



**Survival Factors Attachment -Pinal
County Fire Investigation Team
(PCFIT)
Final Investigation Report**

Coolidge, Arizona

PLD21FR003

(9 pages)

Incident Number

2022-06948 CGFD

Fire Investigator

J. Lodge CGFD

S. Johnson FFD

Casa Grande Fire Department***377 W Val Vista Blvd******Casa Grande, AZ 85122******520-421-8777*****INTRODUCTION**

On August 15, 2021, at approximately 05:29 hours, an explosion occurred in the 5300 block of S. Vail Rd. in the city of Coolidge, County of Pinal, State of Arizona. The explosion was focused above the El Paso Pipeline along the east side of the street. Approximately 150 to 200 yards to the northwest was a single-family home that sustained heavy damage from the blast. The fire from the gas line then caused the home to ignite.

BACKGROUND

At approximately 08:30, I, Fire Investigator Jon Lodge IAAI-CFI, was contacted by the Pinal County Fire Investigation Team (PCFIT) Coordinator, Casa Grande Fire Marshal Michael Wobser, to respond to 4490 N Vail Rd. The request for assistance was received from Coolidge Fire Department Chief Mark Dillon. Chief Dillon stated that an explosion occurred in the area and caught the residence on fire. Once the pipeline was shut down and fire from the line controlled, suppression efforts started on the house. During suppression efforts, Firefighters located what they believed to be two bodies at the south end of the residence.

Upon arrival Chief Dillon requested the Pinal County Fire Investigation Team lead the investigation into the cause of the fire. Roles were assigned, and it was established that the knowledge and resources needed were beyond those of the PCFIT. An additional request for assistance was made to the Bureau of Alcohol, Tobacco, and Firearms (ATF). ATF referred the request to the National Transportation Safety Board (NTSB), which regulates pipeline transportation. The investigation continued as a joint effort between NTSB and PCFIT.

INVESTIGATION TASKS

- August 15, 2021 – Received assignment and conducted scene safety survey.
 - Additional calls were made to ATF and NTSB.
 - Coordination with Coolidge Police and Fire for the security of the scene throughout the investigation.
 - Removal of remains with the medical examiner.
- August 16, 2021 – Witness autopsies
 - Start Scene examination and documentation.
 - Briefing with Coolidge Police Detectives, PCFIT, NTSB
- August 17, 2021 – Continue scene examination
 - Daily debriefing with interested parties.
- August 18, 2021 – Continue scene examination
 - Start room reconstructions
- August 19, 2021 – Continue scene examination
 - Received Computer-Aided Dispatch Timeline of event

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- Received audio recordings of dispatch and 911 calls
- August 20, 2021 – Completed documentation of the scene.
 - Took possession of evidence for safekeeping from NTSB
- August 21, 2021 – Returned evidence items to NTSB.

REVIEWED ITEMS

- Pinal County Residential Property Profile for 4472 S Vail Rd Coolidge, AZ. 85128. (Parcel Number 401210780) (Google Maps and County Assessor differ on North and South Vail.)
- Weather report from www.weatherunderground.com –Los Arboles Station (Coolidge, AZ) Weather Station.
- National Fire Protection Association (NFPA) 921, *Guide for Fire and Explosion Investigations*, 2021 Edition.

STATEMENTS

- See supplemental reports from Florence Fire Department Firefighter Stephen Johnson.
- See NTSB Survival Factors Factual Report for Accident Number PLD21FR003.
- See Coolidge Police and Fire Reports.

SITE EXAMINATION

The one-story single-family residential structure was located at the Northeast corner of Vail Road and Randolph Road.

The residence's front door (main entrance) was located on the structure's west side (Figure 1). The residence was located on the Kelly Freeman Farm. The fire originated from the Kinder Morgan El Paso Pipeline, located approximately 200 yards southeast (Figure 2). The pipeline was a 30-inch line with a burry depth of approximately 10 feet below grade. The images of responding fire crews showed flame jets extending from both sides of the ruptured pipe (Figure 3). The pipeline was used to transport Natural Gas from Texas to California, according to representatives from Kinder Morgan.



Figure 1: Residence from south (pre-fire)

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Figure 2: Flame Jet from pipe site.

Figure 3: Residence within the yellow circle. The star indicates the pipeline burst site.

Examination of the site started at the south wall of the residence. This deviation from methodology was due to the remains of two bodies in this area. With the assistance of the Medical Examiners' office, the PCFIT layered the area around both bodies. The first body was identified by bone structure as a teenage female. The second was identified by mass and bone density as an adult male. While layering the area, the female was positioned on what appeared to be a bed mattress. The mattress sat along the south wall with the head of the bed in the Southwest corner of the room. Under the window. The male body was approximately one and a half to two feet from the female. The male was positioned on the floor with his legs under the air handler that fell through the roof.

After both bodies were removed from the residence, a four-foot area around the bodies was layered to the foundation. This layering was completed to ensure all bone fragments were collected as large portions of both bodies were cremated in the fire. The larger debris on the top

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was roofing material and was removed to a pile outside the structure. Under this layer was small debris of drywall, wood frame, and concrete consistent with stucco from an exterior wall.

Once members of NTSB arrived on site, it was determined that they would investigate the pipeline site. PCFIT focused on the residence. Examination continued from the exterior of the residence. The south and east walls were pushed into the structure before the roof collapsed (figure 4). The west wall had fallen outward. The north wall also fell outward from the structure. The trailer and covered carport protected the northeast side of the residence. (See figure 1 with the white trailer on the left of the photo.)



Figure 4: South wall looking north.

The remainder of the structure was layered, moving outward from the south wall. See photos for progression through the structure. Within the room where the bodies were located, a tv stand was located in the southeast corner, and two dog kennels were located along the north and west walls. Attached to the east wall was a laundry room added to the main structure. The

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laundry room floor was burned through and fell onto the dirt below. The door to the room was located on the northwest wall. Across the hall was the main bathroom. In the southwest corner of the residence was another bedroom with two beds. The master bedroom was located on the north wall.

Within the debris throughout the house, very little wood was located. The fire had burned through the structure with enough intensity to consume most of the studs. The debris from the south wall to the original north wall was cleared to expose the concrete foundation. It was found the Master bedroom was an addition to the original construction. Fire effects on the concrete showed the fire started in the south bedrooms of the residence and spread to the north. As the fire reached the original wall, it wrapped the kitchen wall and entered the master bedroom.

See NTSB Survival Factors Report for further information on the scene, witness statements, and facts obtained throughout this investigation.

OPINIONS

The pipeline's failure caused the displacement of the earth to be pushed several feet in the air. The subsequent gas explosion was felt throughout the community and as far as 17 miles away by residents of the Town of Florence and the City of Casa Grande. A doorbell video camera also captured the incident nearly four miles from the site. The blast wave could also be tracked from the site to the camera location.

The blast and debris were felt approximately 3,865 feet west and 3,900 feet north by a Union Pacific Railroad employee. The employee stated the pressure front of the blast also knocked him back. This employee and another reported dirt "raining down" on them after the explosion.

Following the blast, the flame front caused measurable damage up to 400 - 600 feet away. After the explosion, a flame jet was sustained by natural gas from the severed pipe. Radiant heat damage was observed up to 800 feet away from the flame. The size of the flame jet produced could be seen from several miles away. Based on the photos and Unmanned Aerial Vehicle (UAV = Drone) video, the height of the flame jets reached over 150 feet above ground level. A deputy with the Pinal County Sheriff's Department assigned to assist with traffic control $\frac{3}{4}$ of a mile away compared looking at the scene to looking at the sun. The deputy also stated he was able to feel the radiant heat from the fire at this location.

The only livable structure within this area was 4490 N Vail Rd. The blast first caused structural damage to the south wall of the residence. The subsequent fire ignited the wood frame and contents within. The fire continued to burn till members of Kinder Morgan were able to locate shutoff valves approximately a half-mile away.

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CONCLUSIONS

Natural Gas ignites at approximately 1,200°F. The pipe rupture released several hundred cubic feet of gas into the atmosphere. The quantity released placed the immediate surrounding area within the flammable limits for ignition. The rupture also caused damage to the high voltage power lines running parallel to the pipeline. An electrical arc accrued due to the damage caused to the power lines. An electrical arc averages between 5,000° and 35,000°, well over the minimum temperature needed to ignite the vapor cloud of natural gas. This caused the flame in front of the explosion.

Due to the size of the explosion, contact was made with an ATF explosives expert. He assisted in the calculation of the blast pressure and survivability based on a reasonable degree of certainty. Together with ATF, the blast was evaluated based on the video from the Ring doorbell and other information gained through the investigation. Using the ground displacement as the start of the event and the explosion (flame front) 10 seconds later. The TNT Mass Equivalent was calculated to be approximately 2,350 pounds of TNT. The effects of this size explosion would include shattering all the residence windows and several vehicles within the blast's direct line. Based on the distance from the explosion, anyone in the south bedrooms or living room would have a 100% rupture of the eardrum. This size blast and distance would also result in an estimated 67.8% lethality due to the rupture of hollow organs, such as lungs. A second calculation was completed and accounted for the least gas collection time (approximately 5 seconds). The calculated TNT Mass Equivalent at 5 seconds was 1,175 pounds of TNT. The blast would have a 52% lethality at this level due to lung damage. The damage to the windows on the south side of the house would be the same.

This information is consistent with the findings of the structure's conditions and witness accounts. The two deceased victims were found in locations consistent with the blast's effects. It is presumed the young female was in bed at the time of the blast and did not survive. The male is presumed to have been in the living room or kitchen at the time of the blast. He made his way to the bedroom in an attempt to retrieve the female. A third victim was identified and was able to escape the residence through the master bedroom window. The female was severely injured when she made her way up Vail Rd to the deputies conducting traffic control for the fire. This victim was flown to a burn unit and placed in a medical coma due to her injuries. At the time of this report, she could not be interviewed due to medical intervention.

Based on the information available at the time of this report, I conclude that the cause of the fire was due to a failure of the underground high-pressure gas line. The conclusion as to the cause of the failure will be determined by investigators with NTSB. The damage to the residence and casualties resulted from the explosion and subsequent fire and did not contribute to the cause.

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APPENDICES

See the NTSB accident report for additional supplemental information.

Appendix A: 2853 Digital Photographs taken throughout the scene investigation

Appendix B: Coolidge Fire Department UAV Photos and Videos

Appendix C: Medical Examiners report 21-0889 photos and report

Appendix D: Medical Examiners report 210890 photos and report

Appendix E: Coolidge Police Dispatch Recordings

Addendum to:

Survival Factors Attachment- Pinal County Fire Investigation Team (PCFIT) Final Investigation Report

Note: The Pinal County Fire Investigation Team, also referred to as the Pinal County Task Force in various NTSB Factual Reports of the Investigation, has included several appendices in their final report of the investigation. The NTSB has elected not to release the appendices from this report in the docket. All inquiries regarding supplemental information and the content of this report should be referred to the Office of the Fire Chief, Casa Grande Fire Department, AZ at fire@casagrandeaz.gov.