Pipeline Design

Pipelines are widely used as the transportation method of petroleum. Transporting petroleum products by pipeline is environmentally friendly as it consumes less energy and emits less exhaust than other modes of transportation.

Pipeline Design Considerations:

•It is necessary to determine the size or internal diameters of the pipeline, to keep velocity below the recommended hydrocarbon velocity in pipes and to ensure no static electricity is generated.
•Identify product properties such as specific gravity, viscosity, temperature, pour point, vapor pressure and Reynolds number.
•Research and identify characteristics of the pipeline route. The preferred pipeline route depends upon topographic profile, geotechnical properties, economical factors and predicted obstacles.
•The Maximum Allowable Operating Pressure (MAOP) is considered to be a basis of calculation for the designing of the pipeline, so it is important to calculate.
•Calculate the wall thickness by interpreting the primary and secondary stressors. Primary stressors are internal pressure, external forces and dead load. Secondary stressors are temperature differentials, differentiated settlement and seismic forces.
•Pigging launching and receiving stations should be considered. Pig traps, launchers and receivers are usually installed at the two ends of the pipeline or at multiple sections of the pipeline. The pigs will be used for cleaning and inspection purposes.
•Valve manifolds will be placed in strategic locations along the pipeline to control flow and pressure within the pipe and to isolate pipe segments in the event of upset or emergency conditions. The valves locations should be accessible for maintenance.
•By referring to API recommendations we will determine the type of welding and welding dimensions to be used. Welding testing procedure will also be specified and described.
•Pipe supports will be designed to ensure the stability of the pipeline. The pipelines location, dimensions, material and assembly details are provided.
•Over pressure protection is implemented. The pipeline is armed with a pressure relief system to ensure the pipeline's pressure does not exceed 110% of the Maximum Operating Pressure (MOP) due to thermal expansion or a blockage.
•Pipeline design includes volumetric flowmeters and meter provers to monitor the transfer transactions as well as conducting volumetric balance checks to detect leaks in the system. The flow meters are integrated to the SCADA system to perform calculations in real time.

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•The Supervisory Control and Data Acquisition System (SCADA) system is located alongside the Logic Programmable Control in the pipeline control room. All valves, flowmeters, pressure gauges and temperature gauges along the pipelines will be connected to the SCADA system to provide real time information over Ethernet of fiber optic lines.
•Since 1999 regulations in the US require that pipeline operators incorporate a leak detection procedure in their operations to conform to objectives listed in API 1130 “Computational Pipeline Monitoring”. The design includes a compatible method for leak detection of the pipeline.
•Corrosion usually occurs where the pipe and supports make contact. When water is trapped between the two bodies and the paint system fails then the steel will be directly exposed to water. Over time water becomes oxygenated by air containing chloride which initiates corrosion. As corrosion progresses it will undercut paint and spread along the pipeline. The design shall address the root causes of corrosion issues caused by the pipe and support contact to create a solution for the corrosion and implement certain features that prevent corrosion from occurring.