



# National Transportation Safety Board

## Washington, D.C. 20594

18 May 2001

Mr. Steven R. Weinmann, Petitioner  
Representing: Quality Materials, Inc.

Pipeline Accident  
Edison, New Jersey  
March 23, 1994  
NTSB Report: PAR-95/01

### **RESPONSE TO PETITION FOR RECONSIDERATION**

In accordance with the National Transportation Safety Board's rules (49 *Code of Federal Regulations* Part 845), the Safety Board has reviewed the petition for reconsideration and modification of one of the conclusions in the Safety Board's pipeline accident report regarding the pipeline accident that occurred on March 23, 1994, in Edison, New Jersey. Petitioner asked that the Safety Board "reconsider or modify its conclusion that the damage causing the rupture was not present in 1986." Based on its review of the petition, filed on September 14, 1995, the Safety Board hereby grants the petition in full.

A 36-inch-diameter natural gas pipeline, Line 20, owned and operated by Texas Eastern Transmission Corporation (TETCO), failed catastrophically on March 23, 1994. The ruptured portion of the buried pipeline was on the property of Quality Materials, Inc., (Quality). Escaping gas from the pipeline was ignited within minutes after the rupture, sending flames several hundred feet into the air. Radiant heat from the burning gas ignited a fire at the Durham Woods Apartment Complex, located more than 100 yards from the rupture site. The fire destroyed several buildings on the west side of this apartment complex. Estimated damage from the accident exceeded \$25 million. No fatalities resulted from the accident.

Parties to the investigation were the Middlesex County Police Department, TETCO, the Office of Pipeline Safety (OPS) of the Research and Special Programs Administration, the New Jersey Bureau of Pipeline Safety, and Edison Township.

As a result of its investigation, the Safety Board determined that the probable cause of the pipeline rupture was mechanical damage to the exterior surface of the pipe that reduced the pipe wall thickness and likely created a crack in the gouge that grew, most likely through metal fatigue, to critical size. Petitioner is not disputing the probable cause of the accident.

One of the Safety Board's findings was that TETCO's Line 20 was gouged by excavation equipment, such as a backhoe, at an undetermined time after the pipeline was internally inspected in 1986. Petitioner has requested that the Safety Board modify or reconsider this conclusion.

In support of his petition, petitioner submitted an August 31, 1995, report and a September 11, 1995, affidavit, both prepared by Mr. H. Noel Duckworth, petitioner's consultant. In his affidavit and report, Mr. Duckworth contends that the dent containing the gouge that was determined to be the point of origin of the rupture was, in fact, reflected on the 1986 internal inspection survey logs. Mr. Duckworth identified a four-channel signal on the copies of the 1986 survey logs that he presented to Safety Board staff. This four-channel signal is approximately 62 inches upstream from the girth weld (reference point), at a position of about 1:45 o'clock circumferential (# 21, Exhibit I-2). Mr. Duckworth contends that this four-channel signal reflects defect 21, the point of origin of failure.

A meeting between the parties to the investigation and the petitioner was conducted by the Safety Board on October 30, 1996, at Safety Board headquarters, 490 L'Enfant Plaza, Washington, D.C. The Middlesex County Police Department, TETCO, and the OPS sent representatives to the meeting. TETCO also provided written comments, while the OPS and the New Jersey Bureau of Pipeline Safety each provided a no-comment document. The remaining party to the investigation, Edison Township, did not send representatives to the meeting or provide a written document.

Other information received by the Safety Board in response to the petition included a document prepared by Haskell Excavating Company (predecessor to Quality), reports from two consultants hired by the State of New Jersey Division of Criminal Justice, and an affidavit from Mr. Pat Daigle of Tuboscope (the company that had performed the 1986 internal inspection of the failed pipeline). With the exception of the two reports prepared by the consultants for the State of New Jersey, all the documents received were shared with all the parties.

TETCO stated that Quality did not present any new evidence and that analysis presented on Quality's behalf was flawed and distorted. Mr. Dwayne Kisilevich, an independent TETCO consultant, in documents submitted to the Board and during the investigative meeting, acknowledged a small indication on the survey logs of a possible dent near the point of origin of failure. However, Mr. Kisilevich identified other such survey log indications in the vicinity of the failure origin for which no visible damage was present on the pipe. Mr. Kisilevich attributed these false indications to the metal debris likely buried in proximity to the pipeline. Mr. Kisilevich identified four gouges associated with dents that were similar to the point of origin of failure. He stated that these four damage areas were reflected on the 1986 internal inspection survey logs but that the gouge at the failure origin was not. He therefore concluded that the gouge believed to be the point of origin of failure occurred after the 1986 internal inspection. Mr. Kisilevich also identified five 70- to 120-mils-deep defects (damage areas) on the pipeline within the 10-foot section containing the fracture origin area that should have shown corresponding indications on the survey logs. These indications were not, however, visible to him on the survey logs, leading him to conclude that these defects were produced after the 1986 internal inspection.

Mr. Duckworth stated that the defects that were not visible on the survey logs to which Mr. Kisilevich referred were longitudinal and that this would explain why they probably were not detected by the equipment.

In his February 2, 1996, affidavit, Mr. Pat Daigle of Tuboscope stated that an indication was present on the survey log at the point of origin of failure (approximately 59 inches from the downstream weld). But he stated that the signals presented on the log would not have been considered significant because of their small size and the characteristics of the indication.

In response to questions from the Safety Board to TETCO regarding this investigation, Ms. Pam Moreno of Tuboscope, in a February 17, 1997, letter, stated that indication # 21 in the internal inspection survey log submitted by Mr. Duckworth (Exhibit I-2) appears to be the same as indication B in the internal inspection survey log submitted by TETCO (Exhibit D). In Exhibit I-2, indication # 21 appears on four channels, and in Exhibit D, indication B appears only on one channel. However, the horizontal scale of Exhibit D is approximately six times that of Exhibit I-2. The petitioner contends that the four-channel signal in Exhibit I-2 reflects defect 21, the point of origin of failure.

The two consultants hired by the State of New Jersey noted that a signal is present in the survey log at a location that appears to correspond to that of the dent containing the gouge that is believed to have been the point of origin of failure. They disagreed only about whether the signal represents a gouge or a dent.

After reviewing all the available information, including the pertinent information summarized above, the Safety Board acknowledges the possibility that the dent containing the rupture origin was present on the pipeline when the 1986 internal inspection of Line 20 was performed. Often, a gouge within a dent will occur at the time the dent is created; however, the limitations of the inspection tool and complexities involved in interpreting the survey log data make it impossible to determine conclusively whether the gouge believed to be the point of origin of the failure was present at the time of the 1986 internal inspection.

Based on the above, the petition for reconsideration filed September 14, 1995, requesting reconsideration or modification of an identified conclusion in NTSB Pipeline Accident Report: PAR-95/01 is granted. Accordingly, changes have been made to the Factual (page 21), Analysis (page 40), and Conclusions (page 74) sections of the report. These changes are reflected on the attached revised pages.

Acting Chairman CARMODY and Members HAMMERSCHMIDT, BLACK, and GOGLIA concurred in this response to petition for reconsideration.

Attachments

After the accident, the TETCO South Plainfield Area Superintendent reviewed the log and identified seven indications for the pipe through the asphalt plant property. All indications were graded as minor anomalies, six as 1- and one as 1. He and an inspection tool contractor representative reexamined the log closely to determine whether indications of anomalies were near the rupture origin and found none. The Safety Board's review of the log identified no metal-loss anomalies in the area of the fracture origin or in the numerous large gouges on the pipe. Safety Board investigators noted two log indications on the pipe segment that included the origin gouge and one indication on the next pipe segment which they believed warranted additional investigation. On the origin gouge pipe segment, the two indications were 9.5 feet and 18 feet west of the east girth weld. The Board determined that the indication nearer the east girth weld represented an area of metal loss about 1 inch square and about 0.050 inch deep. The other indication represented a slightly smaller square area about 0.050 inch deep. The indication on the pipe segment east of the origin segment represented an isolated pit about 0.100 inch deep.

The area superintendent stated that after examining the various gouges in the origin pipe segment, he believes that had they been present at the time of the 1986 internal inspection, the smart pig would have detected and charted them. TETCO would then have identified the indications on the log as Grade 2 and excavated to inspect the pipe. He said the absence of any indications logged near the rupture origin convinces him the gouges were not present when Line 20 was pigged in 1986. The TETCO official's observations are supported by the Log Interpretation Department Supervisor of Tuboscope Pipeline Services, the manufacturer and operator of the pig used in the 1986 inspection. In a November 1, 1994, letter, the supervisor states that after comparing the marks and their locations on the pieces of pipe at the rupture site with the metal loss indications on the 1986 inspection log, she determined that some "small gouges" downstream of the rupture "correlated to the indications seen on the 1986 survey." She further states that gouges such as those found at the origin "would be expected to have significant signatures on the 1986 survey..." and that "no such signatures are visible."

A consultant retained by Quality submitted to the Safety Board a report and an affidavit in which he contended that the 1986 internal inspection logs did show a dent at or near the rupture site. An independent TETCO consultant acknowledged an indication in the logs of a possible dent near the origin of failure, but he identified this as a false indication resulting from metal debris likely buried in proximity to the pipeline. A Tuboscope representative also submitted an affidavit stating that an indication was present in the logs, but that the signals would not have been considered significant because of their small size and their characteristics. Two consultants hired by the State of New Jersey noted the presence in the logs of a signal at a location that appeared to correspond to the origin of the rupture; however, the two consultants could not agree on whether the signal represented a dent or a gouge.

TETCO officials said that Line 20 was scheduled and budgeted to be pigged in 1994 because of the line's class location, its criticality to service, and the many grade 1 indications detected in the 1986 internal inspection; however, the company did not have the opportunity to internally inspect the line before the March rupture.

*Postaccident tests.*— Between July 1 and 4, 1994, TETCO contracted for two different types of internal inspections of Line 20: one using a magnetic-flux pig and the other using an inertial geometry internal inspection tool, or inertial/caliper pig, which generates a full picture of the inside shape of a pipeline. The inertial/caliper pig enables operators to determine the deformation and slope of the pipeline and to measure changes in its position. Appendix D provides the contractors' analysis of the two inspections. The inertial/caliper pig has caliper sonars that scan the wall of the pipeline and yield the instrument-to-pipe translation and attitude. An inertial navigation system maintains the tool's position and attitude along its trajectory within the pipe. Other equipment measures the progress of the instrument through the pipeline, transmits a tracking signal, and electronically stores the data for retrieval and interpretation.

*Correlation with 1986 inspection.*— An anomaly indicated by the 1994 magnetic-flux inspection would be greater than the same anomaly indicated by the 1986 magnetic-flux inspec-

## ANALYSIS

Metallurgical analysis of the Line 20 pipe fragments after the accident show the scrapes were made by nonexcavation activities and the gouges were made by mechanized excavation equipment. The Safety Board was able to determine that the nonexcavation scrapes were made in 1984 when plant personnel filled the sediment pond with dirt and plant debris, but the Board was unable to determine when the gouge at the fracture origin was made or who made it. In the following analysis, the Board lists the factors and conditions it was able to exclude, identifies improvements needed for pipelines, especially in urban areas, and discusses the need for improved pipe metal properties to limit pipeline failures and/or mitigate their consequences.

### Exclusions

The findings from TETCO's 1986 magnetic flux internal inspection did not indicate metal loss sufficient to have caused pipe failure. Witnesses recall and aerial photographs show heavy equipment, including a bulldozer and dredging equipment, being operated in the area of the sediment pond over the pipeline before TETCO's 1986 internal inspection of Line 20. The metal loss indications on the 1986 log corresponds with minor scrape marks on the pipe within the pond. The Safety Board concludes that the indications detected in the 1986 internal inspection were the deeper portions of scrapes made when plant employees bulldozed plant debris and dirt into the sediment pond and when dredging equipment contacted the pipe during sediment removal operations. The Board further concludes that the gouge that ultimately resulted in pipe failure was caused by excavation activity performed at some undetermined time.

The gouges on the pipe were not the result of recent excavation damage. The Safety Board examined the microstructure of the pipe material underlying the non-rupture origin crack and found it was heavily deformed and contained a crack covered with corrosion deposits. The large build-up of corrosion deposits in the non-origin crack indicates that the crack was present in the pipe metal for some time, likely from when the pipe was gouged.

The gouge damage alone was not sufficient to cause the steel pipe to fail under operating pressure when it was injured. Also, subsequent operation of the damaged pipe even at maximum pressure did not cause the rupture. During the 2 years before the rupture, TETCO frequently operated Line 20 at maximum pressure without failure.

Pipeline employee performance was not a factor in the pipe being damaged or in the damage not being detected by TETCO. From interviews and observations, the Safety Board determined that the survey pilot can easily observe activities and vegetation along the pipeline route without experiencing any workload problems. From interviews with the Houston controllers, the Lambertville operators, and other TETCO employees, the Safety Board established that they were adequately trained and experienced and correctly performed assigned tasks consistent with

## CONCLUSIONS

### Findings

1. On the day of the accident, Line 20 did not fail as a result of human error or as a result of excessive operating pressure.
2. TETCO's Line 20 was gouged by excavation equipment, such as a backhoe, at some undetermined time.
3. The mechanically-induced gouge at the rupture initiation likely created a crack in the gouge that grew to a critical size, most likely as a result of metal fatigue.
4. Exempting pipelines in any class location from Federal marking requirements increases the potential for excavation damages. Clearly marking the route of Line 20 through the asphalt plant property may have increased the likelihood that the employees of Quality Materials, Inc. notified TETCO prior to excavating.
5. Periodic instrumented inspection of pipelines can identify most types of injurious defects and damages before a rupture occurs.
6. A pipe metal having good toughness properties may have sustained the gouges without failure or sustained a substantially smaller failure opening that would have reduced the rate at which gas was released. The brittle failure of Line 20 allowed the release of the natural gas at the maximum possible rate.
7. Although many TETCO requirements and procedures surpassed those required by Federal regulations, the company's surveillance procedures did not stress that employees identify excavation activities within industrial locations that could endanger its pipeline.
8. Quality Materials, Inc., did not advise its employees about the presence of or potential hazards posed by the pipeline within the plant property, or implement precautionary measures to protect Line 20 from excavation damage by employees.
9. TETCO's lack of automatic- or remote-operated valves on Line 20 prevented the company from promptly stopping the flow of gas to the failed pipeline segment, which exacerbated damage to nearby property.
10. RSPA's study on reducing public safety risks with respect to pipeline siting, if modified to assess the effect of building standards for structures near pipelines, offers significant potential for identifying necessary additional actions.
11. The public will not benefit from the safety improvement recommendations developed in RSPA's public safety risk study without guidance containing implementation procedures and without motivation from associations representing local governments.