National Transportation Safety Board

Office of Railroad, Pipeline and Hazardous Materials Investigations

Washington, D.C. 20594

Operations Group Chairman's Factual Report
Natural Gas Explosion
Carlsbad, NM
August 19, 2000
DCA00-MP-009

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Brief Narrative of the Accident and Consequences

At about 5:26 a.m., mountain daylight time, on Saturday, August 19, 2000, an El Paso Natural Gas Company (EPNG) Pipeline System Controller in EPNG's Gas Control Center/Headquarters in El Paso, Texas, was controlling a pipeline system called the "South System"[1] when alarms began to display on his SCADA[2] control screens. Alarms were coming in from a station in Southeast New Mexico, the Pecos River Station, which was about a mile to the west of the Pecos River. Approximately 625 feet to the southeast of the Pecos River bank, an EPNG pipeline had ruptured, and the escaping natural gas had ignited within 40 seconds.[3] The heat from the fire killed 12 members of two Carlsbad-area extended families who were fishing and camping on the east river bank. EPNG has spent an estimated $6,999,292 as of January 3, 2002, to replace and/or repair the damages resulting from the accident.

[1] EPNG has a north pipeline system and a south pipeline system. Both pipeline systems normally supply California and cities to the west with natural gas. The pipeline systems were controlled out of company headquarters in El Paso, Texas.
[2] Supervisory Control and Data Acquisition
[3] This estimate was derived from seismograph data. (See Appendix 1 – Seismic Signals.)

Events leading to the Accident

On Friday evening, August 18, 2000, twelve members of two Carlsbad-area extended families had driven down Whitethorn Road[4] in three pickup trucks. They crossed the Pecos River at a low water bridge,[5] traveled further and turned off Whitethorn Road onto a caliche dirt road.[6] The caliche dirt road was part of an EPNG right-of-way. They traveled down this road toward the east side of the Pecos River. They were about four and a half miles north of the New Mexico - Texas State Line and about 30 miles south of Carlsbad. The family's destination was a location on the bank of the Pecos River sheltered from the sun by a chained-off, two-lane, concrete bridge. The family camped next to the single-span concrete bridge.[7] The concrete bridge provided both shade for their fishing hole and a support for three natural gas pipelines and a water pipeline. The concrete bridge had been built by EPNG along with two nearby suspension bridges. The concrete bridge had pipelines attached to both sides and EPNG had installed steel posts linked by steel wires and chains to prevent vehicles from traveling onto and across the bridge. In addition, along the pipelines, EPNG had installed markers identifying the lines as high pressure pipelines.

At approximately 5:50 p.m.[8] on August 18, 2000, the evening before the accident, the controller who became most involved in responding to the accident, first arrived for his 12-hour duty shift at the EPNG Gas Control Center in EPNG's El Paso, Texas headquarters. His first task was to read the previous shift's *Log of Operations Report* and get a briefing on what took place during the previous shift. There were no abnormalities that took place during the previous 12-hour shift. In a post accident interview, the controller said this task and others were part of the controller's normal routine. (See Appendix 2 - Controller's Day and Night Shift Checklist.) The controller then sat at a "SCADA work station" (a set of personal computers and control monitors) and began to monitor the "south pipeline system." (See Appendix 3 - Selected Section of EPNG Mainline District Map.) This pipeline system, like the north system, normally flowed east to west. At 6:05 p.m., the controller received an alarm on his console SCADA screen and the controller called an EPNG field employee to assess the situation. The alarm was a shutdown alarm for the Prewitt Station.[9] At 7:15 p.m., the SCADA alerted the controller

[4] This Road was renamed by Eddy County in the mid to late 1980's. This road, as most county roads, was just numbered before being named. Before being named, many people knew of the road as Eddy County Road 725 or informally as "Pipeline Camp Road" or Pipeline Road because EPNG used to maintain housing, accessed from the road, for personnel who manned the Pecos River Station before it was automated. El Paso retired the housing in 1986.

[5] This is more of a crossing then a bridge. It is a concrete slab that water flowed on. A vehicle would not be able to cross on this structure during high water.

[6] Where the trucks turned off Whitethorn Road onto the caliche dirt road, the land was owned by the United States Government and managed by the Federal Bureau of Land Management.

[7] The family was camping on privately-owned land.

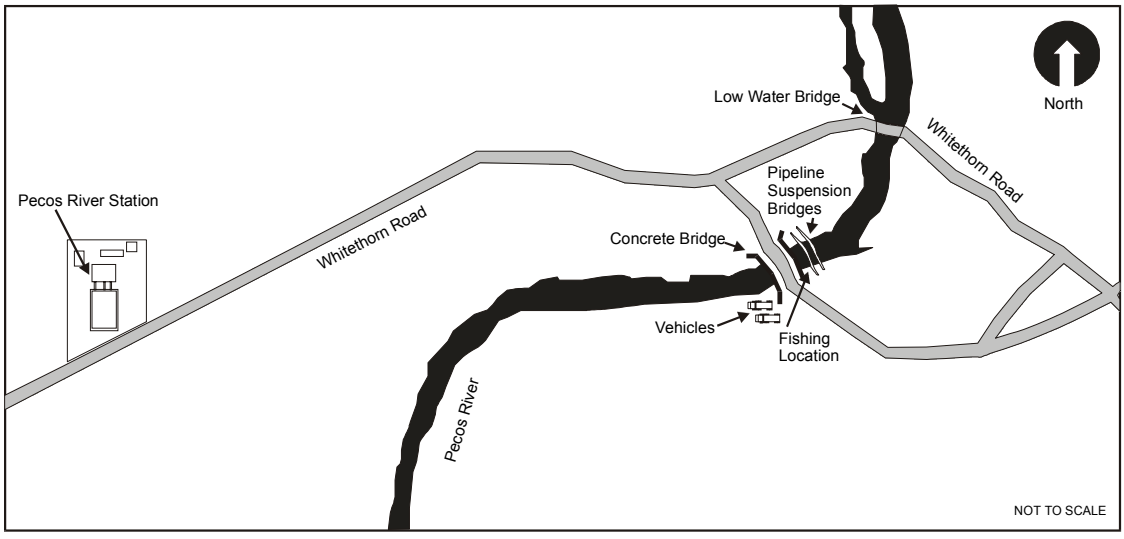
[8] All times are in mountain daylight time, which is the same as local time at the accident site, unless otherwise specified as pipeline time. Most documents and appendices are in pipeline time. Pipeline time does not change when local time becomes daylight savings time. Pipeline time is in mountain standard time.

[9] The Prewitt Station is unique because it was a facility monitored by EPNG on behalf of a third party contractor. It is not owned by EPNG and it is not on pipeline #1103, the pipeline involved in the accident.

to a problem at the Waha plant: natural gas was being received with a water content greater than the tariff rate of 7 pounds per million standard cubic feet of gas (7lbs/mmscf). The controller called the Waha plant and learned that the water content was high because the plant had a reboiler with temperature problems. (See Appendix 4 - South Controller's Log of Operations.) The controller verified that the temperature malfunction was being addressed and monitored the condition as it trended to below the alarm level. At 8:20 p.m. the Laguna Station had an A/C power failure and the controller called someone to investigate that failure. As part of normal pipeline operations, the controller then stopped compressor units at 9:15 p.m. at Plains Station, at 11:23 p.m. at Eunice Station,[10] and at 1:25 a.m. at Plains Station. The next compressor unit stoppage did not occur for several hours.

The Accident

At 5:26 a.m., compressor unit #1 (one of three units) at the unmanned Pecos River Station went down after it tripped due to compressor unit over speed. As a result of the first unit going down, the pressure on the other units decreased causing them to shut down. Within tenths of second, valves began closing and emergency lubrication pumps came on at the Pecos River Station. Alarms from the station showed on the controller's computer monitor. The controller acknowledged the alarms, which were a result of the sudden drop in gas flow rate and pressures. The majority of the alarms were turbine speed decline and suction pressure drop "rate of change" alarms. At 5:27 a.m., as the amount of gas going through the Pecos River Station fell off, the station bypass went on automatically to protect the station from the rapidly declining gas pressures.



At about 5:28 a.m., the controller ran a series of "demand scans" trying to get information back from the Pecos River Station. No information came back on compressor

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El Paso explained that this monitoring is a part of an environmental remediation project related to discontinued business operations involving a predecessor of the El Paso Corporation.

[10] The Eunice Station was 53 miles from the Pecos River Station.

unit # 3. Immediately after the controller's demand scans, the Pecos River Station compressor unit #2 tripped due to a turbo governor under voltage problems. The controller then executed an order to have the SCADA system provide information in a sequence faster than the default time of every 4 minutes. The controller did this so he would not have to continue demanding data.

At approximately 5:29 a.m., the controller telephoned the Pecos River District lead operations specialist[11] (station lead operations specialist) and asked him to send people to that station to learn why the trip had occurred and to investigate the situation. The station lead operations specialist called two operations specialists[12] that he supervised, who were on duty, and told them to go to the Pecos River Station.

While the controller was operating the South System at Gas Control in El Paso, Texas, a Carlsbad Complex operations specialist asleep at his home arose from sleep at around 5:00 a.m. to practice archery in his back yard.[13] This EPNG employee was not on duty that weekend, which meant that he was not scheduled[14] to receive calls to respond to an emergency. After a cup of coffee at about 5:25 a.m., the operations specialist noticed a glow in the sky to the south as he was exiting his home. The operations specialist immediately knew that there was something wrong with the EPNG pipeline system or another system line in that area. The operations specialist called EPNG Gas Control[15] and asked if its personnel had noticed any sudden pressure changes at the Pecos River Station. Gas Control informed the operations specialist that EPNG had lost a compressor at Pecos River Station. He told Gas Control of the glow in the sky and that he suspected a rupture. While on this phone call, Gas Control lost all communication with the Pecos River Station.[16]

In post–accident interviews, the controller recalled that he did notice that the Pecos River had a low suction pressure. When discussing the incident after the accident, he stated that it was unusual because "when our plants go down, the suction pressure

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[11] EPNG had more than one employee with the official title of "Lead Operations Specialist" in the Pecos River District. The Pecos River District had: 1) a lead operations specialist who supervised "operations specialists" that specialized in the operation and maintenance of the Pecos River Station and other stations including compressors, meters and compressor station related equipment, and 2) a lead operations specialist who supervised "operations specialists" that specialized in the operation and maintenance of pipeline facilities. This report will refer to the two employees as the station lead operations specialist and the pipeline lead operations specialist. The (Pecos River District) station lead operations specialist was also responsible for three other stations, Washington Ranch, Gresham, and Guadalupe, besides the Pecos River Station.

[12] Each operations specialist may have an area of interest and one of the two operations specialists had expertise on controls equipment.

[13] The technician's home was on the south side of Carlsbad.

[14] EPNG has a schedule for call outs.

[15] On the technician's first attempt to telephone Gas Control in El Paso, he dialed a wrong number. He then called the Washington Ranch Station knowing that it was manned 24 hours-a-day, and that they would have and provide him with the number of Gas Control.

[16] The data was locked at the last transmitted information from the station and new information was not coming back from the station.

usually goes up." The controller recalled the last suction pressure information was a pressure of 339 pounds.

Early Response to the Accident

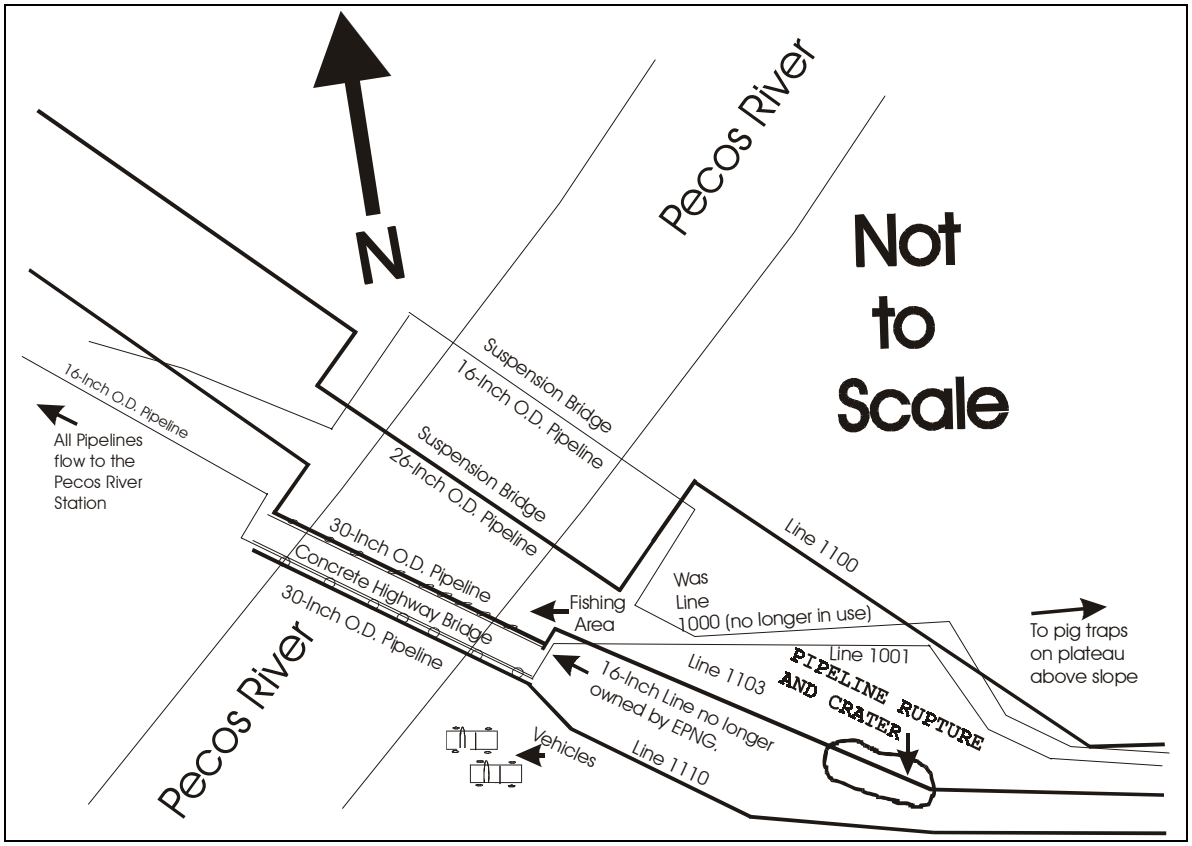
After calling Gas Control and learning of the Pecos River Station communications loss**,** at about 5:30 a.m., the operations specialist telephoned his supervisor, the pipeline lead operations specialist. The operations specialist informed the pipeline lead operations specialist of the glow in the sky, of his call to gas control, and of the communication problems with the Pecos River Station.[17] He then told the pipeline lead operations specialist that he was on his way to the station.

At 5:35 a.m., the controller telephoned the station lead operations specialist as he was getting dressed to go to the station. During this call he informed the station lead operations specialist that he suspected that there might be a "blowout" at the Pecos River Station. The station lead operations specialist asked the controller to hold on a second and he went to his back door to look in the direction of the Pecos River Station. When he returned to the telephone, he told the controller that he could see a fire and he was on his way to the Pecos River Station.

The controller thought that an accident had occurred in the vicinity of the Pecos River Station, but he was unsure as to which pipeline or pipelines was/were involved. The controller could not get any information from the Pecos River Station. Pipelines 1100, 1103 and 1110 each enter the Pecos River Station through a common suction header and then separate on the discharge side of the facility. The pipelines are approximately 86 feet apart at the suction header and they were within close proximity where they crossed the Pecos River, approximately 5200 feet to the east of the station. There were three crossovers between pipelines 1103 and 1110 and one crossover between 1100 and 1103 east of the river.

At approximately 5:44 a.m., the controller called to the manned Keystone Station[18] which was approximately 53 pipeline miles upstream and to the east of the Pecos River Station. Pipeline #1103, a 30-inch pipeline, ran from the Keystone Station to the Pecos River Station. Pipeline #1110 started approximately 10 miles downstream of the Keystone Station and ran to the Pecos River Station. The controller had the Keystone Station operator take off three compressor units. About a minute later, he called the manned Eunice Station and had three compressor units taken off there also. Like the Keystone Station, the Eunice Station was upstream of the Pecos River Station. Pipeline #1100 ran from the Eunice Station southwest toward the Pecos River Station.

[17] The operations specialist, at first, spoke to the station lead operations specialist's wife whom summoned her husband.
[18] The Keystone Station was approximately 53 miles from the Pecos River Station.



At approximately 5:50 a.m., the controller called a Carlsbad controller with El Paso Field Services (a gathering company owned by El Paso Corporation) to make sure that someone would shut down all compressor units at the South Carlsbad Station (another upstream station on pipeline 3191). The controller stated that his shift ended at 6:00 a.m. but he stayed at Gas Control till 8:00 a.m. "to assist in anything else that was needed to be done." He remembered telephoning the Senior Vice President for Public Relations to inform her of the incident. He also remembered typing up his event log.

Actions of the Station Lead Operations Specialist

At approximately 6:10 a.m., the station lead operations specialist arrived at the Pecos River Station.[19] When interviewed following the accident, he stated that he could see the glow at the river while he was driving toward the Pecos River Station and he thought he was the first EPNG employee to arrive at the station. He also stated that shortly after arriving at the station, he met the two operations specialists he had telephoned earlier and saw the Loving Fire Department on Whitethorn Road (where the station driveway turned off).

[19] The station lead operations specialist was the first person Gas Control had called regarding the station trip.

When the station lead operations specialist entered the station, he immediately went upstairs and into the control room to view the equipment. He said that because there were no lights on in the control room, he knew that the AC power was off. He stated that he then checked the DC (auxiliary powered) pumps to learn if the "cool down pumps had come on." This was part of the process of determining the status of the station. The station lead operations specialist said that he understood this process, which included verifying that the emergency shutdown system had detected (what was believed to be) changes of pressure caused by the rupture and had protected the station. He also said that he had checked and verified that the emergency shutdown system had vented all gas and had shutoff electrical service to the station. He said with the aid of the two employees he had telephoned, the entire Pecos River Station was checked "to make sure that everything was operating O.K."

After checking the station with the two operations specialists, the station lead operations specialist suggested: "let's run over to the 3191 to see if everything is O.K." The three employees went over to the 16-inch pipeline #3191 block valve and closed it. This block valve was located just outside the Pecos River Station's fence on the east side of the station. Pipeline #3191 connected the South Carlsbad Station, a station directly to the north, to Pipelines 1103 and 1110 just upstream of the inlet header to the Pecos River Station. Closure of this block valve would "isolate" the South Carlsbad Station from the Pecos River Station. The station lead operations specialist and his two co-workers closed the pipeline #3191 block valve by manually turning the valve wheel. They believed that this block valve was closed between 6:15 and 6:17 a.m.

The station lead operations specialist stated that although all three employees worked two-at-a-time to close the valve, he could have closed it by himself. He stated that the valve worked satisfactorily and closure took between 1 and 1 ½ minutes and it did not require the assist of a lever. The station lead operations specialist stated that he was familiar with the pipeline #3191 block valve and its location because he had previously accompanied service employees who had closed the valve during routine maintenance and DOT inspections of the valve as well as a previous simulation of "a blowout on the South Carlsbad pipeline [#3191]."

After closing the block valve, the station lead operations specialist telephoned Gas Control on his cell phone to inform them that the pipeline #3191 block valve was closed and to have the South Carlsbad Station taken off line. The station lead operations specialist stated that he sent the two operations specialists who had helped him close the block valve back to Whitethorn Road. They were instructed "to stay at the plant entrance and "to be on standby" (at Whitethorn Road) and to help with crowd control as needed. The station lead operations specialist was told that people were already in route to the South Carlsbad station to take it off line. He could hear the pipeline lead operations specialist and the operations specialist on the radio.

Actions of the Pipeline Lead Operations Specialist

The pipeline lead operations specialist stated it took him no longer then 3 minutes to arise from bed, get dressed, and start proceeding toward the station in his truck. He recalled calling the Gas Control while en route to the Pecos River Station and he had spoken to the EPNG general dispatcher about the situation. He asked Gas Control to call the managers for the Jal and Carlsbad Complexes. When the pipeline lead operations specialist arrived at the station turnoff, he recalled that three passers-by stopped their truck to offer assistance. He directed them to leave because they could not help.

After talking to the passers-by, while the station lead operations specialist was in the station, the pipeline lead operations specialist had pulled up to the west side of the station and had shut the block valve number 6 ¾ on the 26-inch pipeline #1100. The pipeline lead operations specialist stated that he had shut the valve by himself. An operations specialist had arrived at that time, and the two then shut the block valve number 6 ¾ on pipeline #1103. They also finished closing the pig launcher valves. Both block valves number 6 ¾ and the pig launcher valves were on the EPNG right-of-way, on the west side (discharge side) of the station. These valves were closed by at approximately 6:11 a.m.

The pipeline lead operations specialist then directed the operations specialist to close block valve number 6 ¾ on the 30-inch pipeline #1110. This valve was closed. Together, the operations specialist and his supervisor, the pipeline lead operations specialist, drove their trucks to the west side of the concrete bridge. They stopped their trucks there and viewed the fire across the river, but they could not see what pipeline had blown out.[20] The pipeline lead operations specialist then told the Carlsbad Complex operations specialist to go around to the other side of the river and determine what pipeline had blown out. The operations specialist then took off in his truck.

When later questioned, the pipeline lead operations specialist stated that he did not know which pipeline had ruptured, so he closed valves to all the pipelines. He also stated that he and the operations specialist, who arrived a short time later, had no difficulty closing all necessary valves to the west of the Pecos River. EPNG had replaced the operators for those valves the year before.

Valve Shutdown

When the Carlsbad Complex operations specialist towards the low-water-crossing to get closer to the fire, the pipeline lead operations specialist called gas control and reported that the valves on the west side of the fire were closed.[21] The dispatcher replied, "OK." A fire engine then pulled up and the pipeline lead operations specialist told the firemen they should stand by while he shut more valves. The pipeline lead operations

[20] One of the pipelines crossing the river was not owned by EPNG.

[21] The lead operations pipeline specialist also wanted his supervisor told that the valves to the west of the fire had been closed.

specialist later stated that with the block valves number 6 ¾ closed on the west side, they could isolate the fire by closing the block valves numbers 5 and 6 upstream of the fire on the east side.

The operations specialist drove to the other side of the river and viewed the fire, but he could not determine which pipeline had failed. The pipelines were in close proximity to one another and the heat from the fire was intense. While he was starting his drive back to his supervisor, the operations specialist noticed pickup trucks near the river.

The operations specialist arrived back to his supervisor's truck and told the pipeline lead operations specialist that he had seen pickup trucks near the river. The pipeline lead operations specialist told him that there was nothing that they could do at that time and that they should get the fire contained.

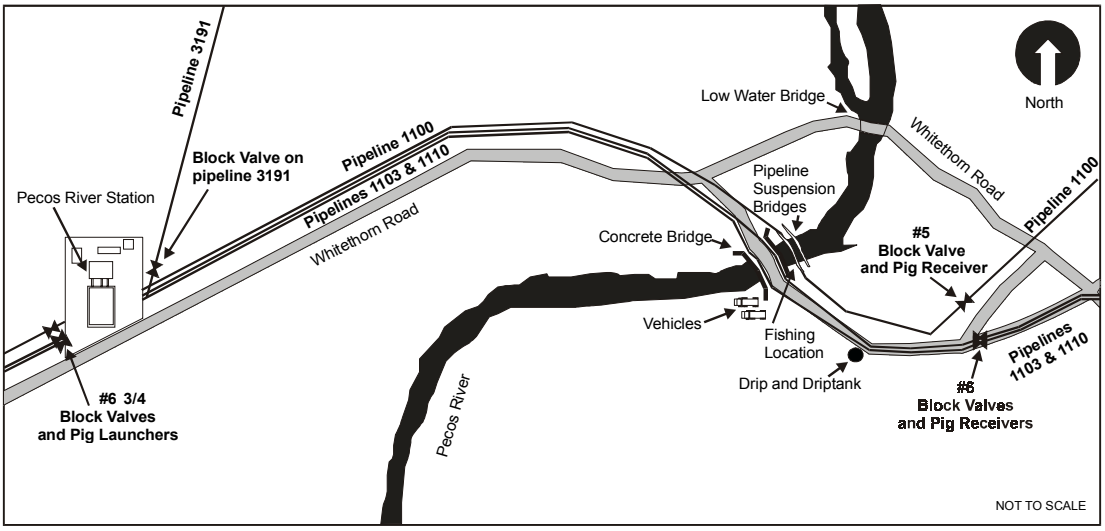
The pipeline lead operations specialist and the operations specialist backed their trucks away from the concrete bridge, drove their trucks east on Whitethorn Road and over the low water crossing. They went further down the road and then took a right turn and drove down the caliche, right-of-way road on the east side of the fire (east of the river).

The pipeline lead operations specialist later recalled putting his fire retardant suit on and carefully opening his door to gauge the heat from the fire. When he realized he could breathe, the pipeline lead operations specialist left his truck and went toward valve number 5 on pipeline # 1100.

The two EPNG employees opened the padlocks on the valves[22] and began closing the valves. The valves on pipelines #1103 and #1110 were block valves number 6 and the valve on pipeline 1100 was a valve number 5. Block valve number 5 was approximately 1550 direct feet east of the concrete bridge center, and about 400 feet north of block valve number 6 on pipeline # 1103. The block valve on pipeline #1110 was about 30 feet further south. The first valve the employees closed was block valve number 5. The employees found it would not close with the hydraulic operator, so they had to manually close the valve using a "hand-jack." The fire did not go down after the valve was closed. Next the block valve number 6 on pipeline #1103 was closed by use of its hand-operated wheel. In a direct measurement, this valve was about 2000 feet east from the center of the concrete bridge. The two employees stood on either side of the valve and alternated turns on the wheel until full closure. The fire went down noticeably after this valve was closed.

The two employees then closed the block valve number 6 on pipeline #1110. They closed this valve manually without using the operator assist. Unlike the valve on pipeline #1103, there was no gas pressure differential across this valve.

[22] All of the valves were padlocked and all field employees carried keys to these valves.



The fire was still present, and in post accident interviews, the employees indicated they were uncertain as to where the gas was coming from. The pipeline lead operations specialist then told the operations specialist to check the bypass valve on the pig trap. The operations specialist determined that the bypass valve was open and the pipeline lead operations specialist instructed him to close the valve. When the bypass valve was closed the fire went down. The employees later stated that they knew that they had some valve leakage. They said that the fire went from 30 feet tall to subsiding all together over a period several minutes. The fire went out at approximately 6:21 a.m. After the fire was out the operations specialist went to the river and assisted the injured persons.

Actions of EPNG Personnel to Balance Their System

With the shutdown of the Pecos River Station, station operators at the Keystone Station acted to stop gas from flowing into pipelines #1103 and 1110. At the time of the accident, both Plant "A" and Plant "B" had natural gas going toward the Pecos River Station. Both plants were part of the Keystone Station, and served pipelines #1103, #1110 and #3162. Pipeline #3162 ran southward from Keystone Station to the Waha Plant. Plant "A" was the larger of the two and it had more horsepower.

Keystone Station had two operations specialists on site at the time of the accident. The first action the Keystone Station operations specialists took was to shut down compressor unit #3 in the "B" plant. The operations specialists then took off compressor units at the "A" Plant. They then made sure that the gas in the "B" plant was being sent to the Waha Plant and not the Pecos River Station. (See Appendix 5 – SCADA System Events for 8/19/2000.) The Keystone Station operations specialists had shut down every compressor unit in the "A" plant by 7:25 a.m. They then began shutting the station valves so that no gas from Keystone Station could go toward the Pecos River Station. These valves were closed by about 7:30 a.m.

At about 6:10 a.m., Gas Control issued an order to the Washington Ranch Storage Station, the first station directly west of the Pecos River Station, to stop injecting gas into the storage field and begin withdrawing natural gas from the field. (See Appendix 6 - Coordinator's Log.) With pipelines #1100, #1103 and #1110 blocked off on the west side of the Pecos River Station, there was no natural gas flowing toward Arizona and California. By withdrawing gas out of storage, EPNG could send gas westward.

EPNG Facts and Pipeline Information

At the time of the accident, EPNG had more than 10,000 miles of mainline transmission pipeline. The EPNG pipeline system had a total of 59 stations and plants containing more than 300 compressor units. Like the Pecos River Station, 40 of these stations, were fully automated and, therefore, had personnel on site 8 hours or less per day.

The accident location was near the north/south border between Texas and New Mexico. It was also near the east/west border between EPNG complexes. For Pipeline 1103, the downstream side of valve #6 was the separation between EPNG's Jal[23] and Pecos River District lines.[24] (See Appendix 3 - Selected Section of EPNG Mainline District Map)

Five natural gas pipelines crossed the Pecos River where the river traveled from the Northeast to the Southwest. Two natural gas pipelines, a 16-inch and a 26-inch,[25] crossed over the river on separate suspension bridges. The suspension bridges held the pipelines approximately 65 feet apart. To the southwest of the suspension bridges, three pipelines (and a water pipeline) crossed the river attached to the sides of the previously mentioned concrete bridge. The northeast side of the concrete bridge was approximately 70 feet from the pipeline supported by the closest suspension bridge. The concrete bridge had been constructed in 1950 at the same time as pipeline #1103, the line that ruptured on August 19, 2000. A steel bridge had been at the location before the concrete bridge.

The EPNG pipeline systems between the Pecos River and Keystone Stations had 2 active interconnects and 4 crossovers as of August 19, 2000. The numbers of interconnects and crossovers changed during the operating history of these pipelines. Pipeline #1103 had a 30-inch pipeline loop designated as pipeline #1110,[26] which began approximately 9 ½ miles west of Keystone Station. Pipeline #1103, was operating at approximately 675 psig at the time of the accident and its MAOP was 837 psig.

The pipe used to build pipeline #1103 was purchased from Republic Steel (now LTV) in a work-order dated 1950. When this pipeline was first built it was named the "California "B" Line." The pipeline's coating was coal-tar wrap.

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[23] Jal is a town in the Southeast corner of New Mexico and is east of the accident location.
[24] Also referred to as the Carlsbad Complex.
[25] All pipeline measurements are outer diameter.
[26] Pipeline #1110 had been constructed in 1952, after the construction of pipeline #1103 in 1950.

Pipeline #1103, was not the first pipeline constructed across the Pecos River right-of-way. The first pipeline constructed along the right-of-way, "Line 1000", a 16-inch pipeline, was known then as the "Jal to El Paso "A" Line." This pipeline was constructed in 1929. Later another Jal to El Paso pipeline, the "Jal to El Paso "B" Line," was constructed and the two pipelines were connected through crossovers. This pipeline later became known as "Line #1001." At the time of the accident, "Line #1001" was conveyed to another company and "Line #1000" was filled with nitrogen (and not in service) at the bridge crossing.

The pipeline system was controlled with a SCADA system that monitors more than 39,000 data points and that collects updated data every 4 minutes. The SCADA system monitors pressures, flows, temperatures, gas quality, vibrations, and oil levels. The system also monitors the rate of change in various measurements, hazardous gas concentrations at various locations, as well as security intrusion alarms and fire detection devices at unmanned stations.

The Pecos River Station had 21,450 horsepower installed in it. Keystone Station had 18,000 horsepower at the Keystone Mainline Station (A Station) to the Pecos River Station and 6,480 horsepower installed at the B Station to the Waha Plant. The first station downstream of both Washington Ranch and the Pecos River Station, the Guadalupe Station had 31,050 horsepower. (See Appendix 7 - Selected Compressor Station Data contained in the 1999 FERC Report.) In addition, EPNG had approximately 70 BCF of natural gas storage capacity at its Washington Ranch storage facility.

El Paso did not inject any inhibitors in these pipelines to prevent corrosion. The natural gas that entered pipeline #1103 came from Keystone Station where transmission pipelines brought gas to the station. Additionally, during the operational histories of pipeline #1103, gas entered into the pipeline at as many as six locations between Keystone Station and the Pecos River.

This is not the first time that pipeline #1103 has had a failure. On January 27, 1998, pipeline # 1103 had a blowout near Milepost 117 (between Guadalupe and Cornudas Stations) and a segment of the pipeline had to be replaced. The rupture was caused by external corrosion.

Cleaning Pigs and In-Line Inspection

Like the other pipelines constructed across the Pecos River, the river crossing portion of Pipeline #1103 was not designed and constructed for the passage of pigs (cleaning or in-line inspection tools). Cleaning pigs[27] were run through the pipeline four times in 1997, three times in 1998, once in 1999, and once in the year 2000. They could only travel from approximately 10 miles west of Keystone Station, where the 1110 loop started, to the pig receiver (trap), which was next to valve number 6 on the plateau above the Pecos River. Because this pig trap was not designed and constructed with enough

[27] The cleaning pigs were bi-directional disk pigs.

length to accommodate in-line inspection tools, only certain types of smaller cleaning pigs could travel from 10 ½ miles[28] west of Keystone Station to the pig trap and fit in it.

Approximately 625 feet west of valve number 6 and the pig trap, there was a liquid separator (drip). The next downstream pig launcher was on the west side of the Pecos River Station downstream of the compressors.

Records indicate that in 1998, pipelines #1100 and 1103 had an in-line inspection tool (low-resolution magnetic flux leakage internal inspection tool) run for a length of approximately 33 miles between Guadalupe and Cornudas Stations. These in-line inspection tool runs occurred after the previously described rupture on pipeline #1103. The Guadalupe Station was approximately 58 miles downstream of the Pecos River Station. The same tool was also run for a length of approximately 33 miles between Guadalupe and Cornudas Stations for pipeline #1100. There were no in-line inspection tools run in 1999 or 2000 on pipelines 1100, 1103, or 1110.

Meteorological information

On the morning of August 19, 2000, the Cavern City Air Terminal,[29] the closest weather monitoring facility to the accident site, recorded a daily low temperature of 68° Fahrenheit and the sunrise was officially recorded at 6:24 a.m. (MDT). Before the accident, the June to July precipitation was 0 to 20% below normal. The temperature may have been as much as a few degrees above normal with maximum daily temperatures reaching 100 to 105 degrees Fahrenheit. (See NTSB Meteorological Factual Report for Carlsbad, New Mexico.)

El Paso Natural Gas Company Personnel and Training

The controller who was responsible for pipeline #1103 at the time of the accident, had been working as a controller for 11 years. He had reached the highest level for an EPNG Gas Controller, he was a 'systems gas controller." The controller had started with EPNG in 1977 and he had a high school GED.

The controllers rotate the south and north system every 5 weeks. The controller involved in this accident had been working on the South System for 3 weeks previous to the accident.

When asked if he ever had anything like this happen to him before, the controller said that he had partaken in mock drills and he had been controlling another pipeline once when a drilling crew had drilled into it.

[28] The pig launcher was a little over a mile to the west of where the loop started. Leaving about a mile not capable of passing a cleaning pig.
[29] The Cavern City Air Terminal was about 5 miles southwest of Carlsbad.

The most recent emergency simulation along pipeline #1103 was conducted at the Keystone Station on August 29th, 1997. The simulation mocked a compressor unit failure necessitating the shutdown of the compressor unit and subsequent investigation. On November 21, 1997, EPNG had a simulated accident in which a local rancher reported a gas leak, which was discovered to be on pipeline #1103. Dispatching and shutdown occurred and blowdown was simulated. A recommendation for future emergency simulation was that the milepost should be made known and listed once the emergency situation is validated. In addition to the 1997 simulation, gas control participated in 3 simulations on the EPNG system in the year 2000 prior to August 19, 2000. Gas control had also participated on 8 simulations on the EPNG system in 1999.

Post-Accident Investigation

Internal corrosion occurs in natural gas pipeline systems when liquid water gathers in a pipeline. The water can enter as a liquid or as a vapor. Due to pressure increases and temperature decreases the water may condense from the vapor phase. To limit internal corrosion, the pipeline operator must focus considerable attention to the quality of gases entering its pipeline system. Title 49 Code of Federal Regulations (CFR) 192.475(a) states: "corrosive gas may not be transported by pipeline, unless the corrosive effect of the gas on the pipeline has been investigated and steps have been taken to minimize internal corrosion."

EPNG had equipment in place to help limit corrosive elements from entering the pipeline system. One example of this equipment was the previously discussed controller alarms. The controller operating the pipeline during the time of the accident had an alarm at 7:15 p.m. the previous evening. The SCADA system alarm alerted the controller to gas entering the Waha Plant with water content greater than 7 lbs/mmscf. (See Appendix 4 - South Controller's Log of Operations.) Another example of EPNG equipment used to prevent impure gas from entering the system could be found at 12:28 p.m. on the previous day, Friday August 18, 2000. At that time, equipment detected sour gas at the delivery point for the Warren-Eunice plant,[30] a delivery plant Northeast of the Pecos River Station, and the delivery point was shut in. This plant had a slam-shut valve that was activated when the monitor sensed the natural gas had a water vapor content above the 7 lbs/mmscf setpoint. (See Appendix 6 – Coordinator's Log.) The slam-shut valve remained closed for approximately 2 hours until the gas was within quality specifications.

Advisory Bulletin

As a result of the August 19, 2000 accident, the U.S. Department of Transportation (DOT) issued an Advisory Bulletin on August 25, 2000. The Advisory Bulletin was issued to owners and operators of "natural gas transmission pipeline systems to advise them to review their internal corrosion monitoring programs and operations." (See Appendix 8 – RSPA Advisory Bulletin, ADB-00-02.) The Advisory Bulletin warned operators to pay attention to factors that influence the formation of internal

[30] Like the Prewitt Station, the Warren-Eunice plant was owned by a gas supplier and not EPNG.

corrosion, especially pipeline alignment features "that may contribute to internal corrosion by allowing condensates to settle out of the gas stream." This is the first instance that OPS issued such an internal corrosion advisory.

Corrective Action Order

On August 23, 2000, DOT issued a Corrective Action Order requiring the "El Paso Natural Gas Company,[31] at the time a wholly owned subsidiary of the El Paso Energy Corporation, to take the necessary corrective action to protect the public and environment from potential hazards associated with its pipeline." (See Appendix 9 - Corrective Action Order, CPF No. 420001004-H with cover letter.) The Corrective Action Order stated the circumstances of the failure near the Pecos River crossing and it stated "that corrective action is necessary to prevent the recurrence of a failure similar to that which occurred on August 19, 2000."

The Corrective Action Order listed 11 preliminary findings regarding the pipeline involved in the accident and the nearby pipelines. These findings included information such as 1) pipeline specifications, ownership, and sizes, 2) dates of initial construction, 3) locations of the pipelines including proximity to cities, 4) known and surmised damages to the pipeline and related facilities (such as supporting bridges), and 5) maximum allowable operating pressures (MAOP). Other findings included the statement that "the El Paso pipelines are critical suppliers of natural gas to Arizona and Southern California [and] El Paso has arranged for rerouting gas supply from other storage sites." Other statements in the Corrective Action Order preliminary findings included information on the time, date and location of the accident and a comment on the preliminary accident investigation: "Internal corrosion may be a contributing factor in the line failure."

After a section outlining the Codes and Regulations that provide for the issuance of a Corrective Action Order, the Corrective Action Order listed twenty-five (25) requirements, required corrective action items, for EPNG. Except for the last 6 items, which were written for all of the EPNG segments mentioned in the Corrective Action Order, each item would pertain to a specific pipeline segment or set of segments.

The first six of the twenty-five requirements, items 1 through 6, were written for a section of pipeline #1110 between valve #6 and the Pecos River Compressor Station.

Item 7 of the twenty-five requirements was written for pipeline #1103. Like the six previous requirements on pipeline #1110, the segment on pipeline #1103, would be for the segment between valve number 6 and the Pecos River Compression Station.

The next seven requirements, items 8 through 14, referred to the segment on pipeline 1100 between station 2482+52 and the Pecos River Compressor Station.

[31] On January 29, 2001, El Paso Energy Company merged with Coastal Corporation and on February 5, 2001, the El Paso Energy Company became the El Paso Corporation.

The next five requirements, items 15 to 19, were "with respect to the line segments between the Keystone Compressor Station and Guadalupe Compressor Stations on pipelines #1110 and #1103, and between the Eunice Compressor Station and the Guadalupe Compressor Station on pipelines #1100."

Requirement number 20 was the first of the last six requirements written for all of the EPNG segments in the Corrective Action Order. Item 20 stated: "prior to implementing any corrective action," a "corrective action plan" had to be submitted for DOT's review and approval. The second of these requirements, item 21, called for El Paso to submit geospatial pipeline data to the National Pipeline Mapping System (NPMS) by August 24, 2000. Specifically the data needed in the submittal was the data that had not been included with the previous Tennessee Gas Pipeline Company submission.[32] The third requirement, item 22, asked that all submittals for permanent Pecos River crossings include "the ability for these segments to be traversed by an internal inspection tool." This requirement was unnecessary because Title 49 Code of Federal Regulations Part 192.150 requires all new and replaced transmission lines to allow passage of internal inspection devices, although OPS regulations have never required internal inspection of existing pipelines.[33] The fourth requirement demanded that OPS be provided "with 48 hours advance notice prior to beginning the direct assessments, hydrotesting or any corrective action required by this order." The fifth requirement, item 24, called for EPNG to "develop a plan to assess the integrity of the remainder of the El Paso Pipeline System." The sixth and last requirement that pertained to all of the EPNG Pipeline System stated "the OPS Southwest Region Director may extend the time for compliance with any of the terms of this order for good cause."

The first of the five requirements, items 15 through 19, pertaining to the pipeline segments on pipelines #1110, #1103, and #1100, required EPNG to "take immediate steps to restrict the maximum allowable operating pressure to 668 psig, which is 80 percent (80%) of the maximum operating pressure." This pressure restriction had to be achieved within 5 days of the receipt of the Corrective Action Order. The second requirement, item 16, compelled EPNG to maintain the pressure restriction until the Associate Administrator for Pipeline Safety gives EPNG written authorization to return to an unrestricted operating level. This requirement promised that the Associate Administrator for Pipeline Safety would review the need for continuing the restriction within 10 working days and would consider removing the restriction depending upon further investigation and completion of the next three requirements.

The third requirement, item 17, pertaining to the pipeline segments on pipelines #1110, #1103, and #1100, required EPNG to "identify all crossings that cannot be traversed with an internal cleaning tool similar to the Pecos River crossing, areas of no

[32]Like El Paso Natural Gas Company, the Tennessee Gas Pipeline Company was a wholly owned subsidiary of the El Paso Energy Company.

[33] This regulation was amended to require smart pig passage in 1998 after several NTSB Safety Recommendations.

flow, and areas that include, but are not limited to, dead end pipe stubs, pig traps, valved off crossovers, low spots, and any other section of piping that liquids might settle in."

The fourth requirement and item 18 called for EPNG to "develop a risk based plan to inspect, assess, and correct, as necessary, all of the areas, in item 17 [the previous requirement] for signs of internal corrosion or other metal loss." EPNG was to perform those inspections and then provide the OPS Southwest Region Director with the results.

The fifth and last requirement pertaining to pipelines #1110, #1103, and #1100, dictated that EPNG "provide the Region Director an analysis of the continued safe operation of Line 1110, Line 1103, and Line 1100, based on testing and inspection required under this Order, what is [has been] discovered about the failure of August 19, 2000, and other information available to the operator [EPNG] about the integrity of these pipelines." To satisfy this requirement, item #19, EPNG had to provide this analysis within 90 days of issuance of the Corrective Action Order.

Item 8, the first of the seven requirements numbered 8 through 14 that pertained to pipeline #1100. This requirement specifically pertained to the pipeline segment between "station 2482+52 and the Pecos River Compressor Station." The requirement stated: "This segment shall not be operated until items 9 through 12 are completed and determined acceptable by the OPS Southwest Region Director." Item 9 compelled EPNG to "submit the design for the temporary crossing of the Pecos River to the Region Director for his approval." Item 10 obligated EPNG to "directly asses the integrity of the line pipe at all low points, pig traps, dead end stub lines, crossover piping that may have a no flow condition, and any other section of piping that liquids might settle in, and implement any needed corrective action. The direct assessment must include both x-ray and ultra-sonic examinations." The next requirement, item 11, mandated EPNG hydrostatically test the newly installed Pecos River Crossing before operating the crossing segment. OPS ordered that the test be to 90% of SMYS. Item 12 demanded that EPNG submit a return to service plan, including a summary of all findings to date, to the Region Director for his approval. The return to service plan was to be submitted after hydrostatically testing the river crossing, "but before resuming operation."

Item 13 restricted "the maximum allowable operating pressure to 80 percent (80%) of the operating pressure of Line 1103 at the time of failure, which was calculated to be 538 psig." The last item that pertained to the segment on pipeline #1100, item 14, obligated EPNG to maintain the pressure restrictions until the Associate Administrator provides written authorization to exceed them. This item stated "the Associate Administrator will review within 10 working days, and consider removing the pressure restriction."

Item 7, the only item that related specifically to a segment of the failed pipeline #1103 prevented EPNG from operating the segment until a review was completed. The review was to be "of additional information about the factors that may have played a role in the accident of August 19, 2000, and the applicability of those factors to the operation of Line 1103."

Of the six requirements pertaining to the pipeline segment on pipeline #1110, the first requirement or item 1 stated that the segment "shall not" be operated until the second and fourth requirements "are completed and determined acceptable by the OPS Southwest Region Director." The second requirement, item 2, stated: "Directly assess the integrity of the line pipe at all low points, pig traps, dead end stub lines, and crossover piping that may have a no flow condition, and any other section of piping that liquids might settle in, and implement any needed corrective action. The direct assessment must include both x-ray and ultrasonic examinations to determine possible metal loss." The third requirement, item 3, required that EPNG hydrostatically test the pipeline #1110 segment "to 90 percent (90%) of specified minimum yield stress (SMYS)." The fourth requirement dictated that: "After completion of item [requirement] 3, but before resuming operation, submit a return to service plan to the Region Director for his approval. The return to service plan should include a summary of all findings to date." The fifth requirement restricted the maximum allowable operating pressure, once operation is resumed, "to 80 percent (80 %) of the operating pressure of the Line 1103 at the time of failure, which was calculated to be 538 psig." The sixth requirement, item 6, demanded that the pressure restrictions stay in place until written authorization by the Associate Administrator for Pipeline Safety allows the pressures to be exceeded. "The Associate Administrator will review within ten (10) working days, and consider removing, this pressure restriction following receipt of additional information about the factors that may have played a role in the accident of August 19, 2000 and the applicability of those factors to the operation of Line 1110."

U.S. Department of Transportation Proposed Civil Penalty

On June 20, 2001, DOT issued a Notice of Probable Violation, Proposed Civil Penalty and Proposed Compliance Order (See Appendix 10 - Notice of Probable Violation). In the Notice, OPS stated that "preliminary findings indicate that internal corrosion likely played a major role in the accident. These findings also indicate that internal corrosion had probably occurred over a long period, where liquids had accumulated in a low point in the pipeline." The Notice contained other "preliminary findings" including (a) that EPNG did not take steps to investigate and to minimize internal corrosion as required by the previously mentioned Title 49 Code of Federal Regulations Section 192.475 and (b) EPNG did not have properly trained corrosion personnel within their Corrosion Control Services Group and there was a failure to communicate essential information necessary for proper corrosion control to Corrosion Control Services. The Notice contained a proposed $2.52 million civil penalty for probable safety violations.

Post-Accident Actions

After the pipeline #1103 failure, DOT/RSPA ordered all of the pipelines crossing the Pecos River at the rupture site to be shut down. Since that time, EPNG has made many prescribed and voluntary changes to their system.

EPNG's first actions were done to comply with the Corrective Action Order. Among those, EPNG performed required hydrostatic testing and internal inspection and

has done repairs to areas with critical metal loss. EPNG, as required by DOT/RSPA, had revised their corrosion control procedures and training, and established a comprehensive integrity management program. Within 6 months of the accident, EPNG had excavated 118 bell holes on 15 pipelines. They had scheduled smart or tethered pigging on an additional 11 pipelines. EPNG had identified three areas of internal corrosion on pipeline #1103 (including the rupture sight). Nearly a year after the accident, the DOT allowed EPNG to reopen pipeline #1103 on July 6, 2001, at reduced pressures.

In correspondence dated December 10, 2001, (See Appendix 11 – EPNG 12/10/2001 Correspondence on Risk Assessment, Pipeline Integrity Testing and Remediation) EPNG explained how they have performed a pipeline integrity assessment and they summarized their inspection and remediation efforts between February 1, 2001 and November 5, 2001. EPNG had "reviewed" each of the sixty segments that DOT required them to identify based on item 17 of the August 23, 2000, Corrective Action Order.[34] The Company had "completed required remedial work on fifty-eight of the sixty segments." In its December 10, 2001 correspondence to NTSB, EPNG stated that the work on the remaining two segments are in "varying stages and scheduled for completion by March 2002." EPNG noted that one of the remaining two segments has undergone an in-line inspection. EPNG has completed the review of that Final In-line Inspection Report and the associated excavation of all anomalies. The work planned "on the other remaining segment involves removing a drip and installing a pig launcher and receiver."

EPNG stated that as a result of pipeline integrity testing, it "found indications of internal metal loss on sections of the 1110 line between Pecos River and Guadalupe Station at approximately Milepost 85." Internal corrosion was also verified on pipeline 1107 between Milepost 0 and 1.47. Both sections were removed and replaced.

EPNG has been running smart pigs and conducting ultra-sonic and x-ray testing. As a result of integrity assessment, "the Company found internal corrosion on isolated segments of lines 1100, 1103, 1105, 3079, 3140, and 3186."

In the conclusion of its December 10, 2001 correspondence to NTSB, EPNG stated: "Identifying areas in the pipeline system that may have the greatest susceptibility to internal corrosion remains a central priority for EPNG and continues to receive the attention of senior management and operations personnel."

Operations Group Chairman

Charles R. Koval
January 8, 2002

[34] Item 17 required identification of all crossings, like the Pecos River Crossing, that could not be traversed with an internal cleaning tool, all "areas of no flow, and areas that include, but are not limited to, dead end pipe stubs, pig traps, valved off cross-overs, low spots and any other section of piping that liquids might settle in."