

**TRANSPORTATION RESEARCH BOARD  
NAS-NRC**

**HMCRP  
HM-15**

# **Task-2 Report**

**Task-2.1 Report  
SUMMARY OF THE INVESTIGATION OF MAJOR PIPELINE  
ACCIDENTS AND ASSOCIATED EMERGENCY RESPONSE  
ISSUES  
1994-2012**

**September 29, 2012**

**Prepared for: John Jay College of Criminal Justice (CUNY)  
Prepared By: Hildebrand Noll Associates, Inc.**

## Table of Contents

|  |          |
|--|----------|
| Introduction   | Page-3   |
| Incident #01: September 9, 2010, San Bruno CA                        | Page-5   |
| Incident #02: December 24, 2008, Rancho Cordova, CA                  | Page-12  |
| Incident #03: March 5, 2008, Plum Borough PA                         | Page-18  |
| Incident #04: November 1, 2007, Carmichael MS                        | Page-19  |
| Incident #05: December 13, 2005, Bergenfield NY                      | Page-26  |
| Incident #06: October 27, 2004, Kingman KS                           | Page-30  |
| Incident #07: August 21, 2004, Du Bois PA                            | Page-31  |
| Incident #08: July 2, 2003, Wilmington DE                            | Page-32  |
| Incident #09: April 7, 2003, Glenpool OK                             | Page-35  |
| Incident #10: July 4, 2002, Cohasset MN                              | Page-38  |
| Incident #11: January 27, 2000, Winchester KY                        | Page-39  |
| Incident #12: March 9, 2000, Greenville TX                           | Page-41  |
| Incident #13: April 7, 2000, Chalk Point MD                          | Page-43  |
| Incident #14: August 19, 2000, Carlsbad NM                           | Page-47  |
| Incident #15: February 9, 1999, Knoxville TN                         | Page-48  |
| Incident #16: January 22, 1999, Bridgeport AL                        | Page-51  |
| Incident #17: June 10, 1999, Bellingham WA                           | Page-54  |
| Incident #18: July 7, 1998, South Riding VA                          | Page-55  |
| Incident #19: March 30, 1998, Sandy Springs GA                       | Page-59  |
| Incident #20: December 11, 1998, Saint Cloud MN                      | Page-62  |
| Incident #21: July 21, 1997, Indianapolis IN                         | Page-70  |
| Incident #22: October 23, 1996, Tiger Pass LA                        | Page-71  |
| Incident #23: November 21, 1996, San Juan PR                         | Page-72  |
| Incident #24: November 5, 1996, Murfreesboro TN                      | Page-83  |
| Incident #25: August 24, 1996, Lively TX                             | Page-87  |
| Incident #26, May 23, 1996, Gramercy LA                              | Page-89  |
| Incident #27: June 26, 1996, Fork Shoals SC                          | Page-92  |
| Incident #28: October 17, 1994, Waterloo IA                          | Page-93  |
| Incident #29: March 23, 1994, Edison NJ                              | Page-94  |
| Incident #30: June 9, 1994, Allentown PA                             | Page-96  |
| Appendix-A: Accidents Investigated 2010 to 1994                      | Page-A-1 |
| Appendix-B: Significant Pipeline Accidents Investigated 2010 to 1994 | Page-A-2 |

## Introduction

This report is an internal working document prepared in support of the research project's objective of preparing a *Guide for Communication of Emergency Response Information for Natural Gas and Liquid Pipelines*. Task 2.1 of the project requires the research team to identify and describe lessons learned from significant U.S. pipeline emergencies dating back to 1994 with respect to emergency response.

The focus of the Lessons Learned section of this report is not intended to provide analysis of emergency response strategy and tactics, but to capture information that may be useful for the research team to develop the final deliverable work product, a *Guide for Communication of Emergency Response Information for Natural Gas and Liquid Pipelines*.

To accomplish this task the researchers selected 30 National Transportation Safety Board (NTSB) significant investigations for evaluation. NTSB was used as the primary source for Task 2.1 research because: 1) NTSB is charged by Congress with investigating significant pipeline accidents involving a fatality or substantial property damage. NTSB findings directly affect development and pipeline safety policy or pipeline regulations within the U.S. Department of Transportation and indirectly affect trade associations, consensus standards organizations, and pipeline operators who may develop best practices; 2) NTSB is recognized widely for the quality and thoroughness of its accident investigations; and 3) NTSB reports are open source documents available to the general public for further study. The NTSB Report number is cited at the end of each accident summary. All NTSB reports can be read in their entirety by clicking on the link at the beginning of each accident summarized in this report.

The incidents selected for further evaluation involved natural gas or propane distribution pipelines as well as gas and hazardous liquid transmission lines. The scope of these incidents ranges from pipeline failures with release of hazardous materials with no fire or casualties to major catastrophes involving explosion and fire that resulted in mass casualty incidents.

The project team reviewed and summarized NTSB investigation final reports spanning 17 years (1994 to 2010) and summarized findings related to emergency planning and response. Information in these reports was supplemented with Open Source research. A summary of the incidents examined and their common emergency response themes are included as Appendix-A of this report.

To facilitate the research team's ability to understand the 30 NTSB accident investigation reports reviewed in preparation for completing the final project task, key information was extracted verbatim from the reports and then distilled into key findings. Each discussion is organized into a brief summary of the incident facts, statement of the probable cause, and a description of the emergency action taken. The emergency response lessons learned attempt to capture the

more important points as they may relate to preparation of the project's final work product. In some cases, the researchers were unable to determine lessons learned because of the limited scope of the investigation or lack of details available. For example, NTSB investigations primarily focus on determining the probable cause of the pipeline accident. NTSB reports do not specifically analyze and highlight emergency response to the incident unless they were contributing factors to the outcome. Consequently many of the lessons learned focus on the negative outcomes rather than the positive simply because all accidents represent some vulnerability or failure.

### **Summary of Analysis**

The 30 pipeline accidents examined by the research team represent incidents occurring in 22 different states and Puerto Rico. These incidents caused 84 fatalities, 310 injuries, and an estimated \$288 million in damages. When adjusted for inflation to 2012 dollars, these incidents are estimated to have cost \$385 million dollars in direct costs, loss of product, and response and recovery costs. The actual costs are believed to be much greater as they do not include the costs of civil lawsuits. A summary of incident data is included as Appendix-B.

Special Note: This report does not include a summary of the July 25, 2010 Enbridge Incorporated Hazardous Liquid Pipeline Rupture and Release at Marshall, Michigan. The NTSB accident investigation report was not released until July 10, 2012, after the research for this report was completed.

**INCIDENT # 1**  
**SEPTEMBER 9, 2010**  
**SAN BRUNO, CALIFORNIA**  
**NATURAL GAS TRANSMISSION PIPELINE RUPTURE AND FIRE**  
**8 Deaths, 15 Injuries, \$>44 Million Damages**  
<http://www.nts.gov/doclib/reports/2011/PAR1101.pdf>

### **Summary of Incident**

On September 9, 2010, about 6:11 p.m. Pacific daylight time, a 30-inch-diameter segment of an intrastate natural gas transmission pipeline known as Line 132, owned and operated by the Pacific Gas and Electric Company (PG&E), ruptured in a residential area in San Bruno, California. The rupture occurred at mile point 39.28 of Line 132, at the intersection of Earl Avenue and Glenview Drive.

The rupture produced a crater about 72 feet long by 26 feet wide. The section of pipe that ruptured, which was about 28 feet long and weighed about 3,000 pounds, was found 100 feet south of the crater. The Pacific Gas and Electric Company estimated that 47.6 million standard cubic feet of natural gas was released. The released natural gas ignited, resulting in a fire that destroyed 38 homes and damaged 70. Eight people were killed, many were injured, and many more were evacuated from the area.

### **Probable Cause of Accident**

The probable cause of the accident was the Pacific Gas and Electric Company's inadequate quality assurance and quality control in 1956 during its Line 132 relocation project, which allowed the installation of a substandard and poorly welded pipe section with a visible seam weld flaw that, over time grew to a critical size, causing the pipeline to rupture during a pressure increase stemming from poorly planned electrical work at the Milpitas Terminal; and an inadequate pipeline integrity management program, which failed to detect and repair or remove the defective pipe section.

Contributing to the accident were the California Public Utilities Commission's (CPUC) and the U.S. Department of Transportation's exemptions of existing pipelines from the regulatory requirement for pressure testing, which likely would have detected the installation defects. Also contributing to the accident was the CPUC's failure to detect the inadequacies of PG&E's pipeline integrity management program.

Contributing to the severity of the accident were the lack of either automatic shutoff valves or remote control valves on the line and PG&E's flawed

emergency response procedures and delay in isolating the rupture to stop the flow of gas.

### **Emergency Response Action Taken**

- The first 911 call reporting an explosion was received about 6:11 p.m. Many subsequent 911 calls were received from residents and police officers reporting a fire, a gas station explosion, and a possible airplane crash. San Bruno Police Department resources were dispatched, and the first police unit arrived on scene about 6:12 p.m.
- The first San Bruno Fire Department (SBFD) firefighters to respond had heard the explosion and seen the fire from their station, which was about 300 yards from the accident site. They had reported the fire and were preparing to respond just as the initial dispatch (first alarm) was issued. They were immediately enroute and on scene by 6:13 pm.
- About the same time, 6:13 p.m., some residents began self evacuating from the accident area. Police officers then began securing the area and conducting evacuations south and north of the fire. At 6:16 p.m., police officers requested that California Highway Patrol troopers divert traffic from the scene. Troopers began closing highways in the immediate area.
- At 6:18 p.m., an off-duty PG&E employee notified the PG&E dispatch center in Concord, California, of an explosion in the San Bruno area. Over the next few minutes, the dispatch center received additional similar reports.
- About 6:20 p.m., the initial incident commander, a Millbrae Fire Department battalion chief, arrived on scene. When the SBFD chief later arrived on scene, he assumed incident command. A battalion chief from the North County Fire Authority was designated as the deputy incident commander. Fire operations were supervised by a Millbrae Fire Department division chief and were organized into area commands. Battalion chiefs supervised each area.
- At 6:23 p.m., 5 minutes after the PG&E dispatch center received the first call reporting an explosion in the San Bruno area, a dispatcher sent a gas service representative (GSR) working in Daly City (about 8 miles from San Bruno) to confirm the report, as required by PG&E procedures.
- About the same time, a PG&E supervisor (supervisor 1) saw the accident fire while driving home from work. He called the PG&E dispatch center, reported the fire, and then proceeded to the scene.
- By 6:24 p.m., firefighters responding to the south side of the accident area had reported to incident command that hydrants were dry. About the same time, firefighters responding to the north side discovered that the explosion had damaged a water line. To address this, firefighters established water

supplies using 1,000–2,000 feet of large-diameter supply hose at two locations.

- At 6:27 p.m., a PG&E dispatcher called the SCADA center and asked SCADA operator C if the SCADA center staff had observed a pressure drop “at a station in [the San Bruno] area.” The dispatcher stated that he had received reports of a flame shooting up in the air accompanied by a sound similar to a jet engine and that a PG&E supervisor and a GSR had been dispatched to the area. Operator C replied that the SCADA center had not received any calls about the incident.
- At 6:29 p.m., the senior SCADA coordinator informed a SCADA coordinator at the Brentwood facility that there had been a gas line break and further stated that there had been an overpressure event at the Milpitas Terminal earlier. Reports of a plane crash, a gas station explosion, or some combination of the two persisted throughout the initial hours of the emergency response.
- By 6:30 p.m., some staff at the SCADA center realized that there had been a rupture along Line 132 in the San Bruno area. However, they did not know the exact location of the rupture and continued to try to identify it.
- About 6:30 p.m., the on-scene fire operations supervisor declared the incident a multi-casualty incident. Soon after, a medical group was established, and medical units were positioned north and south of the accident scene.
- At 6:31 p.m., SCADA operator B reported to dispatch that there was “a major pressure drop at a station up in that area [near San Bruno].”
- About 6:35 p.m., an off-duty PG&E gas measurement and control mechanic (mechanic 1), who was qualified to operate mainline valves, saw media reports about the fire. Suspecting a transmission line break, he notified the PG&E dispatch center, and proceeded to the PG&E Colma yard. While en route to the Colma yard, mechanic 1 received a call from a supervisor (supervisor 2) directing him to report to the yard and to contact a second mechanic (mechanic 2) to do the same. Before mechanic 1 could place the call, mechanic 2 called him to check on his well being. Both mechanics proceeded to the Colma yard. Meanwhile, another PG&E supervisor (supervisor 3), who lived about 4 miles from the rupture site, learned of the explosion and fire through media reports and notified the SCADA center. He then proceeded to the accident site.
- About 6:40 p.m., firefighters requested two water tenders, which were used as water sources and assigned as needed to various locations around the fire. A California wildfire battalion chief was assigned as a liaison to supervise the water tenders.

- Supervisor 1 was the first PG&E employee on scene. The GSR, who had been delayed in traffic, arrived shortly thereafter. Both were confirmed on scene at 6:41 p.m., with supervisor 3 following soon after. However, none of these three PG&E first responders were qualified to operate mainline valves. Upon arrival, supervisor 3 and supervisor 1 informed firefighters of their presence as PG&E representatives on scene.
- At 6:48 p.m., supervisor 1 called the PG&E dispatch center to request that gas and electric crews respond to the scene.
- Mechanic 1 arrived at the Colma yard about 6:50 p.m., and mechanic 2 arrived soon after. They obtained a map showing the location of pipeline valves in the area and watched further news reports regarding the accident. Processing the visual information, mechanic 1 recognized the rupture as occurring in Line 132 and called a supervisor (supervisor 4) to tell him he was going to isolate the rupture. Supervisor 4 authorized the action.
- By 6:55 p.m., supervisor 3 had contacted another supervisor (supervisor 5) who activated the PG&E operations emergency center. The San Carlos operations emergency center command post is permanently equipped with computers, desks, and communication equipment. PG&E's emergency plans define the specific responsibilities of personnel staffing the center. The center directed field resources within the immediate San Bruno area. Later, a larger emergency operations center in the San Francisco headquarters was also activated because of the extent of the emergency. The San Francisco emergency operations center was the central location from which the emergency response activities of the local operating department were prioritized and coordinated.
- About 7:06 p.m., the two PG&E mechanics left the Colma yard, driving toward the first mainline valve (at MP 38.49) that they planned to close; they were joined en route by a supervisor (supervisor 6). The three arrived at the first valve location by 7:20 p.m.
- Meanwhile, the SCADA center and dispatch center staff were occupied with making outgoing calls to brief PG&E departments and officials of the incoming information, such as the rumors of an airplane crash and a gas station explosion.
- Between 6:50 and 7:00 p.m., SCADA operators D29 and B30 made comments indicating that there had been a break on Line 132, but SCADA operator C made comments indicating uncertainty as to the nature of the accident.
- At 7:22 p.m., at the direction of supervisor 3, supervisor 1 contacted the PG&E dispatch center to convey that although it was still unconfirmed, the incident was likely a reportable gas fire. Within minutes, the dispatch center



relayed this information to the SCADA center; the SCADA center confirmed that Line 132 was involved.

- During a phone call at 7:07 p.m., operator D responded to a dispatch employee who reported the rumor that there had been a plane crash by saying, “It’s easy to believe it’s a plane crash. We still have indication that it is a gas line break. We’re staying with that. If you talk to the fire department I would inform them of that.” There was no indication that the dispatch center passed this information to the fire department.
- At 7:27 p.m., supervisor 6, who was with the two mechanics, requested that the SCADA center close two valves at the Martin Station. SCADA operator D remotely closed the valves downstream of the rupture by 7:29 p.m., which stopped the gas flow from north to south.
- By 7:30 p.m., the two mechanics had manually closed the mainline valve (at MP 38.49) south (upstream) of the rupture, stopping the gas flow at that location.
- By 7:42 p.m., 91 minutes after the rupture, the intensity of the fire had decreased such that firefighters could approach the rupture site and begin containment efforts.
- By 7:46 p.m., the two mechanics, with some assistance from supervisor 6, had manually closed two more valves downstream of the rupture (at MPs 40.05 and 40.05-2) at the Healy Station. Closing these valves isolated the ruptured section of pipe.
- About 7:57 p.m., a PG&E pipeline engineer informed the SCADA center staff that the rupture in Line 132 had occurred at MP 39.3332. During a phone call beginning at 6:53 p.m., SCADA operator D said in a conversation with the on-site SCADA supervisor, “Yeah, absolutely we believe it’s a break on line 132.” and explained that several mainline valves had been closed to isolate the break. He also told the staff that the downstream crosstie valves between Lines 109 and 132 had been opened to reestablish gas flow to the Martin Station.
- About 7:57 pm, the San Bruno Recreation Center, staffed by the American Red Cross, was opened as a shelter for evacuees.
- By 11:32 p.m., additional PG&E crews had manually closed two distribution line valves and squeezed (that is, pinched with hand tools) three more distribution lines to stop the gas-fed house fires surrounding the pipeline rupture.
- Although the gas flow through the transmission line break and several local distribution lines had been stopped, the resulting fires continued. Firefighters

declared 75 percent of all active fires to be contained about 4:24 a.m. on September 10.

- Fire operations continued to extinguish fires and monitor the accident area for hot spots until about 8:00 p.m. on September 11, when the SBFDD transferred incident command to the San Bruno Police Department.

### **Key Lessons Learned**

- As a result of the pipeline rupture and fire, 8 people were killed, 10 people sustained serious injuries, and 48 people sustained minor injuries. For five of the fatalities, the cause of death was “generalized conflagration effects,” and for the remaining three, the cause of death was “undetermined.” Twenty-one people were transported to hospitals by ambulance, including three firefighters who were treated for smoke inhalation. Forty-five other people were transported to hospitals by private vehicle.
- The fire damage extended to a radius of about 600 feet from the pipeline blast center, mostly spreading in a northeast direction. The fire affected 108 houses—38 of which were destroyed, 17 of which received severe-to-moderate damage, and 53 of which received minor damage. In addition, 74 vehicles were damaged or destroyed. The burned area also included a park with woodlands and a playground.
- According to PG&E, the cost to repair the pipeline was about \$13,500,000 and the loss of natural gas accounted for \$263,000.
- During the 50 hours following the accident, about 600 firefighting (including emergency medical service) personnel and 325 law enforcement personnel responded. Fire crews and police officers conducted evacuations and door-to-door searches of houses throughout the response. In total, about 300 houses were evacuated. Firefighting efforts included air and forestry operations.
- The San Bruno fire department issued an evacuation order for a  $\frac{3}{4}$  miles radius surrounding the incident. Approximately 377 homes were evacuated. Three shelters were opened in the vicinity. The American Red Cross provided assistance to evacuees. From September 9, 2010 through September 12, 2010, the City of San Bruno maintained a shelter for displaced residents, supported by the Red Cross and various County agencies.
- Firefighters, police officers, and members of mutual aid organizations also formed logistics, planning, communications, finance, and damage assessment groups to orchestrate response efforts and assess residential damage in the accident area.
- Despite that valiant efforts of the fire department, the large volume of fire

encountered by emergency responders and weather at the time of the incident was a factor in loss of property from fire. The wind across the northern and central portion of the San Francisco peninsula was estimated to have been from the west with magnitudes from 17 to 29 mph from the accident time through 10:00 pm.

- PG&E procedures in place at the time of the accident required the GSR to evaluate the danger to life and property, assess damage, and make or ensure that conditions were safe. The procedures also required field personnel to notify a field service supervisor, a dispatcher, a gas maintenance and construction supervisor, or an on-call gas supervisor. Nowhere did the procedure instruct field personnel, the dispatch center, or the SCADA center to contact emergency services through 911 or other means. The procedure did not discuss the involvement of city or emergency officials.
- PG&E operating procedures in place at the time hindered the communications between the PG&E SCADA and dispatch centers. In addition, there were problems related to locating the actual leak location. Questions were raised soon after the accident about the time (95 minutes) that elapsed after the rupture before the transmission line was isolated. Under PG&E's emergency response plan, although the PG&E SCADA center personnel were responsible for pipeline monitoring and operations, the PG&E dispatch center personnel were responsible for sending first responders. Therefore, personnel at these two facilities were required to coordinate with each other to effect PG&E's overall response to the emergency.
- SCADA center staff provided many telephone briefings and updates to various PG&E employees and officials, occupying a significant portion of staff time during the first 90 minutes after the rupture. In addition, the SCADA staff received multiple calls from other PG&E employees and officials regarding the opening of various emergency response centers. These incoming and outgoing calls were handled by whichever SCADA staff member was available, without any command structure. It would have been beneficial to have had one SCADA operator designated as the sole point of contact for the workers at the Milpitas Terminal so that others could handle and monitor the remainder of the system. Such staff allocation would have permitted a direct exchange of information aimed at resolving the issue, while permitting other SCADA personnel to continue monitoring the entire system, maintain situational awareness, and communicate with internal entities, as needed.
- The lack of a centralized PG&E command structure was evident in that key information was not disseminated in a reliable manner. Each SCADA staff member was left to form his or her own impression as to the nature and severity of the rupture based on the information they had, resulting in some conflicting and erroneous assessments.

- PG&E did not notify emergency officials that the accident involved the rupture of one of PG&E's pipelines, even after they had deduced this to be the case.
- There was a lack of either automatic shutoff valves or remote control valves on the pipeline. It took PG&E 95 minutes to stop the flow of gas and to isolate the rupture site - a response time that was excessively long and contributed to the extent and severity of property damage and increased the life-threatening risks to the residents and emergency responders.
- PG&E lacked a detailed and comprehensive procedure for responding to large-scale emergencies such as a transmission pipeline break, including a defined command structure that clearly assigned a single point of leadership and allocated specific duties to supervisory control and data acquisition staff and other involved employees.
- PG&E's supervisory control and data acquisition system limitations caused delays in pinpointing the location of the pipeline break.
- State and local agencies responded in a timely manner. First responders took appropriate initial actions, provided life saving patient care, evaluated and prioritized property at risk, and attempted to establish a successful course of action.
- Implementation of the unified command system resulted in successful and efficient operations. Unified command and strong coordination between fire and law enforcement was key to evacuating residents.

Sources: 1) NTSB Report # NTSB/PAR-11/01. PB2011-916501; 2) San Bruno Explosion After Action/Corrective Action Report, California Emergency Management Agency, 2011.

**INCIDENT # 2**  
**DECEMBER 24, 2008**  
**RANCHO CORDOVA, CALIFORNIA**  
**RELEASE, IGNITION, AND EXPLOSION OF NATURAL GAS**  
**1 Death, 5 Injuries, \$267,000 Damages**  
<http://www.nts.gov/doclib/reports/2010/PAB1001.pdf>

### **Summary of Incident**

About 1:35 p.m. on December 24, 2008, an explosion and fire caused by a natural gas leak destroyed a house at 10708 Paiute Way in Rancho Cordova, California.

On December 24, 2008, about 1:35 p.m., two Rancho Cordova police officers heard a very loud noise that sounded like an explosion, and they immediately notified their dispatch center, which was the Sacramento County Sheriff's Department Dispatch. After hearing from Sheriff's Dispatch that there had been calls about a possible explosion and learning of the possible location of the incident, the police officers drove toward the area. While en route, the officers heard multiple units of the Sacramento Metropolitan Fire Department dispatched to an explosion. First responders arrived on scene about 1:43 p.m. As the fire department worked to extinguish the fire, paramedics prepared the injured for transport. There were six injured, all of whom were transported to the hospital by 2:00 p.m. PG&E supervisors and the fire department verified that there was an active gas leak near the explosion site, and as a result, about 2:04 p.m. an evacuation was enforced 10 houses away from the explosion site in both directions. The fire department concluded the tactical response about 5:03 a.m. on December 25, 2008, when the evacuation was lifted.

One person suffered fatal injuries, and five other people, including one utility employee and one firefighter, were hospitalized as a result of the explosion. Two adjacent homes, one on either side, had severe damage, and several homes suffered minor damage. According to the Pacific Gas and Electric Company (PG&E), the property damage was \$267,000.

### **Probable Cause of Accident**

The probable cause of the release, ignition, and explosion of natural gas was the use of a section of unmarked and out-of-specification polyethylene pipe with inadequate wall thickness that allowed gas to leak from the mechanical coupling installed on September 21, 2006. Contributing to the accident was the 2-hour 47-minute delay in the arrival at the job site of a Pacific Gas and Electric Company crew that was properly trained and equipped to identify and classify outdoor leaks and to begin response activities to ensure the safety of the residents and public.

### **Emergency Response Action Taken**

- On December 24, 2008, at 9:16 a.m., the PG&E Customer Contact Center received a call from a resident at 10716 Paiute Way reporting a gas odor outside her house. The Customer Contact Center prepared a case ticket and contacted the PG&E Dispatch Office (Dispatch). As part of normal procedure, PG&E Dispatch prepared a field order dispatching a gas service representative (technician) to 10716 Paiute Way.
- About 9:21 a.m. on December 24, 2008, PG&E dispatched a technician to respond to 10716 Paiute Way with a field order to investigate an outside gas leak at a meter. The field order had a "zero" priority rating, which called for an immediate response.

- About 9:30 a.m., the technician entered a code into PG&E's field automation system using her laptop computer confirming that she had received the field order.
- About 9:55 a.m., she entered another code into the system indicating that she was en route to 10716 Paiute Way.
- At 10:15 am the technician arrived outside 10716 Paiute Way carrying a combustible gas indicator across the yard to the door of the house. Before reaching the door, she picked up natural gas readings in a water box outside the house. (The combustible gas indicator that the technician carried was a type that can detect gas concentrations between 0 and 5 percent and that is primarily used to detect gas inside a building.) Because she had picked up gas readings in the yard, rather than at the house meter as directed in the field order, she decided that she needed assistance and better detection equipment. The technician met the resident outside the single-story house. The technician interviewed the resident and learned that she no longer smelled gas outside her house as she had when she called in the leak earlier that morning. The resident told the technician that she did, however, smell gas outside her next-door neighbor's house at 10712 Paiute Way, and she pointed out the neighbor who was standing at her door.
- About 10:24 a.m., the technician spoke to the next-door neighbor, who lived at 10712 Paiute Way, who told the technician that she had smelled a gas odor outside her house. The technician then asked the resident of 10712 Paiute Way to call PG&E's Customer Contact Center to report a leak in her yard. The Customer Contact Center subsequently received a call from the resident of 10712 Paiute Way about 10:29 a.m. reporting a strong gas odor outside her house in the garage area.
- At 10:25 a.m., the technician called PG&E's Customer Contact Center on the dedicated telephone line that connects directly to the Dispatch Office. The technician requested that the 10716 Paiute Way case be forwarded to the maintenance and construction department so a maintenance crew could be dispatched to the scene to assist with the leak investigation. The maintenance crew would be equipped with a flame ionization detector that can determine the location of a leak and its migration path, whereas the technician had a instrument that could handle only an inside leak. (An ionization detector that the maintenance crew used was a full-range detector that can detect gas concentrations between 0 and 100 percent and that is used to detect gas outdoors.)
- At 10:28 am the PG&E Customer Contact Center created a case ticket for 10716 Paiute Way; the maintenance supervisor acknowledged the case ticket about 10:42 a.m. and dispatched a fieldman, a leak investigator, and a

foreman to the scene. Recognizing the immediate need for assistance from an ionization detector crew, and because it was Christmas Eve and she was unsure how quickly maintenance could dispatch a crew, the technician then called Concord Dispatch directly about 10:32 a.m. to request that a maintenance crew respond to 10712 and 10716 Paiute Way.

- About 10:35 a.m., the technician made a second phone call directly to the PG&E Customer Contact Center to request that a maintenance crew be dispatched to 10712 Paiute Way to assist with the leak investigation. The Customer Contact Center created a case ticket for 10712 Paiute Way at 10:42 a.m. PG&E requires a field order to be completed before a technician may proceed to the next work location. The technician knew that the call from the resident at 10712 Paiute Way would lead to the creation of a new field order for that address, so about 10:38 a.m. the technician completed the field order for 10716 Paiute Way in the field automation system. She then entered a code into the system indicating that she was en route to 10712 Paiute Way.
- The technician immediately proceeded to 10712 Paiute Way, knocked on the door, and entered the house at the invitation of the female resident. The technician did not detect any gas inside the house, with the exception of a small, “fuzz,” leak at the water heater, which was eliminated by tightening a fitting on the unit. Next, the technician went to the garage where she smelled “a little whiff” of natural gas. She then went back into the kitchen to investigate further and met the male resident, who indicated that the source of the leak was in his next-door neighbor’s yard.
- The resident led the technician outside and into the yard of 10708 Paiute Way. Once in the yard, the technician detected a natural gas leak at a patch of dead grass in the middle of the yard. The location of the leak was about 5 feet west of the driveway, about 45 feet from the house. The technician checked the gas meter at 10708 Paiute Way for leaks but did not find any. After finding the leak in the yard the technician was evaluating the terrain and her gas readings to try to judge the migration path of the natural gas. None of the tests on the three houses showed excessive flow across the meters. The technician knocked on the door of 10708 Paiute Way in an attempt to gain entry and determine whether any leaks existed inside the house, but she received no answer. She then returned to her truck, parked it on the opposite side of the street between 10712 and 10716 Paiute Way, facing in the direction of 10708 Paiute Way, and waited beside it. She did not contact the fire department to request entry into the house, nor did she place signs on the doors or string up tape to warn residents that entry could be hazardous. The technician told investigators that she had become increasingly concerned about the leak at the time. As a result, over the next half-hour she made several phone calls to the PG&E Customer Contact Center, the maintenance department, Concord Dispatch, and the responding leak investigator in an

attempt to determine whether the maintenance crew was en route and its estimated arrival time.

- About 11:11 a.m., the technician called Concord Dispatch to request a field order for 10708 Paiute Way. The field order documented the leak in the front yard and that there was no excessive flow on the gas meter.
- About 11:17 a.m., the technician made a third call to the PG&E Customer Contact Center to request that the 10708 Paiute Way case be forwarded to the maintenance department so a crew could be dispatched to the scene to assist with the leak investigation. The Customer Contact Center created a case ticket for 10708 Paiute Way about 11:22 a.m.; the maintenance department acknowledged it at 11:26 a.m.
- The maintenance department leak investigator arrived at the PG&E service center to pick up the ionization detector about 11:30 a.m. but had problems with his truck brakes, which forced him to acquire another truck and delayed his departure to Paiute Way. He called the technician three times, but he did not notify his supervisor of his delay, nor did he notify Dispatch of his delay. The leak investigator left the PG&E service center about 12:42 p.m., more than an hour after his arrival there.
- About 11:49 a.m., the technician noted in the field order for 10712 Paiute Way that it appeared that the leak was in the vicinity of the patch of dead grass in the front yard of 10708 Paiute Way. After completing the field order in the field automation system, the technician made several calls to co-workers in an effort to determine the status of the responders. One of the gas service supervisors she spoke with advised her to stay on scene until she was relieved by the maintenance department.
- At 1:14 p.m., according to the PG&E timeline, the foreman arrived on scene. The foreman parked his truck behind the technician's truck, and they had a brief discussion. The technician told the foreman that none of the clock tests showed excessive flow across the meter and told him the locations where she obtained gas readings and smelled gas. She also told him that there was a leak in the yard of 10708 Paiute Way, but that she had been unable to gain entry into the house. The foreman relieved the technician, and she left the scene. The leak investigator (equipped with the ionization detector) arrived about 5 minutes later, 2 hours 47 minutes since the technician had called Concord Dispatch to request the specialized equipment to locate the leak. The fieldman arrived immediately after the leak investigator; both parked near the foreman's truck. The foreman asked the leak investigator to display the plat-10 on his laptop computer. The foreman and the fieldman reviewed the plat and then located and marked the service pipelines and a portion of the main pipeline with paint and flags. While the foreman and fieldman were marking pipelines, the leak investigator prepared the ionization detector at his



truck.

- About 1:27 p.m., the leak investigator was attempting to locate the leak on the main pipeline using the ionization detector when a neighbor walked up to the foreman and the fieldman and told them that a leak in the vicinity had been fixed once before. He was not sure of the exact location of the repair, but he said that he remembered that PG&E had dug two holes. The foreman then noticed sunken ground at two ends of the yard at 10708 Paiute Way.
- About 1:34 p.m., the leak investigator located the dead grass in the front yard of 10708 Paiute Way and walked westward over the main pipeline between the two patches of sunken ground. The ionization detector's initial reading was 60,000 parts per million. The reading increased to 80,000 parts per million as the leak investigator continued to walk westward. When he reached the location of the leak, the device flamed out, meaning the flame of the ionization detector went out, and an alarm sounded. The flame-out signaled that the gas-to-air mixture was too rich to burn (that is, there was too much natural gas with the volume of air in the intake), which is indicative of a leak. The three PG&E employees then agreed that they had identified the leak location, and they discussed the likelihood of its being a subsurface leak.
- About 1:35 p.m., the foreman went to his truck to get a probe and to prepare for use another type of gas detector, a combustible gas indicator that helps pinpoint leaks. Meanwhile, the leak investigator knocked on the door of 10708 Paiute Way and talked with a resident. When they had finished talking, he turned away from the house to begin further investigation, and the house exploded. The homeowner sustained fatal injuries as a result of the explosion.

### **Key Lessons Learned**

- The first responder from the gas company who carried a combustible gas indicator had a limited capacity for detecting the outdoor source of the leak. It took the leak investigator equipped with the flame ionization detector about 2 hours 47 minutes to arrive at the scene.
- Despite the evidence of dead grass, a past history of a leak repair, and reports of odors of gas from multiple locations, residents were not made aware of the potential danger and gas company did not notify the fire department of a potential hazardous situation.
- Designated hazard control zones were not established until after the explosion.

Source: NTSB Pipeline Accident Brief # DCA09FP003

**INCIDENT # 3**  
**MARCH 5, 2008**  
**PLUM BOROUGH, PENNSYLVANIA**  
**NATURAL GAS DISTRIBUTION PIPELINE LEAK, EXPLOSION, AND FIRE**  
**1 Death, 1 Injury, \$1 Million Damages**  
<http://www.nts.gov/investigations/fulltext/PAB0801.htm>

### **Summary of Incident**

On March 5, 2008, about 1:39 p.m., a natural gas explosion destroyed a residence at 171 Mardi Gras Drive in Plum Borough, Pennsylvania, killing a man and seriously injuring a 4-year-old girl. Two other houses were destroyed, and 11 houses were damaged. Property damage and losses were \$1,000,000.

### **Probable Cause of Accident**

The probable cause of the leak and explosion was excavation damage to the 2-inch natural gas distribution pipeline that stripped the pipe's protective coating and made the pipe susceptible to corrosion and failure.

### **Emergency Response Action Taken**

- No report of a gas odor was filed with Dominion Peoples Natural Gas Company (Dominion) before the accident before 1:39 pm. Several neighbors and a postal worker who were on the property 30 minutes before the explosion stated during post accident interviews that they had not smelled gas before the accident.
- At 1:40 p.m., the Holiday Park Fire Department was notified about an explosion involving a home with two people inside.
- At 1:44 p.m., Dominion was notified of the explosion by a neighbor who had called Dominion's emergency dispatch telephone number. At that time, Dominion dispatched personnel to the scene.
- About 1:45 p.m., the police were on the scene.
- About 1:50 p.m., the fire chief arrived at the scene. An injured man was pulled from the debris. An injured girl, who had been blown free of the debris and rescued by a neighbor, received on-scene medical assistance. About 30 minutes after the explosion, a helicopter evacuated the man and the girl. The man died en route to the hospital.
- By 2:12 p.m., a Dominion customer serviceperson had arrived at the scene.

- At 2:17 p.m., the maintenance crews arrived.
- About 2:20 p.m., Dominion supervisors arrived.
- The local fire department declared the fire to be under control at 2:20 p.m.; at that time, the gas pipeline was feeding three small fires in the debris. The fire department remained at the scene until the fires were extinguished, at 6:59 p.m.

### **Key Lessons Learned**

- Residents who smelled gas did not report the problem to emergency services through 911, therefore there was a delayed fire department response to the incident.

Source: NTSB Pipeline Accident Brief # DCA08-FP-006

**INCIDENT # 4**  
**NOVEMBER 1, 2007**  
**CARMICHAEL, MISSISSIPPI**  
**RUPTURE OF HAZARDOUS LIQUID PIPELINE WITH RELEASE AND**  
**IGNITION OF PROPANE**  
**2 Deaths, 7 Injuries, \$3,377,247**  
<http://www.nts.gov/doclib/reports/2009/PAR0901.pdf>

### **Summary of Incident**

On November 1, 2007, at 10:35 a.m. central daylight time, a 12-inch-diameter pipeline segment operated by Dixie Pipeline Company was transporting liquid propane at about 1,405 pounds per square inch, gauge, when it ruptured in a rural area near Carmichael, Mississippi. The resulting gas cloud expanded over nearby homes and ignited, creating a large fireball that was heard and seen from miles away. About 10,253 barrels (430,626 gallons) of propane were released. As a result of the ensuing fire, two people were killed and seven people sustained minor injuries. Four houses were destroyed, and several others were damaged. About 71.4 acres of grassland and woodland were burned. Dixie Pipeline Company reported that property damage resulting from the accident, including the loss of product, was \$3,377,247.

The pipeline rupture occurred in a cattle pasture in a relatively unpopulated area in Carmichael, Mississippi, which is an unincorporated section of Clarke County.

The site was occupied by livestock at the time of the rupture. Clarke County has a population of 21,979 and an area of about 416 square miles. The accident site is about 12 miles southeast of Quitman, the Clarke County seat, about 3 miles north of the Wayne County line, and about 3 1/2 miles west of the Alabama-Mississippi state line. About 200 residents live within a 1-mile radius of the accident site.

### **Probable Cause of Accident**

The major contributing factors to the cause of the accident were the failure mechanisms and safety of low-frequency electric resistance welded pipe; the adequacy of Dixie Pipeline Company's public education program; the adequacy of federal pipeline safety regulations and oversight exercised by the Department of Transportation of pipeline operators' public education and emergency responder outreach programs; and emergency communications in the 911 Clarke County, Mississippi Communications Center.

### **Emergency Response Action Taken**

- The first call received at Clarke County Central 911 Dispatch, came in at 10:39:56 a.m. Two operators were on duty at the time. The call was from a person calling from a house at 4195 County Road 621. The caller reported that a gas explosion had occurred somewhere around the area and that smoke and gas surrounded the house. When asked if there was fire, the caller said that she did not see any fire but she saw white gas and smelled gas. The 911 operator told the caller that an emergency responder would be sent.
- The 911 operator did not tell the caller to get out of the house and run away from the smoke. The call lasted 1 minute 20 seconds. The house at this address was subsequently identified as the house in which one of the two fatalities was discovered. At 10:40:13 a.m., during the first 911 call, the second 911 operator received a telephone call from a caller in a house in the 4300 block of County Road 621, about 600 feet south of the house where the first 911 call had originated. The caller reported that an explosion had occurred and he could see smoke when he walked out to the road. The call lasted 1 minute 33 seconds and concluded at 10:41:46 a.m. Clarke County Central Dispatch subsequently received numerous additional calls reporting the incident.
- About 10:42 a.m., after receiving the first two 911 calls, Clarke County Central Dispatch placed a radio dispatch page to the Carmichael Volunteer Fire Department (CVFD) to respond to the house at 4195 County Road 621. The Clarke County Central Dispatch operating personnel did not know at that time that their fire department radio signal repeater did not transmit the page to the

CVFD. Later, it was determined that the repeater system did not send a signal because it had been disabled during routine cleaning in the Clarke County Central Dispatch facility when a floor mop had accidentally dislodged the connector fittings of several communication cables about 90 minutes before the accident.

- The assistant chief of the CVFD was at work about 1/4 mile from the CVFD fire station when, about 10:43 a.m., he heard the sound of a distant explosion. According to the assistant chief, the sound was followed shortly thereafter by the sound of a second explosion and perhaps the sound of a third explosion. About 10 to 15 seconds later, he saw a large plume and a cloud of heavy black smoke rising above the trees. The assistant chief immediately began mobilizing CVFD fire apparatus and personnel to the scene.
- At 10:42:50 a.m., a caller at a construction site on a road north of Waynesboro, used a cellular telephone to call Wayne County, Mississippi, 911. The caller reported that an explosion had occurred northeast of his location. In a post-accident interview, this caller indicated that he had placed the 911 call about 20 seconds after he heard the sound of what appeared to be an explosion that occurred in the distance and after he saw a large plume and a cloud of heavy black smoke rising above the trees and moving northeast from his location. Following another 911 call that was received about 17 seconds after the 10:42:50 phone call, Wayne County 911 sent a Wayne County deputy sheriff to verify the incident location, and then, under a mutual aid agreement with Clarke County, dispatched Wayne County fire and rescue units to the scene.
- About 10:44 a.m., because Clarke County Central Dispatch had not received a response from the CVFD acknowledging the page that had been placed about 2 minutes earlier, Clarke County Central Dispatch sent a second page, this time to the Theadville Volunteer Fire Department to respond to 4195 County Road 621.5 Clarke County Central Dispatch was still unaware at that time that the radio signal repeater was not functioning and the page to the Theadville fire department also had not been transmitted.
- The Clarke County sheriff was at his residence about 20 miles from the accident site when about 10:44 a.m. he received a telephone call from Clarke County Central Dispatch asking whether there were any pipelines near County Roads 630 and 621, because a 911 call had just reported an explosion in that area. The sheriff responded that there was a pipeline in the Carmichael area. During post-accident interviews, the sheriff stated that he had been casually listening to his service radio just before this phone call, and there had not been any radio traffic about an incident occurring in the Carmichael area. Clarke County Central Dispatch told the sheriff that two units (deputies) had been dispatched to that location and the CVFD had been paged to respond. The sheriff then told Clarke County Central Dispatch that

he would monitor the radio closely for updates.

- About 10:48 a.m., Clarke County Central Dispatch had not received a response from the Theadville Volunteer Fire Department acknowledging the page that had been placed about 4 minutes earlier. Clarke County Central Dispatch then repeated the page, this time to the Theadville, Quitman, and Carmichael Volunteer Fire Departments and the Desoto Fire Department.
- About 10:55 a.m., the Clarke County Central Dispatch dispatcher had not received any responses acknowledging his pages to the four fire departments, and he began to suspect that the fire department radio signal repeater was not working and that none of the pages to the fire departments had been transmitted or received. Therefore, following the Clarke County Central Dispatch backup communication plan, the dispatcher switched to the Clarke County Sheriff's Department radio signal repeater, which was operating correctly. Concurrently, the Clarke County sheriff continued monitoring his service radio and did not hear any responses to the Clarke County Central Dispatch pages. The sheriff suspected that the fire department radio signal repeater had failed to transmit, but he was unable to contact Clarke County Central Dispatch because of the range limitations of his service radio. Accordingly, about 10:55 a.m., he contacted a deputy who was within transmission range and directed the deputy to notify Clarke County Central Dispatch that the radio signal repeater appeared not to be working and to use the Clarke County Sheriff's Department radio signal repeater to establish radio communications with the fire and rescue agencies. The sheriff then drove his personal vehicle to the site.
- Upon hearing the explosion and seeing the fireball and heavy black smoke, at 10:43 a.m., the CVFD assistant chief drove his personal vehicle in the direction of the smoke to see the situation firsthand. While en route, the assistant chief spoke to the CVFD chief using his personal cell phone, which had a short-range wireless communication feature similar to a walkie-talkie. The two conferred briefly about what had occurred, made a preliminary identification of the location sufficient to direct CVFD resources to the general area of the accident, and agreed to mobilize the CVFD in response to the accident. The assistant chief then drove toward the CVFD fire station and used the short-range wireless feature on his cell phone to tell several other CVFD personnel what had occurred and to direct resources (two tanker trucks) to the scene. A few moments later, the assistant chief and the CVFD captain arrived simultaneously at the CVFD fire station. They left immediately in a pumper truck and unsuccessfully attempted by radio to contact Clarke County Central Dispatch to report that they were en route to the scene.
- About 10:55 a.m. the assistant fire chief and the captain received word that the fire department radio signal repeater had apparently malfunctioned, and in

accordance with the back-up communication plan, on-scene fire and rescue units were to switch to the Sheriff's Department radio frequency that used the sheriff's department radio signal repeater.

- About 10:56 a.m., Clarke County Central Dispatch received a message from one of the on-scene deputy sheriffs reporting that the CVFD pumper truck with the CVFD assistant chief and the CVFD captain aboard, had just arrived at the scene at the intersection of County Roads 620 and 621, that the CVFD pumper truck was the first firefighting apparatus at the scene, that the CVFD had already begun to dispatch additional CVFD resources to the scene, and that the instruction to switch to the sheriff's department radio frequency had been received by the CVFD.
- About 11:15 a.m., the Clarke County sheriff arrived at the intersection of County Roads 620 and 621, which later became the incident command post location. As prescribed by the Clarke County emergency management plan, the sheriff proceeded to implement an incident command process and assumed the role of incident commander. Later the incident command structure was elevated to a unified command system.
- When the assistant fire chief and the fire captain approached the scene and saw a substantial fire and a cloud of heavy black smoke, they strongly suspected that the likely source of the fire was the propane pipeline buried underneath the cattle pasture. At the time, they did not know the extent of the fire and the number and locations of residents who might be endangered. Both recognized that the houses on County Road 621 would probably be in the greatest danger, so they drove the fire truck toward those houses. The CVFD assistant chief stated during post-accident interviews that although he was aware that the pipeline transported highly flammable propane, the cause of what appeared to be a substantial rupture and product release and a fully involved fire, and the extent of damage to the rest of the pipeline, were not apparent to him at the time. Accordingly, the assistant chief drove the pumper truck on County Road 621 and stopped just short of the location where the Dixie pipeline passed beneath the road. The pumper truck was initially staged at that location, which became the initial forward command staging location. Additional fire and rescue units from other local fire departments were later staged at the parking lot of the Baptist church at the intersection of County Roads 630 and 632. Responding units from Alabama were staged on County Road 630 at the Alabama state line, and responding Wayne County resources were staged on County Road 620 at the Wayne County line.
- When the assistant fire chief and the fire captain performed their initial assessment of the situation, they observed several civilians, whom they assumed to be residents of County Road 621 or 620, assisting others to leave the scene. Several sheriff's deputies arrived about that time, and they also

began to assist civilians to leave the scene and to establish motor vehicle traffic control at the west end of County Road 621.

- A short distance to the east, CVFD personnel observed the burned remains of several houses and several other houses that were fully engulfed in flames and thus were deemed not salvageable. Fire had extensively charred the trees and grass in the area, but had essentially self-extinguished. Several small spot fires remained in the area, but they did not appear to present immediate danger to the evacuating civilians. In the open field, about 900 feet northeast of the initial staging location on County Road 621, there was a large, billowing, uncontrolled fire, which was believed by the CVFD to be within the linear boundary of the Dixie pipeline right-of-way. Flames extended into the air up to an estimated several hundred feet, and the heat generated could be felt as far away as 900 feet from the fire.
- The two CVFD command officers were joined by the CVFD fire chief about 10:57 a.m. The CVFD chief assumed operational command of the responding fire and rescue resources. The CVFD fire chief and the assistant fire chief were aware that another pipeline traversed the open field in the vicinity of the fire; and, given the extent of heavy black smoke, it was unclear at first which pipeline was involved or whether both pipelines were involved.
- The CVFD chief instructed the responding CVFD firefighters to search several residences in the immediate area and confirm that the occupants had been evacuated. Due to limited on-scene fire suppression resources at that time and the need to evacuate the area, fire suppression for the fully engulfed houses was deferred. The initial evacuation effort focused on houses and the one business located within about a 1/4-mile radius of the fire. A short time later, the evacuation radius was increased to about 1 mile. The CVFD conducted a brief inspection of what remained of the houses at 4195 and 4207 County Road 621, where the two fatalities were found (one at each location).
- Upon completion of the initial civilian evacuation within a 1/4-mile radius, the CVFD began to put out the still burning fires in houses in the area. When those fires were out, about 12:00 p.m., the CVFD began to put out several small spot fires that remained in the wooded areas near the burned houses on County Road 621. These fires were suppressed by 2:00 p.m.
- Upon guidance from Dixie's *The Pipeline Group Emergency Response Manual* and the on-scene tactical response plan, the CVFD did not attempt to extinguish the ongoing fire at the ruptured pipeline. Accordingly, after the CVFD completed as much of the evacuation and fire suppression efforts that could be accomplished, it withdrew equipment and personnel to the intersection of County Roads 620 and 621 about 2:30 p.m.



- On-scene activities continued until fire suppression and evacuation activities were fully concluded. A law enforcement presence at the site was deemed necessary only to provide security for the houses on County Road 621 that were damaged by the fire. The fire at the rupture site was officially declared extinguished about 5:05 p.m. on November 2, when the residual propane in the pipeline was exhausted. Incident command activities concluded on November 4 about 4:00 p.m. when on-scene activities ended.

### **Key Lessons Learned**

- Prior to the accident Dixie pipelines conducted pipeline safety and awareness training, through an independent technical contractor. This training was intended for fire and rescue departments, law enforcement, members of local emergency planning committees, and regional emergency management and support organizations, such as the Red Cross, in the eight Mississippi and Alabama counties in which Dixie had pipeline facilities. However, emergency services communications agencies, such as 911 emergency call and central dispatch centers, were not specifically identified as stakeholders in Dixie's public education program plan, consequently they were not invited and thus were not able to take advantage of the opportunity for training.
- In addition to pipeline training, Dixie also sponsored a propane pipeline emergency exercise and distributed emergency response information concerning their pipeline and the hazards of the products transmitted, in their system. A review of the attendance list of emergency response agencies that were invited and participated in the training Dixie provided between 2005 and 2007 indicates limited attendance with only nine people from a total of three agencies participating over three years. Essentially, the training was offered by the pipeline, and few emergency responders took advantage of the training opportunity.
- Dixie pipeline provided a Guideline for Emergency Response Agencies to emergency response agencies in Clark County, however, this booklet was not provided to the Clarke County Central Dispatch personnel. Consequently, dispatch personnel were not familiar with pipeline terminology or pipeline response procedures.
- API RP 1162, the pipeline industry's standard for public education programs, did not identify central dispatch centers as organizations to contact although Dixie, as a regional pipeline operator, had the responsibility to identify and offer training to the appropriate emergency response agencies in those regions in which it operates. Had personnel from Clarke County Central Dispatch participated in Dixie's periodic familiarization training or received the guidance to 911 operators, they may have promptly recognized that the information initially reported indicated a massive propane release in the area

and would have been better prepared to address it. Such actions may have included warning callers to avoid ignition sources and telling them to immediately evacuate the area.

- Failure of a critical radio communications systems component in the Clark County Communications system resulted in delayed alerting, notification, and response to the pipeline incident.
- Dixie's public awareness program distributed safety literature to identified stakeholders that included residents, businesses, emergency response agencies, excavators, and public officials. Under the program, Dixie, through its contractor, mailed pipeline public awareness and safety literature each year to all emergency response officials and excavators in the county, every 2 years to the residents and businesses within 1 mile of either side of the pipeline, and every 3 years to public officials within the county. After the accident, Dixie discovered that 10 addresses on County Road 621 were missing from the mailing data used for the May 2007 distribution of *A Public Service Message—Pipeline Safety is Everyone's Responsibility*; the 10 addresses included the houses of the two fatalities and the houses and one business on County Road 621 that were destroyed and most heavily damaged in the Carmichael accident.

Source: NTSB Report NTSB/PAR-09/01 PB2009-916501

**INCIDENT # 5**  
**DECEMBER 13, 2005**  
**BERGENFIELD, NEW JERSEY**  
**NATURAL GAS DISTRIBUTION PIPELINE BREAK WITH EXPLOSION**  
**AND FIRE**  
**3-Fatalities, 4-Injuries, \$863,300 Damages**  
<http://www.nts.gov/doclib/reports/2007/PAB0701.pdf>

### **Summary of Incident**

About 6:45 p.m. on December 13, 2005, at 9:26 a.m., an apartment building exploded in Bergenfield, New Jersey, after natural gas migrated into the building from a damaged pipeline. Investigators found a break in an underground 1 1/4-inch steel natural gas distribution service line that was operating at 11 1/2 pounds per square inch, gauge. The break occurred at an underground threaded tee connection downstream from where excavators were removing an oil tank that was buried under the asphalt parking lot adjacent to the building. The break occurred, under the parking lot, about 7 feet 4 inches from the building's wall. Three residents of the apartment building were killed. Four residents and a tank

removal worker were injured and transported to hospitals. The property damage consisted of the apartment building, which was a complete loss. According to Bergen County tax records, the assessed value of the apartment building was \$863,300.

JP Management, a real estate company that owned the apartment building, hired the American Tank Service Company (American Tank) to remove and replace the buried oil tank. On December 5, 2005, American Tank requested markouts of the utilities at 30 Elm Street through the New Jersey One Call System. On December 7, 2005, a Public Service Electric and Gas Company (PSE&G) street inspector went to the site and marked the location of the buried gas service line to the building. The marked location showed that the service line ran under the parking lot and about parallel to the building's wall. At a point downstream of the excavation area, the pipeline turned 90 degrees toward the building.

About 8:30 a.m. on Monday, December 12, the American Tank crew arrived at the site, saw the gas and water utility markouts, and began excavating in the asphalt parking lot that was adjacent to the building. The work contract indicated that the tank capacity was 2,000 gallons. According to the American Tank foreman, when the excavation was about 30 inches deep, the top of the tank was exposed. At this time, the crew realized that the tank was a 5,000-gallon tank rather than a 2,000-gallon tank. Because the larger tank was wider, longer, and heavier than expected, and thus closer to the natural gas service line, the excavation crew had concerns about its safe removal. In an interview, one of the crewmembers stated, "[At the time] I said our concern is once we move the tank or roll it over, to roll it and take it out, it may undermine the gas line." An American Tank vice president went to the site to verify that it was a larger tank and to reassess its removal. He arranged for his office staff to call New Jersey One Call for a second markout of the utilities. The PSE&G inspector arrived at the apartment building about 11:14 a.m. and re-marked the gas service line. He made a slight change to the original marking where the gas line entered the building.

The American Tank foreman told investigators that on December 12 he asked the PSE&G inspector whether the gas line could be shut off while they excavated. This request was a precaution to prevent the release of gas if the line was damaged during the tank removal. The PSE&G inspector told investigators he stated to the American Tank foreman that because it was wintertime the gas could not be shut off. However, the PSE&G inspector said that he would ask his supervisor. When the supervisor told the inspector that turning off the natural gas to the building would not be possible, the inspector informed the American Tank foreman. According to the PSE&G, shutting off the gas to the building without making prior arrangements with the PSE&G and the building's owner would have created a health risk to the residents by leaving them without gas for heat, hot water, and cooking.

The PSE&G inspector determined that the pipeline was a PSE&G gas pipeline and that it was accurately marked. According to the inspector, he reminded the American Tank crewmembers of their obligation to protect the gas pipe from damage by supporting the pipe against an immovable object, such as the building, or shoring the trench. The PSE&G inspector did not remain on the job to ensure that the pipeline was adequately protected. In addition, he did not attempt to test the curb valve to ensure it could be rapidly closed if the pipeline was broken. The inspector gave the American Tank foreman his business card and asked him to call if he needed assistance or had any questions. The inspector departed the site at 11:47 a.m. According to the American Tank foreman, the trench was not shored and was about 4 to 5 feet deep at the end of the first day. The American Tank crew (assistant manager, foreman, and two crewmembers) arrived about 8:30 a.m. on Tuesday, December 13, 2005, to continue work on the excavation. The American Tank crewmembers told Safety Board investigators that they did not start any of the excavation equipment or expand the excavation on December 13, the day of the accident. When they first arrived, they saw that the ground surrounding the pipeline had collapsed and fallen from underneath portions of the asphalt parking lot along the eastern wall of the trench.

The crewmembers said that they tied one end of a rope to the gas pipeline and the other end to the oil tank vent pipe at the building wall in an effort to help support the pipeline. The American Tank crew also placed a pump into the trench and was removing some of the water that had accumulated when some crewmembers reported hearing a “popping” sound and two crewmembers smelled natural gas. Shortly afterward, the other two crewmembers smelled natural gas.

At 8:49 am a business owner across the street reported the smell of gas to the Bergenfield Police Department. The Bergenfield fire department was dispatched at 8:52 am along with two police officers.

After arriving on scene about 8:54 a.m., the fire chief asked the police dispatchers to notify the PSE&G. At 8:58 a.m., police dispatchers notified the PSE&G of the incident. The fire chief told investigators that he had not observed any signs of a leak at the trench (that is, smelling gas, hearing a “hissing” sound, or seeing bubbling of water in the trench). The fire official said that he did not smell gas at the scene.

About 9:22 a.m., a PSE&G service technician arrived on scene. The technician attempted to close the curb valve to shut off the gas, but he was unable to apply enough force to close it. In a post accident interview, the service technician said that as he approached the building to investigate the gas leak, an American Tank crewmember told him to not get too close to the trench because it had already collapsed. The service technician said that he had seen a piece of asphalt that had fallen into the trench. The service technician, using a portable gas detector,

detected a positive gas reading just inside the boiler room doorway of the apartment building. He started moving away from the building as it exploded at 9:26 a.m.

### **Probable Cause of Accident**

The probable cause of the December 13, 2005, natural gas explosion and fire in Bergenfield, New Jersey, was the failure of the American Tank Service Company to adequately protect the natural gas service line from shifting soil during excavation, which resulted in damage to the service line and the release and migration of natural gas into the apartment building. Contributing to the accident was the failure of the Public Service Electric and Gas Company to conduct effective oversight of the excavation activities adjacent to the gas service line and to be prepared to promptly shut off the flow of natural gas after the service line was damaged. Contributing to the casualties in the accident was the failure of the Bergenfield Fire Department to evacuate the apartment building despite the strong evidence of a natural gas leak and the potential for gas to migrate into the building.

### **Emergency Response Action Taken**

- Upon arrival at the scene no one from the Bergenfield Fire Department checked the apartment building for the presence of natural gas.
- The police and fire departments, American Tank, and the PSE&G started rescue actions immediately following the explosion. The fire departments started firefighting.
- About 10:00 a.m., a PSE&G street crew was able to shut off the gas to the service line by closing the curb valve.

### **Key Lessons Learned**

- The Bergenfield Fire Department did not have written procedures for natural gas incidents.
- The fire department relied heavily on the assistance of PSE&G in deciding whether to evacuate a structure rather than conducting their own evaluation of the hazards and risks present. Upon arrival at the scene they did not check for the presence of flammable gas inside the effected building.
- The fire department did not take advantage to the time and opportunity they had available early in the incident to evacuate the building before the explosion despite the strong evidence of a natural gas leak and the potential for gas to migrate into the building. Failure to take to action to evacuate the building contributed to the casualties in the accident.

**INCIDENT # 6**  
**OCTOBER 27, 2004**  
**KINGMAN, KANSAS**  
**ANHYDROUS AMMONIA PIPELINE RUPTURE AND LEAK WITH VAPOR CLOUD**  
**No Deaths or Injuries, \$680,000 Damages**  
<http://www.nts.gov/doclib/reports/2007/PAB0702.pdf>

### **Summary of Incident**

About 11:15 a.m. central daylight time on October 27, 2004, an 8-inch-diameter pipeline owned by Magellan Midstream Partners, L.P., (Magellan) and operated by Enterprise Products Operating L.P. (Enterprise) ruptured near Kingman, Kansas, and released approximately 4,858 barrels (204,000 gallons) of anhydrous ammonia. Nobody was killed or injured due to the release.

The anhydrous ammonia leaked into a creek and killed more than 25,000 fish including some from threatened species. The cost of the accident was \$680,715, including \$459,415 for environmental remediation.

### **Probable Cause of Accident**

The probable cause of the pipeline rupture was a pipe gouge created by heavy equipment damage to the pipeline during construction in 1973 or subsequent excavation activity at an unknown time that initiated metal fatigue cracking and led to the eventual rupture of the pipeline. Contributing to the severity of the accident was the pipeline controller's failure to accurately evaluate available operating data and initiate a timely shutdown of the pipeline.

### **Emergency Response Action Taken**

- About 11:18 a.m., an off-duty volunteer firefighter traveling on Highway 54 called 911 to report a huge vapor cloud on the north side of the highway that he believed was a pipeline release. The 911 center in Kingman County, Kansas, is in the county sheriff's office. The Kingman County Fire Department was dispatched to the rupture site about 11:20 a.m.
- Because the rupture site was in an agricultural area that is home to several threatened and endangered species of fish and wildlife, it was designated by Enterprise as a high-consequence area. A high-consequence area is defined

in the Federal pipeline safety regulations as a commercially navigable waterway, high- or concentrated-population area, or unusually sensitive area that might be affected by an accident involving the pipeline (49 CFR 195.450).

- The vapor cloud moved northwest from the rupture and affected vegetation in an area approximately 1/2 mile wide and 1-1/2 miles long. The release entered an unnamed tributary stream that was approximately 36 feet from the pipeline failure. The tributary stream entered Smoots Creek approximately 1-1/2 miles downstream of the rupture.
- On the basis of the 911 call at 11:18 a.m., the Kingman County sheriff's office had responded to the site and started telephoning residents in 35 houses; four families were evacuated; no residents were home at 28 houses.
- By about 11:40 a.m., the sheriff's office and the fire department had blocked roads that could be affected by the vapor cloud.

### **Key Lessons Learned**

- There were no significant emergency response lessons learned documented for this incident.

Source: NTSB Pipeline Accident Brief # DCA-05-MP001

**INCIDENT # 7**  
**AUGUST 21, 2004**  
**Du BOIS, PENNSYLVANIA**  
**NATURAL GAS DISTRIBUTION PIPELINE LEAK, EXPLOSION, AND FIRE**  
**2 Deaths, No Injuries, \$800,000 Damages**  
<http://www.nts.gov/doclib/reports/2006/PAB0601.pdf>

### **Summary of Incident**

On August 21, 2004, about 8:54 am, a natural gas explosion destroyed a residence located at 48 Woodland Lane in Du Bois, Pennsylvania. The two residents were killed in the accident.

### **Probable Cause of Accident**

The probable cause of the accident was a defective butt-fusion joint and the failure of the National Fuel Gas Distribution Corporation to have an adequate

program to inspect butt-fusion joints and replace those joints meeting its inspection criteria.

### **Emergency Response Action Taken**

There were no emergency response issues identified in this incident.

Source: NTSB Pipeline Accident Brief # DCA-04-MP-006

**INCIDENT # 8**  
**JULY 2, 2003**  
**WILMINGTON, DELAWARE**  
**NATURAL GAS DISTRIBUTION PIPELINE RUPTURE, EXPLOSION, AND**  
**FIRE**  
**No Deaths, 14 Injuries, \$300,000 Damages**  
<http://www.nts.gov/investigations/fulltext/PAB0601.htm>

### **Summary of Incident**

On July 2, 2003, a contractor named Quickform Concrete Company (Quickform) which was hired by the city of Wilmington, Delaware, to replace sidewalk and curbing, dug into an unmarked natural gas service line with a backhoe. Although the service line did not leak where it was struck, the contact resulted in a break in the line inside the basement of 1816 West 3rd Street, where gas began to accumulate. A manager for the contractor said that he did not smell gas and therefore did not believe there was imminent danger and that he called an employee of the gas company and left a voice mail message. At approximately 1:44 p.m., an explosion destroyed two residences and damaged two others to the extent that they had to be demolished. Other nearby residences sustained some damage, and the residents on the block were displaced from their homes for about a week. Three contractor employees sustained serious injuries. Eleven additional people sustained minor injuries.

### **Probable Cause of Accident**

The probable cause of the natural gas explosion was the failure of Quickform to verify that all underground facilities were marked within the proposed dig site before beginning excavation. Contributing to the accident was the failure of Tech Consultants and Quickform to effectively communicate about the project scope and the failure of Quickform employees to immediately notify the utility owner and emergency authorities when they realized they had struck and pulled up a gas service line.



## Events Leading Up to the Explosion

- Quickform Concrete Company was awarded a contract by the city of Wilmington to replace sidewalk and curbing at various locations specified in the contract. Tech Consultants was responsible for coordinating the sidewalk and curb improvements with Quickform for the city. The contract noted that street addresses would be used to indicate general work locations but that the exact limits for the work would be marked out on site.
- After the contract was issued, Tech Consultants received additional address locations for this work. One such location was 1820 West 3rd Street. A Tech Consultants project manager surveyed the work site and determined that sidewalk and curbing replacement was needed in front of the residences at 1816, 1818, and 1820 West 3<sup>rd</sup> Street.
- On April 10, 2003, a sketch was prepared by Tech Consultants showing the work to be done in front of the three addresses. On June 23, 2003, Tech Consultants issued a change order to Quickform, which included the 1820 West 3rd Street address location in a list of additional address locations. Tech Consultants did not provide the 1816 and 1818 addresses or sketch to Quickform. According to Tech Consultants, the city asked Tech Consultants not to provide these sketches to contractors because the scope of work could change and there was an expectation that the contractor would attend the work mark-out on site.
- The contract required Quickform to have the underground utilities marked out before beginning excavation. On June 23, a Quickform manager called Miss Utility to have underground utilities marked for 1820 West 3rd Street, but the manager inadvertently called in an incorrect address as 820 West 3rd Street.
- Conectiv Power Delivery provided gas through its pipeline distribution network to the residences in the 800 block of West 3<sup>rd</sup> Street. On June 24, a Conectiv employee placed yellow paint marks on the ground in front of 1818, 1820, and 1822 West 3rd Street to mark the location of its underground service lines to those addresses. The Conectiv employee said that although the Miss Utility information noted planned excavation at 820, he determined that the request for 820 was in error, and he proceeded to mark the correct 1820 address and the additional addresses of 1818 and 1822 to provide a further safety margin.
- In response to a June 30, 2003, request from the Quickform manager to mark out the project scope, on July 1, a Tech Consultants inspector marked in white paint the sidewalk and curbing in front of 1816, 1818, and 1820 to indicate the scope of the work. The Tech Consultants inspector said that the project scope is normally marked out just days ahead of the work in order to (1) reduce the likelihood that those who live in the area will extend the marking in an attempt to get work done in front of their houses, and (2) limit

the amount of open construction ongoing at any given time. Tech Consultants and Quickform said that about half the time, a Quickform representative would accompany the Tech Consultants inspector when locations were being marked; however, on July 1, a Quickform representative did not accompany him. The inspector said that he did not routinely look for signs that the locations of underground utilities had already been marked, and he could not recall noticing which addresses had been marked as he marked the job out in front of 1816, 1818, and 1820 West 3rd Street.

### **Emergency Response Action Taken**

- On July 2nd, a Quickform backhoe contacted and pulled up an unmarked 1-1/4 inch steel service line serving 1816 West 3rd Street. Contractor employees estimated that the damage to the service line occurred at about 1:30 p.m. The crew was not aware that the action of pulling the service line outside resulted in a break to the line inside the basement at 1816 West 3rd Street. Natural gas then began to accumulate in the residence.
- The Quickform crew said when they saw the damage, they stopped excavation activities and notified the Quickform manager when he arrived on site a few minutes after the service line was contacted. The line was not leaking outside, and the crewmembers and manager said that they did not smell a gas odor coming from the pulled line itself; however, four of the five crewmembers reported that they smelled a faint gas odor at other points along the block before the explosion.
- The Quickform manager called the Tech Consultants inspector to ask for the phone number of a Conectiv engineer to report the damage; cell phone records showed that this call was placed at 1:31 p.m. According to cell phone records, the manager placed a call at 1:34 p.m. to the Conectiv engineer's phone, and the manager left a voice mail message.
- A resident of 1816 West 3rd Street said that she smelled a strong odor in her house at about 1:00 p.m. or shortly thereafter. She and her two children left the house, but she did not tell anyone about the odor.
- At 1:44 p.m., the explosion occurred. Eight other residents who lived on the block told investigators that they smelled a gas odor before the explosion. Except for Quickform's voice mail to Conectiv, no calls were placed to Conectiv or the fire department about the damaged line or a leak before the explosion.
- Beginning at 1:45 p.m., the Wilmington Police Department's dispatcher received numerous telephone calls reporting an explosion on West 3rd Street. The police department responded to the site to evacuate residents, conduct crowd and traffic control, and provide security.

- At 1:45 p.m., the Wilmington Fire Department initially dispatched two engine companies, a ladder company, and a battalion chief.
- At 1:48 p.m., the first responding city ambulance arrived at the accident site. New Castle County Emergency Medical Services (EMS) received the initial dispatch and was en route to the scene at 1:49 p.m.
- At 1:50 p.m., the first fire department units arrived at the site.
- At 1:53 p.m., the first EMS responders arrived at the site along with the deputy chief of operations for the fire department who assumed command of the incident.

### **Key Lessons Learned**

Excavators failed to notify the pipeline operator immediately when damage occurred. They also failed to call 911 or other local emergency response numbers.

Source: NTSB Pipeline Accident Brief # DCA-03-MP-004

**INCIDENT # 9**  
**APRIL 7, 2003**  
**GLENPOOL, OKLAHOMA**  
**PIPELINE FILLING OF STORAGE TANK WITH EXPLOSION AND FIRE**  
**No Deaths, No Injuries, \$2,357,483 damages**  
<http://www.nts.gov/doclib/reports/2004/PAR0402.pdf>

### **Summary of Incident**

About 8:55 p.m., central daylight time, on April 7, 2003, an 80,000-barrel storage tank at ConocoPhillips Company's Glenpool South tank farm in Glenpool, Oklahoma, exploded and burned as it was being filled with diesel. Gasoline had been removed from the tank earlier in the day. The resulting fire burned for about 21 hours and damaged two other storage tanks in the area. The cost of the accident was \$2,357,483. There were no injuries or fatalities. Nearby residents were evacuated, and schools were closed for 2 days.

### **Probable Cause of Accident**

The major contributing factors identified in this accident were tank operations, including switch loading, at the ConocoPhillips Company tank farm; the adequacy

of emergency planning and emergency response by ConocoPhillips and American Electric Power; and the adequacy of Federal regulations and industry standards for emergency planning (CFR 49 Part 195).

### **Emergency Response Action Taken**

- At 11:56 pm, The Glenpool Fire Department received a 911 report of a tank explosion and fire at 9:00 p.m. and was on scene by 9:06 p.m., at which time tank 11 had already collapsed and was engulfed by flames 75 feet high.
- The emergency response eventually involved 13 fire departments and firefighting personnel from ConocoPhillips, Sun Refinery, and Williams Fire and Hazard Control.
- ConocoPhillips had preplanned with Sun Refinery for mutual aid assistance in firefighting. Initially, the fire departments applied foam from the west side of the dike between tanks 7 and 12 and placed it around the burning tank so that the wind would disperse the foam to contain the ground fire. However, the manner in which the tank collapsed hindered the application of foam to the tank. Firefighters also applied water to tank 12, which contained gasoline, to cool it. Explorer and ConocoPhillips checked the dike drain valves to ensure that they were closed.
- After the power lines fell and diesel in the north area of the dike caught fire, a fire started inside tank 8 (which contained naphtha) in the area of the internal floating roof seal. This fire eventually extinguished itself, and the heat from the internal fire damaged tank 8. Also, the burning diesel in the north area of the dike caused a flange assembly in the crude oil pipeline overpressure protection system to fail and release crude oil in the area.
- The ConocoPhillips Glenpool area supervisor stated that because of a concern about the quantity of foam available, he called ConocoPhillips in Ponca City for additional supplies. Another ConocoPhillips employee called the Sinclair Refinery and the Tulsa airport and asked for information about available foam supplies. A staging area was set up to receive foam deliveries.
- In addition to a family living approximately 1,000 feet east of the tank farm, about 300 families living near the tank farm were evacuated. This was a voluntary evacuation that was lifted on the afternoon of April 9. ConocoPhillips provided housing for the evacuees. Nearby schools were closed for 2 days.
- Several AEP employees called the AEP transmission system operator between 9:00 p.m. and 9:30 p.m. to notify him of the accident, but he had already seen the fire on the television news. He stated that he knew the AEP power lines were near the fire. About midnight, ConocoPhillips personnel called the AEP dispatcher and requested that an AEP representative inspect

the power lines near and to the east of the tank, because the flames were impinging on them. At 12:30 a.m. on April 8, an AEP servicer was dispatched to the site, and by 1:14 a.m., he had inspected the power lines and reported to the transmission system operator. No sag in the lines was observed, and the servicer, who did not communicate with any incident command staff, returned home. He did suggest to the AEP transmission system operator that an AEP representative inspect the wooden power pole near the fire, but there is no record of action being taken.

- About 3:43 a.m., the incident command noted that the wind had shifted to the east, but the tank 11 fire appeared contained, the cooling operation on tanks 7 and 12 was successful, and the incident appeared to be stable. Within an hour, however, the fire in tank 11 was worse, possibly because the firefighting foam inside the tank was degrading.
- About 5:00 a.m., after having been contacted again by on-scene personnel at 4:45 a.m., the AEP dispatcher again called the servicer at home. The transmission system operator documented in his log that the fire had restarted and was worse than before and that AEP should recheck the lines. The servicer returned to the scene at about 5:30 a.m. and observed that the conductor closest to the fire now had a slight sag. This indicated that heat from the fire was affecting the power line. Incident command was notified that the servicer was on site, but the servicer did not check in or otherwise communicate with incident command. About 20 minutes later, one or more wires fell onto the diked area east of the tanks and the diesel that was contained inside that area of the dike ignited. The AEP transmission system operator stated that any decision to deenergize the lines was to be made by him based on information provided by the on-site inspectors and an AEP field representative. He stated that if these lines had been deenergized, power would have been cut to the AEP substation at an Explorer pump station (not at the Glenpool tank farm) and to the pump station. No other outages would have been expected, because the system would have automatically rerouted power. The AEP transmission system operator stated that his emergency response training had not included training for nonelectrical issues. He said his training had involved neither visits to the ConocoPhillips Glenpool South tank farm nor face-to-face meetings with ConocoPhillips personnel. The AEP field representative stated that his training had been primarily on the job and that he had gained experience in actual emergencies.

### **Key Lessons Learned**

- The foam concentrate stockpile was inadequate to support attack and extinguishment of the tank and dike fires.
- The electrical utility (AEP) failed to integrate their decision making process

into the Unified Command, which contributed to the re-ignition of the fire.

Source: NTSB Report # PB2004-916502

**INCIDENT # 10**  
**JULY 4, 2002**  
**COHASSET, MINNESOTA**  
**RUPTURE OF ENBRIDGE PIPELINE AND RELEASE OF CRUDE OIL**  
**No Deaths or Injuries, \$5.6 Million Damages**  
<http://www.nts.gov/doclib/reports/2004/PAR0401.pdf>

### **Summary of Incident**

About 2:12 a.m., central daylight time. On July 4, 2002, a 34-inch-diameter steel pipeline owned and operated by Enbridge Pipelines, LLC ruptured in a marsh west of Cohasset, Minnesota. Approximately 6,000 barrels (252,000 gallons) of crude oil were released from the pipeline as a result of the rupture. The cost of the accident was reported to be approximately \$5.6 million. No deaths or injuries resulted from the release.

### **Probable Cause of Accident**

The probable cause of the pipeline rupture was inadequate loading of the pipe for transportation prior to installation that allowed a fatigue crack to initiate along the seam of the longitudinal weld during transit. After the pipeline was installed, the fatigue crack grew with pressure cycle stresses until the crack reached a critical size and the pipe ruptured.

### **Emergency Response Action Taken**

- A unified command was established and included the Cohasset Fire Department, Enbridge, the Minnesota Pollution Control Agency, the Minnesota Department of Emergency Management, and the Forestry Division of the Minnesota Department of Natural Resources.
- Booms were placed in Blackwater Creek as a precaution to prevent crude oil from moving away from the spill site toward nearby waterways, including the Mississippi River.
- Enbridge built a ¼ mile long road along the right-of-way to the spill site using wooden mats. Heavy rain was forecast, so responders were concerned that

crude oil might spread farther and contaminate the Mississippi River.

- After initial spill control measures were implemented, the unified command determined that the best way to prevent crude oil from entering nearby waterways was to implement a controlled burn. As a precaution, the command designated 12 homes in the local area to be evacuated, and seven residents were evacuated. Later in the afternoon, the Minnesota Department of Natural Resources coated the spill's perimeter with chemical fire retardant from tanker planes. After the chemical fire protection barrier was established, flares were shot into the crude oil to ignite it.
- The controlled burn was initiated at about 4:45 pm. The burn created a smoke plume about one mile high and five miles long. The controlled burn lasted until about 5:00 pm the following day.

### **Key Lessons Learned**

- There were no significant emergency response lessons learned documented for this incident.

Source: NTSB Report # PB2004-916501

**INCIDENT # 11**  
**JANUARY 27, 2000**  
**WINCHESTER, KENTUCKY**  
**HAZARDOUS LIQUID PIPELINE FAILURE AND LEAK**  
**No Deaths or Injuries, \$7.1 Million Damages**  
<http://www.nts.gov/doclib/reports/2001/PAB0102.pdf>

### **Summary of Incident**

About 12:12 p.m. CST on January 27, 2000, a Marathon Ashland Pipe Line LLC (Marathon Ashland) 24-inch-diameter pipeline that runs 265 miles between Owensboro and Catlettsburg, Kentucky, ruptured near Winchester, Kentucky. The ruptured pipeline released about 11,644 barrels (about 489,000 gallons) of crude oil onto a golf course and into Two mile Creek. No injuries or deaths resulted from the accident. As of December 13, 2000, Marathon Ashland had spent about \$7.1 million in response to the accident.

### **Probable Cause**

The probable cause of the accident was fatigue cracking due to a dent in the pipe that, in combination with fluctuating pressures within the pipe, produced high

local stresses in the pipe wall. Contributing to the severity of the accident was the failure of the controller and supervisors to timely recognize the rupture, shut down the pipeline, and isolate the ruptured section of the pipeline.

### **Emergency Response Action Taken**

- During the morning of January 27, 2000, the pipeline had been shut down for previously planned maintenance work at the Catlettsburg terminal. The shutdown of the line began at 6:59 a.m., and the line was out of operation until 11:12 a.m. At this time, a controller at the Marathon Ashland operations center in Findlay, Ohio, opened manifold valves at Owensboro and Catlettsburg to allow the pipeline to return to normal operations.
- At 11:14 a.m., the controller began to restart the pipeline. About 11:30 a.m., a pipeline leak monitor (PLM) alarm sounded in the Findlay operations center and flashed on the supervisory control and data acquisition (SCADA) screen. This alarm indicated that the liquids into and out of the pipeline were not in balance. After the controller focused on some pressure set points and flow rates to reestablish balance, he resumed starting additional pumping units on the line.
- About 11:52 a.m., the SCADA system flashed “NORMAL” on the screen, indicating that the alarm had cleared and the flow rates were in balance. The controller continued to monitor pressures at stations along the line.
- At 12:00 noon, a PLM alarm again sounded, indicating that the parameters for the 2- hour and 4-hour line balance were still showing an imbalance on the system. (The controller explained during a postaccident interview that he had expected the PLM alarms to sound during the startup of the system, so he was not surprised by the alarms sounding.) SCADA records show that the pipeline rupture occurred between the Marathon Ashland Tates Creek and Preston Stations at approximately 12:12 p.m. A PLM alarm displayed almost immediately after the pipeline ruptured.
- About 12:37 p.m., the controller, uncomfortable about the lower-than-expected pressures at pumping stations along the pipeline and a lost flow rate at Catlettsburg, started to shut the system down. Additional PLM alarms, showing losses, displayed at 12:45 and 12:54 p.m.
- About 1:00 p.m., the controller paged the operations supervisor and, shortly afterwards, the supervisor came into the Findlay operations center. After the controller and the supervisor had discussed the situation and reviewed the data, they called the area supervisor for this pipeline segment. The two supervisors discussed the situation and agreed that they should pressure up the pipeline to monitor the pressures. The downstream valves at Catlettsburg were closed about 1:02 p.m.



- About 1:28 p.m., a single pumping unit at Owensboro, the originating pump station, was started to put pressure on the pipeline. Pressures along the pipeline were observed and recorded.
- At about 1:00, 1:38, 1:40, and 1:44 p.m., PLM alarms sounded and showed on the SCADA screen. At 1:46 p.m., and again at 1:57 p.m., the pressures were recorded. About 2:00 p.m., the controller expressed concern to the operations supervisor that they had put about 1,000 barrels of crude oil into the pipeline, but pressures were not rising as expected. After making a phone call to the area supervisor, the operations supervisor told the controller to shut down the pipeline. The shutdown was accomplished about 2:05 p.m.
- At 2:11 p.m., the Winchester Fire Department called the pipeline operations center in Findlay, Ohio, to report the odor of gas in the air. The operations center immediately relayed this information to the area supervisor, who dispatched a four-person crew to close the two manual valves nearest the leak site. Marathon Ashland employees closed these manual valves at 3:30 p.m.
- About 2:20 p.m., a landowner downstream of the leak site telephoned the Findlay operations center to report oil flowing onto his property. The operations supervisor told the controller to automatically shut the mainline block valves at the Preston and Tates Creek Stations.

### **Key Lessons Learned**

There were no emergency response lessons learned from this incident.

Source: Pipeline Accident Brief # DCA-00-MP-004

**INCIDENT # 12**  
**MARCH 9, 2000**  
**GREENVILLE, TEXAS**  
**HAZARDOUS LIQUID PIPELINE FAILURE AND LEAK**  
**No Deaths, No Injuries, \$18 Million Damages**  
<http://www.nts.gov/doclib/reports/2001/PAB0103.pdf>

### **Summary of Incident**

On March 9, 2000, about 10:20 p.m., Central Standard Time, a 28-inch-diameter pipeline owned and operated by Explorer Pipeline Company (Explorer) ruptured and released 13,436 barrels (about 564,000 gallons) of gasoline. The pipeline

was buried about 4 feet 6 inches under ranch land. The release site was near Greenville, Texas, about 45 miles northeast of Dallas.

Explorer's Greenville pumping station on the 28-inch pipeline was about 10.3 miles south and upstream of the rupture site. This station automatically shut down its two running pumping units when the rupture occurred. Before the failure, the pipeline had been in steady-state operation, and its flow rate was approximately 20,000 barrels per hour. About 2 minutes after the rupture and the automatic shutdown of the Greenville pumping station, the pipeline controller (located in Tulsa, Oklahoma) started a different pumping unit at the Greenville pumping station in an effort to keep the entire pipeline balanced and operating. Meanwhile, the operator of the Greenville pumping station attempted to determine the cause of the automatic shutdown of his pumping units. The pumping unit that the controller had started also shut down automatically after about 2 minutes. The controller shut down the entire line. After a few minutes, thinking that the cause of the initial shutdown had been a control valve problem, the controller restarted the line at a reduced rate. About 13 minutes later (around 10:49 p.m.), the controller shut the entire line down for evaluation.

### **Probable Cause of Accident**

The probable cause of the pipeline failure was corrosion-fatigue cracking that initiated at the edge of the longitudinal seam weld at a likely pre-existing weld defect. Contributing to the failure was the loss of pipe coating integrity.

### **Emergency Response Action Taken**

- Individuals near the rupture began calling 911 soon after the pipeline failure. Other residents who detected the odor of gasoline called Explorer personnel because they were aware that the Explorer pipeline passed through the area.
- The released gasoline flowed a few hundred feet across the surrounding terrain and into a dry creek bed, which was a tributary to East Caddo Creek. From the tributary, the gasoline flowed downstream into East Caddo Creek. The banks of the tributary and creek contained the escaping gasoline as it flowed away from the ruptured pipe.
- Explorer closed remotely operated valves at pump stations about 10:59 p.m. to isolate the ruptured section of pipeline. By 11:05 p.m., Explorer personnel were on the scene and meeting with emergency responders. About midnight, a local contractor arrived on the scene to construct dams across East Caddo Creek to stop the flow of gasoline.
- About 1:30 a.m., Explorer personnel manually closed a mainline valve to further isolate the rupture area.

- By morning, three dams had been constructed across the East Caddo Creek. The leading edge of the escaping gasoline was eventually contained about 2 1/2 miles from the rupture site. Then, about 8:30 a.m. the morning after the rupture, heavy rains began to fall. The rain lasted throughout much of the day. An estimated 1.5 to 2 inches of rain fell in the area, and East Caddo Creek rose about 12 feet. The rising waters destroyed the three dams that had been constructed in the night and allowed the gasoline to move further downstream.
- Work continued during the day, and the leading edge of the gasoline appeared to have been stopped about 15 miles from the rupture site, about 7 miles upstream of Lake Tawakoni. The lake is a major water supply for Dallas and numerous smaller communities. After the accident, the chemical MTBE (methyl tertiary butyl ether), a component of the gasoline, was found in Lake Tawakoni.

### **Key Lessons Learned**

- There were no significant emergency response lessons learned documented for this incident.

Source: Pipeline Accident Brief # DCA-00-MP-005

**INCIDENT # 13**  
**APRIL 7, 2000**  
**CHALK POINT, MARYLAND**  
**RUPTURE OF PINEY POINT OIL PIPELINE AND RELEASE OF FUEL OIL**  
**No Deaths or Injuries, \$71 million Damages**  
<http://www.nts.gov/doclib/reports/2002/PAR0201.pdf>

### **Summary of Incident**

On the morning of April 7, 2000, the Piney Point Oil Pipeline System, which was owned by Potomac Power Company, experienced a pipe failure at the Chalk Point Generating Station in southeastern Prince George's County, Maryland. The release was not discovered and addressed by the contract operating company, Support Terminal Services, Inc. until the late afternoon.

Approximately 140,000 gallons of fuel were released into the surrounding wetlands and Swanson Creek and, subsequently, the Patuxent River as a result of the accident. No injuries were caused by the accident, which cost

approximately \$71 million for environmental response and clean-up operations.

### **Probable Cause of Accident**

The probable cause of the accident was a fracture in a buckle in the pipe that was undiscovered because the data from an in-line inspection tool were interpreted inaccurately as representing a T-piece. Contributing to the magnitude of the fuel oil release were inadequate operating procedures and practices for monitoring the flow of fuel oil through the pipeline to ensure timely leak detection.

### **Emergency Response Action Taken**

- At 6:02 pm the Support Terminal Services, Inc. assistant terminal manger learned of oil release from a pipeline patrol plane flight which observed an oil release in the Swanson Creek wetlands area. By 6:07 pm, the Support Terminal Services, Inc. had put the Chalk Point pipeline emergency response plan into effect by contacting a PEPCO qualified individual and an oil spill clean-up contractor. This plan listed the criteria for notifying local emergency response agencies if there were a “fire, explosion, personal injury, or release or significant threat of a release off-site.” Despite the criteria, local response agencies were not notified of the major spill in progress.
- The Pepco Chalk Point general supervisor for operations reviewed the three Pepco spill response plans for the area to ensure that all emergency response requirements were being met. The three plans were: 1) the Pepco Oil Spill Response Plan for the Reyceville Pumping Station and Pipeline, 2) the Pepco Oil Spill Emergency Response Plan for the Chalk Point Generating Station, and 3) the Pepco Spill Prevention, Control, and Emergency Response Plan for the Chalk Point Generating Station. Because each plan had a somewhat different purpose and focus and the general supervisor did not know which plan applied to this accident. Consequently, he attempted to notify all response personnel identified in all three plans.
- At 6:17 pm, the Pepco Chalk Point supervisor called the Pepco Chalk Point general supervisor and reported that he would deploy an oil boom to contain Swanson Creek.
- At 6:22 pm, the Support Terminal Services, Inc. assistant terminal manger asked the Pepco control room operations supervisor to notify Federal and State agencies about the release, as required by the oil spill response plan for the Chalk Point Generating Station. At 6:27 pm the senior environmental coordinator for Pepco notified the national Response Center.
- The original “best guess” magnitude of the release was 1,000 to 2,000 gallons as compared to the actual 140,000 eventually calculated to have been released. Based on this estimate the both the National Response Center and

the Maryland Department of the Environment were notified at 6:45 pm that the amount released into the wetlands was 2,000 gallons. As a result, the National Response Center watch officer designated the release as an Incident Report and, lacking information on the exact source of the leak, inaccurately classified it as a fixed (power plant) facility rather than a pipeline-type incident. The National Response Center officer sent notifications to the agencies on the fixed facility distribution list. The Office of Pipeline Safety was on the pipeline accident distribution list but not on the fixed facility distribution list. Following notification of the National Response Center, Pepco also notified the U.S. Coast Guard Marine Safety Office in Baltimore, Maryland.

- By 6:50 pm, the Pepco spill response teams had completed the initial deployment of more than 1-mile of floating boom in the wetland area on the north side of Swanson Creek and at the mouth of Swanson Creek on the Patuxent River.
- About 7:11 pm, the National Response Center notified the Environmental Protection Agency Region III (Philadelphia) of the accident by fax. About 7:30 pm, the on-call EPA Federal On-Scene Coordinator (FOCC) for Region III contacted the Prince George's County Fire Department requesting directions to the site and was advised that the fire department had not been notified of the spill. Consequently, the EPA-FOCC contacted the Pepco senior environmental coordinator and advised him to call the Prince George's County Communications Center and provide the spill information. The Pepco environmental coordinator contacted the Prince George's County Communications Center and advised them that "2,000 gallons of fuel oil was released and a county fire response was not necessary." The communications center then notified the county fire departments hazardous materials coordinator about the spill and the hazmat coordinator arrived within 15 minutes to assess the situation.
- At 8:15 pm the Pepco qualified individual returned to the Chalk Point Command Center and learned that the estimated spill volume was actually 3,000 barrels or 126,000 gallons. When Maryland Department of Environment officials arrived at the scene around 8:35 pm they were advised the spill was around 3,000 barrels. This prompted further notifications and updates to Federal and State agencies.
- By 9:00 pm outside response personnel started arriving at the site with oil spill boom and deployment boats to augment what Pepco had already deployed.
- At 2:50 am the Coast Guard Federal On-Scene Coordinator arrived at the site to coordinate Federal, State, and local efforts. After consulting the Coast Guard Area Contingency Plan, it was determined that the spill was above the Benedict Bridge which marks the jurisdictional boundary line between the Coast Guard and the EPA's Region III. Had the spill been below the bridge on

the river the jurisdiction would have been with the Coast Guard. Around 6:00 am the EPA FOSC deployed from Philadelphia and arrived on scene at 10:15 am and assumed command of the spill. The first organizational meeting of all agencies involved in the response was held at 11:00 am.

- The multi-agency emergency response and recovery effort continued through May 16, 2000.

### **Key Lessons Learned**

- The EPA Federal On-Scene Coordinator did not implement an Incident Command System to manage the incident and this hindered the establishment of resource tracking and accountability as the incident progressed.
- Local emergency responders were not notified immediately. Consequently the local Hazardous Materials Response Team was not deployed until late in the initial response.
- The EPA Federal On-Scene Coordinator failed to include local emergency responders in the immediate response. As a result, their capabilities to support communications and disseminate information to the impacted community and to coordinate local response efforts were underutilized.
- The task oriented response effort implemented by the EPA Federal On-Scene Coordinator was not conducive to managing the rapid expansion of a major oil spill. Essentially there was no Unified Command organized in the early phase of the response.
- The U.S. Coast Guard had internalized the use of the Incident Command System many years prior to the accident, However, USCG was not the designated lead agency to assume command based on the geographic location of the spill.
- Data gathered from overflights and other assessment tools were not effectively integrated into decision-making.
- Because EPA did not initially put a fully implemented Incident Command System in place, it was several days before responders were able to mobilize and control and effective response to the loss of oil containment.

Source: NTSB Report # PB2002-916501

**INCIDENT # 14**  
**AUGUST 19, 2000**  
**NEAR CARLSBAD, NEW MEXICO**  
**NATURAL GAS PIPELINE RUPTURE AND FIRE**  
**12-Fatalities, No Injuries, \$998,296 Damages**  
<http://www.nts.gov/doclib/reports/2003/PAR0301.pdf>

### **Summary of Incident**

At 5:26 am on Saturday, August 19, 2000, a 30-inch diameter natural gas transmission line operated by El Paso Natural Gas Company ruptured adjacent to the Pecos River near Carlsbad, New Mexico. The released gas ignited and burned for 55 minutes. Twelve persons who were camping under a concrete-decked steel bridge that supported the pipeline across the river were killed and their vehicles were destroyed. Two nearby steel suspension bridges for gas pipelines crossing the river were extensively damaged. According to El Paso Natural Gas Company, property damages totaled \$998,296.

### **Probable Cause of Accident**

The major contributing factors of the incident were the design and construction of the pipeline and the adequacy of El Paso Natural Gas Company's internal corrosion control program.

### **Emergency Response Action Taken**

- The pipeline rupture was reported via 911 within 5 minutes of the rupture. The Loving Fire Department and Carlsbad Fire Department were dispatched. First responders arrived on the scene at 5:51 pm. A staging area was established 1/3-mile from the accident site.
- Pipeline operators were on the scene within 19 minutes and worked quickly and effectively to stop the flow of natural gas from the ruptured pipeline and to extinguish the fire. A pipeline lead operations specialist was the first to arrive at the accident site at 5:45 am. The operator closed valves downstream of the fire and were able to close the pig launcher valves.
- Emergency responders arrived on the scene within 25 minutes of the rupture. The responders anticipated that they would be involved in a routine standby assignment that would terminate when the flow of natural gas was stopped and the fire was extinguished. Because the accident was in a rural area,

emergency responders did not expect to find any persons injured. The fire department did not realize there were campers and motor vehicles near the fire area until the fire was extinguished.

- Emergency responder access to the scene was delayed due to intense fire and heat. Intense radiant heat was a major factor in preventing emergency responders from entering the area. Pipeline operators needed to close more valves to reduce the magnitude of the fire. Emergency vehicles were not admitted to the accident site until the gas fire was out.
- The fire victims were 675 feet from the crater and the river. Emergency personnel located victims with the assistance of a pipeline operations specialist. Six victims were found at the camping area; six others were either in the river or on the river bank. Firefighters evacuated six victims to a hospital burn center in Texas. None of the victims survived.
- The New Mexico State Police responded to the accident and assumed responsibility for emergency management of the incident.
- Prior to August 2000 El Paso Natural Gas Company held training sessions with local emergency responders four times over a period of four years. During the training pipeline company reviewed safety precautions for natural gas emergencies. The company also held two exercises involving simulated leaks from compressor stations.

Source: NTSB Report PB2003-916501

**INCIDENT # 15**  
**FEBRUARY 9, 1999**  
**KNOXVILLE, TENNESSEE**  
**HAZARDOUS LIQUID PETROLEUM PIPELINE RUPTURE**  
**No Deaths or Injuries, \$7 Million Damages**  
NTSB Pipeline Accident Brief #DCA99-MP005  
<http://www.nts.gov/doclib/reports/2001/PAB0101.pdf>

### **Summary of Incident**

On the afternoon of February 9, 1999, Colonial Pipeline Company (Colonial) successfully completed a delivery of diesel fuel to the East Knoxville delivery facility (East Knoxville) in Knoxville, Tennessee, using its Atlanta Junction/Knoxville stubline. To initiate the delivery, an operator at Colonial's Knoxville Terminal began operating valves that directed product into a 10-inch-diameter steel pipeline leading to the East Knoxville facility, about 8 miles away.



At about the same time, a valve was opened at the other end of that line to allow the product to flow into the East Knoxville facility tanks. At the completion of the delivery, the valves were closed, which left the pipeline filled with diesel fuel at a pressure of about 91 psig.

About 11:58 p.m. on February 9, the supervisory control and data acquisition (SCADA) system at Colonial's Atlanta control center registered and recorded a sudden drop in pressure from 91 to 72 psig at East Knoxville. After several minutes of oscillation, the pressure stabilized at 73 to 74 psig. The controller on duty in the Atlanta control center at the time of the accident stated that he normally displays the SCADA pressure strip charts across the two CRT screens at the top of his operating console. The SCADA system did not alarm in response to the decrease in pressure, and the controller said he was not aware of the pressure drop. As determined later, the pressure drop occurred when the pipeline leading to East Knoxville ruptured on a Pitner Place residential property near Knoxville's Goose Creek.

### **Probable Cause of Accident**

The probable cause of this accident was pipe rupture initiated by environment-induced cracking in an area of pipe coating failure. A contributing factor to the failure was the relatively low fracture toughness of the pipe. Contributing to the severity of the accident was Colonial Pipeline Company's failure to determine from the supervisory control and data acquisition system that a leak had occurred, with the result that the pipeline controller started and restarted the pipeline, thereby increasing the amount of diesel fuel that was released.

### **Emergency Response Action Taken**

- On the east side of the Tennessee River, Colonial's pipeline crosses Scottish Pike and then Pitner Place. Between midnight and 12:15 a.m. on February 10, a Scottish Pike resident walking outside his home smelled a kerosene odor, but he said he took no action in regard to the smell.
- At 1:02 a.m. on February 10, a resident of Pitner Place called 911 to report a very strong diesel or gasoline odor in the area. The Knoxville Fire Department responded and concluded that the reported odors came from an asphalt plant across the river from the community. Thus believing this odor did not pose any further concern but was merely a nuisance odor, the firefighters cancelled the fire call and left the scene.
- About 2:05 a.m., another Pitner Place resident closer to the pipe rupture, called 911 to report a very strong petroleum gas odor in the area. The fire department returned to the scene to investigate. Again, the fire company attributed the odor to the nearby asphalt plant.

- At 2:17 a.m., a Knoxville area resident called 911 to report oil on the Tennessee River.
- At 3:45 a.m., Knoxville Fire Department responders found fuel running into Goose Creek, which discharges into the Tennessee River about 1/2 mile downstream. Noting a nearby Colonial pipeline marker with contact information, the incident commander directed a Knoxville Fire Department dispatcher trainee to contact Colonial about the leak; however, Colonial was not notified at that time.
- Meanwhile, the Colonial employee who had been asked to check the East Knoxville facility had driven by the site where an internal inspection tool had been removed from the pipeline on February 9. About 4:00 a.m., he reported that he saw no evidence of a failure in the pipeline at that location, nor did he find any problem at the East Knoxville facility.
- Still unaware of the nature of the problem, the Knoxville operator and the called-out Colonial employee discussed the situation with the Atlanta controller. At the end of the discussion, the Atlanta controller decided that the Knoxville operator should attempt another delivery to East Knoxville. The senior controller was not involved in the decision to restart delivery. This time, the called-out operator would be observing at East Knoxville.
- About 4:03 a.m., the operator attempted to pressure up the line between Knoxville and East Knoxville, but the pressure did not rise as expected. About 4:20 a.m., he again opened the East Knoxville valve to operate this pipeline section, and initially no flow was noted at East Knoxville. After a few minutes, the pressure began to fluctuate and a lower-than-expected flow rate was indicated. The hourly flow rate was expected to be more than 3,000 barrels per hour (bph); however, it peaked at approximately 2,000 bph.
- About 4:30 a.m., the Knoxville Fire Department found diesel fuel spraying from a pipeline onto a Pitner Place residence and running downhill into Goose Creek, which was about 170 feet from the rupture site. The incident commander asked the fire department communications center dispatcher to contact Colonial and have the company shut down the pipeline. The fire department dispatcher, who was talking to Colonial's senior controller in Atlanta at that time, notified him of the leak and asked that the pipeline be shut down. The senior controller immediately ordered that the Knoxville stubline be shut down. The East Knoxville segment shutdown was completed at 4:35 a.m.
- At 4:46 a.m., the East Knoxville delivery valve was opened, and the pipeline segment was then allowed to drain into the East Knoxville terminal.
- The ruptured pipeline released approximately 53,550 gallons (1,275 barrels)

of diesel fuel. Fifteen people were reported to have voluntarily evacuated the immediate area of the leak.

- During the first 24 hours, the leading edge of the oil slick on the Tennessee River advanced about 6 miles downstream from Goose Creek. For the next several days, the Tennessee River in the Knoxville area was closed to navigation as containment booms were placed downriver. Nine collection points for escaped petroleum product were placed downstream of the accident site. Colonial estimated that 44,016 gallons (1,048 barrels) of product were recovered. No fire resulted from the spill and there were no injuries.
- Approximately 18,000 tons of contaminated soil were excavated at the leak site area during March and April 1999. The excavated soil was transported to a waste management landfill.

### **Key Lessons Learned**

- In its review of this accident, the Knoxville Fire Department identified internal operations problems in its response, including the use of trainees and the fact that some of the communications channels monitored by the fire department were not recorded.
- The fire department officials identified an issue regarding the lack of pipeline location maps during the early stage of the emergency, which might have helped them locate pipelines in the complaint area.

Source: NTSB Pipeline Accident Brief #DCA99-MP005

**INCIDENT # 16**  
**JANUARY 22, 1999**  
**BRIDGEPORT, ALABAMA**  
**NATURAL GAS SERVICE LINE RUPTURE, EXPLOSION, AND FIRE**  
**3-Fatalities, 6 Injuries, \$1.4 Million Damages**  
<http://www.nts.gov/doclib/reports/2000/PAB0001.pdf>

### **Summary of Incident**

On January 22, 1999, while digging a trench behind a building at 406 Alabama Avenue, a backhoe operator damaged a 3/4-inch steel natural gas service line and a 1-inch water service line. This resulted in two leaks in the natural gas service line, which was operated at 35 psig. One leak occurred where the

backhoe bucket had contacted and pulled the natural gas service line. The other leak was a physical separation of the gas service line at an underground joint near the meter, which was close to the building.

The owner of R&B Construction (R&B) told investigators that the owner of 408 Alabama Avenue had hired R&B to dig a trench from an electric pole behind 404 Alabama Avenue to his building for an underground electric service cable. The owner stated that he had not planned beforehand to dig the trench to 408 Alabama Avenue on the morning of the accident and consequently, he did not call the Alabama Line Location Center, Inc. However, when a part-time employee, who had operated a backhoe for R&B in the past, arrived at the R&B office the morning of January 22 looking for work, the owner of R&B decided to have the employee dig the trench that day.

The R&B backhoe operator arrived at the excavation site some time after 8:15 a.m. While digging the trench, the backhoe operator damaged the underground gas and water service lines to 406 Alabama Avenue, resulting in leaks in the water and gas service lines. About 9:15 a.m., the owner of 408 Alabama Avenue went to the Utilities Board office at 513 Alabama Avenue and reported the excavation damage. He then returned to the excavation site. The General Manager of the Utilities Board said the owner of 408 Alabama Avenue also reported that the water line and possibly the gas line were damaged.

The Utilities Board paged its field personnel between 9:18 and 9:22 a.m. Shortly afterward, five Utilities Board employees responded to the excavation site from three locations to locate and repair the leaks. One of the Utilities Board employees told investigators that upon his arrival at the accident scene, the R&B backhoe operator showed him where he had wrapped black tape over the leak in the gas service line. In addition, he and other Utilities Board employees noticed that water was running on the ground. They could hear the hissing of leaking gas and smell a strong natural gas odor in the general area.

The Utilities Board employee who was the acting supervisor turned the water off so that field personnel could excavate and locate the leak. The acting supervisor could see a portion of the pulled gas service line above ground and said that he suspected that the gas service line was severed at some point. Though the acting supervisor could hear the gas blowing and see the gas bubbling from the water in the excavated ditch, he did not know the direction in which the gas was blowing. He told investigators that he "was hoping" that the line was pulled off at the main and that the gas was blowing up into the air. He added that he believed the leak was routine and the situation was safe. The Utilities Board employees did not check for gas migrating underground or accumulating in buildings and did not stop the flow of gas. After the acting supervisor turned off the water, a Utilities Board employee started digging to remove water and soil from the trench with a

backhoe.

Because the gas service line was not closed gas migrated into the building at 406 Alabama Avenue, where it ignited about 10:02 a.m. An explosion followed, destroying three buildings: 404, 406, and 408 Alabama Avenue Other buildings within a two-block area of the explosion sustained significant damage. Three fatalities, five serious injuries, 1 and one minor injury resulted from this accident.

### **Probable Cause of the Accident**

The probable cause of the accident was the failure of R&B Construction to establish and follow safe procedures for excavation activities, resulting in damage to a 3/4-inch natural gas service line, and the failure of the Utilities Board of the City of Bridgeport to provide appropriate emergency response to the resulting natural gas leak.

### **Lessons Learned**

- The Bridgeport Utilities Board's written emergency procedures in effect at the time of the January 22, 1999 accident instructed service personnel to "...evaluate the extent of the emergency, request assistance as needed, and inform the manager as necessary."
- The procedures further directed service personnel to evaluate and secure the area if necessary and take actions towards protecting people first and then property. The procedures further stated that if in the opinion of the person in charge, the emergency is so severe that immediate shutdown is imperative, he may do so without clearance from the manager. The procedures did not instruct employees responding to a reported leak to consider the possibility of multiple leaks, check for gas accumulation in nearby buildings, and if necessary, to take steps to promptly stop the flow of gas.

Source: NTSB Pipeline Accident Brief #DCA99-MP004

**INCIDENT # 17**  
**JUNE 10, 1999**  
**BELLINGHAM, WASHINGTON**  
**PIPELINE RUPTURE AND SUBSEQUENT FIRE**  
**3-Fatalities, 8-Injuries, \$45 million damages**  
<http://www.nts.gov/doclib/reports/2002/PAR0202.pdf>

### **Summary of Incident**

About 3:28 pm, on June 10, 1999, a 16-inch diameter steel pipeline owned by Olympic Pipeline Company ruptured and released 237,000 gallons of gasoline into a creek that flowed through Whatcom Falls Park in Bellingham, Washington. About 1-1/2 hours after the rupture, the gasoline ignited and burned approximately 1-1/2 miles along the creek. Two 10-year old boys and an 18-year old young man died as a result of the accident. Eight additional injuries were documented. A single-family residence and the City of Bellingham's water treatment plant were severely damaged. The cost of the accident was estimated at \$45 million.

### **Probable Cause of Accident**

The major contributing causes of the accident were the excavations performed by IMCO General Construction, Inc. in the vicinity of Olympic's pipeline during a major construction project; the adequacy of Olympic Pipeline Company's inspections; the performance of Olympic's supervisory control and data acquisition system; and the adequacy of Federal regulations regarding the testing of relief valves used in the protection of pipeline systems.

### **Emergency Response Action Taken**

- The incident occurred at 3:28 pm but the fire department was not notified until 4:24 pm, nearly 56 minutes later. The initial call to 911 was made by a citizen who smelled gasoline. The fire department dispatched emergency responders at 4:26 pm. The Olympic Pipeline did not notify the Bellingham Fire Department until 4:57 pm.
- Bellingham's first responders included the fire, police, and public works departments. Once notified, all agencies responded promptly to the reports of gasoline odors, rapidly elevated the response to the incident, and began

evacuating the area and established an isolation perimeter.

- State and Federal agencies responded promptly. Unified Command was established by responding agencies and served as the principal decision-making body. The EPA concluded that “The Whatcom Creek Incident was an excellent example of the incident command system being used as an effective management tool for a large, multi-jurisdictional emergency response and subsequent spill clean-up activities.
- ARCO Cherry Point Refinery in Whatcom County conducted a major oil spill exercise in September 1988, about 7 months before the incident. The exercise focused on the Northwest Area Contingency Plan and the Olympic Oil Spill Response Plan, and using the incident command system. The exercise improved the ability of Olympic Pipeline to work with Federal, State, and local spill response agencies in a unified command format.

### **Key Lessons Learned**

- The incident occurred at 3:28 pm but the fire department was not notified until 4:24 pm, nearly 56 minutes later.
- State and Federal agencies responded promptly. Unified Command was established by responding agencies and served as the principal decision-making body to effectively manage the incident.
- Prior joint federal, state, and pipeline operator exercises contributed to a successful spill response and recovery operation.

Source: NTSB Report # NTSB/PAR-02/02

**INCIDENT # 18**  
**JULY 7, 1998**  
**SOUTH RIDING, VIRGINIA**  
**NATURAL GAS EXPLOSION AND FIRE**  
**1 Death, 3 Injuries, \$250,000 Damages**  
<http://www.nts.gov/doclib/reports/2001/PAR0101.pdf>

### **Summary of Incident**

About 12:25 a.m. on July 7, 1998, a natural gas explosion and fire destroyed a newly constructed residence in the South Riding community in Loudoun County, Virginia. A family consisting of a husband and wife and their two children were spending their first night in their new home at the time of the explosion. As a result of the accident, the wife was killed, the husband was seriously injured, and

the two children received minor injuries. Five other homes and two vehicles were damaged.

### **Probable Cause of Accident**

The probable cause of the accident was the corrosion and subsequent overheating and arcing at a splice in one of the conductors of the triplex electrical service line, which, because of inadequate separation between the electrical conductors and the gas service line, led to the failure of the gas service line and the subsequent uncontrolled release of natural gas that accumulated in the basement and was subsequently ignited. Precipitating the electrical service line failure was damage done to the electrical service line during installation of the gas service line and/or during subsequent excavation of the electrical line.

The safety issues identified during this investigation were (1) the adequacy of standards for minimum separation distances between gas service lines and electrical service lines and (2) the lack of a requirement for the installation of excess flow valves.

### **Summary of Events Leading Up to the Incident**

- At the time of the accident in 1998, South Riding, Virginia, was a growing planned community in Loudoun County, Virginia, near Washington, D.C., and new homes were in various stages of construction.
- On April 22, 1998, a Northern Virginia Electric Cooperative (NOVEC) crew dug a trench and installed electrical service to a new home on Rickmansworth Lane, the home that would later be involved in the accident. Underground three-wire electrical service triplex had previously been “stubbed in,” that is, installed (buried in a trench) to within a short distance of the home site so that the service line to the house could be spliced onto it when the structure was ready for electrical service. The NOVEC crew spliced onto this stubbed-in triplex an additional 23-foot section of triplex that they then attached to the house’s electric meter.
- During the first week in May, a Washington Gas Light Company contractor, Northern Pipeline Company, installed a 3/4-inch-diameter polyethylene gas service line in a trench to the house. The one-call system was used before the excavation, and the location of the electrical lines had been marked. The contractor foreman said that during excavation for the gas service line, a portion of the electric service line to the house was exposed. He stated that he understood that gas pipelines needed to be separated at least 12 inches from electrical service lines, so at the point where the electrical line had been exposed, he moved the gas service line to maintain 12 inches of horizontal separation.



- Bluestone rock dust was used as a backfill material around the gas pipelines and electric service installed in trenches and buried within the South Riding neighborhood to protect the utilities from damage from rocks and other materials in the local soil. Native soil was then placed atop the imported backfill to bring the surface back to its original grade.
- The gas meter was installed on June 9, 1998, and the gas piping was inspected, pressure-tested, and approved by the Loudoun County Department of Building and Development by June 11. The gas meter reading at the time of installation was 1645.2. Washington Gas Light Company had verified the accuracy of the gas meter on January 14, 1997. An excess flow valve (EFV) was not installed in the gas service line supplying the residence.
- On June 15, about 6 weeks after the gas service line was installed, a contractor working inside the house found that the house was not receiving full electrical service. He found a NOVEC supervisor working nearby and told him of the problem. The supervisor arranged for a NOVEC crew to go to the site when their current job was completed. Near the end of the day, according to the foreman of the NOVEC crew, the crew came to the site and exposed the electrical service line by hand-digging. He said they were unable to locate the fault before the end of their shift and, because the house was unoccupied, they left the repairs for the next day.
- The next morning, June 16, another NOVEC crew was sent to make the permanent repairs. The one-call system was not used, but the crew said they recalled seeing utility markings on the ground near the site of the excavation. After excavating the site with mechanized equipment, the crew located a fault near a point at which the electrical service triplex crossed underneath the gas service line. This was also the area along the triplex where, before the gas pipeline was installed, the electrical service to the residence had been spliced to the preexisting triplex stub. The crew said they observed that the gas service line crossed about 6 inches above the electrical service line. They stated that they found that one conductor of the triplex had been damaged. They said they repaired the fault by cutting out the damaged section, which included the original splice connection, and splicing in a short section of new cable. They said they also examined the gas service line to ensure that their repairs had not damaged it. After their repair, the crew stated, they maintained or increased the 6-inch separation between the electric line and the gas service line while they backfilled the area.
- The house was purchased on June 23, 1998. Construction of the house had just been completed, and a walk-through inspection was conducted a few days before settlement. The inspection noted no problems with any of the appliances. Shortly after settlement, the gas meter for the property was read so that the service could be transferred to the new owners. At the time of the transfer, on June 24, 1998, the gas meter reading was reading 1,654.

- After purchase, the family began moving furniture into the residence. The husband stated that they experienced no problems with any of the appliances after they took possession and that they did not move or modify the gas appliances, nor had they installed new ones. The night of July 6, 1998, was to be the first night the family was to spend together in their new home. The husband said that on the evening of July 6, the air conditioner was working and the house was cool. He also stated that he had not smelled gas. He said the family retired between 10:00 and 10:30 p.m. Because not all the furniture had arrived, the parents were sleeping in the study on the main level of the three-level house; the children were sleeping on the upper level.
- Shortly before the accident on July 7, a South Riding resident standing near his home at the corner of Chorley Wood Street and Rickmansworth Lane, about 150 feet from the accident house, noticed what he described as a “strong” odor of natural gas. He said that after attempting unsuccessfully to identify the source of the odor, he called Washington Gas Light Company at about 12:19 a.m. to report it. A few minutes later, the house at Rickmansworth Lane exploded and was engulfed in flames.

### **Emergency Response Action Taken**

- The children were thrown out of the house and onto the lawn, suffering minor injuries. The husband and wife fell into the basement as the first floor collapsed. The husband was able to crawl to safety, but the wife did not escape. The husband was burned severely; the wife died as a result of her injuries. The adjacent, unoccupied house was damaged by the accident and had to be demolished. Four other houses and two vehicles were also damaged.
- As a result of the explosion, the piping inside the house broke, and natural gas that was being metered escaped through the broken piping. Firefighters partially shut the valve to the meter upon their arrival. Natural gas continued to escape until shortly after the first Washington Gas Light Company personnel arrived at the scene shortly after 1:00 a.m. and closed the valve that stopped the flow of natural gas through the meter. At that time, the gas meter reading was 1,665. About 1:20 a.m., the fire was extinguished.

### **Key Lessons Learned**

- There were no significant emergency lessons learned documented in this incident.

Source: NTSB Report # PB2001-916501 NTSB/PAR-01/01

**INCIDENT # 19**  
**MARCH 30, 1998**  
**SANDY SPRINGS, GEORGIA**  
**REFINED PRODUCTS TRANSMISSION PIPELINE FAILURE**  
**No Deaths or Injuries, \$3.2 Million Damages**  
<http://www.nts.gov/doclib/reports/1999/PAB9901.pdf>

### **Summary of Incident**

About 3:48 p.m. eastern standard time on March 30, 1998, a recycling company employee detected the odor of gasoline at the site of the closed Morgan Falls landfill at Sandy Springs, Georgia. He investigated and found gasoline flowing up through the ground in the vicinity of a Colonial Pipeline Company 40-inch-diameter steel pipeline that ran through the landfill. The employee called the 800 number shown on a nearby pipeline marker and reported gasoline on the ground. About 15 to 20 minutes later, a Colonial employee confirmed the leak by on-site inspection and requested that Colonial's pipeline control center shut down the line. The rupture resulted in the release of more than 30,000 gallons of gasoline, about 17,000 gallons of which were eventually recovered. No alarms were detected in the control center to signify that the line had failed. By September 1998, costs of cleanup efforts and repair to the pipeline exceeded \$3.2 million.

When the accident occurred, a portion of the landfill site was being used by GreenCycle of Georgia as a recycling center for trees, shrubs, and other landscape debris. The debris was collected at a location away from the pipeline where GreenCycle employees ground the debris into mulch and compost and arranged for it to be trucked off site.

In the weeks leading up to the accident, the amount of incoming materials began to build up at the normal staging area (away from the pipeline) because GreenCycle could not process the debris as quickly as it was being received. Because of the backlog at the normal receiving area, GreenCycle began to temporarily accept and process debris at a landfill location that was in the vicinity of the Colonial pipeline. GreenCycle officials stated that they were aware of the pipeline and kept the tub grinder and conveyor away from it.

About 2 weeks before the accident, GreenCycle workers began using an area over the pipeline to generate and stockpile mulch. At the time of the accident, the mulch pile had reached a height of 17 feet. The center of the mulch pile was over the pipeline and about 80 feet from the point of failure. A rubber-tired front-end loader occasionally traversed the pipeline right-of-way while moving equipment around the site. Crossing the pipeline right-of-way with heavy equipment and storing materials on or near the right-of-way were inconsistent with the agreement made between Colonial and GreenCycle for activities in the pipeline

area.

A Colonial aerial pipeline patrol pilot noted the mulch stockpile on the right-of-way during his patrols, but he said he did not believe this to be of concern, and he further believed that the appropriate Colonial employees were aware of the mulch pile on the right-of-way. After the accident, Colonial expanded its aerial patrol procedures to require reporting of rubbish, sludge, dirt, or unknown substances on the right-of-way and to require written instructions from ground personnel before pilots stop reporting ongoing activity.

### **Probable Cause**

The probable cause of the pipeline rupture at the Morgan Falls landfill was settlement of soil and compacted trash underneath the pipeline, which resulted from the failure of Colonial Pipeline Company to take effective steps during construction to adequately support the pipeline.

Contributing to the pipeline failure were the activities of the GreenCycle Recycling Center, which subjected the pipeline to additional stresses at and near the site of the rupture, and the failure of the aerial patrols to report to Colonial that recycling activities were ongoing on the pipeline right-of-way.

### **Emergency Response Action Taken**

- On March 30, 1998, an employee of GreenCycle was delivering equipment to the work location near the pipeline when he noted the smell of gasoline. He reported to investigators that he investigated and found a “small stream” of gasoline flowing out of the ground at the pipeline location. Using the 800 emergency response number from a nearby Colonial pipeline marker, he called Colonial to report the leak.
- The initial call was received at a Colonial switchboard in Atlanta by a 5-year Colonial employee who was temporarily covering the switchboard for the regular operator. When the covering switchboard operator took the call on the 800 line and the caller identified himself, the operator asked the caller for his location. She did not inquire about the nature of his call. She said later that she assumed that he was requesting a line marking prior to an excavation, so she immediately referred him to the telephone number for a right-of-way inspector at the Atlanta field office. The written procedures to be used by the Colonial switchboard operator provide detailed guidance as to the actions to take once the purpose of a call to the switchboard has been determined, but, in this case, the operator did not accurately determine the nature of the call and therefore improperly referred to caller to the right-of-way inspector.

- The GreenCycle employee called the second number and reached the right-of-way inspector, who was preparing to leave the office for the day. According to the GreenCycle employee, he told the inspector about the odor and reported seeing gasoline on the ground. The right-of-way inspector immediately called Colonial's pipeline control center and reported the call. The inspector told the control center he was on his way to the site and would call again after he had assessed the situation. The control center operator who took the call noted in the company's contemporaneous "time log" that the right-of-way inspector stated that "a property owner called in and reported gas on the ground" at the landfill location.
- After the call from the right-of-way inspector, a pipeline controller reduced the amount of gasoline flowing through the affected section of the pipeline. According to Colonial emergency procedures, any positive report of product on the ground should be treated as confirmed evidence of a leak and the pipeline should be shut down.
- The right-of-way inspector was on site within 15 to 20 minutes and recognized immediately that a leak had occurred. He called the control center to report the leak and to have the pipeline shutdown. He then called 911 to request assistance.
- Firefighters and police arrived within about 5 minutes and remained on scene for several days until their assistance was no longer needed. Several State and Federal agencies, including the Office of Pipeline Safety (OPS) and the Environmental Protection Agency, were on site throughout the days following the accident.
- After the accident, Colonial changed its telephone reporting system and eliminated the switchboard. Under the new system, all calls to the 800 line are routed to an automated response system. Callers are asked to press 1 if they are calling to report a leak or accident. These calls are directed to the pipeline control center. Callers who call for other, non-emergency, reasons are referred to another number and asked to call during regular business hours. Callers who call from a rotary phone or who hold the line without making a selection are automatically directed to the pipeline control center.

### **Key Lessons Learned**

There were no significant emergency response lessons learned documented in this incident.

Source: NTSB Pipeline Accident Brief # DCA-98-MP-002

**INCIDENT # 20**  
**DECEMBER 11, 1998**  
**SAINT CLOUD, MINNESOTA**  
**NATURAL GAS PIPELINE RUPTURE AND SUBSEQUENT EXPLOSION**  
**4 Deaths, 11 Injured, \$399,000 Damages**  
<http://www.nts.gov/doclib/reports/2000/PAR0001.pdf>

### **Summary of Incident**

About 10:50 a.m. on December 11, 1998, while attempting to install a utility pole support anchor in a city sidewalk in Saint. Cloud, Minnesota, a communications network installation crew struck and ruptured an underground, 1-inch-diameter, high-pressure plastic gas service pipeline, thereby precipitating a natural gas leak. About 39 minutes later, while utility workers and emergency response personnel were taking preliminary precautions and assessing the situation, an explosion occurred. As a result of the explosion, 4 persons were fatally injured; 1 person was seriously injured; and 10 persons, including 2 firefighters and 1 police officer, received minor injuries. Six buildings were destroyed. Damage assessments estimated property losses at \$399,000.

### **Probable Cause of Accident**

The probable cause of this accident was the lack of adequate procedures by Cable Constructors, Inc., to prevent damage to nearby utilities when its anchor installation crews encountered unusual conditions such as striking an underground obstacle. Contributing to the severity of the accident was the delay by Cable Constructors, Inc., in notifying the proper authorities.

Contributing to the outcome of this accident was the adequacy of the safety and emergency procedures used by Cable Constructors, Inc., crews when working in the vicinity of underground facilities and the adequacy of Saint Cloud Fire Department procedures and training for responding to natural gas leaks.

### **Emergency Response Action Taken**

- Four Cable Constructors, Inc., (CCI) workers were tasked with installing a utility pole support anchor vertically through a concrete sidewalk. They used a jackhammer to break about a 9-inch-diameter hole in the concrete sidewalk. They then placed an auger known as an “anchor cranker” (a gasoline powered earth auger that had been specially modified to install anchors) on top of the anchor, and the crew began using the machine to auger the anchor into the ground.

- According to the workers, when the anchor had bored to a depth of 1 1/2 to 2 feet, it hit something hard. The object impeding the anchor's travel was later determined to be a large granite slab about 18 inches wide, 90 inches long, and 8 inches thick. The crew removed the auger and struck the top of the anchor with a sledgehammer in an attempt to break up what crewmembers thought was a rock or rocks in the anchor's path. The crew then reattached the auger to the anchor, and all four men recommenced the attempt to screw the anchor into the ground. They stated that the anchor then appeared to proceed normally, with no further unusual resistance, and they believed the anchor had broken through the obstacle or been deflected to the side of it. They said that "everything went fine, just as normal" until the top of the anchor was about 12 to 18 inches from the surface. At that point, they noticed dirt blowing out of the anchor hole and immediately began to smell gas. They then stopped the auger and released it. At that point, according to the foreman, "it [the auger] just laid over towards the [utility] pole."
- After telling other crewmembers to keep people off the street and away from the leaking gas, the crew foreman went into Book Em's Bar with a crewmember to telephone his supervisor. The foreman reached the CCI site project manager about 10:51 a.m. and told him that his crew had struck a gas pipeline while installing an anchor. The foreman later estimated that "no more than a minute" elapsed from the time he smelled gas to the time he made the phone call to his supervisor.
- The CCI site project manager told the foreman to follow the company's utility strike procedures, and he went over the procedures with the foreman. The procedure did not advise supervisors to call 911. The foreman said that after completing the call, he told the four people in the bar of the gas leak outside and informed them that they should not smoke, nor should they exit the building using the doorway near the escaping gas.
- The CCI site project manager, as required by Seren's utility damage reporting procedures, then telephoned the Sirti safety coordinator and told him that a gas line had been hit. According to phone records, this call was made about 10:52 a.m. The CCI site project manager said he did not know all of the people to call in Saint Cloud. The CCI site project manager said the Sirti safety coordinator told him to call NSP and to let NSP employees make the emergency response calls.
- The Sirti safety coordinator told the CCI site project manager that he (the safety coordinator) would immediately leave for the accident site, which he did. On the way, he placed a cell phone call to Seren management, informing them that a gas line had been hit and he was on his way. Some time thereafter, the CCI site project manager departed his office for the accident site. Along the way, he placed a cell phone call to NSP's customer service 800 number to report the leak. According to cell phone records, this call was

placed at 11:21 a.m. Meanwhile, the CCI foreman had gone back to the site to make sure his crewmembers had blocked off the area. He directed that cones and orange tape be used to help keep out vehicular traffic. (Note: Minnesota State Law, Chapter 216D.06, required an excavator who damages an underground facility to notify the operator and “take immediate action to protect the public and property and to minimize the hazard until the operator’s personnel or emergency responders have arrived.”)

- While gas was exiting the ground, a CCI crewmember moved the crew’s aerial truck into Courthouse Square and to the north of First Street North. He parked the truck so as to help prevent southbound Courthouse Square traffic from entering First Street North.
- After the CCI crew had placed cones and strung orange tape across First Street North where it adjoined Ninth Avenue North, the crew waited for the emergency responders (who, in fact, had not yet been called) and tried to keep people away from the taped off, secured area. The CCI foreman later said, “For about the first 10 minutes, we had people coming and going, and then people were slowly dissipating. There weren’t people coming and going anymore. So basically the street was shut off.”
- By this time, a receptionist in the Stearns County Administration Building was receiving complaints by telephone and from walk-ins of a strong smell of gas outside. The receptionist relayed the reports downstairs to the office of the Stearns County building facilities director. Upon learning of the reports, the facilities director left by the west entrance of the administration building to investigate. Once outside, he called to have an air handler turned off in the Administration Building. Knowing of construction on Second Street North, the facilities director approached the site and asked the excavators if they had hit a gas line. The excavators said they had not and pointed him toward the CCI workers. After walking past the police department building and smelling gas, he asked the CCI workers if they had damaged a gas line. The crew foreman told him they had. The director asked if the crew had called the fire department, and the crew foreman reported that they had not. At about 11:05 am, the director placed a cell phone call to the Stearns County chief deputy sheriff and reported the leak. The deputy sheriff then called the sheriff’s department dispatcher, who immediately called the Saint Cloud Fire Department.
- At 11:06 a.m., Engine Company 21, based at Fire Station 1, about 2 blocks from the leak site, was dispatched to the scene. According to telephone records, at 11:07 a.m., the fire department dispatcher notified the NSP dispatcher of the leak.
- Also about 11:06 a.m., Saint Cloud police units 41 and 42 were assigned for traffic control in front of Book Em’s Bar because of the gas leak. About the



same time, unit 40, a police sergeant, reported that the area had already been barricaded and that police assistance was available to the fire department through the dispatcher.

- The firefighters arrived on the scene about 11:08 a.m. According to interviews, a CCI employee moved the tape to allow the engine company into the secured area. The first responders in the engine company included a lieutenant and three firefighters. The lieutenant said he immediately took notice of the wind direction when he arrived at the site. He later said that he planned to use the information to decide which buildings needed to be evacuated first if evacuation became necessary.
- One of the firefighters, accompanied by another firefighter, began testing the area using a hazardous and combustible gas monitor. After radio approval from his lieutenant, and within a minute of arrival, the other firefighter moved the fire truck to the east end of First Street North to eliminate a possible ignition source.
- The Sirti safety coordinator said he arrived at the scene about 11:15 a.m. He said he parked across the street from the police station and walked to the accident site. He took several photographs of the anchor location and the general area around the scene.
- Four vehicles were parked on First Street North next to Book Em's Bar. The Saint Cloud Fire Department lieutenant told the firefighters that NSP would need to bring heavy equipment into the area to repair the leak and that the vehicles would have to be moved. The lieutenant then walked to the police department building and asked that the license numbers for the parked vehicles be researched and their owners contacted. None of the owners were contacted, but they all eventually came out of nearby buildings and moved their vehicles.
- With another firefighter at his side, the firefighter with the gas monitor first tested the concentration of natural gas above the leak site. He then performed the same test alongside the buildings housing Book Em's Bar and Bellanti's Pizza and Deli. The firefighter who carried the gas monitor said the area "smelled really bad." He said he essentially got no reading when he placed the monitor directly adjacent to the hole in the ground made by the anchor. He said that the monitor's lower explosive limit (LEL) reading went from -2 to 0.6. A firefighter stated that they had not had time to do a fresh-air calibration of the monitor because of the short distance between Fire Station 1 and the accident site.
- After the fire truck moved to the east end of First Street North, the CCI site project manager arrived on Courthouse Square. He parked his truck on Courthouse Square so as to prevent traffic from entering the east end of First

Street North. With the CCI project manager's truck on one side of Courthouse Square and the crewmember's aerial truck on the other side, traffic could not travel from Courthouse Square toward the east end of First Street North.

- About 11:16 a.m., two NSP trucks arrived. As was done earlier for the fire department, a CCI lineman moved the tape to permit entry for both NSP trucks. An NSP gas technician specialist arrived in one truck, which he parked on the street alongside the damage area. He then went to the location of the damage to assess its extent and to talk to the CCI foreman. An NSP locator technician (the individual who finds and marks the locations of buried utilities) was in the other truck, which was parked behind the gas technician specialist's truck. With NSP personnel on scene, two of the fire department responders joined the third already at the fire truck, while the lieutenant remained in the vicinity of the leak.
- At the anchor leak site, the NSP gas technician specialist asked the CCI foreman to fill out a damage report detailing how the gas line was damaged and providing the address of the responsible contractor. While this report was being filled out, the NSP gas technician specialist was readying his equipment.
- Witnesses stated that after the form was completed, the NSP gas technician specialist entered Book Em's Bar at street level (the building did not have a basement). Inside the bar, he took readings on a combustible gas indicator and was overheard stating he obtained a reading of 7 percent. Bar patrons said the gas technician specialist then left the bar to look for an entrance to the basement of the adjacent building, which housed Bellanti's Pizza and Deli. The four persons who were in the bar during this time later told police that no one at any time asked them to evacuate the building.
- While the gas technician specialist was taking his readings, according to witness statements, the NSP locator technician was determining if the service line had been properly marked. He was also seen assisting with the movement of a vehicle from the secured area. According to radio and cell phone records, about 11:29 a.m., an explosion occurred in the basement of the building where Bellanti's Pizza was located.
- Three firefighters were in their truck at the time of the explosion. They reported that they saw no fire but that they could see little because their vehicle was immediately enveloped in a cloud of dust. Two of the firefighters exited the fire truck while the third used the radio to report the explosion and request ambulance service. He said he "knew that there were injuries." A police officer patrolling nearby also radioed a report of the explosion. After making the report, one of the firefighters then moved the truck to the northeast, putting the county facilities building between the fire truck and the explosion site.

- According to NSP, when the NSP gas technician specialist received the call of the leak, about 11:09 a.m., he immediately called for a company construction crew, which was equipped to shut down the damaged portion of the line. At the time of the explosion, this three-person crew was 2 blocks away from the accident site. About 11:30 a.m., the NSP construction crew foreman radioed the NSP dispatcher to report the explosion. The NSP dispatcher directed 26 gas technicians to the explosion site. An NSP manager stated that the technicians were sent to help close off the damaged line and to enter and check all adjacent buildings in the surrounding area for potential gas-related problems. NSP workers stopped the flow of gas to the damaged gas line at 12:25 p.m. and shut off electrical power at 12:31 p.m.
- According to the report of the Minnesota State fire marshal, the explosion occurred in the basement of the building where Bellanti's Pizza was located. The basement walls were made of stacked stones and crumbling mortar. According to the fire marshal's report, as collected in the basement of the building and was ignited by an unknown source. In the basement of the building were several potential sources of ignition, including gas water heaters.
- In addition to the building containing Bellanti's Pizza and Deli, the explosion destroyed the buildings containing Book Em's Bar, Tom's Bar, and Bartsh Bail Bonds, and the two buildings containing the Hall Law Offices. The law office buildings were joined with a fire door. The blast also damaged the Stearns County court facilities building and the buildings housing Taco John's and Howies Bar. According to the St. Cloud city assessor, the damage assessment for the buildings destroyed by the natural gas explosion was \$399,000.
- Immediately after the explosion, one engine company each responded from Saint Cloud Fire Department's Fire Stations 2 and 3, and a ladder truck responded from Fire Station 1. Fire department personnel notified Gold Cross Ambulance Service to respond and requested heavy excavation equipment. Crewmembers of Engine Company 21, already on scene, began search and rescue operations immediately.
- Four people were trapped inside the rear portion of the Hall law offices, which was between the Bellanti's building and Tom's Bar. Three of those trapped were extricated by firefighters within 20 minutes. Some 30 minutes after that, the fourth person was freed and taken to the hospital. None of these individuals reported seeing any NSP or fire department personnel before the explosion.
- At 11:30 a.m., St. Cloud Police Department Unit 43 advised the Stearns County Sheriff's Department dispatcher of the explosion. All available

ambulances were asked to respond to the scene, as were all available law enforcement personnel. A request was also made for construction equipment. About the same time, the Saint Cloud fire chief and the assistant fire chief, who was the incident commander, arrived on scene.

- At 11:31 a.m., the Saint Cloud Police Department began evacuating the immediate area, including Courthouse Square and the north side of the courthouse building. At this time, all of the St. Cloud off-duty firefighters and volunteer division firefighters were called to report to duty.
- At 11:32 a.m., an incident command post was established 100 feet west of the intersection of Ninth Avenue North and First Street North and a staging area was established at the rear of Fire Station 1.
- About 11:32 a.m., Engine 21 firefighters notified the incident commander that they were going to begin evacuation of the Stearns County courts facilities building.
- At 11:33 a.m., the incident commander requested additional NSP personnel because of the gas leak and downed electrical wires.
- The first ambulance arrived at 11:34 a.m.
- At 11:37 a.m., the fire chief activated the Saint Cloud *Emergency Action Plan*. At 11:38 a.m., the fire chief asked for help from the Waite Park and Sauk Rapids fire departments.
- At 11:42 a.m., the St. Cloud police established an evacuation perimeter. This perimeter included the Law Enforcement Center, the courthouse, and the Stearns County Administration Building.
- At 11:44 a.m., Gold Cross Ambulance Service called the Saint Cloud Hospital and informed the emergency trauma center charge nurse of the gas explosion and advised her that approximately 20 patients possibly could be transported to the hospital. Subsequently, the hospital evaluated its resources and determined that three air ambulances were available to transport patients to burn centers if necessary.
- By 11:47 a.m., all injured survivors, with the exception of the seriously injured and trapped victim, had been removed from the immediate area surrounding the explosion. The evacuation perimeter was further secured using police line tape and road barricades with security checkpoints established.
- At 11:50 a.m., the owner of the building housing Bellantti's Pizza informed a police supervisor that two rooms on the second floor of the Bellantti's building were rented.

- At 12:07 p.m., the incident commander called for the Anoka County Search and Rescue Canine unit.
- At 12:09 p.m., St. Cloud Hospital initiated its disaster plan and notified 50 medical professionals to respond to an upper floor staging area. The emergency trauma center monitored the activities of the ambulance crews on site and was kept informed on the conditions of patients and their transportation to the hospital. A total of 11 people were either transported by ambulance or arrived by private vehicle at the hospital. At 1:30 p.m., the hospital's disaster plan was discontinued.
- At 1:51 p.m., the Anoka County Search and Rescue Canine Unit arrived on scene.
- At 2:24 p.m., St. Cloud police received reports that two individuals had been in a rented room above Bellanti's at the time of the explosion.
- At 3 p.m., the police department confirmed that all four people who had been inside Book Em's Bar at the time of the explosion had been accounted for. At 3:05 p.m., police officers were assigned to start door-to-door checks within the affected area. At the same time, Red Cross workers were on site at a nearby home for senior citizens to assist with a possible evacuation. Search and rescue operations continued with the use of manual and heavy equipment until approximately 10 p.m., in the event that more victims were buried in the debris; however, none were found. At 10 p.m., the St. Cloud Police Department and the 34th Military Police Company of the Minnesota National Guard secured the area for the night. NSP continued operations in the area.

### **Key Lessons Learned**

- The explosion in the Saint Cloud accident occurred in the building housing Bellanti's Pizza and Deli. The escaping natural gas from the damaged pipeline apparently migrated underground, through the crumbling foundation of the building, and into the basement.
- Because of the delay by the Cable Constructors, Inc., in notifying the gas company and emergency response personnel, about 18 minutes elapsed from the time the pipeline was ruptured until the first firefighters arrived (about 21 minutes before the explosion). About 26 minutes after the rupture (about 13 minutes before the explosion), gas company personnel arrived. An NSP gas technician specialist was assessing the hazard when the explosion occurred. The delayed response resulted in lost time that could have been used to evacuate building occupants.
- Firefighters of the Saint Cloud Fire Department responded quickly to the

scene of the leak; however, once on the scene, the firefighters' actions did not fully address the risk to people and property posed by the leak or reduce the consequences of a possible fire or explosion.

- Although all of the fire department responders were trained on the basic characteristics of natural gas, at the time of the accident, the Saint Cloud Fire Department had no written procedures in place providing detailed guidance on responding to natural gas leaks. The firefighters were instructed during in-house training, State-sponsored training, and training sponsored by NSP to be aware of wind direction as well as the general characteristics of natural gas.
- Four days after the accident, investigators downloaded data from the memory bank of the combustible gas indicator and analyzed the recorded gas monitor readings obtained by Saint Cloud firefighters at the accident scene before the explosion. The monitor was calibrated. The calibration of the monitor was tested by exposing the unit to a calibration gas with a concentration that was 50 percent of LEL. When tested against this gas, the monitor registered 34 percent of LEL. Also, the timing mechanism on the monitor was in error by about 4 minutes.

Source: NTSB Report # PB2000-916501 NTSB/PAR-00/01

**INCIDENT # 21**  
**JULY 21, 1997**  
**INDIANAPOLIS, INDIANA**  
**NATURAL GAS TRANSMISSION PIPELINE AND FIRE**  
**1 Death, 1 Injury, \$2 Million Damages**  
<http://www.nts.gov/doclib/reports/2000/PAR0001.pdf>

### **Summary of Incident**

About 2:33 p.m. on July 21, 1997, a 20-inch-diameter steel natural gas transmission pipeline owned and operated by Citizens Gas & Coke Utility Company (Citizens Gas) ruptured and released natural gas near an intersection adjoining the Charter Pointe subdivision in Indianapolis, Indiana. The gas ignited and burned, killing one resident and injuring another. About 75 residents required temporary shelter. Six homes were destroyed, and about 65 others sustained damage significant enough to be documented by the local investigation team.

The pipeline had not been under full internal pressure since March 31, 1997, when the pressure was reduced to approximately 30 pounds per square inch

gauge (psig) in anticipation of road construction work in the area. On May 19, 1997, a directional drilling operation had been performed to install an 8-inch-diameter steel natural gas distribution main parallel to the transmission pipeline. About 1 hour and 40 minutes before the rupture, Citizens Gas had begun to return the 20-inch transmission pipeline to full service.

On-site inspection of the ruptured pipe revealed a near-longitudinal gaping fracture about 5.8 feet long. Along the entire length of the longitudinal fracture, the newly installed 8-inch distribution main was within approximately 4 inches of the 20-inch transmission pipeline.

### **Probable Cause of Accident**

The probable cause of this accident was the failure of Citizens Gas & Coke Utility and Miller Pipeline Corporation to have adequate controls in place to ensure that directional drilling operations carried out in the proximity of existing underground facilities would not cause damage to those facilities.

### **Emergency Response Action Taken**

There were no emergency response issues documented in this investigation.

Source: NTSB Pipeline Accident Brief # DCA-97-FP-005

**INCIDENT # 22**  
**OCTOBER 23, 1996**  
**TIGER PASS, LOUISIANA**  
**NATURAL GAS PIPELINE RUPTURE FROM DREDGING OF TIGER PASS**  
**No Deaths, or Injuries, Damage Cost Unknown**  
<http://ncsp.tamu.edu/reports/NTSB/ntsbPipeReport/PAR9801S.pdf>

### **Summary of Incident**

About 4:50 a.m. on October 23, 1996, in Tiger Pass, Louisiana, the crew of the Bean Horizon Corporation dredge dropped a stern spud into the bottom of the channel in preparation for dredging operations. The spud struck and ruptured a 12-inch-diameter submerged natural gas steel pipeline owned by Tennessee Gas Pipeline Company. The pressurized natural gas released from the pipeline enveloped the stern of the dredge and an accompanying tug, then ignited, destroying the dredge and the tug. No fatalities resulted from the accident.

## **Probable Cause of Accident**

The probable cause of this accident was the failure of Tennessee Gas Pipeline Company to accurately locate the company's pipeline across Tiger Pass before that location was dredged. Contributing to the accident was the lack of Federal requirements for placing and maintaining permanent markers where gas and hazardous liquid pipelines cross navigable waterways; and the adequacy of Bean Horizon Corporation's vessel emergency and crew accounting procedures.

## **Key Emergency Response Lessons Learned**

- There was a 30-minute delay between the time of the rupture and Tennessee Gas Pipeline Company realizing there might be a pipeline failure. It took 1-hour to shut in the pipeline. A faster response would have minimized environmental damage.

Source: NTSB Report PB98-916501 NTSB/PAR-98/01/SUM

**INCIDENT # 23**  
**NOVEMBER 21, 1996**  
**SAN JUAN, PUERTO RICO**  
**PROPANE GAS EXPLOSION**  
**33 Deaths, 69 Injuries, \$8.5 Million Damages**  
<http://www.nts.gov/doclib/reports/1997/PAR9701.pdf>

## **Summary of Incident**

About 8:30 a.m. on November 21, 1996, a commercial building in San Juan, Puerto Rico, exploded because of a propane gas leak from a municipal gas distribution pipeline. Thirty-three people were killed, and at least 69 were injured.

The primary building impacted by the explosion was the Humberto Vidal (HV) building located on the corner of José de Diego and Camelia Soto in the Río Piedras shopping district in San Juan. The structure was a six-story mixture of offices and stores owned by Humberto Vidal, Inc. The company's administrative offices occupied the third, fourth, fifth, and sixth floors, and the first and second floors housed a jewelry store, a record store, and a shoe store.

The San Juan Gas Company (SJGC) was the local gas pipeline distribution company for the Río Piedras district. Near the building, the company had a 4-inch cast-iron gas main on de Diego Street and a 2-inch abandoned gas line. A pressurized steel service pipe, also ran from the gas main to the HV building,



about 6 to 8 inches east of the east wall. The service pipe did not enter the building, as gas had not been used in the building for more than 10 years. The Humberto Vidal Shoe Store was on the first floor, and its front door was on de Diego.

### **Probable Cause of Accident**

The probable cause of the propane gas explosion, fueled by an excavation caused gas leak, in the basement of the Humberto Vidal, Inc., office building was the failure of San Juan Gas Company, Inc., (1) to oversee its employees' actions to ensure timely identification and correction of unsafe conditions and strict adherence to operating practices and (2) to provide adequate training to employees.

Also contributing to the explosion was (1) the failure of the Department of Transportation to oversee effectively the pipeline safety program in Puerto Rico, (2) the failure of the Puerto Rico Public Service Commission to require San Juan Gas Company, Inc., to correct identified safety deficiencies, and (3) the failure of Enron Corp. to oversee adequately the operation of San Juan Gas Company, Inc. Contributing to the loss of life was the failure of San Juan Gas Company, Inc., to inform adequately citizens and businesses of the dangers of propane gas and the safety steps to take when a gas leak is suspected or detected.

### **Activity Prior to the Day of the Explosion**

- During the post-incident investigation, many people reported that they had detected the odor of gas inside buildings and along streets adjacent to the Humberto Vidal (HV) building for at least a week before the explosion. Several HV employees had worked in the basement and on the first floor early in the mornings before the air conditioning was started. They had smelled a strong odor that they identified as propane gas. Those who had worked in the basement complained of dizziness, nausea, and difficulty breathing while in the basement. One HV employee stated that most of the HV employees had smelled the gas odor, as did some customers. She said the odor was strongest in the basement, where merchandise was stored. The manager of the shoe store (who later died in the explosion) told her that he had advised one of the HV officials that employees could not go into the basement because of the strong smell of propane gas.
- Some of the employees at the nearby Chicken Kingdom restaurant told their supervisor that they had smelled a strong odor of gas that came and went. The supervisor stated that he called the company that serviced his gas cooking equipment and had all of the equipment tested. No leaks were found. He stated that the equipment-company personnel assumed that the odor must be associated with gas work going on along Camelia Soto, since

someone was constantly checking for gas leaks.

- The administrator of the Chicken Kingdom stated that he used a pay telephone to report to the SJGC that his employees had smelled gas. The SJGC employee receiving the call asked for the street name. The administrator explained to him that the smell came and went. The SJGC employee said the gas company would take care of the problem. The administrator stated that the SJGC employee did not ask for his name, for his company's name, whether the smell was inside or outside, or any other questions. The administrator also said that the SJGC employee did not tell him what actions he should take. After he made the report, the administrator said, he saw an SJGC truck and SJGC employees working in the area and assumed that they had come in response to his call. He stated that he never smelled gas in the area while he was outside his building. He also said that during the week or so before the explosion, he had been in Joyería Super Precio, Disco Fiesta, and La California stores and had not detected the odor of gas.
- The owner of Pepe Ganga stated that some of his employees had commented to him before the explosion about detecting an odor in the store that they thought might be propane gas. He said that he thought that the odor might have come from the exhaust fumes of the local bus or other vehicles using the street.
- **Activity on Thursday, November 14** - - According to the SJGC, the first report it received of the odor was on Thursday, November 14. The SJGC dispatcher on duty that morning said that the manager of the shoe store telephoned him at 8:15 a.m. The dispatcher said the manager told him that he smelled gas when he opened the store and that when he went into the basement, he could smell gas, although the odor was not very strong. The dispatcher stated that he recorded the call and told the manager what he told anyone else who reported smelling gas, to leave the basement door open and try not to turn on any electrical appliances or anything that has to do with electricity.
- The dispatcher sent a technician to investigate. The technician arrived at the shoe store about 9:30 a.m. and met with a store employee, probably the store manager. The two then walked down the basement stairs, which were on the east side of the building (the side next to La California). They walked to the north wall of the building (the wall along de Diego), where the manager pointed to the upper right part of the wall and said that the odor seemed to be coming from there. He told the technician that he smelled gas in the mornings when he entered the store. The technician had a gas detector with him, the kind that is not accurate unless it is turned on in an area that is free of gas. Once turned on and moved to an area that is suspected of containing gas, the

detector will beep if it detects gas. The technician did not turn the detector on until he had been in the store for about 5 to 10 minutes. When he used it to test the basement area, the detector did not beep.

- **Activity on Friday, November 15** --On Friday, November 15, the SJGC sent a gas response team, known locally as a “brigade” to the building. The brigade, consisting of four men and a leader, arrived at 8:15 a.m. The leader had been told by his supervisor that the store manager was complaining of an odor of propane gas inside the building. When the brigade arrived, the store manager told the leader that he smelled propane gas in the store, and both men entered the basement by the stairs at the east wall. In the basement, they walked about 12 to 15 feet north from the stairs, and the manager told the leader that they had reached the spot where he had smelled gas and that the odor seemed to be coming down from the basement ceiling.
- According to the leader, both he and the manager agreed that they could not smell gas at that time. The leader later stated that the manager had told him that sometimes in the morning when he opened the store he could smell gas. The leader did not have an instrument with him for testing the basement atmosphere for the presence of gas, so he went outside to test the underground with a combustible gas indicator (CGI).
- The brigade made about 18 to 20 barholes about 4 feet apart in de Diego and, according to the leader, about 18 to 20 inches deep or deeper. They began east of La California and proceeded west. The leader said that the CGI read 0 until it was about 2 to 3 feet beyond the east wall of the HV building. In a barhole about 4 feet west, the CGI indicated about 2 to 3 percent on the lower explosive limit (LEL) scale. As the leader pumped the CGI to draw in more air from the barhole, the CGI reading dropped. He repeated the test several times, and each time he obtained the same result. The brigade continued its survey until it was within 20 to 30 feet of Camelia Soto, and the CGI continued to read 0. The leader called the gas company to find out whether any gas pipes went from the main to the HV building. The company told him about the old line that ran from the main into the building. The brigade excavated the area over the old line, located it, disconnected it from the main, and plugged the opening of the main. The leader stated that a laborer plugged the open end of the old line. (Note: Inspection by investigators after the explosion found that the gas service pipe had not been plugged.) According to the leader, the brigade members used a soap solution to test for leaks in the part of the main they had uncovered. They detected no leaks, so they reburied the main and compacted the soil over and around it. The brigade leader stated that he told the manager to call the SJGC if he again smelled gas.
- **Activity on Monday, November 18** -- On Monday morning, November 18,

an HV employee told the manager that the odor of gas in the shoe store was very strong. The manager told her that he had already spoken with the SJGC and that the company was not paying much attention.

- She later stated that he asked her to go to the basement with him and that she walked from the staircase about halfway to the north wall, but could not go any farther because the odor was strong enough to make her dizzy and nauseated. She had to go back upstairs to get some air. The following day, November 19, was a holiday, and the shoe store was closed.
- **Activity on Wednesday, November 20** --The employee who had gone into the basement on Monday said that on Wednesday, November 20, the odor was still present and the smell appeared to be about the same. She stated that she did not go into the basement again because she was afraid. According to the SJGC dispatcher, an unidentified person (believed to be the store manager) called from the HV building a short time before 8 a.m. and said that a slight odor of gas was detectable in the building. The dispatcher did not record the call. The dispatcher stated that he used the November 14 work order to dispatch a brigade because “they keep on calling.” He said that, as before, he advised the caller that the building should be left open.
- The dispatcher said that later in the morning a woman called to report an odor of gas in the building, but he did not take her name since the company had already dispatched a brigade. (According to the SJGC’s records, the only other call the SJGC received that day from the HV building was in the early afternoon.) Later that morning, when the store manager saw an HV official who worked in the building, he told the official about the odor. The official told the manager to open the door or get some fans if the smell got worse, as he did not want customers to smell the gas. Reportedly, the manager did not follow the instructions because it would have been difficult for him to watch the merchandise if the door were open.
- After the accident, the SJGC operations superintendent, the supervisor of the dispatcher, stated that he recalled the dispatcher telling him on November 20 about receiving a complaint from the store manager. The operations superintendent said that he responded to the complaint by dispatching a brigade leader and a five-person crew to investigate. He instructed them to go into the store and store basement and to probe the street outside the store to make certain that there were no problems inside the building. He stated that he instructed the brigade leader to take all the time needed to investigate the report because the brigade leader who went to the building on November 15 had not gone all the way into the basement. The leader of the November 20 brigade stated that he understood that he was responding to a call reporting a strong odor of gas in the store. He was aware that other SJGC employees had previously responded to a similar complaint and that they had made some barholes. He said that when he arrived at the store, he talked to the

manager, who, he claimed, said that he was not sure that what they were smelling in the basement was gas, but that his employees were telling him that it was gas. The leader said that he went throughout the basement with the manager checking for any gas pipe or odor of gas; he said he found neither. He did not use an instrument to check for gas, but he smelled a strong odor, which he believed to be the odor of rubber. He said that when he smelled what he believed to be rubber, HV employees were unpacking shoes, readying them to be put on shelves.

- According to two HV employees, no one worked in the basement on November 20 because the odor of gas was too strong. Merchandise arriving at the store that day was stored on the first floor instead of in the basement. One of the two employees reported entering the basement to look for merchandise requested by customers. She said that she tried holding her breath because of the odor. She estimated that she was in the basement about 5 minutes and became dizzy and nauseated. The other reported that he was unable to fully enter the basement because the “fumes” were too strong.
- Another HV employee, a messenger, said that he had walked with the store manager and the leader to the stairs. The messenger said that although he did not go into the basement, he became nauseated from the gas odor, as did another employee. The messenger stated that he stayed at the top of the stairs because the gas odor was too strong, but that the leader and the manager walked about halfway down the stairs. The messenger said that the two men did not go completely into the basement and that he overheard the leader say that it smelled like gas. Propane gas is heavier than air. The leader stated that he knew that propane gas tends to pool and not to rise when it is released underground and that it is therefore necessary to probe deeper into the soil because pockets of propane may be below the gas main. A few days after the explosion, the leader said the barholes his brigade had made were about 12 to 18 inches deep. He said that he did not verify the depth of the holes except by comparing their depth to the length of the probe for his CGI. He estimated the probe was 2 feet long. In January 1997, the leader said that he made new barholes rather than using the old ones because he recalled being instructed never to use old holes because water might have collected in them, which could damage the CGI. He claimed that he had observed the barholes to be about 2 to 2 1/2 feet deep and was aware that the gas main was 2 feet deep. He said that, beginning at the intersection of Camelia Soto and de Diego, on the west side of the building, his brigade made barholes, first at 20-foot intervals and then at 10-foot intervals, to the east until they were about 15 to 20 feet from Monseñor Torres. He said he had had two reasons for thinking that he knew where the gas main on de Diego was: he had had previous experience with it; another brigade had marked the location of the gas main with crayon when it was repairing the service line to La Milagrosa School. The brigade made barholes at 10-foot intervals along both

sides of Camelia Soto. (The barholes on the eastern side of Camelia Soto started about 5 feet south of the Chicken Kingdom and continued to de Diego. The barholes on the western side of Camelia Soto began at the Commercial Ubiñas gas service line and continued to de Diego.) The leader said he had decided on making barholes along Camelia Soto because he thought there was a gas main on Camelia Soto and that he had thought that gas might have migrated from the main on Arzuaga or the main on Camelia Soto to de Diego. (De Diego is downhill from Arzuaga.) He said that the crew found no indications of combustible gas in any of the holes they made that morning.

- The leader said that had he known there was a gas service to the Chicken Kingdom, he would have probed over that line also. He said that he knew that a service line ran to the Commercial Ubiñas building because he could see the meter, but he was not aware that a service line ran to the Chicken Kingdom. He did not call the dispatcher to learn the locations of gas pipes in the area, nor did he use a pipe locator, the maps in his truck, or other means to locate the gas lines. The SJGC operations superintendent later testified that on November 20, the leader reported that he had found a power transformer that was leaking oil in the basement of the HV Building. (The leader did not report this information when interviewed by an investigator, nor was there a transformer in the basement.) The operations superintendent stated that the leader told him that his crew had used a soap-and-water solution to test the location where a gas service had once entered the building (the leader testified that he looked for evidence of gas lines entering the basement and found none) and at other locations, but found no areas indicating the entry of propane gas. The leader said that his CGI had been used by others the previous day and around noon he wondered whether it was operating correctly, since he had not found any indication of combustible gas in the barholes. He and the rest of the brigade drove to the SJGC shop, where they had the CGI tested. It was found to be functioning properly. Meanwhile, the HV messenger told the HV attorney that the gas odor was still in the basement and, at times, the odor could be detected in the stores in the building. According to the attorney, she called the SJGC after 1 p.m. and reported what the messenger had told her. On receiving her complaint, the SJGC dispatcher informed the operations superintendent. He radioed the leader, who was in the shop testing the CGI, and told him to return to the HV building to check again for gas leaks. He stated that he instructed the leader to test in all directions for leaks and to test even further from the building because he wanted to know why the HV employees were calling. The leader and the rest of the brigade returned to the HV building and re-tested all of the holes that had been made that morning. Again, they did not detect combustible gas. About 5 p.m., the brigade returned to the SJGC shop. The brigade leader talked with the maintenance and construction coordinator (MCC) and reported that his testing had not revealed evidence of combustible gas near the HV building. He also advised that a store employee had reported

detecting the odor of gas that morning when the store was first opened. The MCC stated that he did not believe that there was a gas leak at the HV building because he knew the results obtained by previous crews and because he trusted his personnel and the instruments that they used.

- **Activity on Thursday, November 21** --On November 21 about 6:45 a.m., air conditioning contractors (a father-and-son team) arrived to do the routine, monthly maintenance on the air conditioners that they had been doing for the past 10 years. They met the store manager and the messenger outside. According to the messenger, the manager opened the door to the store and said that he smelled gas. The messenger said his stomach became upset and he told the manager to call the SJGC because the odor was so strong. The manager turned on the lights, and the four men entered the building together. The manager and the contractors walked through the store to the elevator on the west side of the building. The son (the father died in the accident) later stated that when he entered the building, he did not detect any unusual odors but said the manager told him about detecting a strong odor of gas. The three used the elevator to go to the building receptionist area on the fourth floor, where the manager opened the office doors and left. According to the son, the building air conditioners usually were not turned on until 8 a.m. or later. It was usual for the store manager to turn on all the air conditioning units at their control panels; however, the son stated that when he worked on the basement air conditioner, he would turn the unit on and off as needed. To perform their work, the contractors would feel the air conditioner pipes after the air conditioner had run for a while to assess whether the machine was working properly, and as needed, they would wash the compressor and filters.
- An employee who arrived at work between about 7:00 am and 7:10 a.m. said that as she entered the building, she smelled the odor of gas, an odor that had been present for the past week and a half. She said the odor was strong enough that it “went over the top of the regular odor [new shoes] of the store.” She recognized the odor as propane gas because she had a propane gas stove at home. As she did most mornings during this period, she mentioned the odor to the store manager. He told her that he would call the gas company again that morning and that he was continuing to keep a log of his calls. (His call log was not found after the explosion.) The store manager’s brother entered the store, and the three of them were together until 8:00 am or 8:05 a.m., when the employee left the building to get breakfast.
- The manager’s brother stated that when he entered the building, he smelled propane gas. The manager complained to him about the strong odor of gas and told him that he had become dizzy and nauseated. The manager asked him to go into the basement to check on the odor. The brother walked to the bottom of the basement stairs, sniffed the air, and would go no farther because his eyes became irritated and he could not stand the smell. He ran

back upstairs, advised the manager to leave the building, and soon left himself. The son from the air conditioning contractor team said that he completed his work on the third and fourth floors about 7:50 am and left the building. He stated that his father began working on the fifth floor and was to work all floors other than the third and fourth. The son said that he was aware of the odor produced by the shoes stored in the building and of the smell of propane gas from the pipe system. He stated that he did not detect the odor of gas that day in the areas he visited. In the meantime, the MCC had decided to send a third brigade, which he dispatched at 7:00 am.

- The workmen arrived about 7:30 am and parked their truck on de Diego, in front of the building. The MCC said he sent the brigade to make sure there was no gas in the building and to learn what the HV employees were smelling when they opened the building. The brigade leader reported that he was given no instructions on contacts to be made at the building and that he had not been told that there had been previous complaints or what the previous SJGC crews had done. He said that because he was not told of the previous actions, he did not take with him any plans or other information about the gas piping in the area. He knew that there was suppose to be a map of the gas mains in the truck, but he did not consider the map important because he knew he could use his radio to obtain any information he needed.
- The leader said that he did not smell gas on the outside of the building when he arrived and that he did not see anyone at the store door. He believed the store had not yet opened because the outside roll-up door was halfway up and the inside door was closed. At no time did he or his brigade members meet with or talk to any HV employee. Without referring to the gas main map in the truck, he went to the barholes he saw in de Diego, beginning in front of the entrance to the HV building and extending west to the intersection of de Diego and Camelia Soto. He believed that the barholes had been made the previous day by another brigade. He stated that the holes were about 18 inches deep and about 6 feet north of the curb. He believed their locations to be over the gas main because he recalled the location of the gas main from an earlier time when he saw it exposed to reestablish gas service to the school across from the HV building. He inserted his CGI probe into the holes and tested in each. He detected no odor of gas, and his CGI did not register any indication of a combustible gas.
- The administrator of the Chicken Kingdom stated that as he drove past the HV building on his way to work, he saw the SJGC brigade working in the area. He said that about a half hour before the explosion he detected a “little” gas odor in the store when the breeze blew into the store.
- The leader had three new barholes made in de Diego, between the jewelry store and the manholes in the intersection of Camelia Soto and de Diego. He said that the holes were 18 inches deep and about in line with the previously



made barholes that he had already tested that morning. No combustible gas was detected in the three new holes. Next he had the crew make more barholes in the intersection of Camelia Soto and de Diego. As soon as the barholes were made, just before 8:30, he used his CGI and obtained a reading of 20 percent on the gas scale, but he detected no odor of gas.

- About 5 to 10 seconds afterwards, while he was standing on the manhole cover and another employee was making another barhole, the explosion occurred. The force lifted him into the air and threw him about 15 to 20 feet to the north. People who were in the HV and adjacent buildings sustained minor to serious injuries.
- Those on the lower floors of the HV building received the more serious injuries. The bodies of the store manager and the air conditioning service technician were later found in the basement. Some people outside and near the HV building were severely injured or killed by debris propelled by the explosion.

### **Emergency Response Action Taken**

- About 8:30 a.m. on November 21, immediately after the explosion, police officers on Camelia Soto and Arzuaga ran toward the building and began helping the injured and those trapped on the upper floors.
- Firefighters at the Río Piedras fire station, which was about 1/4-mile from the HV building, heard the explosion and arrived in an engine company about a minute later. They observed cars turned upside down, injured and dead people in the street, and devastated buildings, but no fire. They radioed for assistance, and within minutes additional fire, medical, and police personnel and equipment arrived. Firefighters provided first aid, removed bodies, and evaluated the risks of entering the building. The Puerto Rico Police dispatched members of its bomb squad to investigate.
- At 8:42 am, the police notified the trauma center at the Río Piedras Medical Center, which initiated its disaster plan. A triage area was set up at La Milagrosa School.
- At 8:45, a San Juan Civil Defense Department search and rescue worker, who had been trained in handling gas emergencies, was dispatched to the scene. When he arrived, he smelled a strong odor of gas, but did not see any evidence of fire or smoke. Dust was still coming from the building, and he said he saw injured and dead people all over the area. He said that people were shouting and screaming and that although he attempted to administer first aid, many victims could not be reached because the debris and objects falling from the HV building made it dangerous to approach them. The streets into the area were narrow and became congested with arriving vehicles,

hampering traffic flow into and out of the area.

- The Puerto Rico Secretary of Health was notified of the accident at 8:50 am and dispatched medical teams and Mental Health Crisis Counseling personnel. A medivac unit was dispatched to transport patients as necessary.
- The Disaster Preparedness Improvement Director of the State Civil Defense arrived about 9:00 am and assumed the role of incident commander, and coordinated the response efforts of participating agencies.
- At 9:15 am, the San Juan Civil Defense Department dispatched more search and rescue people.
- At 10:00 am, rescue groups entered the HV building, and some areas of the structure began to collapse. The rescue was discontinued until the Department of Housing, which is responsible for public safety related to the damaged buildings, arranged for structural engineers to assess the stability of the building.
- By 12:30 p.m., the engineers had identified those areas of the building believed to be stable enough for the rescue workers to enter. The Salvation Army and the American Red Cross also responded and provided support services.
- Representatives of the Federal Emergency Management Agency (FEMA) and the Puerto Rico Secretary of State, as Acting Governor, worked with the incident commander to coordinate the response.
- At 2:30 p.m., the Acting Governor requested a Presidential Declaration that the area in which the explosion occurred was a disaster zone. The President of the United States declared a state of emergency, and a FEMA representative then activated and coordinated the U.S. Urban Search and Rescue Task Force.
- A search and rescue team from Bayamon, Puerto Rico, arrived at 4:45 p.m. and joined the rescue operations. FEMA gave interim support to the local response forces by providing flatbed trucks for removing the damaged vehicles and by providing search dogs to help locate missing people.
- By 6:00 pm, an advance party of the FEMA Urban Search and Rescue Task Force had arrived, including personnel from Florida, New York, and California.
- At 7:15 pm, rescue teams reported a strong odor of gas in the debris of La California store.
- At 9:00 pm, the rescue was suspended again because of the instability of the building. By that time, 18 bodies had been found, and more than 80 people

had been transported to area hospitals. The building was reinforced at various locations and supported by a crane so that the rescue could continue. Search and rescue efforts continued on until December 21, when the bodies of the last four people reported missing were found, bringing the total of those who had died in the explosion to 33.

### **Key Lessons Learned**

- The San Juan Gas Company (SJGC) did not respond in a timely manner to complaints of odors of propane gas which eventually resulted in a propane gas explosion that produced mass casualty disaster.
- SJGC did not conduct an adequate hazard and risk assessment which contributed to the deaths of 33 people and the injury of 69 people.
- The incident had the potential for generating greater numbers of casualties. According to interviews with investigators, most stores were not yet open in the morning, consequently few shoppers were in the area at the time of the explosion and many employees had not arrived for work. The Humberto Vidal building usually held 50 or more employees, including 37 who worked in the offices, 7 who worked in the jewelry store, 12 who worked in the shoe store, and 2 who worked in the record store. On a routine business day, other people worked in adjacent buildings, and hundreds of shoppers and tourists came into or passed by the building during shopping hours.

Source: NTSB Report # PB97-916501 NTSB/PAR-97/01

**INCIDENT # 24  
NOVEMBER 5, 1996  
MURFREESBORO, TENNESSEE  
HAZARDOUS LIQUID PETROLEUM PRODUCTS PIPELINE OVERPRESSURE  
No Deaths, No Injuries, \$5.7 Million Damages  
<http://www.nts.gov/doclib/reports/1999/PAB9903.pdf>**

### **Summary of Incident**

On the morning of November 5, 1996, Colonial Pipeline Company (Colonial) was preparing to perform a maintenance operation that required that a section of pipeline be isolated and purged of product, which in this case was diesel fuel. The pipeline involved was 8-inch-diameter steel pipe used to transport hazardous liquid petroleum products from Colonial's Atlanta Junction in Georgia to its Nashville, Tennessee, delivery facility.

The affected section of the pipeline was between the Murfreesboro, Tennessee, pump station and the Nashville delivery facility. Colonial planned to begin the operation by blocking the line at the Murfreesboro station and allowing product to drain into the Nashville facility. With pressure and product volume decreased in the line, the company planned to introduce into the pipeline section a mechanical device called a pipeline pig that, propelled by pressurized nitrogen gas introduced in the pipeline behind it, would move down the pipeline and displace the remaining product.

A member of the project team at Murfreesboro called Colonial's pipeline controller in its Atlanta control center just before 9:00 a.m. eastern standard time to start the project.

The controller first shut down some pumps and opened a valve to divert product into its Lookout Mountain delivery facility. At 9:12:17 a.m., he closed the remotely controlled, electric-motor-operated mainline block valve at Murfreesboro.

Shortly after the block valve was closed at Murfreesboro, the controller's shift supervisor in Atlanta informed the controller that the plan had changed. Members of the project team had decided to restart the delivery to Nashville long enough to complete delivery of the product batch to the terminal that was currently on line there.

The controller did not reopen the electric block valve at Murfreesboro before resuming pumping product through the pipeline. Instead, at 9:19:08 a.m., he began starting pipeline pumps upstream of Murfreesboro, at Chattanooga, Signal Mountain, and Coalmont. He also slowed the delivery flow rate at Lookout Mountain. Contrary to procedures contained in Colonial's operating manual, the controller had started product flow in a blocked pipeline.

The increased pipeline pressure was registered at the Coalmont pump station, the first station upstream of Murfreesboro, but the overpressure shutdown set points at the station allowed the pipeline to be overpressureized before the protective device activated to shut the pump station down automatically.

With the pipeline continuing to operate, pressure was increasing at Murfreesboro. The controller did not note the overpressure condition that had developed at Murfreesboro, because the pressure transmitter for the station was downstream of the closed mainline block valve. The controller was not aware of the actual pressure transmitter location because the supervisory control and data acquisition (SCADA) system schematic for the Murfreesboro station erroneously depicted the pressure transmitter as located upstream of the electric block valve, as it was at most other stations on the pipeline.

The controller attempted to reopen the electric block valve at Murfreesboro for the first time at 9:35:02 a.m. Although the controller saw no indication of high pressure at the station because of the location of the pressure transmitter, pressure data evaluated after the accident indicated that a high differential pressure, at least 1,700 psig, existed across the valve at that time. This pressure exceeded the design limits (1,440 psi) of the motor used to remotely operate the valve, and the valve did not open.

Colonial's operating manual regarding abnormal operations requires that the controller shut down the pipeline immediately in the event of a blocked line. The controller did not attempt to shut down the line. Instead, during the next minute, he twice more sent commands to try to open the valve at Murfreesboro. He then called the station to request that a technician check the valve. A technician did check the valve and control equipment and found no problems. Next, the controller turned off pumps at the Coalmont and Signal Mountain stations and increased the flow rate at the Lookout Mountain delivery station, which would lower the pipeline pressure so the electric block valve could be opened. The valve opened on the controller's fourth attempt, made at 9:39:07 a.m. Unknown to the controller, the pipeline had already ruptured at approximately 9:36:21 a.m.

The pipeline ruptured at a longitudinal seam weld. The rupture occurred in a rural area about 46.2 miles downstream of the Coalmont station and about 10.9 miles upstream of the Murfreesboro station. The SCADA system indicated a sudden pressure drop of 416 psi at Coalmont station at 9:37:35 a.m.; however no SCADA alarms were generated as a result of the pressure drop. From this data, Colonial later calculated that the pressure had reached approximately 1,820 psig at the rupture site before the failure. The rupture depressurization wave was calculated to have taken 74 seconds to travel from the rupture site to Coalmont. From this data, the time of the failure is estimated to be approximately 9:36:21 a.m.

### **Probable Cause of Accident**

The probable cause of this accident was the failure of the pipeline operator to follow company procedures for operating the pipeline and the failure of the pipeline control and monitoring system to inform the operator of unsafe conditions prior to the rupture. Contributing to the severity of the accident was the delay in recognizing that a leak had occurred, which delayed shutting down the pipeline and isolating the rupture.

### **Emergency Response Action Taken**

- The line section containing the leak was isolated at 10:39:44 a.m. Colonial

activated its emergency procedures and began to search for a possible leak. Colonial crews were dispatched from the Murfreesboro station to examine the pipeline right-of-way, and a helicopter was used to fly over the pipeline route. At 11:20 a.m., Colonial notified the Tennessee Emergency Management Agency.

- After checking the SCADA overfill and shortage report to confirm the likelihood of a leak, Colonial personnel telephoned a leak report to the National Response Center at 12:23 p.m. Personnel in a helicopter discovered the site of the leak at 2:00 p.m.
- Colonial reported a release of approximately 84,700 gallons (2,017 bbl.) of diesel fuel. No fatalities or injuries were reported. The accident did not cause a fire or explosion.
- Colonial's low initial product recovery of 24 percent was influenced by geologic formations in the leak area. Most of the product entered sink holes or small caverns, and no signs of product were evident immediately after the leak. Colonial has conducted ground water remediation and product recovery under the oversight of the Tennessee Department of Environment and Conservation.
- Total diesel fuel recovered through October 1998 was about 36,500 gallons (867 bbl, or 43 percent of the total estimated spill). Diesel fuel recovery efforts continued by the company well after the spill.
- Expenditures by Colonial as of December 1998 totaled about \$5.7 million, which includes property damages, clean-up and recovery costs, and the value of lost product.

### **Key Lessons Learned**

There were no significant emergency response lessons learned document in this incident.

Source: NTSB Pipeline Accident Brief # DCA-97-FP-002

**INCIDENT # 25  
AUGUST 24, 1996  
LIVELY, TEXAS  
PIPELINE RUPTURE INVOLVING LIQUID BUTANE RELEASE AND FIRE  
2 Deaths, No Injuries, \$217,000 Damages  
<http://www.nts.gov/doclib/reports/1998/PAR9802.pdf>**

### **Summary of Incident**

On Saturday, August 24, 1996 about 3:26 pm, an 8-inch diameter steel pipeline transporting liquid butane operated by Koch Pipeline Company, LP ruptured and released a butane vapor cloud into the surrounding residential area. The butane vapor ignited as two residents in a pickup truck drove into the cloud. The occupants of the truck died from thermal injuries. About 25 families were evacuated from the area. Damages related to the accident exceeded \$217,000.

### **Probable Cause of Accident**

The major factors that contributed to the outcome of the incident were the adequacy of Koch's corrosion inspection and mitigation actions, and the effectiveness of Koch's public education program, particularly with respect to educating residents near the pipeline about recognizing hazards and responding appropriately during a pipeline leak.

### **Emergency Response Action Taken**

- At 3:29 p.m., Koch's supervisory control and data acquisition (SCADA) system generated a discharge pressure rate-of-change alarm at Nevada pump station. At 3:36 p.m., another rate-of-change alarm was generated at Nevada pump station, and the pipeline controller shut down the pump because of the unexplained pressure loss.
- At 3:39 p.m., Koch received a telephone call from an Oak Circle Estates resident reporting a pipeline leak near his home. Koch immediately began shutdown procedures for the entire pipeline, dispatched an employee to the accident site, and called the Kaufman County sheriff's department. During its call to the sheriff's department, Koch learned that the butane had ignited. The sheriff's department and 911 each received a call about the release at about the same time that Koch received its call.
- Following the shutdown of its pump stations, Koch began to isolate the

ruptured section of the pipeline by closing the manual block valves upstream (4:20 p.m.) and downstream (4:37 p.m.) of the rupture. At 5:25 p.m., Koch reported the release to the National Response Center. By 6:00 p.m. the next day, line-plugging equipment had been installed and used to isolate a section of pipeline about 100 yards on either side of the rupture. With the closing of the line-plugging equipment, the fuel was cut off and the fire extinguished within minutes.

### **Key Lessons Learned**

- The format and content of the public education bulletin mailed by Koch before the accident did not effectively convey important safety information to the public. The content of the 1996 bulletin sent by Koch prior to the pipeline accident as part of its public education package before the accident had two important shortcomings. The bulletin's first shortcoming was that key information on recognizing a leak and taking appropriate action lacked clarity and was not formatted to alert readers of its importance. In addition, the complex language used in the bulletin diluted the warning. For example, while the bulletin stated that vapors are extremely flammable, it also provided technical information on vapor ignition temperature and atmospheric concentration that distracted readers' attention from the message that such vapors pose a major hazard and require caution if their presence is suspected. The bulletin's second shortcoming was that the warning was not specific enough. It omitted crucial information such as warning people not to operate switches, equipment, machinery, or motor vehicles in or near a vapor cloud; not to light a match or smoke; and not to drive into or go back into the vapor cloud. Furthermore, the bulletin failed to urge readers to inform others in the household of the warning, which is a way to disseminate crucial safety information beyond the initial reader.
- Another significant issue involved the distribution of Koch's public education materials. Before the accident, Koch developed its mailing list through door-to-door canvassing and then used response card returns to verify the accuracy of coverage in the accident area. However, during the 1996 mailing, only 5 of the 45 residences near the accident site were sent Koch's educational materials. Significantly, Koch's 1996 mailing list did not include the two families that suffered fatalities in the accident. In all, Koch's mailing on the dangers of a pipeline release and actions to take during a pipeline emergency reached only a limited number of people living near the accident location. Since the accident, Koch has improved the information presented in its educational bulletin and its method for distributing public education materials.



## Key Lessons Learned

There were no significant emergency response lessons learned documented in this incident.

Source: NTSB Report # PB98-916503 NTSB/PAR-98/02/SUM

**INCIDENT # 26  
MAY 23, 1996  
# 26 GRAMERCY, LOUISIANA  
PETROLEUM PRODUCTS PIPELINE RUPTURE  
No Deaths, No Injuries, \$7 Million Damages  
<http://www.nts.gov/doclib/reports/1998/pab9801.pdf>**

## Summary of Incident

On May 23, 1996, a pipeline controller was on duty in Marathon Pipe Line Company's pipeline operations center in Findlay, Ohio, operating and monitoring a 68-mile-long segment of Marathon pipeline located in Louisiana. The pipeline was used to transport hazardous liquids between a refinery at Garyville, Louisiana, and a station at Zachary, Louisiana. Pumps at the Garyville refinery pressurized the pipeline and generate the power to transport the liquids to the Zachary station.

About 9:53 p.m. central daylight time on May 23, the pipeline controller had just completed operations to transport a batch of unleaded gasoline through the pipeline. He then remotely executed commands to introduce into the pipeline (behind the gasoline) a batch of 125,000 barrels of low-sulfur diesel fuel.

About 10 p.m., unknown to the controller, the pipeline ruptured at a location near Gramercy, Louisiana. At 10:01:53 p.m., the supervisory control and data acquisition (SCADA) system reported high-pump-case pressure at Garyville. The SCADA system activated an audible alarm and also displayed a message on a display screen. Almost immediately, the SCADA system sounded and displayed alarms reporting that certain pumping units at the Garyville station had automatically shut down because of low suction pressure (low liquid pressure on the inlet side of the pump). At 10:02:30 p.m., the SCADA system reported a line balance alarm.

The pipeline controller said he initially believed that the alarms resulted from activity at the refinery adjacent to the Garyville station. He said that on occasion the refinery would deliver product from the pipeline to river barges, an operation

that sometimes decreased the pipeline pressure sufficiently to cause the SCADA system to alarm and to automatically shut down pumping units. According to the controller, this scenario had, in fact, occurred a few days before the accident. The pipeline controller continued to receive alarms. Initially, he acknowledged each one individually, but believing that each subsequent alarm was related to operations at the refinery, he elected to simultaneously acknowledge all the alarms and the alarm text messages without attending to the nature of each alarm. The controller said he had anticipated a positive differential line balance alarm because of the shutdown of the pumping units. He said he therefore did not read the full alarm message on the SCADA screen and consequently did not notice that the line balance alarm was reporting a negative differential (indicating that less product was exiting the pipeline at Zachary than was being introduced at Garyville).

The controller said he called Garyville and discussed the situation with the station operator there. The station operator confirmed the automatic pump shutdowns. The station operator determined that the Garyville refinery was, indeed, loading product to a barge. Even though refinery personnel reported that the volume of product being delivered was insufficient to have caused the SCADA system to alarm, the pipeline controller and the station operator concluded that the loading of the barge had precipitated the alarms and the pump shutdowns.

About 10 minutes after the initial alarm, the controller attempted to restart the pumps that had shut down automatically. The pumps restarted, but went down again. At 11:00:30 p.m., about 1 hour after the pipeline rupture, the controller received another line balance alarm. This time, he closely examined the data and also checked the readings of the flow meters for the Zachary station. Determining that product was leaking from the pipeline, he immediately initiated emergency action. Marathon crews were dispatched to the site, determined the approximate leak location, and completed manual closure of valves on either side of the rupture at approximately 2:30 a.m. on May 24, 1996. Closing these valves isolated the rupture site within an approximate 3.5-mile segment of the pipeline. The ruptured pipeline ultimately released about 475,000 gallons of gasoline into a common pipeline right-of-way and marsh land. Gasoline also entered the Blind River, causing environmental damage and killing fish, wildlife, and vegetation in the area. After the accident, Marathon arranged for the deployment and construction of containment and sorbent booms, berms, and fencing at several locations to minimize damage and deter public access.

Investigation of the rupture site revealed an approximate 200- by 100-foot excavation area that extended over the Marathon pipeline and included the rupture site. Investigators found a longitudinal crack approximately 53 inches long near the top of the pipe. In the area of the crack were multiple dents, scrapes, and gouges that were consistent with damage that would be made by a

backhoe or similar digging tool.

The investigation determined that in 1995, LaRoche Industries, Inc., arranged for excavation of and repairs to various portions of its 8-inch pipeline, which was located about 30 feet from the Marathon pipeline. These excavations took place in September and October 1995 in the vicinity of the Marathon pipeline rupture. According to Louisiana law, an excavator, before beginning work, must use the Louisiana One Call system to ensure that no buried utilities will be affected by the excavation. No evidence was found that LaRoche or its excavation contractor used the Louisiana One Call system or made any attempt to coordinate the excavation activities with Marathon or any of the other operators with pipelines in the vicinity of the excavation near the site of the eventual rupture.<sup>5</sup> According to officials from LaRoche's contractor, the equipment operators were told by LaRoche superintendents that no pipelines were located in the area of the Marathon pipeline. A LaRoche superintendent who supervised the excavation stated that when the excavation work was completed, the excavation crew did not fill in the excavated area. According to Marathon officials, the company was not informed by LaRoche or LaRoche's excavation contractor of any incident or activity involving its pipeline in the area of the eventual rupture. Other pipeline operators with pipelines in the area of the Marathon pipeline told the investigators that they had not performed any excavation work in the area of the rupture since at least May 1990.

### **Probable Cause of Accident**

The probable cause of the accident was damage done to the Marathon pipeline during excavations of a nearby pipeline operated by LaRoche Industries, Inc., which resulted from the failure of LaRoche Industries, Inc., either to take adequate measures to ensure that excavations performed under its supervision did not damage underground utilities or to notify Marathon Pipe Line Company that those excavations may have damaged the Marathon pipeline. Contributing to the severity of the accident was Marathon's delay in recognizing the rupture, which delayed shutting down the pipeline and isolating the rupture.

### **Key Emergency Response Lessons Learned**

There were no lessons learned documented in this investigation.

Source: NTSB Pipeline Accident Brief # DCA-96-MP-004

**INCIDENT # 27**  
**JUNE 26, 1996**  
**FORK SHOALS, SOUTH CAROLINA**  
**PIPELINE RUPTURE AND RELEASE OF FUEL OIL INTO THE REEDY RIVER**  
**No Deaths or Injuries, \$20.5 million damages**  
<http://www.nts.gov/doclib/reports/1998/PAR9801.pdf>

### **Summary of Incident**

About 11:54 p.m. eastern daylight time on June 26, 1996, a 36-inch-diameter Colonial Pipeline Company pipeline ruptured where a corroded section of the pipeline crossed the Reedy River at Fork Shoals, South Carolina. The ruptured pipeline released about 957,600 gallons of fuel oil into the Reedy River and surrounding areas. The estimated cost to Colonial for cleanup and settlement with the State of South Carolina exceeded \$20.5 million. No one was injured in the accident.

### **Probable Cause of Accident**

The major contributing factors in the accident were the effectiveness of Colonial's operations management in ensuring that the pipeline was operated within safe pressure limits; adequacy of the training given to controllers and shift supervisors as it relates to preparing them to recognize and effectively respond to abnormal conditions, emergency situations, and leaks in the pipeline; and effects of Colonial controller work schedules on safe pipeline operation.

### **Emergency Response Action Taken**

- Colonial's cleanup contractors were called at 1:15 a.m. on June 27, 1996. Local police departments were notified at 2 a.m.
- At 2:15 a.m., Colonial emergency response and other personnel were called. The National Response Center was notified at 2:34 a.m.
- Eight cleanup areas were established along the river downstream of the pipeline rupture, as well as a cleanup area at the leak site itself. According to Colonial, by July 8, 1996, the company had recovered 897,120 gallons of the spilled fuel oil. By January 30, 1998, an additional 4,136 gallons had been collected from groundwater recovery wells near the spill site, bringing the total recovered to 901,256 gallons, or about 94 percent of the amount spilled.

## **Key Lessons Learned**

There were no key emergency response lessons learned documented in this incident.

Source: NTSB Report # PB98-916502

**INCIDENT # 28**  
**OCTOBER 17, 1994**  
**WATERLOO, IOWA**  
**GAS DISTRIBUTION PIPELINE EXPLOSION AND FIRE**  
**6 Deaths, 7 Injuries, \$250,000 Damages**  
<http://www.nts.gov/doclib/reports/1998/PAB9802.pdf>

## **Summary of Incident**

At 10:07 a.m. central daylight savings time on Monday, October 17, 1994, a natural gas explosion and fire destroyed a one-story, wood frame building in Waterloo, Iowa. The force of the explosion scattered debris over a 200-foot radius.

Six persons inside the building died, and one person sustained serious injuries. Three persons working in an adjacent building sustained minor injuries when a wall of the building collapsed inward from the force of the explosion. The explosion also damaged nine parked cars. A person in a vehicle who had just exited the adjacent building suffered minor injuries. Additionally, two firefighters sustained minor injuries during the emergency response. Two other nearby buildings also sustained structural damage and broken windows.

## **Probable Cause of Accident**

The probable cause of the natural gas explosion and fire was stress intensification, primarily generated by soil settlement at a connection to a steel main, on a 1/2-inch polyethylene pipe that had poor resistance to brittle-like cracking.

## **Emergency Response Lessons Learned**

There were no emergency response lessons learned documented for this incident.

Source: NTSB Pipeline Accident Brief # DCA-95-MP-0

**INCIDENT # 29**  
**MARCH 23, 1994**  
**EDISON, NEW JERSEY**  
**NATURAL GAS PIPELINE EXPLOSION AND FIRE**  
**1 Death, 93 Injuries, \$25 million damages**  
<http://www.nts.gov/doclib/reports/1995/PAR9501.pdf>

### **Summary of Incident**

On March 23, 1994, around 11:55 pm, a 36-inch diameter pipeline owned and operated by Texas Eastern Transmission Corporation ruptured catastrophically in Edison Township, New Jersey, within the property of Qualify Materials, Inc., an asphalt plant. The force of the rupture and of natural gas escaping at a pressure of about 970 psig excavated soil around the pipe blew gas hundreds of feet in the air, propelling pipe fragments, rocks, and debris more than 800 feet. Within 1 to 2 minutes of the rupture, one of several possible sources ignited the escaping gas, sending flames upward 400 to 500 feet in the air. Heat radiating from the massive fire ignited several building roofs in a nearby apartment complex. Occupants, alerted to the emergency by noises from escaping gas and rocks hitting the roofs, fled from burning buildings. The fire destroyed 8 buildings. Approximately 1,500 apartment residents evacuated.

Most injuries were minor foot burns and cuts that apartment residents sustained from the hot pavement and glass shards as they fled the complex. Response personnel evacuated 23 people to a local hospital and another estimated 70 residents made their own way to hospitals where they were treated and released. No resident of the apartment complex suffered a fatal injury as a result of the accident, however, a woman who lived about a mile from the incident and who had a history of heart trouble suffered a heart attack and died shortly after the rupture and fire.

### **Probable Cause of Accident**

The probable cause of the rupture was mechanical damage to the exterior surface of the pipe that reduced the wall thickness and likely created a crack in the gouge that grew, most likely through metal fatigue, to critical size. Contributing to the rupture were the brittle properties of the pipe material at the operating temperature.

### **Emergency Response Action Taken**

- At 11:56 pm, an Edison police officers patrolling in his car reported the accident to his headquarters, An estimated 200,000 calls were made to the

Edison Township 911 within an hour of the rupture.

- At 11:57 pm, the Edison Township Fire Department dispatched three engines and a ladder truck, which arrived at the apartment complex about 12:02 am, on March 24. Before leaving the station, firefighters saw the intensity of the fire and called for additional units to respond. When firefighters arrived at the rupture site, number 12 apartment building was fully involved in fire and three buildings adjacent to it were rapidly becoming involved in fire. When firefighters attempted to get close to building 12, the heat from the massive fire cracked the tail light lenses and began to char the paint on fire apparatus. Firefighters then moved a short distance south of building 12, where they continued fire and rescue operations. They could not suppress the fires in the eight buildings closest to the gas flame, so they concentrated on containing the fire by wetting down adjacent buildings.
- Emergency responders established a medical command post and triage area at 12:20 am and an incident command post (ICP) at 12:30 am on Talmadge Road, about ¾ mile from the rupture. The Edison Township Fire Chief served as the incident commander for all operations and the Edison Police Department staffed the ICP.
- At 12:30 am the IC established a staging area for emergency response personnel and equipment at the Pines Manor Banquet Hall parking lot on Route 27, about 1-1/2 miles from the rupture. By 12:30 am firefighters were able to prevent the spread of the fire to additional buildings.
- TETCO conducted annual emergency response association briefings and a general meeting with emergency responders. TETCO also provides a map to showing the locations of its pipelines. The Edison Fire Chief stated that because of the many pipelines in the area, his department receives too many invitations for his staff to attend all of the training sessions offered by pipeline operators. He believed the information provided at a training session conducted by one company was reasonably applicable to other pipeline operations and that its personnel are adequately knowledgeable about the actions to take when dealing with pipeline emergencies.

### **Key Lessons Learned**

There were no key emergency response lessons learned documented for this incident.

Source: NTSB Report # PB95-916501 NTSB/PAR-95/01

**INCIDENT # 30**  
**JUNE 9, 1994**  
**ALLENTOWN, PENNSYLVANIA**  
**NATURAL GAS DISTRIBUTION PIPELINE EXPLOSION AND FIRE**  
**1-Fatality, 66-Injuries, \$5 Million Damages**  
<http://www.nts.gov/doclib/reports/1996/PAR9601.pdf>

### **Summary of Incident**

About 6:45 p.m. on June 9, 1994, a 2-inch-diameter steel gas service line that had been exposed during excavation separated at a compression coupling about 5 feet from the north wall of John T. Gross Towers, an eight-story retirement home operated by the Allentown Housing Authority at Allentown, Pennsylvania. The failed UGI Utilities, Inc., service line released natural gas at 55 psig pressure, and the escaping gas flowed underground to Gross Towers. The gas passed through openings in the building foundation, entered the mechanical room through floor vents, and migrated to other building floors.

An Environmental Preservation Associates, Inc., employee, who had been using a backhoe to excavate fuel-contaminated soil from the area, detected the odor of gas and heard a third-floor resident shout that she smelled a strong gas odor. The employee went to a building entrance and encountered a very strong odor of natural gas. He told his foreman, who, after having the backhoe shut down, telephoned the gas company and the housing authority, telling them of the gas odor. The foreman then instructed other employees to locate and shut off the gas line valve.

About 6:58 p.m., the natural gas that had accumulated within the building was ignited, causing an explosion. A second explosion occurred about 5 minutes later. At the time of the explosion, many of the Gross Towers and Towers East residents were out of the building. The accident resulted in 1 fatality, 66 injuries, and more than \$5 million in property damage.

### **Probable Cause of Accident**

The probable cause of the natural gas explosion and fire at Gross Towers in Allentown, Pennsylvania, was the failure of the management of Environmental Preservation Associates, Inc., to ensure compliance with OSHA's and its own excavation requirements through project oversight. Contributing to the accident was the failure of the workmen from Environmental Preservation Associates, Inc., to notify UGI Utilities, Inc., that the line had been damaged and was unsupported.



Contributing to the severity of the accident was the absence of an excess flow valve or a similar device, which could have rapidly stopped the flow of gas once the service line was ruptured. Also contributing to the severity of the accident was the absence of a gas detector, which could have alerted the fire department and residents promptly when escaping gas entered the building.

### **Emergency Response Action Taken**

- The excavation foreman called UGI and reported a gas leak. UGI's procedures did not require UGI's gas control center to notify the Allentown Fire Department.
- The initial caller from the excavation company did not indicate to the UGI control center that there was an imminent threat so the fire department was not notified. The failure of UGI to notify the fire department of the incident resulted in a 15-minute delay in the emergency response.
- Once the fire department arrived at the incident scene the excavation crew did not advise the firefighters that they had unsuccessfully attempted to close the valve on the gas meter at the apartment building.
- UGI had conducted gas emergency training for the Allentown Fire Department. The fire department had been trained by the gas company one month before the incident.
- UGI did have an Emergency Response Plan which met the requirements of 49 CFR 192.165. (See page-19 of NTSB report for a discussion on the ERP.)
- The fire department had procedures for preventing accidental ignition from a gas leak, ventilating buildings of accumulated gas, shutting off service lines at the meter or the curb valve, if possible, and communicating with the UGI representative on scene.
- When the Communication Center alerted the fire department, at 6:59, it dispatched three engine companies, one aerial unit, and one command car. When they arrived, the emergency on-scene coordinator (coordinator), an assistant fire chief, learned that occupants were trapped by heavy smoke on the seventh floor and that several residents were trapped in an elevator. After UGI personnel shut off the valve, emergency-response personnel searched each floor to ensure that all residents had been evacuated.
- The fire department used the city's mass casualty incident plan, and the coordinator used the fire department's incident command system.
- Allentown and the housing authority recognized the unique challenges presented by having to respond to an emergency involving a densely

populated high-rise building inhabited by elderly and handicapped people. The city and the authority worked together closely in developing and testing preparedness plans. The National Transportation Safety Board attributed the efficient evacuation of the building to the preparedness of the city agencies and the authority. Because the city and the authority had been so careful about preparing the residents, they knew what to do before and during the evacuation. For example, the residents were able to instruct the untrained volunteer responders about how to evacuate people requiring assistance. The emergency responders put the fire out and took care of the displaced residents efficiently. The Safety Board concluded that the emergency response was well coordinated and effective in reducing further injury.

Special Note: The circumstances of the June 9, 1994 Allentown, PA incident are very similar to the July 22, 1993 gas explosion of an eight-story apartment building in Saint Paul, Minnesota. A Department of Public Works (DPW) backhoe doing excavation stuck a 1-inch plastic gas line. The DPW procedures required notification of the DPW control center and the fire department was not immediately notified. The explosion and fire killed 1 apartment building occupant and injured 12 people. The fire department response was delayed by 20-minutes. The Saint Paul Fire Department had conducted a full-scale exercise involving a simulated building collapse with 45 injuries just two months before the incident.

### **Key Lessons Learned**

There were no key emergency response lessons learned documented for this incident.

Source: NTSB Report # PB96-916501 NTSB/PAR-96/01