Pipeline & Hazardous material

National Transportation Safety Board
Washington, D.C. 20594

Preliminary Report

- Accident No.: DCA10MP008
- Type of System: 30-inch natural gas transmission pipeline
- Accident Type: Pipeline rupture
- Location: San Bruno, CA
- Date: September 9, 2010
- Time: About 6:11 p.m., Pacific Daylight Time
- Owner/Operator: Pacific Gas & Electric Company
- Fatalities/Injuries: Eight fatalities, multiple injuries
- Pipeline Pressure: 386 pounds per square inch gauge (psig) at the time of rupture
- Quantity Released: Approximately 47.6 million standard cubic feet (MMSCF)

On September 9, 2010, at approximately 6:11 p.m. Pacific Daylight Time(1), a 30-inch diameter natural gas transmission pipeline (Line 132) owned and operated by Pacific Gas & Electric Company (PG&E) ruptured in a residential area in San Bruno, California. On September 10, the NTSB launched a team to California to investigate this tragedy. Vice Chairman Christopher Hart was the NTSB Board Member on scene in San Bruno.

The rupture on Line 132 occurred near mile post (MP) 39.33, at the intersection of Earl Avenue and Glenview Drive in the city of San Bruno. Approximately 47.6 million standard cubic feet (MMSCF) of natural gas was released as a result of the rupture. The rupture created a crater approximately 72 feet long by 26 feet wide. A pipe segment approximately 28 feet long was found about 100 feet away from the crater. The released natural gas was ignited sometime after the rupture; the resulting fire destroyed 37 homes and damaged 18. Eight people were killed, numerous individuals were injured, and many more were evacuated from the area.

The Incident Command was set up by the local fire department. The immediate response by local emergency responders, as well as three strategic drops of fire retardant and water by air, assisted in stopping the spread of the fire.

According to PG&E records, Line 132, which is regulated by the California Public Utilities Commission (CPUC), was constructed using 30-inch diameter steel pipe (API 5L Grade X42) with 0.375-inch thick wall. The pipeline was coated with hot applied asphalt, and was cathodically protected. The ruptured pipeline segment was installed circa 1956. The specified maximum operating pressure (MOP) for the ruptured pipeline was 375 pounds per square inch gauge (psig). According to PG&E, the maximum allowable operating pressure for the line was 400 psig.

Just before the accident, PG&E was working on their uninterruptable power supply (UPS) system at Milpitas Terminal, which is located about 39.33 miles southeast of the accident site. During the course

of this work, the power supply from the UPS system to the supervisory control and data acquisition (SCADA) system malfunctioned so that instead of supplying a predetermined output of 24 volts of direct current (VDC), the UPS system supplied approximately 7 VDC or less to the SCADA system. Because of this anomaly, the electronic signal to the regulating valve for Line 132 was lost. The loss of the electrical signal resulted in the regulating valve moving from partially open to the full open position as designed. The pressure then increased to 386 psig. The over-protection valve, which was pneumatically activated and did not require electronic input, maintained the pressure at 386 psig.

At about 5:45 p.m., the SCADA system indicated that the pressure at Martin Station, which is downstream of the rupture location, exceeded 375 psig. The SCADA system indicated that the pressure at Martin Station continued to increase until it reached about 390 psig at about 6:00 p.m. At 6:08 p.m., it dropped to 386 psig. At 6:11 p.m., the pressure at Martin Station decreased from 386 to 361.4 psig; within one minute the pressure dropped to 289.9 psig.

PG&E dispatched a crew at 6:45 p.m. to isolate the ruptured pipe section by closing the nearest mainline valves. The upstream valve (MP 38.49) was closed at about 7:20 p.m. and the downstream valve at Healy Station (MP 40.05) was closed at about 7:40 p.m. Once the ruptured section was isolated and the gas flow was stopped, the resulting fire from the ruptured line self-extinguished. Later that evening, PG&E isolated the natural gas distribution system serving residences in the area, and within a minute of stopping the gas flow at about 11:30 p.m., fires from escaping natural gas at damaged houses went out.

When the NTSB arrived on scene on September 10, the investigation began with a visual examination of the pipe and the surrounding area. The investigators measured, photographed, and secured the approximately 28-foot-long ruptured pipe segment. On Monday, September 13, the ruptured pipe segment and two shorter segments of pipe, cut from the north and south sides of the rupture, were crated for transport to an NTSB facility in Ashburn, Va., for examination.

The examination revealed that the ruptured segment was 27 feet 8 inches long at its longest length, and consisted of a pipe section and four smaller pipe pieces (pups) between 3 feet 8.5 inches and 3 feet 11 inches long (pups are numbered one through four from south to north).

The segment north of the rupture (north segment) was 15 feet 9 inches long and consisted of a pipe section and two pups, 3 feet 7 inches and 4 feet 7 inches long (numbered five and six from south to north).

The section south of the rupture (south segment) was 12 feet 4.5 inches long at its longest length; it contained no pups.

All pipe pieces and pups showed fairly uniform wall thickness of 0.36 to 0.38 inches.

There were longitudinal fractures in the first and second pup of the ruptured segment and a partial circumferential fracture at the girth weld between the first and second pup. There was a complete circumferential fracture at the girth weld between the fourth pup in the ruptured segment and the fifth pup in the north segment. The longitudinal fracture in the first pup continued south into the pipe ending in a circumferential fracture in the middle of the pipe.

The following laboratory work on the pipe has been completed:

- Written documentation, photo documentation and visual inspection of the pipe.
- Removal of the asphalt coating from outside of the three pipe segments in preparation for non-

destructive examination work.
- Radiography of the girth welds and select seams.
- Microbiological testing of the pipe surface (samples currently being analyzed).
- Ultrasonic wall thickness measurements.
- Magnetic particle inspection of welds and seams.
- 3-D laser scanning of the pipe pieces for a digital dimensional record of the evidence.
- Measurement of the longitudinal and circumferential pup dimensions.
- Removal of key fracture surfaces from the ruptured segment for further laboratory examination at the NTSB materials lab in Washington.

The following additional work is currently on-going:

- Precision cleaning of the fracture surfaces on the pieces cut from the ruptured pipe segment.
- Hardness and microhardness testing.
- Optical fractographic analysis and photodocumentation of the fracture surfaces on the pieces cut from the ruptured pipe segment.
- Preliminary scanning electron microscopy of the fracture surfaces on the pieces cut from the ruptured pipe segment

Additional factual updates will be provided and distributed via media advisory as investigative information is developed.

Footnote

1. All times mentioned in this report refer to Pacific Daylight Time, unless otherwise specified.

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