APPENDIX-1A

SHUAIBA REFINERY OVERVIEW

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1.0 PROCESS OVERVIEW

SHUAIBA REFINERY was commissioned in 1968 at 95000 BBLS/D Crude oil processing capacity. In mid 60's Shuaiba Refinery Process Units were designed with high level technology and techniques available at that time. The refinery was capable to handle relatively high sulfur heavy crude oils which necessitate special processing technology.

SHUAIBA REFINERY is considered the world's first all-Hydrogen refinery with full usage of Hydrogen gas manufactured from natural gas. In Process Units, Hydrogen gas is effective in removing/reducing sulfur and nitrogen impurities from oil/gas streams upgrading products quality to meet the required international products specification. Refinery utilizes Hydro-cracking technology to convert heavy oils producing high quality light products.

Shuaiba Refinery makes a wide range of products, i.e. Naphtha as raw material for petrochemical industries, Gasoline for Internal Combustion Engines, Aviation Turbine Kerosene for Jet planes, Diesel for engines and Fuel Oil for power plant or other furnaces.

In 1975 Shuaiba Refinery was revamped to 180,000 BBLS/D Crude oil processing capacity utilizing the most updated process technology in order to achieve the needed products quality and maximize refinery profitability.

Presently SHUAIBA REFINERY is operating at 200,000 BBLS/D Crude Oil processing on sustained basis.

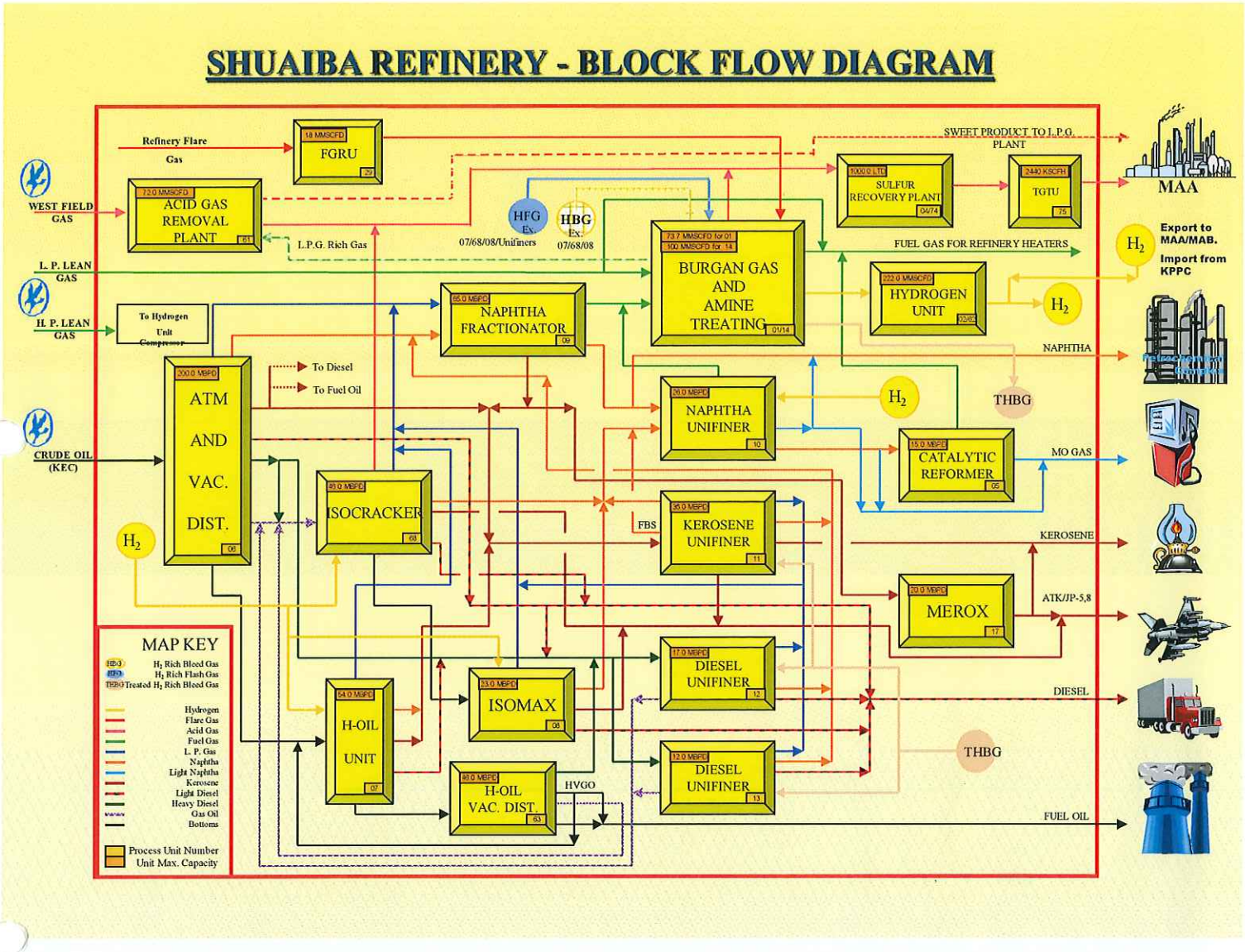
The Refinery have added new plant facilities to improve performance and comply with stringent products specifications and Environmental requirements introduced at various stages.

In 2002 Flare gas Recovery Unit and in 2006 Tail gas Treating Unit were added to enhance the environmental performance.

Process Hazard Analysis (PHA) completed for all Process units.

New Effluent Treatment Facility at MAB commissioned in 2012 to treat the effluent from SHU to meet KEPA regulations.

SHUAIBA REFINERY OVERVIEW



KNPC Shuaiba Refinery Processing Scheme comprises the following process units.

1.1 Crude Distillation Unit (Unit-06)

The redesigned capacity of the Unit was 180,000 BPSD which was subsequently upgraded to 195,000 BPSD. However, it has been subsequently operating at 200,000 BPD. The Crude Oil is separated by fractionation into the following raw products and feedstock for various downstream processing units:

Naphtha	- Naphtha Fractionation Unit (09)
Kerosene	-Hydrotreating Units (11), Merox Treating Unit (17), and Fuel Oil Blending.
Light Diesel	- Hydro-treating Units (12 & 13) and Gas Oil Blending
Heavy Diesel	- Hydrotreating Units (12 & 13)

Vacuum Gas Oil - Isocracker Unit (68 /08)
Vacuum Bottoms - H-Oil Unit (07)

1.2 Hydrogen Manufacturing Units (Units – 02E, 02W, & 62) and Hydrogen Compression Unit (Unit-03)

Each of the three identical Steam/Gas Reforming Units can produce 74 MMSCFD of 95% pure Hydrogen. The Hydrogen product is available at about 260 psig and 110°F which is then compressed to a pressure of about 2800 psig by compressors in Unit – 03.

Unit – 03 consists of five gas engine driven compressors, each of 30 MMSCFD capacity and two electric motor driven compressors, each of 40 MMSCFD capacity. The compressed Hydrogen is supplied to Hydro-cracking and Hydro-treating Units. Some modifications have been made enabling import and export of hydrogen from KPPC to Mina-Abdulla & Mina-Ahmadi Refinery through interconnecting pipelines.

1.3 Catalytic Reforming Unit (Unit – 05)

This unit is for production of Reformate – high octane motor gasoline blending component and has a design capacity of 15,820 BPSD Max. The unit operates with Hydrotreated Naphtha feed from U-10 using a Platinum based catalyst in three reactors at a system pressure of 280 psig and temperatures above 900°F.

1.4 Isocracker Unit (Unit – 68)

Unit original design capacity is 44,000 BPSD and current max. Operating capacity of 46,000 BPSD. The feed comprises a mixture of Heavy Gas Oil and Heavy Diesel from Crude Unit, Heavy Diesel Unifiner Bottoms and LVGO from H-Oil Vacuum Unit. Hydro-Cracking reactions take place in a fixed bed reactor using proprietary catalyst. Unit operates at 2500 psig and Reactor temperature varies from 750-800°F. The reactor product stream is fractionated into quality products, Naphtha, Kerosene (ATK or JP-5) and High Pour Diesel. The fractionator bottoms (unconverted part of Gas Oil) is fed to the Isomax Unit.

1.5 Isomax Unit (Unit – 08)

Unit design capacity is 36,000 BPD with 23,000 BPSD of fresh feed. The feed is normally fractionator bottoms from unit - 68. Hydro-cracking reactions take place in a fixed bed reactor using proprietary catalyst. Unit operates at 2500 psig and reactor temperature is maintained at 700-800°F. The reactor effluent, is separated into Naphtha, Kerosene (ATK or JP-5), and High Pour Diesel products. Unconverted oil & fractionator bottom, is recycled as feed while small part is sent out as bleed which normally goes to FCC feed.

1.6 H-OIL Unit (Unit – 07)

H-Oil unit consists of two reactor trains. Each H-Oil Unit train design capacity is 36000 BPSD (14400 BPSD fresh feed and 21600 BPSD Recycle). H-Oil Unit processes about 50,000 BPSD of Vacuum Bottoms from Crude Unit. By hydrocracking with a catalyst, it converts about 50% of the heavy feed into value Distillates, and a Fuel Oil of considerably low Sulfur content. The unit consists of two independent trains (07A & 07B) each of 25,000 BPSD capacity. Each train reactor section consists of feed and hydrogen heaters, an ebullating catalyst bed reactor, and recycle gas compressor. The reaction product passes thru common fractionation and vacuum distillation facilities (Unit – 63) producing mainly Naphtha, Kerosene, Diesel, light and heavy Gas Oils. These streams are further refined except heavy Gas oil that can be partly recycled with the feed.

1.7 H-Oil Vacuum Unit (Unit- 63)

The unit is designed to process 42700 BPD of Unit – 07 bottoms. Mainly the heavy ends that cannot be distilled under atmospheric pressure is separated in the vacuum tower operating at -27 in Hg vacuum. The feed is heated up to a temperature of 730°F and is sent to vacuum tower. The separation products are Heavy Diesel, LVGO, HVGO and Fuel Oil. Heavy diesel and LVGO is sent to U-13 and U-68 for further treatment. HVGO and Fuel Oil is sent to tanks.

1.8 Burgan Gas Unit (Unit – 01)

Original Design Capacity: 73.3 MMSCFD

The unit capacity is 65 MMSCFD Burgan Gas (LP Gas) feed. Part goes to Refinery Fuel Gas system while other part is compressed to above 450 psig with a pair of compressors. Compressed gas is amine treated for removal of H2S and used as feed gas for production of Hydrogen.

HP lean gas from MAA is used as Engine Fuel Gas for gas engine driven Hydrogen Compressors in Unit – 03 as well as H_2 plant feed utilizing a new compressor in Unit-14 and amine treating.

1.9 Naphtha Fractionation Unit (Unit – 09)

Unit design capacity is 65000 BPSD of Naphtha liquid feed and 17.5 MMSCFD of Naphtha Gas feed from Crude Distillation and other secondary process units. It produces stabilized Naphtha, Kerosene and low pressure gas destined for Refinery Fuel Gas System. The Unit also provides circulating Kerosene lean oil to Gas Absorbers in unit – 09 and Burgan gas unit (unit – 01) for recovery of Butane and heavier hydrocarbons.

1.10 Naphtha Unifiner Unit (Unit – 10)

This unit has a design capacity of 26,000 BPSD Max. It hydrotreats Naphtha using Hydrogen on a fixed catalyst bed. Heavy Naphtha is separated from the Reaction product

to be used as feed for Catalytic Reforming Unit. The unit operates at a system pressure of 600 psig. Hydrogen requirement is normally met by excess Hydrogen available from Catalytic Reformer.

1.11 Kerosene Unifiner Unit (Unit – 11)

This Unit has a design capacity of 34,250 BPSD, normally operating at 35,000 BPD Maximum. It hydrotreates and hydrodesulfurises kerosene fraction from Crude and H-Oil Units into finished products i.e. ATK and kerosene. The Unit utilises Hydrogen in a fixed bed reactor operating at a pressure of 2200 psig.

1.12 Light Diesel Unifiner Unit (Unit – 12)

The unit design capacity is 12,600 BPSD BPSD but normally operated at enhanced capacity of 17,000 BPD. It hydrotreats and hydro-desulfurises light and heavy diesel fractions from Crude. The Unit utilises Hydrogen in a fixed bed reactor operating at a pressure of 2200 psig.

The products are diesel Base stock for blending and Gas Oil optionally used as part feed to the Isocracker Unit-68.

1.13 Heavy Diesel Unifiner Unit (Unit – 13)

The unit design capacity is 9,300 BPSD but normally operated at enhanced capacity of 12,000 BPD. It hydrotreats and hydro-desulfurises light and heavy diesel fractions from H-Oil Vacuum Unit and Crude Unit. The Unit utilises Hydrogen in a fixed bed reactor operating at a pressure of 2200 psig.

The products are light diesel Base stock for blending. Bottom heavy Diesel is used as part feed to the Isocracker Unit-68.

This unit can also operate on an alternate feed of raw kerosene like Unit-11.

1.14 Amine Treating Unit (Unit – 14)

This unit essentially serves to remove H_2S from various gas streams mainly resulting from hydrocracking and hydrodesulphurization operations. The H_2S is removed by absorption with 15% Mono-ethanolamine solution circulating in three contactors. The first contactor (V-14-01) treats Refinery off Gases and recovered flare gases from FGRU for use as Fuel Gas. Second contactor (V-14-02) treats compressed L.P. Lean Gas for use as a feed gas to Hydrogen Unit. Third contactor (V-14-03) treats High Pressure Flash Gas and excess High Pressure Purge Gas from various Hydrocracking and Unifining Units and the treated gas is used as Hydrogen Unit feed gas. Recovered Acid Gases are sent to Sulfur Recovery Plants.

1.15 Kerosene Merox Unit (Unit – 17)

The Unit is designed to sweeten 15,000 BPSD of light kerosene from Naphtha Fractionation Unit (Unit-09) to produce ATK product. The process utilizes a proprietary

catalyst on charcoal and air at ambient temperatures to remove Mercaptans and any H_2S. Unit currently operates at enhanced capacity of 20,000 BPD.

1.16 Sulfur Recovery Plant (Units – 04 & 74) and Sulfur Degasser (Unit-35)

Each of these units (Unit – 04 & 74) is capable of processing 19.2 MMSCFD of Acid Gas for production of about 600 Lt/D elemental Sulfur product. Normally both units operate for operation security. H_2S rich gas is burnt with controlled amount of air in the presence of a catalyst to produce liquid sulfur after degassing in Sulfur degasser (Unit-35) which is sent to MAA for export. Tail gases, still containing about 5% of original Sulfur, is fed to the TGTU for recovering the residual Sulfur.

1.17 Tail Gas Treating Unit (Unit-75)

The unit was commissioned in 2006. The tail gas exiting the Sulfur Recovery Units (U-04 and U-74), merges into one stream and enters Unit – 75. The purpose of the Tail Gas Treating Unit (TGTU) is to convert the remaining sulfur compounds, mainly H_2S and SO_2, into liquid sulfur, thus increasing the recovery of sulfur up to 99.5%. The Unit uses Clauspol Process which is based on the reaction between residual H_2S and SO_2 in a catalyst solution containing Polyethylene Glycol, Salicylic Acid and Sodium Hydroxide.

1.18 Acid Gas Removal Plant (Unit – 61)

The unit is designed to treat 48.5 MMSCFD West Field Gases, 17.5 MMSCFD Refinery Gases and 4,000 BPSD (currently not used) West Field Condensate for removal of H_2S and CO_2. The treated sweet product is routed to LPG Plant at Mina Al-Ahmadi Refinery and Acid Gas is routed to Sulfur Units (Units-04/74) for Recovering Sulfur. A compressor C-61-01, is used to feed Refinery LPG gases to U-61.

1.19 Ammonical Water Treating Units (U-15C, 15 & 06F)

The units 15 & 15C are designed for treating sour water from various unit to remove mainly H_2S and NH_3. Unit-15C is the Ammonical Sour Water Concentrator, designed for 340 GPM. It operates in parallel to Unit-06F, Foul Water Concentrator, which is designed for 350GPM. Both 06F and 15C produce concentrated Ammonical Water. The concentrate is reprocessed in Unit-15 to remove the H_2S and NH_3 separately and produce treated water for safe discharge and/or recycling. Recovered H_2S is sent to Sulfur Recovery Unit and NH_3 is burnt in SRU furnace or, alternately flared.

1.20 Utilities (Area-19, 20, 29, 22, 64)

Besides above mentioned units, there are other auxiliary and support units /systems in the Refinery, e.g. Boilers and Steam Stations to supply four levels of steams i.e. 900psig, 475 psig, and 50 psig and Instrument Air, Cooling Water, Distilled water, Process water, high and low pressure condensates and Nitrogen supply system.

1.21 Flare Gas Recovery Unit (Unit-29)

SHUAIBA REFINERY OVERVIEW

This unit designed to recover 18.76 million SCFD of flared gas from refinery process units. Flared gases, which earlier was burnt at Flare Stacks, are now recovered with a pair of compressors and utilized as fuel gas after necessary amine treatment for H_2S removal. The amount of gas burnt in the flare is reduced from 16.5 (average) to 0.9 million SCFD. This has drastically reduced the emission of sulfur oxides to atmosphere and minimized pollution.

2.0 STATIC & PIPING OVERVIEW

All pressure vessels, heat transfer equipment, steam generators and piping of Shuaiba Refinery are designed and installed as per the standards and codes pertinent for a Petroleum Refinery viz ASME, API, TEMA etc. in addition to the guidelines of Process Licensors. Design reviews & root cause analysis were carried out with the help of premier International consultants like Chevron, Shell, Haldor Topsoe, ABB, UOP, Fluor etc. whenever any process upsets or equipment malfunctions were noticed. Subsequently, design / material up-gradations were carried out so as to adhere with the latest specifications, standards and industrial practices prevailing at that time to ensure safety, integrity, operability, and efficiency of the plants. Further, scientific advances made to address adverse effects of H_2S, Carbonate, H_2 etc. were adopted in the design & metallurgy of equipment by replacing the components or the equipment itself during the plant life.

Equipment and piping were inspected and maintained as per the parameters of Process Licensor / good Engineering practices and an exclusive inspection manual was developed by KNPC specifying the inspection requirements and frequency covering all the items in the Refinery. Turn around schedules were fixed as per these procedures, so that unexpected Unit Downtimes were avoided.

Now KNPC is executing a mega venture" Clean Fuel Project" to revamp, upgrade and integrate KNPC's Refineries. Subsequent to this, some of the Shuaiba Refining Units are retired. Retired units are decommissioned & cleaned. All equipment, piping and related components are preserved & maintained in a fit to use condition.

3.0 ROTATING OVERVIEW

KNPC – Shuaiba Refinery comprises of various types of Rotating equipment i.e. Compressors, Pumps, Turbines, and Blowers etc...

Refinery Compressors (Centrifugal, Reciprocating, Screw types) are used for Hydrogen Compression, Recycle Gas Compression, Atmospheric Overhead Gas Compression, Overhead Gas Recovery, Isomax Gas Compression, Flare Gas Compression & to fulfil Instrument air applications etc.

Pumps (Centrifugal, Reciprocating, Screw types) are used for Feed Pumps, Splitter bottom, Cooling Water Pumps, Reflux Pumps, Sump Pumps, Chemical Dosing, Charge Pumps, Circulation Pumps & Lube oil / Seal oil applications.

Turbines used as Drivers (majority of Motors as standby) for the Pumps/ Compressors/ Blowers/ HPRT equipment.

Pumps, Compressors, Turbines are manufactured suitable for Refinery applications & Area classifications, Compliance to international standards i.e. ISO, API, Shell DEP etc.

Many Rotating Equipment have been replaced / revamped to suit advanced/modern technology, deemed necessary to ensure reliability, maintainability, standardization and extended equipment life.

4.0 INSPECTION & CORROSION OVERVIEW

KNPC has developed Inspection & Corrosion Policy and Procedure manual, in accordance with which Inspection / repairs of static equipment are carried out. The manual is based on International standards and best practices, and approved by management; it is subject to periodic updates.

Risk Based Inspection (RBI) study has been completed for all Process units using SHELL GLOBAL SOLUTIONS – I (SGS Software) except for the off sites; Inspection frequency established by RBI and I & C policy guidelines have been followed.

Integrity Operating Windows (IOW) parameters were finalized and automatic alerts for deviations / resolved alerts were established

ERW piping in wet H_2S service were analysed and high risk piping were replaced with seamless piping.

M/s Shell Global Solutions carried out detailed assessment of Plant & Equipment in the year 2008; major recommendations given by SGSI were executed during GRTA-2011.

All the equipment and piping were inspected & certified up to 31/03/2017 {Based on Risk Based Inspection (RBI) / Insp. & Corr. Policy and Procedure Manual (ICPPM) frequency} except unit-07; Unit-07 was decommissioned in August 2015 due to a fire incident.

Equipment history and inspection records for static equipment are available in MAXIMO; further, hard copies of old records are available in I&C Division - SHU.

Non Destructive Testing (NDT) records are available in Equipment Files. These include various NDT Techniques used like UT survey, Ultrasonic Flaw Detection, Radiography, Dye Penetrant Test, Eddy Current Test, IRIS / ECT, Magnetic Flux Leakage Test, TOFD / Phased Array etc. Acoustic emission test for tanks wherever done reports are available.

Fitness For Service (FFS) as per API 579 and CODECALC 2006 level 1 & 2 was carried out wherever required based on NDT findings; Reports are available in the Equipment Files. FFSs Level # 1 & 2 carried out are listed under the respective unit Static equipment list.

FFS level 3 was carried out through External agencies like JSW, TWI wherever required. The reports are available in Equipment Files. FFSs Level # 3 carried out are listed under the respective unit Static equipment list.

The following are the Corrosion related activities done in SHU Refinery:

a) Painting & wrapping coating activities.

b) Corrosion probe monitoring.

c) Cooling water, boiler feed water treatment, Process unit's corrosion control and chemical dosing

d) C P system monitoring.

e) Lessons learnt from failure analysis / RCA

4.1 ELECTRICAL OVERVIEW

KNPC Shuaiba Refinery receives power from "MEW" Ministry of Electricity and Water, Kuwait through the 132kV grid at two main power intake Substations, S/S #1A and S/S #1B.

S/S #1A has four (4) Nos. of 31.5MVA 132/6.9kV Transformers connected in parallel to 6.6kV Switchgear with Is-Limiters between the bus-sections in order to limit maximum short circuit fault current at its bus to 31.5kA. Similarly, S/S #1B has two (2) Nos. of 31.5MVA 132/6.9kV Transformers connected in parallel to 6.6kV Switchgear with Is-Limiters between the bus-sections in order to limit maximum short circuit fault current at its bus to 31.5kA.

Power fed from these main substations to various satellite substations and to some 6.6kV Synchronous and Induction motors directly, as shown in Key Single Line Diagram of 6.6kV Distribution System, Drawing reference R-00-6012 (Refer Annexure-01 in Unit Overview).

Satellite substations 2, 3, 4, 5A, 5B, 6, 7, 8, 11 12,15,16, 17, 19, 20 and 21 receive power at 6.6kV from the above Main Receiving Stations 1A & 1B; except S/S # 18, SS # 9, SS # 10 and oil pier substations where incomers are from SS#1A, SS#11, SS#9 & SS#2 respectively. The substations S/S # 9 & 10, is provided with only one incomer. Main Receiving Substations, SS # 1A, 1B, and Satellite Substations 2, 3, 9, 10, 11, 12, 19, 20, 21 & Oil pier will be retained post SHU.

Satellite substation consist of 6.6kV Switchboard with two incomers with Auto/Manual Change-over scheme, having outgoing circuit breakers for required 6.6kV motors and 1MVA, 6.6kV/440V transformers and 440V MCC. The incomers are arranged in such a way that only one incomer will be switched ON at a time while the second incomer is kept as standby in OFF position. In case of power outage in the feeding incomer, standby incomer will be automatically closed after tripping the other incomer. Manual changeover of incomers is also possible with momentary paralleling for non-interrupted changeover. All the substations are not unit specific. It shares the loads between different units.

Hence, the substations and its equipment will be excluded from the sale of units. Sale of Substation equipment shall be separately as bulk. The table below shows the connected Units to the retiring substations.

Sl. #	Retiring Substations	Connected Units
1	SS # 4	Unit 01, 09, 11, 12, 13, 14,17 & 29
2	SS # 5A	Unit 05,10 & 15
3	SS # 5B	Unit 20, 15 & 29
4	SS # 6	Unit 07& 08
5	SS # 7	Unit 06
6	SS # 8	Unit 02, 03 & 62
7	SS # 15	Unit 62 & 03
8	SS # 16	Unit 68
9	SS # 17	Unit 63 & 64
10	SS # 18	Unit 22, 29 & 61

The SS # 15/16/17 is a single building with basement type and facilitated as non-classified area by employing pressurized / Air conditioned systems.

The plant has mainly three voltage levels 6.6kV, 440V and 230V.

The maximum power demand of the plant is around 69 MW.

Diesel Engine Driven emergency generators (9 nos.) are provided at various locations; capacity varying from 300kVA to 1250kVA , 440V , 50HZ. These generators are provided with automatic starting in case of power outage and run independently (i.e. no parallel with grid power) to feed the Emergency loads of the plant as selected by plant Operator.

Automatic re-acceleration scheme is provided for some 440V motors and they are equipped with time delay under voltage protection based on process requirements.

5.0 INSTRUMENTATION OVERVIEW

5.1 INTRODUCTION

Kuwait National Petroleum Company (KNPC)'s Shuaiba refinery is comprising of various process units; the Process control systems are installed in Satellite Instrument Houses (SIHs) located in each unit . The complete refinery Operation is from the Central Control Room (CCR), where operator consoles (GUS) of all Process units are installed. The systems installed for Process control functions are as below:

5.2 DCS (Distributed Control) System

SHUAIBA REFINERY OVERVIEW

The basic Process control is managed by DCS (Distributed Control System) manufactured by M/s Honeywell; the system installed is TPS (Total Plant solution).

The function carried out by DCS are:-

a) Basic and complex field measurement control and regulatory control of Process unit.

b) Alarm Function

c) Interfacing with DMC (Dynamic Matrix control). DMC is a model based advanced control system which is more advanced than the normal PID controls in the DCS

d) Managing History of Process parameters, Trends

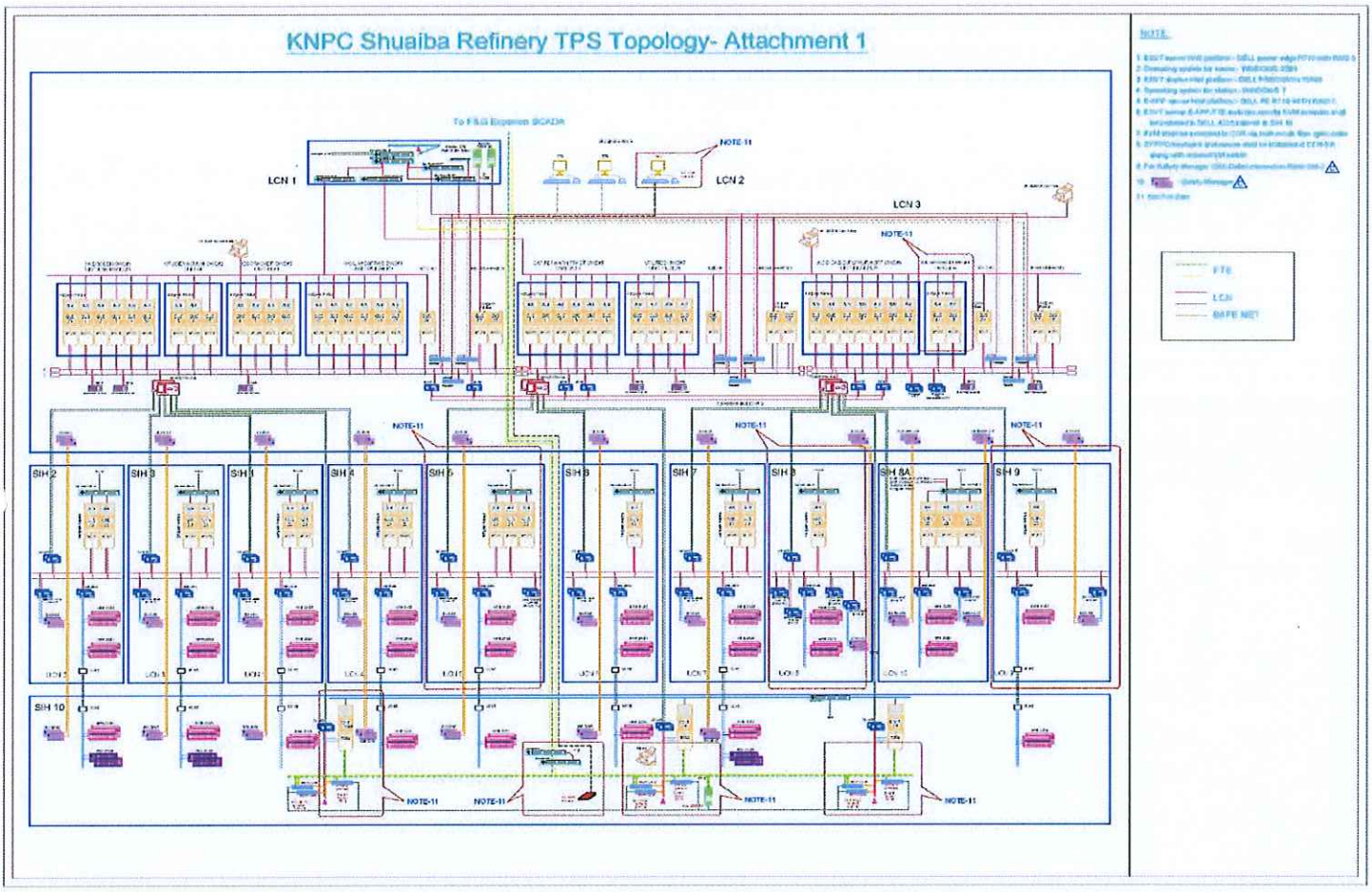
e) Relaying of signals and SOEs from other systems including ESD. SOE (sequence of events). Solution can capture both the first event and sequence of events that occur in the plant during a shutdown or a trip sequence to help in documenting when events have occurred

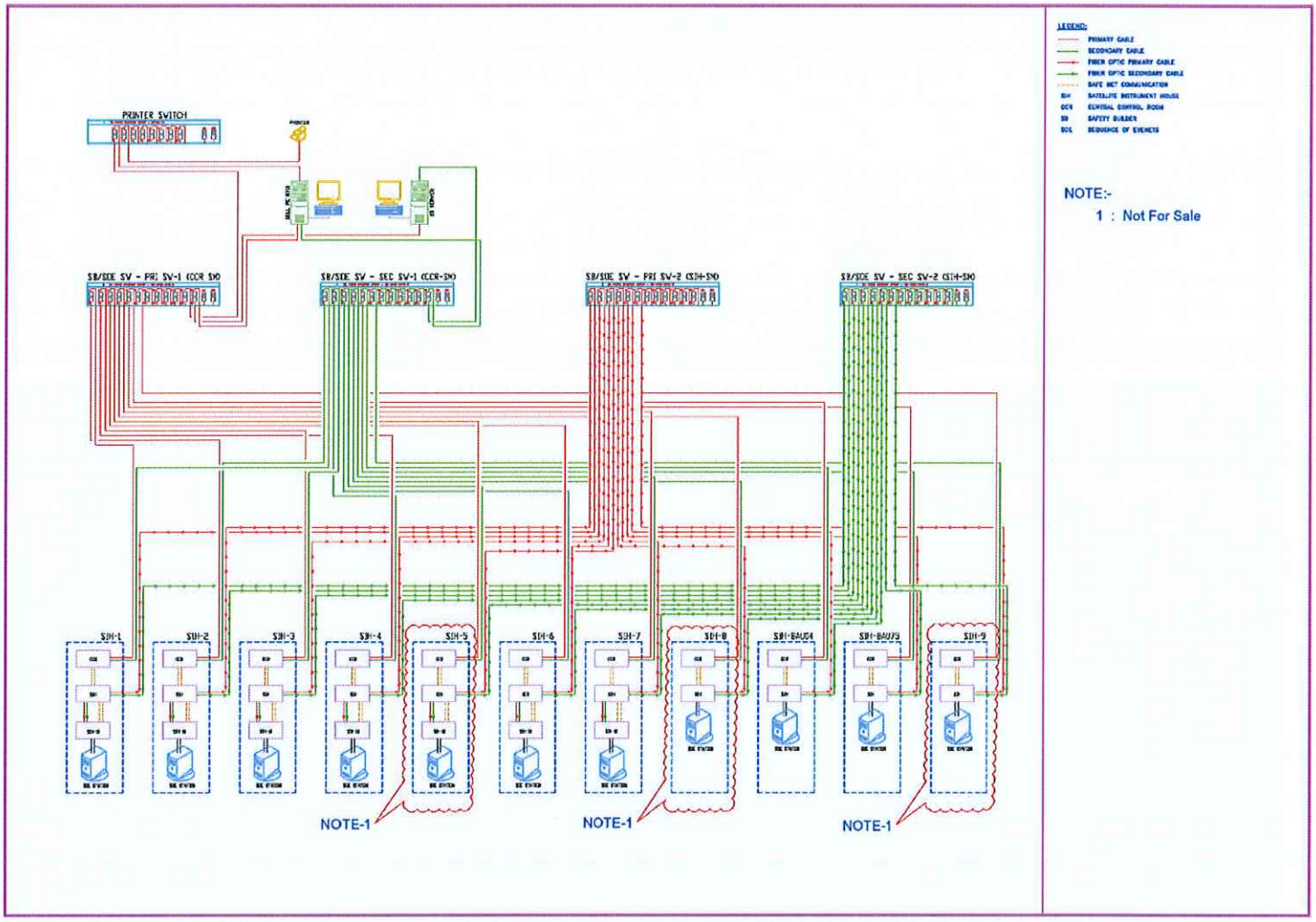
f) Providing accurate detection and storing of events with accurate time stamps.

g) Providing details on occurrence of change of states in Process control and precise order of occurrence

Honeywell make TPS System was installed and commissioned in the year **2000.** The overall System Architecture in Shuaiba Refinery is as below (attachment no 1 & 2).

SHUAIBA REFINERY OVERVIEW





5.3 ESD (Emergency Shutdown) system

Unlike a process control system, which is designed to control process variables, **an Emergency Shutdown System represents a layer of protection that mitigates and prevents a hazardous situation from occurring**. An ESD system is extremely reliable and function on demand. During an emergency, it shutdowns the process in a safe and orderly fashion.

In Shuaiba refinery the ESD functions are managed mainly by M/s Honeywell Safety Manager The system was installed in Year **2011** replacing the ABB August System. The main Functions of ESD are:-

a) Tripping of Unit/process train/Equipment on demand

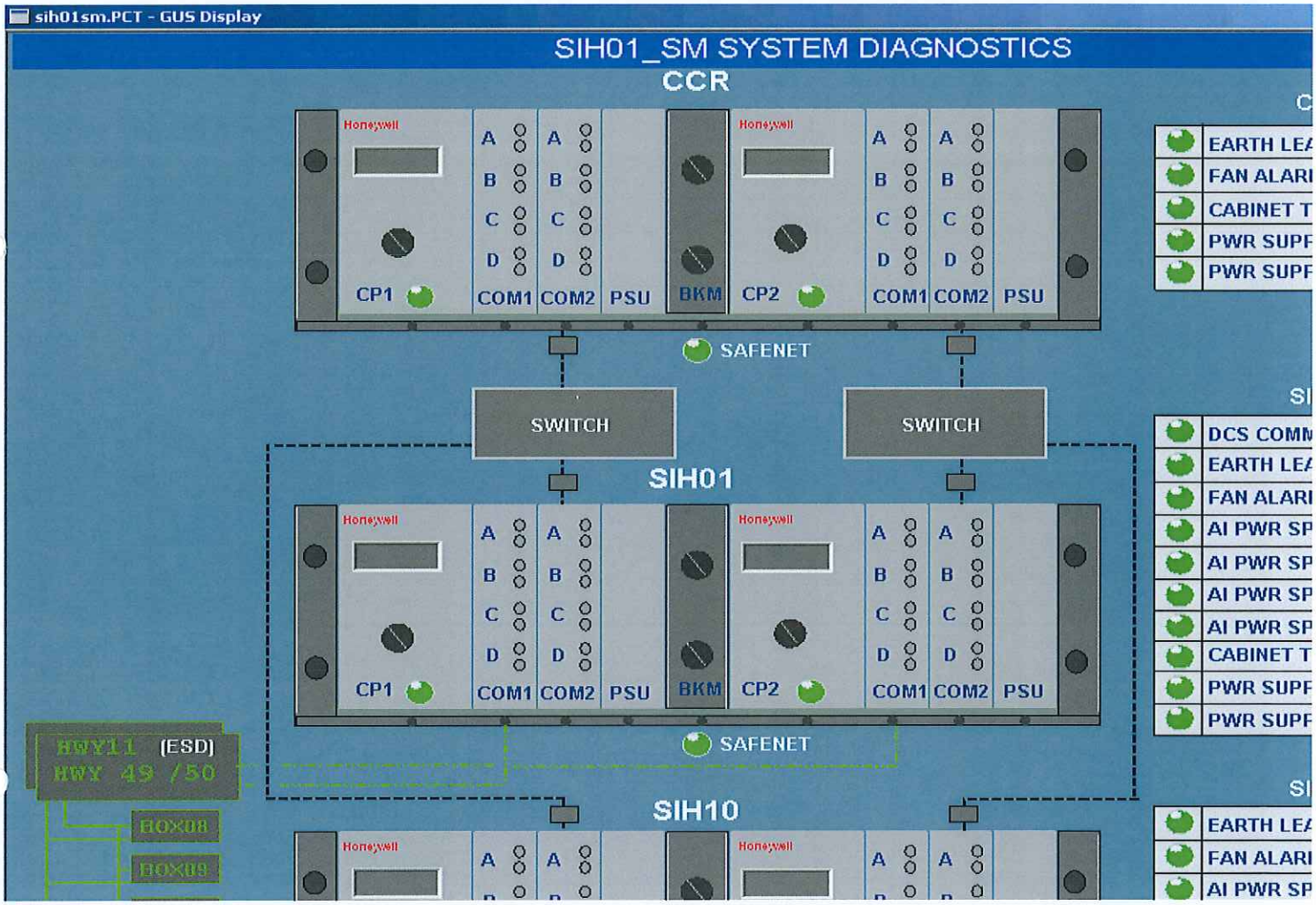
- Protection of life
- Protection of plant equipment
- Avoidance of environmental pollution

b) Provide alarms on plant abnormalities (through annunciator/ DCS)

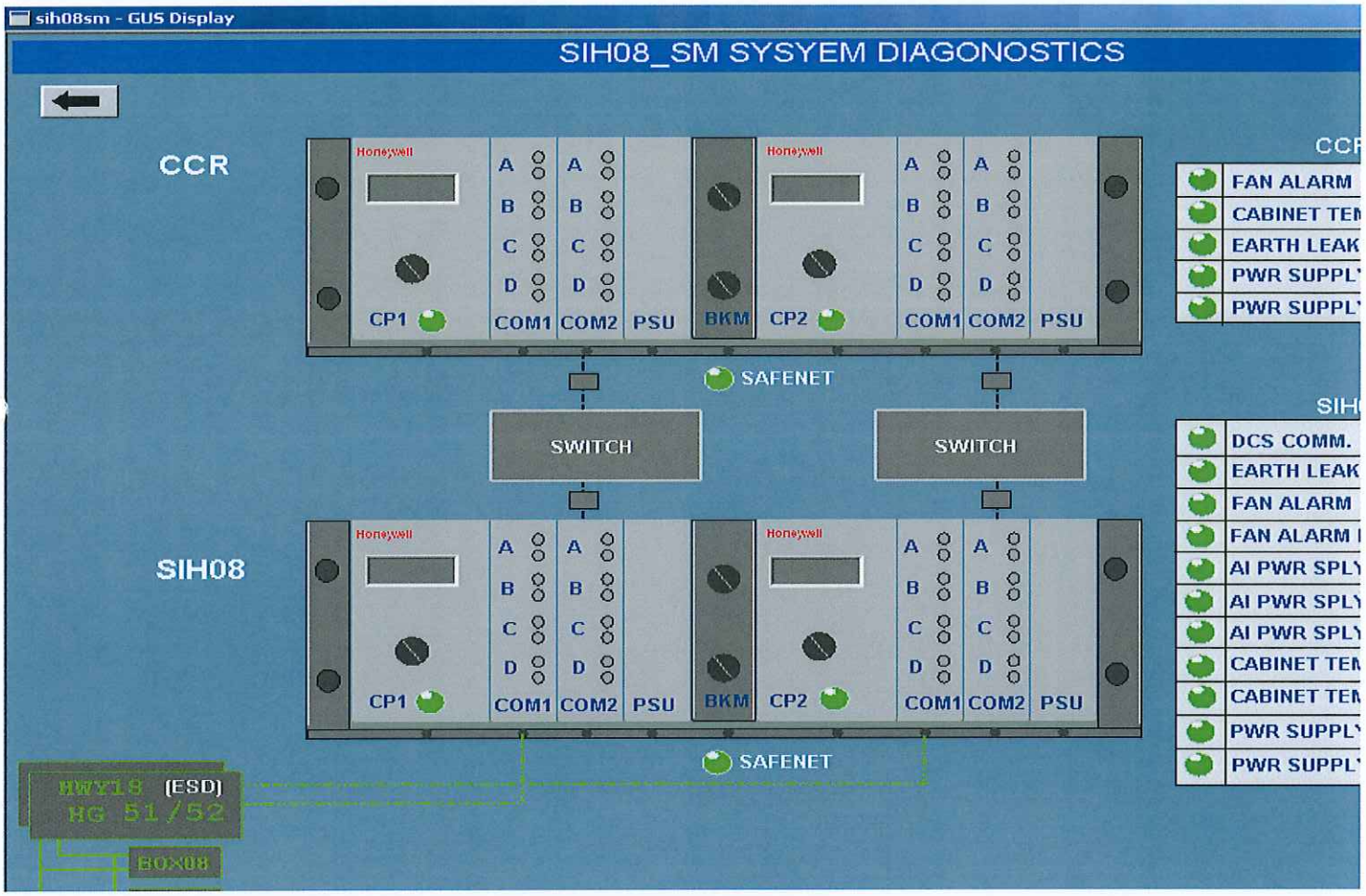
c) Provide Diagnostic Status of System.

d) Maximizing plant production *i.e* avoiding unnecessary shutdowns

5.4 Typical Architecture of Installed ESD System (SIHs # 1 to 7)



5.5 Architecture of Installed ESD System (SIHs # 8, 9, 8A-TGTU, 8A- SRU)



5.6 FSC (Fail Safe Controller) System for ROIV

Remote Operated Isolation Valves (ROIVs) are emergency block valves used to isolate equipment, by remote operation to control the hazardous situation. ROIVs are operated from existing Global User Station (GUS) of Honeywell DCS at Control Room (CCR) & Satellite Instrument Houses (SIHs) and locally at field. To facilitate such operation, ROIVs are connected to a safety PLCs of Honeywell make and provided in SIH#10.

The system was installed in the year **2006.** There are 3 no. FSC system installed in SIH and performing control of RIOV's as per the detail below

FSC-1 for 23 nos. ROIV's: Unit 02 & Unit 03

FSC-2 for 21nos. ROIV's: Unit 06 &Unit 08

FSC-3 for 16 nos. ROIV's: Unit 01, 09, 14 & unit 29

5.7 Units Covered Under Each SIH (DCS & ESD System)

SIH1 System: (Includes SIH1, SIH1 portion in SIH10 and SIH1 portion in CCR):- Unit 63, Unit 68

SIH2 System: (Includes SIH2, SIH2 portion in SIH10 and SIH2 portion in CCR):-Unit 02E, Unit 02W, Unit 62, Unit 03

SIH3 System: (Includes SIH3, SIH3 portion in SIH10 and SIH3 portion in CCR):- Unit 06, Unit 08

SIH4 System: (Includes SIH4, SIH4 portion in SIH10 and SIH4 portion in CCR):- Unit 07A, Unit 07B, Unit 07F

SIH5 System: (Includes SIH5, SIH5 portion in SIH10 and SIH5 portion in CCR):- Unit 05, Unit 10, Unit 20, unit 15

SIH6 System: (Includes SIH6, SIH6 portion in SIH10 and SIH6 portion in CCR):- Unit 11, Unit 12, Unit 13

SIH7 System: (Includes SIH7, SIH7 portion in SIH10 and SIH7 portion in CCR):- Unit 01, 09, 14, Unit 61

SIH8 System: (Includes SIH8, SIH8 portion in CCR):- Unit 74, Unit 35

SIH8A-TGTU System: (Includes SIH8A-TGTU, SIH8A-TGTU portion in CCR):- Unit 75

SIH8A-SRU System: (Includes SIH8A-SRU, SIH8A-SRU portion in CCR):- Unit 04

SIH9 System: (Includes SIH9 system in SIH100:- Unit 34, Unit 24 Local Marketing, Fire and Gas alarm system.

SIH10 System: (Includes Extension cabinet (DCS & ESD) of SIH1 to SIH7, SIH9), 3 no FSC system for RIOV

Note1: Detail of DCS, ESD and GUS Systems installed in SIH & CCR, which can be considered for sale as well as the items which are not for sale are listed in Appendix 2A & 2B.

6.0 HSE OVERVIEW

KNPC is committed to lead its business in a manner that the Health and Safety of its employees, contractors, public as well as environment are protected. To achieve the above, KNPC has implemented HSE Management System (HSEMS) in the year 2003 named SHEMS. Later, in the year 2014, KNPC has integrated PSM and Security with SHEMS and became iSHEMS.

KNPC HSSEMS (i-SHEMS) has 16 elements, designed with an objective to manage the risk to Personnel, Asset, Environment and Reputation arising from business, thereby achieving the objectives of Company's Mission, Vision and HSSEMS policy.

Elements of i-SHEMS are developed based on industry standards & international best practices. Out of 16 elements, the following elements address (directly or indirectly) the integrity of equipment, pipeline and process integrity.

- Element # 4: Process Hazard Analysis (PHA)
- Element # 5: Management of Change (MOC)
- Element # 6: Quality Assurance-Projects (QA)
- Element # 8: Mechanical Integrity (MI)

The implementation of HSSEMS is being monitored periodically through Internal and External audits.

As process incidents are very serious that will result in catastrophic effect, Process Safety Management System (PSM) has been implemented in KNPC during 2012 to control/prevent Process incidents. Process Safety requirements are being handled by a dedicated division named Process Safety Management headed by Team Leader, PSM reporting directly to Manager, HSE. PSM KPI's are prepared in line with international best practices and being monitored periodically in the SHEEC meeting headed by CEO of KNPC.

To ensure KNPC Management System is a robust HSSEMS and having all the essential features, KNPC has developed, implemented and got certified for the expanded Integrated Management System (e-IMS) integrating OHSAS 18001:2007 for Occupational Health & Safety (OH&S), ISO 14001:2015 for Environment (E) and ISO 9001:2015 for Quality. Top Management is fully committed to this Expanded IMS Implementation by providing continuous support & guidance.

The ongoing Safety Culture Enhancement Consultancy Study would go a long way in ensuring that the HSSEMS in KNPC would get continual improvement in the years ahead. KNPC is a consistent winner of RoSPA & BSC International Safety Awards since 2006. Strategic Initiatives are in place under the Long Term HSE Strategic Planning 2030, which would ensure alignment of KNPC's HSE Policy with that of its umbrella Organization KPC.

KNPC has the best HSE Documentation System prepared in line with international standards, codes and practices which includes Specifications, Standards, Guidelines, Safe Work Practices etc., which governs all its operations as well as contractor activities.

Legal requirements and requirements of International standards are strictly being complied with at KNPC. Typical legal requirements, which are being referred, are Kuwait Environment Public Authority (KEPA), Kuwait Fire Regulations, various Ministerial Decrees, and Kuwait Labor Law etc. Typical International requirements are Basel Convention Guidelines, International Standards etc.

To motivate employees towards HSE, regular HSE events such as Campaigns, Contractor HSE Seminar, CEO HSE Awards, HSE Rolling Trophy Award Function etc. are being conducted by involving Company and Contractor employees.

KNPC is having an excellent Safety Training System (STS) which ensures the workforce are equipped with appropriate skills and knowledge to perform their duties effectively without harm to either themselves or others which will help to protect the environment and our business assets.

Relevant details of KNPC HSSEMS are available under https://portal.knpc.net/HSE/Pages/default.aspx.

7.0 ENVIRONMENTAL OVERVIEW

KNPC's Environmental Management System (EMS) has been certified as per the ISO 14001 standard from the year 2005. Over the last few years, KNPC has been integrating its various management systems. KNPC's integrated HSSE policy is developed based on Company's Visions, Mission and Values and KPC HSE policy.

KNPC has an elaborate EMS which includes various procedures which cover a variety of environmental issues. Shuaiba Refinery Operations and activities were in line with these established procedures.

Environmental Procedures at KNPC

Common Wastes Generated at KNPC

Environmental Guidelines During Shutdown-Star

Guideline on Management of Wild Life Habitat

KNPC Environmental Legislative Register

KNPC Environmental Management System Objec

Procedure for Identification and Evaluation of En

Procedure for Solid Waste Management

Kuwait Environmental Public Authority (KEPA) came into existence in Kuwait in year 2001 & KEPA regulations came as law binding on all industries. KNPC has been proactively engaging with the Environmental Authority and has pioneered implementation of Environmental Regulations in Kuwait. KNPC has a well-established Environmental monitoring plan and engages a third party environmental laboratory to carry out independent Environmental monitoring.

Environmental monitoring includes stack monitoring, Ambient Air quality monitoring, Effluent monitoring and Solid Waste testing. The stacks of heaters and boilers in Shuaiba Refinery were monitored either monthly or quarterly based on heat duty and results compared with KEPA regulations. Over the years of operation, many projects have been implemented in Shuaiba Refinery to enhance its environmental performance in line with the company's HSSE Policy.

8.0 ARCHIVE OVERVIEW

Shuaiba Refinery has central archive for storing various documents e.g. Drawings, Manuals, Reference books, Data sheets, etc. , has operating procedure complying with ISO 9001:2008 standard. Documents are well indexed, stored properly, easily retrievable and manned by well-qualified personnel. Some of the documents are in Electronic form also.

9.0 SHU CLOSURE ACTIVITIES OVERVIEW

Shuaiba Refinery ceased operations on 31 March 2017 as part of the plan for retiring Shuaiba facilities and commissioning of CFP facilities. Prior to shutdown, dedicated closure teams consisting of multi-disciplinary personnel have drawn up detailed plans for the safe closure and subsequent activities. In addition, a consultant study was also conducted for safe execution of the closure activities. The summary is as below:

9.1 De-inventorying Activities:

It is consisting of emptying out the hydrocarbons from the unit and their storage handling. Detailed plans were in place before the shutdown and the activities were carried out safely in time.

9.2 Purging, Flushing and Decontamination Activities:

The columns and piping and vessels were all purged with Steam to remove the hydrocarbon traces from the piping and equipment. Wherever, pyrophoric material presence is anticipated such as Crude Unit Hydrocrackers, Sour water handling units and Flare were cleaned with Chemical decontamination. The interconnecting lines between units were also steam purged / flushed. Some of piping were flushed with water and then steamed out.

9.3 Isolation Activities:

All Unit battery limits were isolated and blinded at the battery limit post cleaning activities. All related blind list and other checklists have been duly filled and kept ready for future reference.

9.4 Catalyst and packing removal Activities:

Reactors were isolated and blinded and catalyst were removed from all the reactors. Wherever, the catalyst is pyrophoric, catalyst dumping has been carried out under inert

atmosphere. Similarly, removal of packings from various Columns and Vessels have also been carried out.

9.5 Equipment Box up:

Post emptying of vessels and cleaning, each equipment was checked by Operations and Process team and cleared for box up. All the equipment were boxed up.

9.6 Preservation:

Preservation of all static equipment post box up is under Nitrogen pressure at around five psig. (Process Loop-wise); Preservation of rotating equipment such as Compressors and pumps have also been carried out as necessary.

9.7 Waste Management:

Waste management and Effluent handling plans were all made and kept ready before closure activities and handled according to the plan.

9.8 Marking up Lines:

Post preservation, P&IDs have been marked (indicating the Loop wise segregation / preservation), and lines have been marked up physically at each process unit Battery limit (where it shall be dismantled at a later stage). Since, some of the lines and part of few units would be in service post closure, these lines have also been marked in P&ID and kept for future reference; at Site, and such live lines will be marked specifically.