Standardized natural gas well pads improve production efficiency

Well pad information collected by the SCADA system from the XRC RTUs gives the operator access to a large toolbox of choices for optimization.

Sheldon Ford, Peyto Exploration and Development

Peyto Exploration and Development in Alberta, Canada, has experienced significant savings and natural gas production efficiencies by standardizing well pad designs. The company now has 20 identical well pads located in its Sundance fields about 282 km (175 miles) west of Edmonton. Each well pad contains two to four wellheads. Horizontal drilling permits consolidate the four wellheads into a single pad.

To date, Peyto's assets in the Sundance area consist of approximately 624 (2,182 stacked) net sections of land over approximately 2,200 sq km (849 sq miles). The SCADA system collects information from about 750 well sites in these fields. Each field contains a building with a control room to house computers for the SCADA system.

A single remote terminal unit (RTU) controls the operations of an entire pad. Data from the RTU connect wirelessly to the company's SCADA system. Operators often use tablets anywhere in the field to log into the SCADA system to view well pad variables and change control and logic parameters.

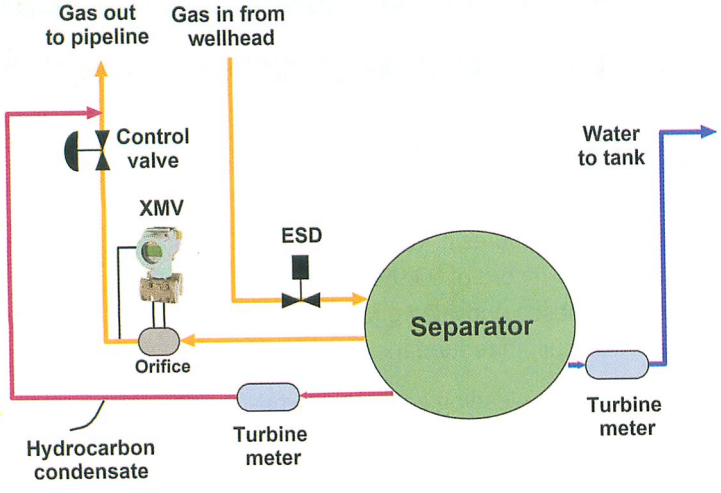

FIGURE 1. Each wellhead has a separator, producing flows of gas, hydrocarbon condensate, and water. (Images courtesy of Peyto Exploration and Development)

Wellhead design

Raw gas from each wellhead flows through a three-phase separator. Gas, hydrocarbon condensate, and water are measured after separation as shown in Figure 1. Transmitters monitor tubing and casing pressures for each well. Turbine meters measure volumes of the condensate and water. The separated water flows to a shared water tank, and from there it is trucked for disposal. The condensate is then recombined with the gas downstream from an outlet control valve.

An ABB multivariable XMV transmitter connected across an orifice in the gas line measures differential and static pressures as well as temperature. The RTU, called the Totalflow XRCG4, calculates volumetric gas flow using these variables. It contains Totalflow input-output modules to provide analog, digital, and pulse input-ouput as well as valve interface functions and communication ports for the entire well pad.

The RTU operates a Kimray outlet control valve in the gas line to regulate gas flow rates and pressures. For intermittent and plunger well operations, it also opens and shuts the gas line. Typically, the RTU shuts the well on low gas flows and opens it based on the pressure differential between the well tubing and pipeline pressure. The RTU comes with built-in programmable logic controller software functions for intermittent and plunger wells. In some cases, the on/off well operations are simply timed.

If necessary, the RTU operates emergency shutdown (ESD) valves located at each wellhead and prior to each separator. The ESD valve protecting the separator shuts down gas flow on high and low pressures. The ESD protecting the flowline downstream of the wellhead shuts down the gas flow on high and low tubing pressure as well as high and low gas flow rate. The RTU can shut down individual wells or the entire well pad, such as in instances when the water tank levels are too high. Appli-

FIGURE 2. The well pads experience freezing temperatures for half of the year, so many well pad functions are contained in heated sheds (background), with one for each wellhead.

cations for shutdown functions also come preinstalled on the XRC RTU.

Field well pads

About six months out of the year the well pads experience below-freezing temperatures. As a result, the separators, orifice runs, outlet control valves, and liquid metering reside inside enclosed sheds, with one for each wellhead (Figure 2). Infrared gas catalytic heaters fueled by well gas heat the buildings. The water tanks are similarly heated to prevent freezing.

Power for the well pads comes from 12-volt DC batteries charged by a regulator and solar panels. Typically, a pad runs off six 120-Amp/hr batteries and two to three 125-watt solar panels.

Real-time and trend data from the XRC RTU communicate with the Peyto Cygnet SCADA system via wireless mesh network and 900-MHz spread spectrum radios (Figure 3). Recently Peyto started using ABB Tropos networks for these wireless transmissions.

Well pad information collected by the SCADA system from the XRC RTUs includes gas volume, gas flow rate, differential pressure, static pressure, flow time, condensate, and water volumes for the current day as well as high-resolution gas flow rate, tubing, casing, and real-time pipeline pressures and trends. Operators also can view plunger and intermittent operational data from the applications on the RTUs.

Advanced options within the XRC RTU plunger and timer-control application have given Peyto an array of tools to choose from for optimization, offering solutions that were not previously available on all sites. Field operators now can choose from many different opening and closing conditions based on pressure differentials, flow rates, high/low pressure, time, rise, or slopes, to name a few. These additional options have proved beneficial in optimizing well sites in different situations as well as reducing man hours spent at the site. E&P

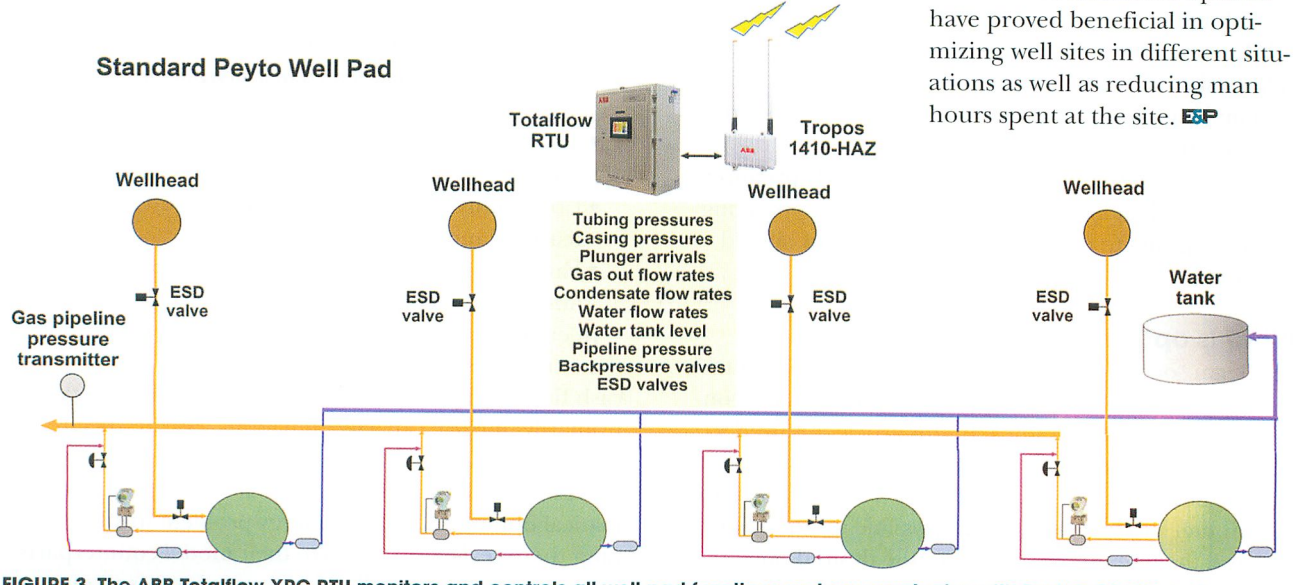

FIGURE 3. The ABB Totalflow XRC RTU monitors and controls all well pad functions and communicates with Peyto's SCADA system through an ABB Tropos network.