.4	36.4	36.4	36.4
DEPRECIATION & ALLOWANCE				1.5	1.5	1.5	1.5	1.5	1.5	1.5
GENERAL EXPENSE				0.8	0.8	0.8	0.8	0.8	0.8	0.8
FINANCING COST				0.8	1.1	1.2	1.2	1.3	1.4	1.5
TOTAL PRODUCTION COST				34.2	38.0	39.8	39.9	40.0	40.1	40.2
INCOME BEFORE TAX				-1.8	-1.8	-1.7	-1.7	-1.8	-1.9	-1.9
INCOME TAX										
NET INCOME				-1.8	-1.8	-1.7	-1.7	-1.8	-1.9	-1.9
DIVIDEND										
RETAINED EARNINGS				-1.8	-1.8	-1.7	-1.7	-1.8	-1.9	-1.9
CUM RETAINED EARNINGS				-1.8	-3.6	-5.3	-7.0	-8.8	-10.7	-12.6

— continued —

INCOME STATEMENT — OMAN REF.F/S (20MBPSD/REFORMER/P)

(22 MAY 79) — PART 2 — UNIT : MM R.O

	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
SALES REVENUE									
FOR DOMESTIC	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	370.5
FOR EXPORT	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	195.1
SUB TOTAL	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2	565.6
DIRECT PRODUCTION COST									
RAW MATERIAL COST	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	506.6
OPERATING LABOR COST	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	13.4
UTILITY COST	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	8.9
OTHERS	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	10.4
SUB TOTAL	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	539.3
DEPRECIATION & ALLOWANCE	1.5	1.5	1.5						15.0
GENERAL EXPENSE	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	11.7
FINANCING COST	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	23.9
TOTAL PRODUCTION COST	40.3	40.4	40.5	39.1	39.2	39.3	39.4	39.5	589.9
INCOME BEFORE TAX	-2.0	-2.1	-2.3	-0.8	-0.9	-1.0	-1.1	-1.3	-24.3
INCOME TAX									
NET INCOME	-2.0	-2.1	-2.3	-0.8	-0.9	-1.0	-1.1	-1.3	-24.3
DIVIDEND									
RETAINED EARNINGS	-2.0	-2.1	-2.3	-0.8	-0.9	-1.0	-1.1	-1.3	-24.3
CUM RETAINED EARNINGS	-14.6	-16.8	-19.0	-19.9	-20.8	-21.8	-23.0	-24.3	

FUNDS OUTLOOK — OMAN REF.F/S (20MBPSD/REFORMER/P)

(2 MAY 79) — PART I — UNIT : MM R.O

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
CASH GENERATION										
NET INCOME				-1.8	-1.8	-1.7	-1.7	-1.8	-1.9	-1.9
ADD BACK DEPRECIATION				1.5	1.5	1.5	1.5	1.5	1.5	1.5
CASH FROM OPERATION				-0.3	-0.3	-0.2	-0.2	-0.3	-0.3	-0.4
EQUITY	0.8	3.6	1.3							
LONG TERM LOAN	1.3	5.6	3.7	0.3						
SHORT TERM LOAN				2.2	1.8	1.6	1.6	1.7	1.7	1.8
CAPITAL FUND	2.1	9.3	5.0	2.4	1.8	1.6	1.6	1.7	1.7	1.8
TOTAL CASH AVAILABLE	2.1	9.3	5.0	2.1	1.6	1.5	1.4	1.4	1.4	1.4
CASH REQUIREMENT										
PLANT COST	2.1	9.3	5.0	0.3						
INC WORKING CAPITAL				1.8	0.2	0.1				
REPAYMENT L.T LOAN					1.4	1.4	1.4	1.4	1.4	1.4
PAYMENT OF DIVIDEND										
TOTAL CASH REQUIREMENT	2.1	9.3	5.0	2.1	1.6	1.5	1.4	1.4	1.4	1.4
CASH SURPLUS										
CUM CASH SURPLUS										

— continued —

FUNDS OUTLOOK — OMAN REF.F/S (20MBPSD/REFORMER/P)

(22 MAY 79) — PART 2 — UNIT : MM R.O

	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
CASH GENERATION									
NET INCOME	-2.0	-2.1	-2.3	-0.8	-0.9	-1.0	-1.1	-1.3	-24.3
ADD BACK DEPRECIATION	1.5	1.5	1.5						15.0
CASH FROM OPERATION	-0.5	-0.6	-0.8	-0.8	-0.9	-1.0	-1.1	-1.3	-9.2
EQUITY									5.8
LONG TERM LOAN									10.9
SHORT TERM LOAN	1.9	2.0	0.8	0.8	0.9	1.0	1.1	-0.9	20.1
CAPITAL FUND	1.9	2.0	0.8	0.8	0.9	1.0	1.1	-0.9	36.8
TOTAL CASH AVAILABLE	1.4	1.4						-2.1	27.6
CASH REQUIREMENT									
PLANT COST									16.7
INC WORKING CAPITAL								-2.1	
REPAYMENT L.T LOAN	1.4	1.4							10.9
PAYMENT OF DIVIDEND									
TOTAL CASH REQUIREMENT	1.4	1.4						-2.1	27.6
CASH SURPLUS									
CUM CASH SURPLUS									

CASH FLOW ANALYSIS OMAN REF.F/S (20MBPSD/REFORMER/P)

(22 MAY 79) PART I UNIT : MM R.O

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
CAPITAL INVESTMENT	2.1	9.3	5.0	2.1						
INCOME BEF TAX				-1.8	-1.8	-1.7	-1.7	-1.8	-1.9	-1.9
DEPRECIATION				1.5	1.5	1.5	1.5	1.5	1.5	1.5
INTEREST				0.8	1.1	1.2	1.2	1.3	1.4	1.5
CASH FLOW	-2.1	-9.3	-5.0	-1.6	0.8	1.0	1.0	1.0	1.0	1.0
DISCOUNT RATE	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
DISCOUNTED CASH FLOW	-2.0	-8.4	-4.3	-1.3	0.6	0.7	0.7	0.7	0.7	0.6
ACC DCF	-2.0	-10.5	-14.8	-16.1	-15.5	-14.8	-14.1	-13.4	-12.7	-12.1
INI RATE OF RETURN	-2.52	-2.52	-2.52	-2.52	-2.52	-2.52	-2.52	-2.52	-2.52	-2.52

– continued –

CASH FLOW ANALYSIS — OMAN REF.F/S (20MBPSD/REFORMER/P)

(22 MAY 79) — PART 2 — UNIT : MM R.O

	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
CAPITAL INVESTMENT									18.5
INCOME BEF TAX	-2.0	-2.1	-2.3	-0.8	-0.9	-1.0	-1.1	-1.3	-24.3
DEPRECIATION	1.5	1.5	1.5						15.0
INTEREST	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	23.9
CASH FLOW	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-3.9
DISCOUNT RATE	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	
DISCOUNTED CASH FLOW	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.4	-8.0
ACC DCF	-11.5	-10.9	-10.3	-9.8	-9.3	-8.8	-8.4	-8.0	
INT RATE OF RETURN	-2.52	-2.52	-2.52	-2.52	-2.52	-2.52	-2.52	-2.52	

BALANCE SHEET — OMAN REF.F/S (20MBPSD/REFORMER/P)

(22 MAY 79) — PART 1 — UNIT : MM R.O

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
ASSETS										
CURRENT ASSETS										
OPERATING CASH				0.3	0.4	0.4	0.4	0.4	0.4	0.4
RECEIVABLES				2.6	2.9	3.1	3.1	3.1	3.1	3.1
INVENTORIES				1.4	1.5	1.6	1.6	1.6	1.6	1.6
SUB TOTAL				4.3	4.8	5.0	5.1	5.1	5.1	5.1
CUM SURPLUS CASH										
FIXED ASSETS										
PLANT & EQUIPMENT	2.1	11.4	16.4	16.7	16.7	16.7	16.7	16.7	16.7	16.7
LESS ACCUM. DEPRE.				1.5	3.0	4.5	6.0	7.5	9.0	10.5
NET FIXED ASSETS	2.1	11.4	16.4	15.2	13.7	12.2	10.7	9.2	7.7	6.2
TOTAL ASSETS	2.1	11.4	16.4	19.5	18.5	17.2	15.7	14.3	12.7	11.2
LIABILITIES										
CURRENT LIABILITIES										
PAYABLES				2.5	2.8	2.9	2.9	2.9	2.9	2.9
SHORT TERM LOAN				2.2	4.0	5.6	7.2	8.9	10.6	12.4
SUB TOTAL				4.7	6.8	8.6	10.2	11.8	13.5	15.3
LONG TERM LIABILITIES	1.3	6.9	10.6	10.9	9.5	8.2	6.8	5.5	4.1	2.7
EQUITY										
PAID UP CAPITAL	0.8	4.5	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
CUM. RETAINED EARNIGS				-1.8	-3.6	-5.3	-7.0	-8.8	-10.7	-12.6
SUB TOTAL	0.8	4.5	5.8	4.0	2.2	0.5	-1.2	-3.0	-4.9	-6.8
TOT. EQUITY & LIABIL.	2.1	11.4	16.4	19.5	18.5	17.2	15.7	14.3	12.7	11.2

— continued —

BALANCE SHEET — OMAN REF.F/S (20MBPSD/REFORMER/P)

(22 MAY 79) — PART 2 — UNIT : MM R.O

	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
ASSETS									
CURRENT ASSETS									
OPERATING CASH	0.4	0.4	0.4	0.4	0.4	0.4	0.4		
RECEIVABLES	3.1	3.1	3.1	3.1	3.1	3.1	3.1		
INVENTORIES	1.6	1.6	1.6	1.6	1.6	1.6	1.6		
SUB TOTAL	5.1	5.1	5.1	5.1	5.1	5.1	5.1		
CUM SURPLUS CASH									
FIXED ASSETS									
PLANT & EQUIPMENT	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	
LESS ACCUM. DEPRE.	12.0	13.5	15.0	15.0	15.0	15.0	15.0	15.0	
NET FIXED ASSETS	4.7	3.2	1.7	1.7	1.7	1.7	1.7	1.7	
TOTAL ASSETS	9.7	8.2	6.7	6.7	6.7	6.7	6.7	1.7	
LIABILITIES									
CURRENT LIABILITIES									
PAYABLES	2.9	2.9	2.9	2.9	2.9	2.9	2.9		
SHORT TERM LOAN	14.3	16.3	17.1	17.9	18.8	19.9	21.0	20.1	
SUB TOTAL	17.2	19.2	20.0	20.8	21.7	22.8	23.9	20.1	
LONG TERM LIABITILIES	1.4								
EQUITY									
PAID UP CAPITAL	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	
CUM. RETAINED EARNIGS	-14.6	-16.8	-19.0	-19.9	-20.8	-21.8	-23.0	-24.3	
SUB TOTAL	-8.8	-11.0	-13.2	-14.1	-15.0	-16.0	-17.2	-18.5	
TOT. EQUITY & LIABIL.	9.7	8.2	6.7	6.7	6.7	6.7	6.7	1.7	

TABLE A-4 PROJECTED FINANCIAL STATEMENTS (20,000 BPSD/S)

INCOME STATEMENT — TAIWAN REF.C. (20MBPSD/REFORMER/S)

(22 MAY 79) PART 1 UNIT : MM $.U

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
SALES REVENUE										
FOR DOMESTIC				21.2	23.7	25.0	25.0	25.1	25.1	25.1
FOR EXPORT				11.2	12.5	13.2	13.2	13.2	13.2	13.2
SUB TOTAL				32.4	36.2	38.1	38.2	38.2	38.2	38.2
DIRECT PRODUCTION COST										
RAW MATERIAL COST				29.1	32.5	34.2	34.2	34.2	34.2	34.2
OPERATING LABOR COST				0.9	0.9	0.9	0.9	0.9	0.9	0.9
UTILITY COST				0.3	0.4	0.4	0.4	0.4	0.4	0.4
OTHERS				0.7	0.8	0.8	0.8	0.8	0.8	0.8
SUB TOTAL				31.1	34.6	36.3	36.3	36.4	36.4	36.4
DEPRECIATION & ALLOWANCE				1.6	1.6	1.6	1.6	1.6	1.6	1.6
GENERAL EXPENSE				0.8	0.8	0.8	0.8	0.8	0.8	0.8
FINANCING COST				0.9	1.1	1.2	1.3	1.4	1.5	1.6
TOTAL PRODUCTION COST				34.4	38.2	40.0	40.1	40.2	40.3	40.4
INCOME BEFORE TAX				-2.0	-2.0	-1.9	-2.0	-2.0	-2.1	-2.2
INCOME TAX										
NET INCOME				-2.0	-2.0	-1.9	-2.0	-2.0	-2.1	-2.2
DIVIDEND										
RETAINED EARNINGS				-2.0	-2.0	-1.9	-2.0	-2.0	-2.1	-2.2
CUM RETAINED EARNINGS				-2.0	-4.0	-5.9	-7.9	-9.9	-12.0	-14.2

– continued –

INCOME STATEMENT — OMAN REF.F/S (20MBPSD/ REFORMER/S)

(22 MAY 79) PART 2 UNIT : MM R.U

	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
SALES REVENUE									
FOR DOMESTIC	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	370.5
FOR EXPORT	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	195.1
SUB TOTAL	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2	565.6
DIRECT PRODUCTION COST									
RAW MATERIAL COST	34.2	34.2	34.2	34.2	34.2	34.2	34.2	34.2	506.6
OPERATING LABOR COST	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	14.1
UTILITY COST	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	6.5
OTHERS	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	11.3
SUB TOTAL	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	538.4
DEPRECIATION & ALLOWANCE	1.6	1.6	1.6						16.4
GENERAL EXPENSE	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	12.4
FINANCING COST	1.7	1.8	2.0	2.1	2.2	2.3	2.5	2.6	26.3
TOTAL PRODUCTION COST	40.6	40.7	40.8	39.3	39.4	39.5	39.7	39.8	593.5
INCOME BEFORE TAX	-2.3	-2.4	-2.6	-1.0	-1.1	-1.3	-1.4	-1.6	-27.9
INCOME TAX									
NET INCOME	-2.3	-2.4	-2.6	-1.0	-1.1	-1.3	-1.4	-1.6	-27.9
DIVIDEND									
RETAINED EARNINGS	-2.3	-2.4	-2.6	-1.0	-1.1	-1.3	-1.4	-1.6	-27.9
CUM RETAINED EARNINGS	-16.5	-18.9	-21.5	-22.5	-23.6	-24.9	-26.3	-27.9	

FUNDS OUTLOOK

OMAN REF.F/S (20MBPSD/REFORMER/S)

(22 MAY 79) PART 1 UNIT : MM R.O

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
CASH GENERATION										
NET_INCOME				-2.0	-2.0	-1.9	-2.0	-2.0	-2.1	-2.2
ADD BACK DEPRECIATION				1.6	1.6	1.6	1.6	1.6	1.6	1.6
CASH FROM OPERATION				-0.4	-0.3	-0.3	-0.3	-0.4	-0.5	-0.6
EQUITY	0.9	4.0	1.5							
LONG TERM LOAN	1.4	6.1	3.9	0.3						
SHORT TERM LOAN				2.2	2.0	1.8	1.8	1.8	1.9	2.0
CAPITAL FUND	2.4	10.2	5.4	2.5	2.0	1.8	1.8	1.8	1.9	2.0
TOTAL CASH AVAILABLE	2.4	10.2	5.4	2.1	1.7	1.6	1.5	1.5	1.5	1.5
CASH REQUIREMENT										
PLANT COST	2.4	10.2	5.4	0.3						
INC WORKING CAPITAL				1.8	0.2	0.1				
REPAYMENT L.T LOAN					1.5	1.5	1.5	1.5	1.5	1.5
PAYMENT OF DIVIDEND										
TOTAL CASH REQUIREMENT	2.4	10.2	5.4	2.1	1.7	1.6	1.5	1.5	1.5	1.5
CASH SURPLUS										
CUM CASH SURPLUS										

– continued –

FUNDS OUTLOOK

OMAN REF.F/S (20MBPSD/REFORMER/S)

(22 MAY 79)

PART 2 UNIT : MM R.O

	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
CASH GENERATION									
NET INCOME	-2.3	-2.4	-2.6	-1.0	-1.1	-1.3	-1.4	-1.6	-27.9
ADD BACK DEPRECIATION	1.6	1.6	1.6						16.4
CASH FROM OPERATION	-0.7	-0.8	-0.9	-1.0	-1.1	-1.3	-1.4	-1.6	-11.5
EQUITY									6.5
LONG TERM LOAN									11.7
SHORT TERM LOAN	2.1	2.3	0.9	1.0	1.1	1.3	1.4	-0.6	23.2
CAPITAL FUND	2.1	2.3	0.9	1.0	1.1	1.3	1.4	-0.6	41.4
TOTAL CASH AVAILABLE	1.5	1.5						-2.1	29.9
CASH REQUIREMENT									
PLANT COST									18.2
INC WORKING CAPITAL								-2.1	
REPAYMENT L.T LOAN	1.5	1.5							11.7
PAYMENT OF DIVIDEND									
TOTAL CASH REQUIREMENT	1.5	1.5						-2.1	29.9
CASH SURPLUS									
CUM CASH SURPLUS									

CASH FLOW ANALYSIS — OMAN REF.F/S (20MBPSD/REFORMER/S)

(22 MAY 79) — PART 1 — UNIT : MM R.O

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
CAPITAL INVESTMENT	2.4	10.2	5.4	2.1						
INCOME BEF TAX				-2.0	-2.0	-1.9	-2.0	-2.0	-2.1	-2.2
DEPRECIATION				1.6	1.6	1.6	1.6	1.6	1.6	1.6
INTEREST				0.9	1.1	1.2	1.3	1.4	1.5	1.6
CASH FLOW	-2.4	-10.2	-5.4	-1.6	0.8	1.0	1.0	1.0	1.0	1.0
DISCOUNT RATE	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
DISCOUNTED CASH FLOW	-2.2	-9.2	-4.7	-1.4	0.6	0.7	0.7	0.7	0.7	0.6
ACC DCF	-2.2	-11.5	-16.1	-17.5	-16.9	-16.1	-15.4	-14.7	-14.0	-13.4
INT RATE OF RETURN	-3.23	-3.23	-3.23	-3.23	-3.23	-3.23	-3.23	-3.23	-3.23	-3.23

– continued –

CASH FLOW ANALYSIS — OMAN REF.F/S (20MBPSD/ REFORMER/S)

(22 MAY 79) — PART 2 — UNIT : MM R.O

	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
CAPITAL INVESTMENT									20.0
INCOME BEF TAX	-2.3	-2.4	-2.6	-1.0	-1.1	-1.3	-1.4	-1.6	-27.9
DEPRECIATION	1.6	1.6	1.6						16.4
INTEREST	1.7	1.8	2.0	2.1	2.2	2.3	2.5	2.6	26.3
CASH FLOW	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-5.3
DISCOUNT RATE	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	
DISCOUNTED CASH FLOW	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.4	-9.2
ACC DCF	-12.8	-12.2	-11.7	-11.1	-10.6	-10.1	-9.7	-9.2	
INT RATE OF RETURN	-3.23	-3.23	-3.23	-3.23	-3.23	-3.23	-3.23	-3.23	

– continued –

BALANCE SHEET — OMAN REF.F/S (20MBPSD/REFORMER/S)

(22 MAY 79) — PART 1 — UNIT : MM R.O

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
ASSETS										
CURRENT ASSETS										
OPERATING CASH				0.3	0.3	0.4	0.4	0.4	0.4	0.4
RECEIVABLES				2.6	2.9	3.1	3.1	3.1	3.1	3.1
INVENTORIES				1.4	1.5	1.6	1.6	1.6	1.6	1.6
SUB TOTAL				4.3	4.8	5.0	5.0	5.0	5.1	5.1
CUM SURPLUS CASH										
FIXED ASSETS										
PLANT & EQUIPMENT	2.4	12.5	17.9	18.2	18.2	18.2	18.2	18.2	18.2	18.2
LESS ACCUM. DEPRE.				1.6	3.3	4.9	6.6	8.2	9.8	11.5
NET FIXED ASSETS	2.4	12.5	17.9	16.6	14.9	13.3	11.6	10.0	8.4	6.7
TOTAL ASSETS	2.4	12.5	17.9	20.9	19.7	18.3	16.7	15.1	13.4	11.8
LIABILITIES										
CURRENT LIABILITIES										
PAYABLES				2.5	2.8	2.9	2.9	2.9	2.9	2.9
SHORT TERM LOAN				2.2	4.2	6.0	7.8	9.7	11.6	13.6
SUB. TOTAL				4.7	7.0	8.9	10.7	12.6	14.5	16.5
LONG TERM LIABILITIES	1.4	7.5	11.4	11.7	10.2	8.8	7.3	5.9	4.4	2.9
EQUITY										
PAID UP CAPITAL	0.9	5.0	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
CUM. RETAINED EARNIGS				-2.0	-4.0	-5.9	-7.9	-9.9	-12.0	-14.2
SUB TOTAL	0.9	5.0	6.5	4.5	2.5	0.6	-1.4	-3.4	-5.5	-7.7
TOT. EQUITY & LIABIL.	2.4	12.5	17.9	20.9	19.7	18.3	16.7	15.1	13.4	11.8

– continued –

BALANCE SHEET — OMAN REF.F/S (20MBPSD/ REFORMER/S)

(22 MAY 79) — PART 2 — UNIT : MM R.O

	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
ASSETS									
CURRENT ASSETS									
OPERATING CASH	0.4	0.4	0.4	0.4	0.4	0.4	0.4		
RECEIVABLES	3.1	3.1	3.1	3.1	3.1	3.1	3.1		
INVENTORIES	1.6	1.6	1.6	1.6	1.6	1.6	1.6		
SUB TOTAL	5.1	5.1	5.1	5.1	5.1	5.1	5.1		
CUM SURPLUS CASH									
FIXED ASSETS									
PLANT & EQUIPMENT	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	
LESS ACCUM. DEPRE.	13.1	14.7	16.4	16.4	16.4	16.4	16.4	16.4	
NET FIXED ASSETS	5.1	3.5	1.8	1.8	1.8	1.8	1.8	1.8	
TOTAL ASSETS	10.1	8.5	6.9	6.9	6.9	6.9	6.9	1.8	
LIABILITIES									
CURRENT LIABILITIES									
PAYABLES	2.9	2.9	2.9	2.9	2.9	2.9	2.9		
SHORT TERM LOAN	15.7	18.0	18.9	20.0	21.1	22.4	23.8	23.2	
SUB TOTAL	18.6	20.9	21.8	22.9	24.0	25.3	26.7	23.2	
LONG TERM LIABILITIES	1.5								
EQUITY									
PAID UP CAPITAL	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
CUM. RETAINED EARNIGS	-16.5	-18.9	-21.5	-22.5	-23.6	-24.9	-26.3	-27.9	
SUB TOTAL	-10.0	-12.4	-15.0	-16.0	-17.1	-18.4	-19.8	-21.4	
TOT. EQUITY & LIABIL.	10.1	8.5	6.9	6.9	6.9	6.9	6.9	1.8	

TABLE A-5 CALCULATED EIRR (40,000 BPSD/P)

40MBPSD/P BASE CASE PR & COST 0%UP

YEAR	COST (INVESTMENT)	COST (OPERATION)	COST (SECURITY)	COST (TOTAL)	BENEFIT (REVENUE)	DIS. RATEIO	B/C RATIO	NET PV
1980	3.3	0.0	0.0	3.3	0.0	1	1.024	24.1
1981	14.1	0.0	1.6	12.5	0.0	2	1.022	19.8
1982	7.0	0.0	1.0	6.0	0.0	3	1.019	16.0
1983	4.0	61.9	0.0	65.9	64.6	4	1.017	12.8
1984	0.0	68.9	0.0	68.9	72.1	5	1.014	9.9
1985	0.0	72.4	0.0	72.4	76.0	6	1.011	7.3
1986	0.0	72.4	0.0	72.4	76.0	7	1.009	5.0
1987	0.0	72.4	0.0	72.4	76.1	8	1.006	3.1
1988	0.0	72.4	0.0	72.4	76.2	9	1.003	1.3
1989	0.0	72.4	0.0	72.4	76.2	10	0.999	-0.3
1990	0.0	72.4	0.0	72.4	76.2	11	0.996	-1.7
1991	0.0	72.4	0.0	72.4	76.2	12	0.993	-2.9
1992	0.0	72.4	0.0	72.4	76.2	13	0.989	-4.0
1993	0.0	72.4	0.0	72.4	76.2	14	0.986	-5.0
1994	0.0	72.4	0.0	72.4	76.2	15	0.982	-5.8
1995	0.0	72.4	0.0	72.4	76.2	16	0.979	-6.6
1996	0.0	72.4	0.0	72.4	76.2	17	0.975	-7.3
1997	0.0	72.4	0.0	72.4	76.2	18	0.971	-7.9

INTERNAL RATE OF RETURN = 9.9 REMAINDER= -0.08510

TABLE A-6 CALCULATED EIRR (40,000 BPSD/S)

40MBPSD/S BASE CASE PR & COST UP

YEAR	COST (INVESTMENT)	COST (OPERATION)	COST (SECURITY)	COST (TOTAL)	BENEFIT (REVENUE)	DIS. RATIO	B/C RATIO	NET PV
1980	3.6	0.0	0.0	3.6	0.0	1	1.023	23.0
1981	15.4	0.0	1.6	13.8	0.0	2	1.021	18.6
1982	7.6	0.0	1.0	6.6	0.0	3	1.018	14.8
1983	4.0	61.9	0.0	65.9	64.6	4	1.015	11.4
1984	0.0	68.8	0.0	68.8	72.1	5	1.012	8.5
1985	0.0	72.3	0.0	72.3	76.0	6	1.009	5.9
1986	0.0	72.3	0.0	72.3	76.0	7	1.006	3.6
1987	0.0	72.3	0.0	72.3	76.1	8	1.003	1.6
1988	0.0	72.3	0.0	72.3	76.2	9	1.000	-0.2
1989	0.0	72.4	0.0	72.4	76.2	10	0.996	-1.8
1990	0.0	72.4	0.0	72.4	76.2	11	0.993	-3.2
1991	0.0	72.3	0.0	72.3	76.2	12	0.989	-4.4
1992	0.0	72.3	0.0	72.3	76.2	13	0.985	-5.5
1993	0.0	72.3	0.0	72.3	76.2	14	0.982	-6.5
1994	0.0	72.3	0.0	72.3	76.2	15	0.978	-7.4
1995	0.0	72.3	0.0	72.3	76.2	16	0.974	-8.2
1996	0.0	72.3	0.0	72.3	76.2	17	0.970	-8.9
1997	0.0	72.3	0.0	72.3	76.2	18	0.966	-9.5

INTERNAL RATE OF RETURN = 9.0 REMAINDER= -0.16904

TABLE A-7 CALCULATED EIRR (20,000 BPSD/P)

20M8PSD/P BASE CASE PR & COST 0%UP

YEAR	COST (INVESTMENT)	COST (OPERATION)	COST (SECURITY)	COST (TOTAL)	BENEFIT (REVENUE)	DIS. RATEIO	B/C RATIO	NET PV
1980	2.1	0.0	0.0	2.1	0.0	1	0.993	-3.5
1981	9.3	0.0	1.4	7.9	0.0	2	0.991	-4.4
1982	5.0	0.0	0.6	4.4	0.0	3	0.988	-5.3
1983	2.1	31.9	0.0	34.0	32.4	4	0.985	-6.0
1984	0.0	35.4	0.0	35.4	36.2	5	0.981	-6.7
1985	0.0	37.2	0.0	37.2	38.1	6	0.978	-7.2
1986	0.0	37.2	0.0	37.2	38.2	7	0.975	-7.7
1987	0.0	37.2	0.0	37.2	38.2	8	0.971	-8.1
1988	0.0	37.2	0.0	37.2	38.2	9	0.968	-8.5
1989	0.0	37.2	0.0	37.2	38.2	10	0.964	-8.8
1990	0.0	37.2	0.0	37.2	38.2	11	0.960	-9.0
1991	0.0	37.2	0.0	37.2	38.2	12	0.956	-9.3
1992	0.0	37.2	0.0	37.2	38.2	13	0.952	-9.5
1993	0.0	37.2	0.0	37.2	38.2	14	0.948	-9.6
1994	0.0	37.2	0.0	37.2	38.2	15	0.944	-9.7
1995	0.0	37.2	0.0	37.2	38.2	16	0.940	-9.9
1996	0.0	37.2	0.0	37.2	38.2	17	0.935	-10.0
1997	0.0	37.2	0.0	37.2	38.2	18	0.931	-10.0

INTERNAL RATE OF RETURN = minus

TABLE A-8 CALCULATED EIRR (20,000 BPSD/S)

20MBPSD/S BASE CASE PR & COST 0% UP

YEAR	COST (INVESTMENT)	COST (OPERATION)	COST (SECURITY)	COST (TOTAL)	BENEFIT (REVENUE)	DIS. RATEIO	B/C RATIO	NET PV
1980	2.4	0.0	0.0	2.4	0.0	1	0.991	-4.8
1981	10.2	0.0	1.4	8.8	0.0	2	0.988	-5.8
1982	5.4	0.0	0.6	4.8	0.0	3	0.984	-6.7
1983	2.1	31.9	0.0	34.0	32.4	4	0.981	-7.4
1984	0.0	35.4	0.0	35.4	36.2	5	0.978	-8.1
1985	0.0	37.1	0.0	37.1	38.1	6	0.974	-8.6
1986	0.0	37.1	0.0	37.1	38.2	7	0.970	-9.1
1987	0.0	37.2	0.0	37.2	38.2	8	0.967	-9.5
1988	0.0	37.2	0.0	37.2	38.2	9	0.963	-9.8
1989	0.0	37.2	0.0	37.2	38.2	10	0.959	-10.1
1990	0.0	37.2	0.0	37.2	38.2	11	0.954	-10.4
1991	0.0	37.2	0.0	37.2	38.2	12	0.950	-10.6
1992	0.0	37.2	0.0	37.2	38.2	13	0.946	-10.8
1993	0.0	37.2	0.0	37.2	38.2	14	0.941	-10.9
1994	0.0	37.2	0.0	37.2	38.2	15	0.937	-11.0
1995	0.0	37.2	0.0	37.2	38.2	16	0.932	-11.1
1996	0.0	37.2	0.0	37.2	38.2	17	0.928	-11.2
1997	0.0	37.2	0.0	37.2	38.2	18	0.923	-11.3

INTERNAL RATE OF RETURN = minus

ANNEX III

FIELD SURVEY REPORT
FOR THE
FEASIBILITY STUDY
OF THE
OIL REFINERY CONSTRUCTION PLAN
IN
SULTANATE OF OMAN

MARCH, 1979

JAPANESE STUDY TEAM

JAPAN INTERNATIONAL COOPERATION AGENCY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
P. O. BOX 216 MITSUI BLDG
2-1, NISHI-SHINJUKU, SHINJUKU-KU TOKYO
160 JAPAN

Your Excellency
Mr. Mohammed Zubair
The Ministry of Commerce and Industry
Sultante of Oman

Your Excellency:

We have the pleasure of submitting our report of the survey that have been carried out by our Survey Team in the Sultanate of Oman.

During the limited period of our stay in this country, we tried to make every effort to collect data and information relevant to the planning and construction of a petroleum refinery in Oman. We are confident that our purpose is achieved almost satisfactorily and that the data and information collected will form a sound basis to make our feasibility study on the refinery most scientific and reliable.

It is the sincerest hope of the Japan International Cooperation Agency as well as the Japanese Government that the technical cooperation with your Government as represented by the present study will further solidify the relationship already existence between our two countries.

Yours faithfully,

M. Kitamura

Mizuho Kitamura
Head of the Survey Team
for Refinery Construction
Plan in Oman.

CONTENTS

INTRODUCTION

In February and March 1978, the Japan International Cooperation Agency dispatched a group of experts to examine and identify potentials of industrialization in Oman.

Result of the study, which came out in the form of "The Prefeasibility Study for Industrial Development, Sultanate of Oman", has identified a refinery construction project as prefeasible, namely, a feasibility study being recommended.

In spite of some foreseeable disadvantages of constructing a refinery in Oman, the project is now regarded as necessity of Omani economy, not only in terms of domestic market but also in view of national security. Although several alternative refinery projects have been proposed and studied according to the I.B.R.D. report in 1977, none of them seems to have been successful in fully meeting requirements of Oman's economy which has been and still is rapidly changing. A new feasibility study on the refinery construction project is therefore needed at this moment.

We exerted every possible effort to gather information which will constitute a solid baisis of a neutral and scientific feasibility study on a refinery project in Oman. Furthermore the feasibility study is hoped to be made useful and practical enough to provide decision makers in the government of Oman with exact information as to what next steps be taken.

Our scope of work for this study is summarized in Annex 1.

The survey mission consists of the following eight experts:

1. Mr. Mizuho Kitamura
   Project Manager, Senior Techno-Economist
   (General Supervision)
2. Mr. Masahiro Nakamura
   Senior Plant Engineer
   (Refinery Design)
3. Mr. Tan Hashida
   Senior Economist
   (Economic Evaluation)
4. Mr. Kojiro Kobayashi
   Senior Civil Engineer
   (Plant Location, Civil Work Design)
5. Mr. Masashi Shishiwa
   Senior Project Engineer
   (Planning of Construction Work)
6. Mr. Ryosuke Hashimoto
   Senior Chemical Engineer
   (Refining Process Design)

7. Mr. Akio Iwaki
   Economist
   (Financial Evaluation)
8. Mr. Toshio Kurokawa
   Chemical Engineer
   (Market Research)

1. OUTLINE OF THE WORK PERFORMED

The main purpose of the present Field Survey is to collect data and information, which are to be analysed after the Survey Team goes back to Japan, and are to be used as bases of the further study.

During the stay of the Team in Oman, the collection of data and information has been carried out almost satisfactorily with few exception of those concerning the experience and record of past construction works which was performed in the country, as mentioned later.

The following is a brief description of the work performed by the Team.

1.1 Economy

Omani economy, having experienced modest growth both in 1977 and 1978, is now on the stage of stablized growth according to the Development Council and the Central Bank of Oman. Forecast of oil production has been revised upward and oil price increase in 1979 will undoubtedly stimulate economic growth to a certain degree.

The current lending interest rates of commercial banks are reported to remain not more than 11.5% p.a., which seems to be still high for financing industrial projects. The lending interest rate of 8% offered by the Oman Development Bank is therefore reasonable.

Foreign exchange rates of Rials Omani have been regulated by way of U.S. Dollars, on which R.O. has been pegged. Omani currency, consequently, suffered devaluation together with U.S. Dollars. Floating R.O. as such will not be a solution and be left out of consideration for the time being, according to the Central Bank. On account of this, development funds raised in the form of foreign currency other than U.S. Dollars may suffer from continued depreciation of value.

Construction of a refinery, which constitutes a major part of industrialization program of the current Five Year Plan, is also expected to remain as one of prime development project in the next Five Year Plan (1981–1985) now in preparation.

1.2 Policy on the Refinery Construction

Through repeated meetings with Ministry of Commerce and Industry, Ministry of Agriculture, Fisheries, Petroleum and Minerals as well as the Development Council, the Team had a

strong impression that the refinery project had been rendered an increasing importance in the policy making of the Government.

It is recognized by the Team that as early completion of the refinery as possible is desired when its necessity and economy are proven.

1.3 Market for Refined Petroleum Product

The team obtained from the Ministry of Commerce and Industry the past record of sales of various petroleum products up to the year 1978. Also obtained was a forecast of demand for the products from 1979 to 1985 that is agreed upon between the Ministry and Shell, the biggest marketer of the petroleum products in the country.

In addition the Team collected a number of statistics related to the consumption of petroleum products mostly up to 1978 from relevant organizations. The data collected are, among others:

- number of registered vehicles
- movement of civil aircrafts
- road construction
- electric power generation, etc.

These data are sufficient for the analysis of consumption of the petroleum products in the past and also for making the Team's own estimation for the future demand of the products.

1.4 Location of the Refinery

Two candidate locations were indicated by the Ministry of Commerce and Industry and by the Ministry of Agriculture, Fisheries, Petroleum and Minerals at the early stage of the Field Survey. Also indicated was that there is no third candidate, at least presently.

The two candidate locations are:

- Mina al Fahal area, in the existing PDO-Shell-BP compound
- Al Ghubra area, around the existing Electric Power and Desalination plants

The Team paid repeated visits to the two areas to make visual observations as well as interviews to the people of the existing establishements. At least one site in each of the two areas was found to be suitable as the site for the refinery.

The Team collected the following materials and information concerning the two candidate locations:

- topographical map
- climatic data
- tidal data

However, soil and marine data except for the tidal data have not become available during the stay of the Team, so that the Team has made request for the above data to the Ministry of

Commerce and Industry (concerning BP site) and SOGEX International Ltd. (concerning Electricity/Desalination site).

However, toward the end of the stay, the Team was told by the Ministry of Land Affairs and Municipalities that the Al Ghubra area is designated in the "CAPITAL AREA STRATEGIC PLAN" of April 1978 as "Reserve Area" in which no development will be permitted. Therefore, if the refinery is to be located in this particular area, special compromise should be made among the Ministries concerned.

As to the environmental problems, a Marine Pollution Law of 15th August, 1974 is already in force and it is suggested by the Central Laboratory that an environmental appraisal report should preferably submitted to the authority concerned prior to the start of the construction.

1.5 Crude Oil

The following is indicated to the Team by the Ministry of Agriculture, Fisheries, Petroleum and Minerals:

- Crude oils from various oil fields in the country are blended and sold under a single brand name of Oman Crude. However, the characteristics of the Crude have changed and will change according to the change of the blending ratio of the component crudes.
- The refinery shall be given the first priority as to the supply of crude oil, in spite of existing export agreements.
- The refinery will receive its crude supply at the entrance of the refinery from the existing PDO crude terminal. The crude supply could be made by minor modifications of either existing crude loading pipeline (to Mina al Fahal area) or the crude pipeline to the Power/Desalination Plants which is no more in use (to Al Ghubra area).
- The supply price of crude oil to the refinery shall be the market price.

The ministry also provided the Team with the following information:

- the Assay of Oman Crude lately placed on the market
- future prospect of blending ratio of various crude oils
- tank and piping arrangements of PDO crude terminal.

1.6 Utilities

The team is indicated by the Ministry of Electricity and Water as the following:

- The generating capacity of Al Ghubra Power Station will be increased in this September to 225 MW from present 125 MW, and further 300 MW of generating capacity will be added by 1985. Therefore, no problem is foressen as to the electricity supply for the construction and operation of the refinery.
- In line with the abovementioned new generating capacity of 300 MW of Al Ghubra, 25 million gallon per day of desalination capacity will be added so that water supply to the

refinery will become possible. However, it would be recommended the refinery have its own desalination plant and supply from public water system be considered as a stand-by.

- During the construction period, water supply to the site seems very difficult because of the limitation of the existing supply capacity. It will be recommended to consult the Water Resources Council who control the extraction of underground water.
- Presently flat electricity tariff of Baisa 20/KWH is applied to all consumers. Water price is Baisa 2.0/gallon for citizens and Baisa 3.0/gallon for industrial users.

The team also obtained information on the ground-water levels and analysis of the water from the Water Resources Department, Ministry of Agriculture, Fisheries, Petroleum and Minerals.

1.7 Construction Work

The Team tried to obtain information concerning the past records or experience of such construction works as those of oil tanks or big industrial plants in the country. For that purpose, the Team met a number of contractors who had taken parts in the construction works of the kinds as well as some of the owners of such installations.

The result was not very satisfactory. Some of the findings are as follows:

- Applicable national standards are only those for quality of water, aggregates, and cement for making concrete. There is no national building code. To imported plants, standards or codes of the exporting countries are mainly applied as well as company standards of such owner companies as Shell and BP.
- All major equipment and machinery and also most of major materials such as tank plate were imported. Installation was carried out by big foreign contractors who can manage to mobilize necessary construction machinery and skilled workforce. Local contractors are only capable of construction of small tanks and the alike.
- In Mina al Fahal area, no piling was needed for foundations of the Shell oil depots and the first stage of the BP depot. But for the second stage expansion of the latter which completed in 1978, piling works to the depth of 6 meters were needed. The Team interviewed the Port Services Corporation Ltd. and found that unloading facilities and experience at the Mina Quaboos, where the imported equipment and materials for the construction of the refinery are presumablly landed, are almost satisfactory.

Observations are made by the Team on the main roads connecting the two candidate locations to the Mina Quaboos. It was found that a number of roundabouts, overhead bridges, and overhead electricity lines may hinder the transportation of big equipment and machinery.

Then, the team approached SOGEX International Ltd., through the kind arrangement by Mr. Seif Salim al Mammary, the Undersecretary of the Ministry of Electricity and Water to obtain data on soil and marine conditions at Al Ghubra area and data related to the construction cost of the Electricity/Desalination plants. Although no immediate answer was obtained, SOGEX

agreed, not very willingly, to provide the data requested. Since the data are to become available after the departure of the Team, close follow-up and expedition by the Ministry of Commerce and Industry is most desired.

1.8 Existing Depots

The Team visited all of the three existing depots of the refined petroleum products in the country, two in Mina al Fahal area and one at Port Raysut near Salalah, Dhofar. All three depots serve as import terminals and domestic distribution basis.

One of Mina al Fahal depots is owned by Shell Market (Middle East) Ltd. The depot has nine tanks with a total storing capacity of around 24,000 tons. Products are mostly shipped from the terminal in Dubai by 3,000 ton coastal tankers.

Another depot in Mina al Fahal is owned by BP Arabian Agencies Ltd. It has a combined storing capacity of about 9,500 tons in sixteen tanks. Most of the products are from Caltex's refinery in Bahrain and carried by six tankers with capacities ranging from 350 to 2,800 tons.

The depot at Raysut is owned by the Ministry of Commerce and Industry and is operated by Shell. Total storing capacity is 16,000 tons in seven tanks. Products are brought mostly from Dubai and the number of trips by 2,500 ton coastal tankers is four times per month.

Even if the new refinery is completed, the depot at Port Raysut will maintain its present function, that is, to receive products and distribute them in the local market. Its storing capacity which corresponds to the demand for about two months at the present level of consumption, seems sufficient for that task.

In the contrary, the duties of the Mina al Fahal depots will have to change upon completion of the new refinery. They will no more be import terminals, but will be expected to serve as product storages of the refinery and also as distribution basis. Products to be sent to Raysut will also have to be shipped from these depots.

Present combined storing capacity of the two depots in Mina al Fahal area corresponds to the demand of about 0.8 month at the present level of consumption, which seems insufficient to meet the future increase of the demands. Therefore, it will have to be supplemented by new storage capacities in the refinery.

Unloading facilities of the Mina al Fahal depots that are presently used to receive products will be easily converted to loading services by minor modifications.

2. BASIS OF STUDY

2.1 Crude Oil

The base feedstock for the proposed refinery is the Oman Crude.

2.1.1 Properties

The properties of the Oman crude is as described in the Crude Assay dated June 1976, received from the Ministry of Agriculture, Fisheries, Petroleum and Minerals.

Although crude properties may be changed by blending of crudes from new oilfields, data and information now available is not sufficient to allow forecast of the properties as precise as the Crude Assay.

2.1.2 Supply conditions

A sufficient quantity of crude oil is supplied at the entrance of the proposed refinery.

2.2 Petroleum Products

Petroleum products to be studied are:

- LPG
- Super motor gasoline (Mogas 97)
- Regular motor gasoline (Mogas 90)
- Aviation fuel (Jet A-1)
- Domestic kerosene
- Gas oil (Diesel Oil)
- Bunker Fuel oil
- Aviation gasoline (Avgas)
- Asphalt (Bitumen)

2.2.1 Specifications

The specification of the petroleum products are fundamentally as described in the specifications of the following products received from the Ministry of Commerce and Industry:

- Super motor gasoline
- Regular motor gasoline
- Jet A-1
- Gas oil
- Bunker fuel oil

Specifications for the products other than the above are to be set forth in accordance with internationally accepted standards.

2.2.2 Prices

Prices of the petroleum products to be used in the financial analysis are as indicated by the Ministry of Commerce and Industry, that is:

	1978	1979
– LPG	–	88.18 Baisa/kg
– Super motor gasoline	46.13	52.56 Baisa/L
– Regular motor gasoline	41.92	47.87 Baisa/L
– Jet A-1	42.47	48.15 Baisa/L
– Domestic kerosene	42.47	48.15 Baisa/L
– Gas oil	38.37	43.45 Baisa/L
– Bunker fuel oil	–	26.5 Baisa/L
– Aviation gasoline	–	– Baisa/L
– Asphalt	–	– R.O./ton

2.3 Site

Two site as indicated by the Ministry of Commerce and Industry and by the Ministry of Agriculture, Fisheries, Petroleum and Minerals are to be considered for the proposed refinery, they are:

Site A: PDO area at Mina al Fahal

Site B: Near Desalination Plant at Al Ghubra

2.4 Utilities

2.4.1 Water

Potable and industrial water are supplied at the fence of the proposed refinery by the Ministry of Electricity and Water at a price of 2 Baisa/gallon, which is the supply price to P.D.O.

Sea water is used for process cooling.

Electricity is supplied by the Ministry of Electricity and Water at the fence of the proposed refinery at a price of 20 Baisa/KWH.

Economy of owning the refinery's own generating plant is to be examined.

2.5 Oil Handling Facilities

2.5.1 Crude Oil Tank

Only a minimum capacity of crude tank that is technically needed is to be installed in the proposed refinery since the existing PDO crude tanks are promised to serve as the crude storage of the refinery.

2.5.2 Products Storage and Shipping

Existing depots for distribution are to be considered as supplements for the products storage to be held by the proposed refinery in order to economize the latter.

Pipelines to transfer the products to the two existing depots are included in the scope of the proposed refinery.

Existing unloading facilities of the two depots are easily be converted to products loading purposes by minor modifications, so that the costs of the convertion is not included in the study.

2.6 Financial and Economic Evaluation

2.6.1 Monery Term

All monetary value is to be expressed in terms of Rial Omani: (R.O.), fixed exchange rate to US$ being 2.89234:1.

2.6.2 Price Basis

Evaluation is to be made on "present price basis", i.e. no price escalation is to be considered.

2.6.3 Product price

Prices described under 4.2.2 are to be used as the ex-refinery prices of the products.

2.6.4 Crude Cost

US$ 13/bbl and US$ 15/bbl, which are the FOB export prices in 1978 and at present, respectively, of the Oman Crude of 35.5 degrees API, will be taken as the cost of the crude oil to the proposed refinery.

2.6.5 Utility Cost

Supply prices of water and electricity described under 4.4.1 and 4.4.2 are to be used as the costs of these utilities supplied from outside to the proposed refinery.

The cost of natural gas, if necessary, is to be set force at half the present price of crude oil in terms of heat value.

2.6.6 Depreciation

A ten-year straight-line method of depreciation is to be applied with 10% salvage value.

2.6.7 Taxation

No taxation will be considered since the proposed refinery is a government project.

3. STUDY SCHEDUELE

The Draft Final Report of the present study shall be submitted as quickly as possible in consideration of the urgent need of decision on the refinery project.

A number of the Experts shall visit Oman at the end of five weeks after the Draft Final Report is mailed, and shall stay in Oman for one week for presentation of and discussion on the Report.

Ten copies of the Final Report incorporating the results of the discussion shall be mailed within one month after the Experts' return to Japan.

Annex 1

March 1979

SCOPE OF WORK

Feasibility Study Team
for the Oil Refinery Construction Plan
in the Sultanate of Oman
JICA

Purpose of the Study

The purpose of the Feasibility Study is to assist the Government of the Sultanate of Oman in the preparation of a plan for the construction of an oil refinery which is expected to meet primarily the future demand for various refined petroleum products in the country.

Work Procedure

The overall procedure of the Feasibility Study intended by the Study Team is illustrated schematically in the attached chart, "WORK FLOW DIAGRAM".

The major activities in the Study are indicated by the boxes in the chart. There are two kind of boxes: double-edged and single-edged ones. The former represent the collection of data and information, which are to be undertaken mainly during the present Field Survey. The latter works concern mostly analyses of the data collected and the planning of refinery facilities based on the analyses mentioned above.

(1) Collection of Data and Information

The following is the description of major activities in accordance with the chart:

(a) Data on the Economy and Industry of the Country
- Economic and industrial policies
- Tax and financing systems
- Forecast of the economy
- Parameters and indicators concerning to the national economy
- Labour force, etc.

(b) Data on Markets for Refined Petroleum Products
- Past and present consumption of each refined petroleum products
- Demand forecasts for the refined petroleum products
- Present status and future prospects for the petroleum consuming industries
- Specifications of the petroleum products, etc.

(These data are to be concerned primarily to the domestic market, though data on the neighbouring countries will be collected by the Team as well as by the home officies mainly from literature)

(c) Data on the Crude Oil Produced in the Country
- Names of crude oils and their places of production
- Properties
- Quantities available
- Methods and conditions of supply, etc.

(d) Data on Refinery Location
- Places regarded as candidates for the location of the refinery
- Natural conditions
- Infrastructures, etc.

(e) Data on the Utility Supplies
- Natural gas
- Electricity
- Industrial water
- Sea water, etc.

(f) Data related to the Planning of the Construction Works
- Overall natural and social circumferences
- Ports
- Land transportation
- Utilities for the construction works
- Labour
- Laws and regulations
- Locally available materials and equipment, etc.
- Environmental control

(g) Data on the Existing Depots for Petroleum Products
- Onwers and locations
- Type, number and capacity of tanks
- Operations, etc.

(2) Analysis and Planning

Based on the above data and information, the following works are to be carried out in the home offices:

(2.1) Market Analysis and Forecasting

Future demands for the each refined petroleum product as well as their expected specifications and competitive conditions are to be forecasted.

(2.2) Planning of the Refinery

Such major features of the refinery as location, crude processing capacity, refining scheme, requirements for the refining and utility plants, manning and organization, etc. are to be examined and proposed.

As an alternative to the refinery, a plan will also be worked out for a reserve storage of petroleum products for emergency.

(2.3) Cost Estimation

Construction and operating costs of the refinery and the reserve storage are to be estimated.

(2.4) Financial and Economic Analysis

Commercial profitability of the refinery is to be calculated and developed into a form of anticipated financial statements. Expected effects which the construction and operation of the refinery will exert on the national economy of the country are also to be estimated. Comparison will be made between the effects of the alternatives.

(2.5) Overall Evaluation and Recommendations

On the basis of the above studies, overall evaluation will be made on the refinery construction project. In addition, various problems which are likely to be encountered in the course of implementation of the project will be pointed out and recommendations will be made as to the necessary measures to be taken to cope with such problems.

(3) Reporting

The results of the study will be submitted as a Fianl Report in English language.

Prior to the completion of the Final Report, a Draft Final Report will be prepared and will be subjected to the review of the Government.

Some of the experts of the Study Team will be sent to the country to make presentation and discussion with the Government.

The Government is expected to give its comments, if any, on the Draft Final Report in writing to the experts.

Necessary improvements are to be made on the Draft Final Report incorporating the Government's comment. And the Final Report will be submitted in printed and bound form.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
P.O. BOX 216 MITSUI BLDG
2-1, NISHI-SHINJUKU, SHINJUKU-KU TOKYO
160 JAPAN

WORK FLOW DIAGRAM