

David Lindstrom parked his car near the front door of a nondescript one-story building in a rural area on the outskirts of Sandy, California, a bedroom community of 20,000 residents primarily working in the agriculture industry. After locking the car, he glanced at his watch; it was a few minutes before 4 o'clock, the beginning of his shift. Next to the main entry door was a framed wall plate with the word SCADA etched in the gold veneer. What the other tenants in the building didn't know was the room housed a state-of-the-art Supervisory Control and Data Acquisition Control Center for the distribution and management of pressurized natural gas through a network of pipelines. The SCADA Center was a data collection and pipeline management facility for information on pressure, directional flow and valve positions in the pipes to ensure a timely and balanced flow of natural gas to consumers, businesses, and Government. As the Second Shift Senior Operator, it was David's job to monitor data, identify and resolve anomalies, dispatch technicians, and manage scheduled maintenance. He has been an SCADA operator for almost 25 years and was looking forward to retiring at the end of the year. David had earned his pension and was considering a new career. At 48 years old, he worried about a recent news item reporting that 90% of people over 50 do not find employment. David didn't want to be on the wrong side of the percentage. He'd dedicate two years finding a new job with his unique skill set.

David carefully positioned the ID badge attached to a lariat around his neck to the front of a small white box on the left wall near the glass door. Immediately, a green LED glowed, and the door electronically unlocked. He pulled on the door handle, opened it and walked into a foyer. The door automatically shut behind him. David turned to the right, walked down the hallway, and using his ID again on another badge reader, unlocked a windowless door and walked in.

The room has the same appearance as an Air Traffic Control Center. On one wall were three rows of carefully-positioned multiple monitors stretching across the wall, giving a perception of a single screen 15 feet across and seven feet tall. Above the display array was a digital display indicating the date and time. Appearing on the monitor configuration was a flow chart of named pipelines, compressor stations, and valves. Stacked below each name were three highlighted bars surrounding the words, "PRESSURE" with a number to its right, "FLOW" next to a white arrow pointing left or right, and "STATUS" with either the word, "ONLINE" highlighted in green or "OFFLINE" highlighted in yellow. A green highlight behind the number next to "PRESSURE" indicated the value was in the acceptable range; a red highlight signified a violation of the MAOP, the Maximum Allowable Operating Pressure.

Eight feet away from the screen array was a long Formica table anchored to a linoleum tile floor. On the desk were computer displays, keyboards, mice, and telephones. Five six-wheeled chairs were strategically placed in front of the table allowing operators to see the Wall and the monitors of computers.

Left of the affectionately named “Wall,” was a kitchenette area with a coffee station, sink, and a refrigerator. Employees were encouraged to bring food from home stored in plastic tumblers. Management supplied soda, coffee, Gatorade, and water.

To the right of the Wall were tall metal-framed shelves with technical reference books and loose papers related to operations. On the back wall, an array of black and white and color photographs appear in chronological order. Pictures of previous and current SCADA operators with management and dignitaries were prominently displayed.

David looked at his watch. It was 4 o’clock. Right on time, he thought. David sat down at one of the Center chairs, logged on the computer and displayed the control center Current Status Report. It was a standard operating procedure for incoming shift personnel to review open issues, pipeline monitoring problems, and maintenance assignments.

Steve Mulvey, the Junior Shift Operator, was already seated in one of the other chairs. He turned his seat toward David. “Hi, David, it looks like another one of those quiet shifts. I guess it’s good for us that everything is operating smoothly. The only thing that I would keep a keen eye on is the installation of an uninterruptible power supply. There is a team that is connecting a new system as part of a new government regulation - something to do with earthquake protection of our system. Probably makes sense. We sure don’t want to go dark in case of a quake.”

David looked at the activity log. “Yeah, you’re right. According to the log, the Wall has gone dark a couple of times today already.”

“Are you concerned?”

“No, from what I see everything appears to be running smoothly. As you see on the Wall, there are no valve problems in the field, and the compressor stations are running efficiently. As you know, the system will automatically adjust around 6 o’clock to synchronize with the increase in demand for gas for residential stoves and heaters.”

Steve pointed to the right end of the Wall. “Everything is green except for those two pipelines over there. They are off-line.”

David scanned the display wall again. “Guess it’s time for a coffee. Do you want one?”

“No thanks.”

David rose from his chair, walked to the kitchenette, prepared a fresh pot of coffee, and poured himself a cup. He opened the refrigerator door and grabbed the half-gallon box of 1% milk, checked the date, removed the cap, and poured a little milk into his coffee. David returned the milk to the refrigerator. With his coffee in hand, he noticed that Steve was standing in front of the array of pictures on the back wall.

Steve leaned forward and pointed at one of the pictures. “Is this you?”

David, holding the cup of coffee in his right hand, walked over to the wall and looked at the picture.

“Yeah, that’s me. It was taken two days after the Loma Prieta Earthquake south of San Francisco in 1989. It measured as a 6.9 magnitude quake on the Richter scale and killed over 60 people. Nationally, it was known as the 1989 San Francisco Earthquake. However, the epicenter was around 70 miles south of San Francisco in Aptos, California. I was here at Sandy when the alarms went off. We scrambled to make sure our part of the pipeline network remained intact. It turns out that we had to shut down only one pipeline temporarily as a precaution. The rest of the pipeline system operated without a hitch.”

Steve moved his head closer to the picture. "Look at all of that equipment in the background. What did all that gear do?"

David looked at the picture and turned to Steve. "The natural gas pipeline infrastructure has come a long way in the last 25 years. When the computer age arrived, our SCADA centers were controlled by minicomputers. However, each center managed its assigned little island of pipeline controls. It was our personal merry-go-round; we only knew when riders got on or off. We didn't have any idea where they came from or where they went. Unfortunately, there were no data connections to other SCADA centers at that time.

Steve was surprised. "You mean, each SCADA center was on its own?"

"Yes. Then the pipeline industry discovered the benefits of installing a local area network. With LAN technology, multiple desktop computers within a single SCADA center could share information. Later, we employed the Internet to connect SCADA centers to a single board computer, called a Programmable Logic Controller (PLC) that manage natural gas compressor stations in remote locations. Today, we can retrieve real-time data and respond to alarms from networked devices at any time. Also, the network eliminates the need to have personnel present at compressor stations. Bottom line, with the advent of the Internet the connection is always on."

"I guess everything we need to know is right in front of us at all times. Right?"

"You are correct. Connecting through the Internet allowed us to remove all of the obsolete telephone equipment and dedicated phone lines that you see in the equipment racks behind me in the picture."

David and Steve returned to their assigned stations and sat down. A quick glance at the Wall indicated that the pipeline system was operating smoothly. What they didn't know was that in two hours, a dangerous situation would challenge David and Steve's training and expertise.