

POSSIBLE SCENARIO

- SCADA Center
- Wells with direct line of sight to SCADA center
- Wells with direct line of sight to SCADA center that shall also act as a repeater.
- Wells without direct line of sight to SCADA center

SCADA & OPERATIONS MONITORING CONTROL CENTER:

SCADA and Operations Monitoring Control Center shall be designed as to provide remote monitoring capabilities for well data and to provide online video transfer from the wells during injection and de-paraffinization operations.

SCADA and Operations Monitoring Control Center shall be equipped with the following components;

For SCADA functionality:

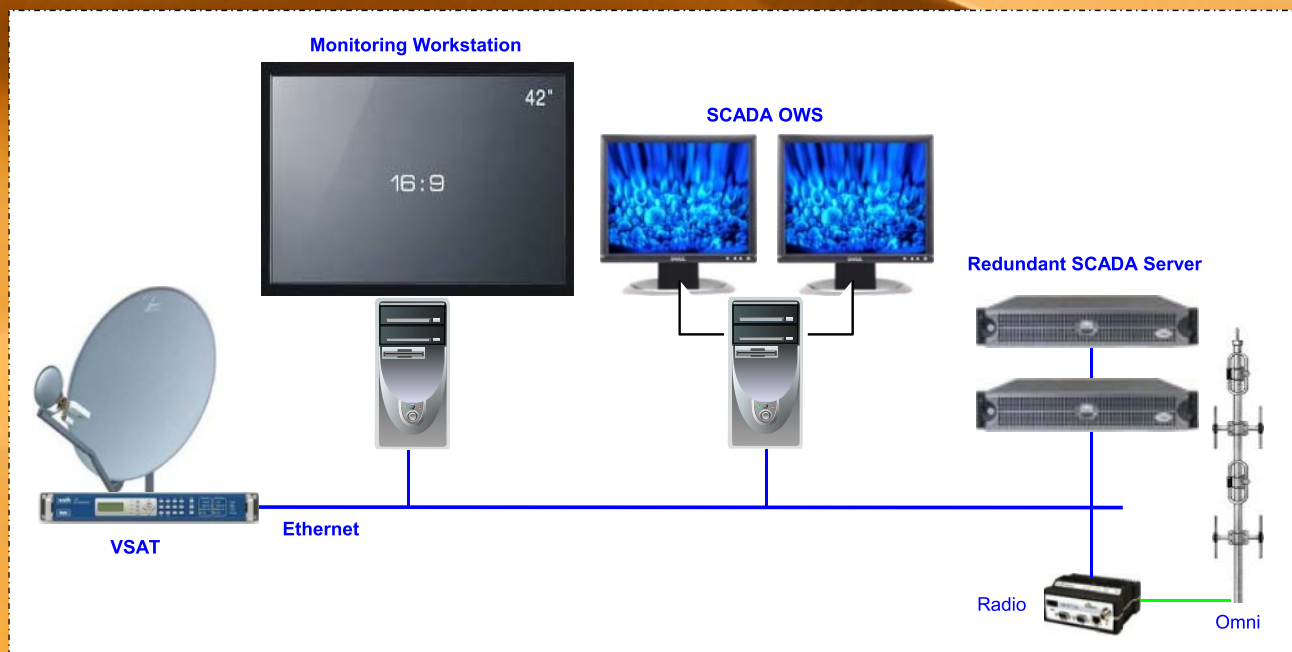
- Redundant SCADA Servers,
- SCADA Operator Workstation with dual monitors,
- UHF Master Radio and Omni-directional antenna,

Well data received from the remote terminal units shall be processed in the SCADA servers and presented to the operators for remote monitoring and control of the wells, alarming, reporting and trending purposes.

For Operations Monitoring functionality:

- Video monitoring Workstation,
- VSAT ground station equipment,

Video monitoring station shall be utilized for real-time or on-demand video transfer from a well under cleaning / re-mount / de-paraffinization operation. VSAT communications shall be used in order to provide sufficient bandwidth and fast connectivity to the wells.



Proposed Control Center

SCADA REMOTE TERMINAL UNITS:

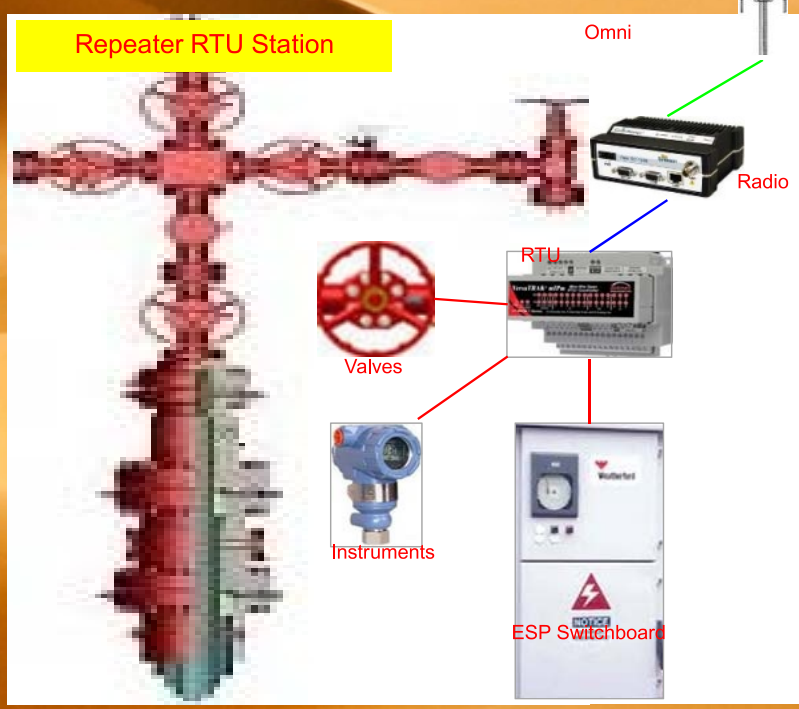
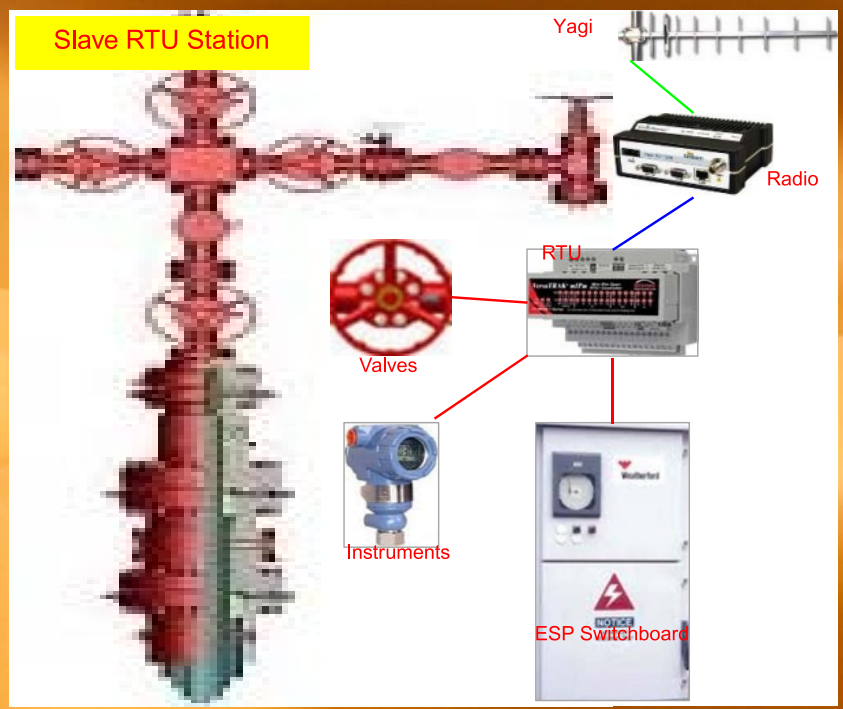
SCADA Remote Terminal Units – RTUs shall be provided in order to gather well data for remote monitoring and control functions.

The RTU station components shall be industrial grade, hazardous area certified products suitable for harsh desert environment RTU stations shall be equipped with the following components;

- Compact RTU controllers with I/O and communications capability,
- 400MHz Multiple Address System – MAS Radio frequency type UHF remote radios,
- Directional Yagi antennas in slave stations and Omni-directional antennas in repeater stations,

SCADA Remote Terminal Units – RTUs shall collect the following data from the well-heads;

- Submersible ESP pump monitoring and control capability depending on the status of the ESP switchboards,
 - Instrumentation data such as pressures, temperatures and flow rates if instruments are available,
- Surface / sub-surface / wing Valves position information if valves are equipped with proper sensors & switches,



WELL OPERATIONS MONITORING:

Wells under cleaning / re-mount / de-paraffinization operations shall be remotely monitored from the control center.

Wells under operation shall be equipped with the following equipment which shall be suitable for harsh desert environment.

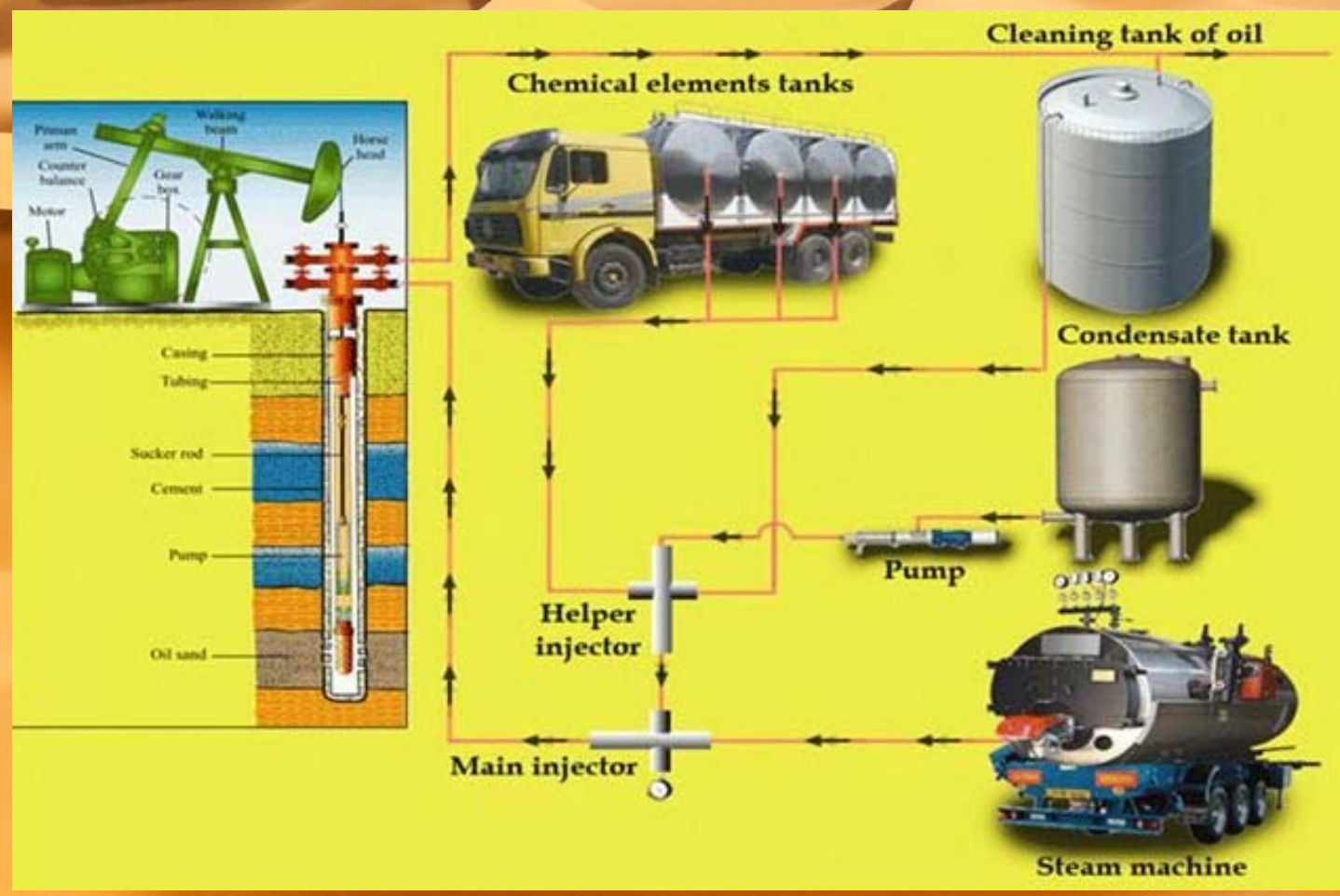
- IP type PTZ cameras for video surveillance during the operations,
- Mobile / portable VSAT stations,

The above installations shall be provided only during the cleaning operations and shall be portable.

Note: Usage of 400MHz Radio Frequency System might be subject to approval of local regulating bodies in Yemen. Hence, should be investigated first.



VSAT Components



SCADA SYSTEM COMMUNICATIONS BACKBONE:

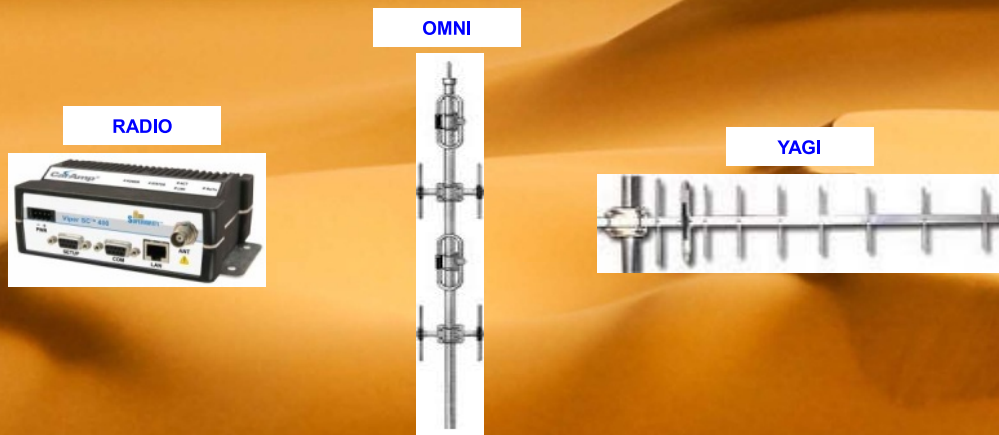
Communications backbone for the SCADA System shall utilize a 400MHz, MAS – Multiple Address Radio - MAS Frequency System operating in a licensed frequency spectrum.

Proposed UHF Radio Frequency System shall utilize the following components;

- Master Radio in SCADA Control Center,
- Omni-directional Antenna in SCADA Control Center,
- Repeater/Router Radio in Repeater Well RTUs,
- Omni-directional Antennas in Repeater Well RTUs,
 - Slave Remote Radios for Slave Well RTUs,
 - Directional Yagi Antennas for Slave Well RTUs,

Final selection of the radio frequency system components (radios and antennas) depends on the terrain data, the distances between stations and the local frequency regulations. A typical UHF MAS Radio with 5W output can provide coverage upto 50km if the path is clear / Line of Sight – LOS is free of obstructions.

Note: Usage of 400MHz Radio Frequency System might be subject to approval of local regulating bodies in Yemen. Hence, should be investigated first.



UHF RF System Components

REMOTE TERMINAL UNITS – RTUs POWER SUPPLY:

SCADA Remote Terminal Units – RTUs shall be powered from one of the following sources of electrical energy;

- 220VAC Low Voltage power supply if available in the ESP switchboards,
 - 12/24VDC power supply generated from solar energy,

If 220VAC is available in the ESP switchboards, the RTU panels shall be designed to receive 220VAC and produce 12/24VDC for internal use.

If 220VAC is not available, then the RTU stations shall be equipped with the following solar energy components;

- 12/24VDC Photovoltaic Modules,
- 12/24VDC Solar Charge Controllers,
- 12/24VDC, VRLA, Gel type batteries,

Note: If Solar Power System is utilized, battery banks shall be sized for an autonomy of one day.



PV Module



Charger



Battery

STEEL STRUCTURES FOR SCADA SYSTEM:

SCADA Remote Terminal Units – RTUs shall be installed on a structure with the following components;

- 20mt – 30mt truss tower for the Master Radio in SCADA Control Center,
 - 20mt – 30mt truss tower for the Repeater Radios,
- 6mt - 12mt hot dip galvanized poles for Slave RTU stations,
 - Sun-shades covering the RTU panels,

Height of the poles and the towers depends on the terrain data which should be investigated / surveyed.



**Sample Structure
For Master & Repeater RTUs**



**Sample Structure
For Remote RTUs**