

Handhelds Enhance Operational Excellence Program

Written by Skip Doucette, Keyspan Energy, and Read Hayward, DST Controls
Saturday, 01 May 2004 14:49

Even with 2.5 million customers, KeySpan Energy (KSE), the largest distributor of natural gas in the Northeast, did not have a serious problem with its liquid natural gas (LNG) storage plants' maintenance data collection. The company just wanted to make it better because of tough new standards for profitability, plant security, and community safety—and the critical role equipment maintenance data plays in each.

KSE operates 14 LNG facilities in the Northeast. The 70-acre facility in Tewksbury, MA, supports a low-profile 95 x 185 ft double-walled, cryogenically insulated steel storage tank. When full, the vessel holds 12 million gal of LNG maintained at 260 F. Liquefied product is brought into the facility by cryogenic tanker trucks. Later, when vaporized for distribution to customers, the gas leaves the facility via three pipelines at a "street pressure" of 60 psi and a temperature of 75 F.

The plant is completely self-sufficient energy-wise, with three natural-gas powered, 460 hp Caterpillar reciprocating engines each running a 350 kW electric generator set. Also, two 240 hp six cylinder Caterpillar engines drive the plant's two Ariel gas compressors that pack up to 3 million cu ft per day of boil-off, which is produced as the LNG gradually warms, into the distribution system.

To ensure plant safety and profitability, KSE uses condition based maintenance (CBM). Its program is part of the company's enterprise-wide Operational Excellence initiative. The success of both programs ultimately depends on comprehensive, reliable, and timely plant metrics.

Upgrading data collection

In an effort to keep costs down yet improve critical maintenance data collection, KSE management opted to upgrade its existing manual data collection systems rather than incur the capital costs of expanding their existing human-machine interface (HMI) and supervisory control and data acquisition (SCADA) systems.

Equipment and systems requiring at least once a day inspection or data extraction included smaller LNG satellite facilities, propane storage sites, remotely located generator sets, compressor stations, etc., and much of the field instrumentation that was the eyes and ears of the existing SCADA.

Handhelds Enhance Operational Excellence Program

Written by Skip Doucette, Keyspan Energy, and Read Hayward, DST Controls
Saturday, 01 May 2004 14:49

Besides being able to record meter readings, valve positions, power on/off status, etc., human inspectors also could make subjective assessments of equipment condition or status that would be too expensive or even impossible to do with instrumentation, e.g., leaky gaskets, anomalous noises from rotating equipment, corrosion damage, worn drive belts and bearings, and structural defects such as fatigue cracks.

KeySpan's existing manual inspection system needed improvements in:

- Time consumption. Selecting proper paper forms, hand writing each meter reading or equipment-status report, and manually keying those entries into the plant database PC terminal took time and money.
- Entry accuracy. Human errors and omissions in transcription on the front end, and crumpled and illegible grease-stained or rain-soddened papers on the back end conspired with keyboarding errors to defeat accurate data entry, adding risk and cost.
- Flexibility. Data sets and their configurations were difficult to change or replace. Reformatting, reprinting, and replacing data sheet templates produced their own version-control nightmares, and discouraged system improvements.

Choosing PDAs

A customizable handheld personal digital assistant (PDA) data acquisition system was the company's natural choice, as it preserved the comprehensive aspects of manual inspection and eliminated the drawbacks to paper and pencil.

When KSE staff surveyed the handheld market, they discovered a variety of products and packages to choose from, with most consisting of proprietary hardware. Many of these systems cost thousands of dollars per device, require high wireless and software licensing fees, and involve costly after-purchase integration by the supplier.

Handhelds Enhance Operational Excellence Program

Written by Skip Doucette, Keyspan Energy, and Read Hayward, DST Controls
Saturday, 01 May 2004 14:49

KSE staff felt the cost of cell-based or other wireless handheld data entry was not warranted, nor was heavy duty data processing in the handheld device— inspectors already carried two-way radios to report immediate concerns, the existing SCADA system already monitored all safety-critical systems, and immediate data transfer was not necessary for CBM record-keeping. The company wanted a maintenance data collection and storage system, not a manufacturing or warehousing situation that required constant real-time updates to company-wide systems.

The search for a handheld system that would fit the KSE Operational Excellence program and its budget constraints ended with dBehold from ClearControls, a division of DST Controls, Benicia, CA. The application is nonproprietary and runs on any third party Palm OS or Pocket PC platform, so KSE selected Symbol Technologies' Model 1800 industrially hardened barcode scanner with integrated Palm OS as the PDA hardware.



Compressor discharge temperatures are easily gathered using the handheld, providing a way to baseline performance data. A standard database is used to convert data to information for analysis.

How the system works

All equipment and systems to be read or assessed are assigned an identification number in the plant's maintenance database. An industrial-strength barcode label is generated by the dBehold application for placement on or near the equipment to be inspected. When a

Handhelds Enhance Operational Excellence Program

Written by Skip Doucette, Keyspan Energy, and Read Hayward, DST Controls
Saturday, 01 May 2004 14:49

technician approaches a meter to be read or piece of equipment to be inspected, either the bar code label located on the piece of equipment is scanned or the equipment's name or ID number is entered using the stylus.

The appropriate data entry template for that equipment displays on the screen and the inspector taps in the data. Pre-configured radio buttons, check boxes, text boxes, and textual prompts speed the data entry process. At the end of the shift, the PDA is returned to its cradle, the Synchronization button is pushed, and the collected data is auto-uploaded into any ODBC-compliant database. All entries are time stamped, which increases the value and reliability of the reports generated by the application.

The system can be configured with password protection and acceptable ranges for data. An entry that is out of the acceptable range will prompt the inspector to verify the data. If accurate, an extreme reading may indicate that a service condition exists.

Factors in the decision

The nonproprietary hardware platform means additional or replacement handheld units can be purchased independently of the application provider and supported locally. The software can be easily installed by users. The PDA is small, light, and rugged. ODBC compliance means easy data upload to any mainstream database, ERP, or MRP software on a local PC or the company Intranet. Palm or Pocket PC devices are ubiquitous and reasonably priced.

During the winter of 2003, KSE began using the system to collect equipment and system readings at its Tewksbury plant. Readings are taken daily and stored in an Access database for equipment such as air compressors, air dryers, natural gas compressors, engines, electric power generators, furnaces, water pumps, liquid natural gas pumps, liquid natural gas vaporization exchangers, electric motors, tank heater circuits, battery charger systems, and cooling tower systems. Data gathered includes pressure, temperature, flow rates, amperages, kilowatts, voltages, and pressure differentials.

Improved data gathering

KSE configured its system so that a particular unit or equipment group to be inspected is given a unique location identity and all related reading points carry that association. This minimizes scanning actions and saves time, as only the first point for a location has a bar code label to be read. Once that first point is scanned, each successive point to be read is displayed by tapping the Next button. After the final point is entered, the display indicates that

Handhelds Enhance Operational Excellence Program

Written by Skip Doucette, Keyspan Energy, and Read Hayward, DST Controls
Saturday, 01 May 2004 14:49

all readings for the current location are complete. The unit is then ready for the next location and its associated reading points.

Most readings for equipment are taken twice per shift across all three shifts. Other systems are inspected daily, weekly, or monthly as required.

Because of the cryogenic temperatures in the LNG storage vessel, foundation heating systems are required to prevent frost-heave from deflecting the tank's base. This system consists of nichrome wire heating elements latticed across the bottom of the storage tank. Amperage readings from the heating grid provide quick indication of system performance. If one element fails, a drop in amperage will result. Weekly readings entered into the handheld system provide the baseline from which amperage drops are quickly discerned.

The company also uses the PDAs for tracking water pump performance. LNG must be vaporized to a gaseous state for distribution to customers. This is accomplished by a falling film of heated water and glycol being cascaded through troughs and over a series of thermally conductive steel leaves in the vaporization units. Performance degradation of the pumps controlling this process occurs gradually. Pump discharge pressures, amperage draws, and flow rates are recorded regularly for benchmark comparisons.

Many heat exchangers are in service throughout the plant, providing cooling tasks for various plant processes. Tracking the change in temperature across a heat exchanger assesses the unit's performance. When the change in temperature narrows, it is time to service the unit. This is easily monitored from a table or a report generated by the software—much better than paper data sheets.

After collecting and uploading via the PDA cradle, the data is converted to information using a database. Then it is easy to query certain points across specific date ranges to view the performance of a unit more closely. Tables from those queries easily can be copied to a spreadsheet to create trend charts or other graphic representations to assist with data analysis.

Operational Excellence CBM coupled with the fiscal realities of twenty-first century energy distribution constantly challenge the KeySpan staff to increase efficiencies while maintaining

Handhelds Enhance Operational Excellence Program

Written by Skip Doucette, Keyspan Energy, and Read Hayward, DST Controls
Saturday, 01 May 2004 14:49

safety margins. No longer being locked into the fixed data configurations goes along way in helping meet that challenge while discovering new ways to use plant data that is now convenient to collect, easy to use, and trustworthy. **MT**

Skip Doucette is plant supervisor at KeySpan Energy's LNG facility, 20 Pierce Ave., Salem, MA 01970; (781) 466-4720. Read Hayward is integration manager at [DST Controls](#), 651 Stone Rd., Benicia, CA 94510; (800) 251-0773