



Durango Fire & Rescue Authority
Fire Investigation (Explosion) Report
Incident #00001-2008-000718-00
Address: 750 Main Avenue
Date & Time: February 22, 2008 @ 1340 Hours

Submitted by:
Karola J. Hanks
Fire Investigator DFRA

History

On February 22, 2008 at approximately 1340 hours, Durango Fire & Rescue Authority was paged to a report of smoke and flames in the Restaurant known as Seasons Grill located at 764 Main Avenue. A *Cause and Origin Report of the fire at 764 Main Avenue* was prepared by Fire Marshall Kaufman from the Durango Fire & Rescue Authority and can be seen in Appendix A of this report.

The fire that originated in 764 Main Avenue spread to 758 Main Avenue, otherwise known as ½ Price T's.. Approximately 40 to 50 minutes after the page out for the fire at 764 Main Avenue the structure adjacent to 758 Main Avenue suffered a major explosion. This structure was known as Le Rendezvous and was addressed as 750 Main Avenue. At the time of the explosion firefighters were engaged in activities on the roof of 750 Main Avenue causing injuries to firefighter personnel. Fire Chief Dan Noonan ordered an investigation into the explosion.

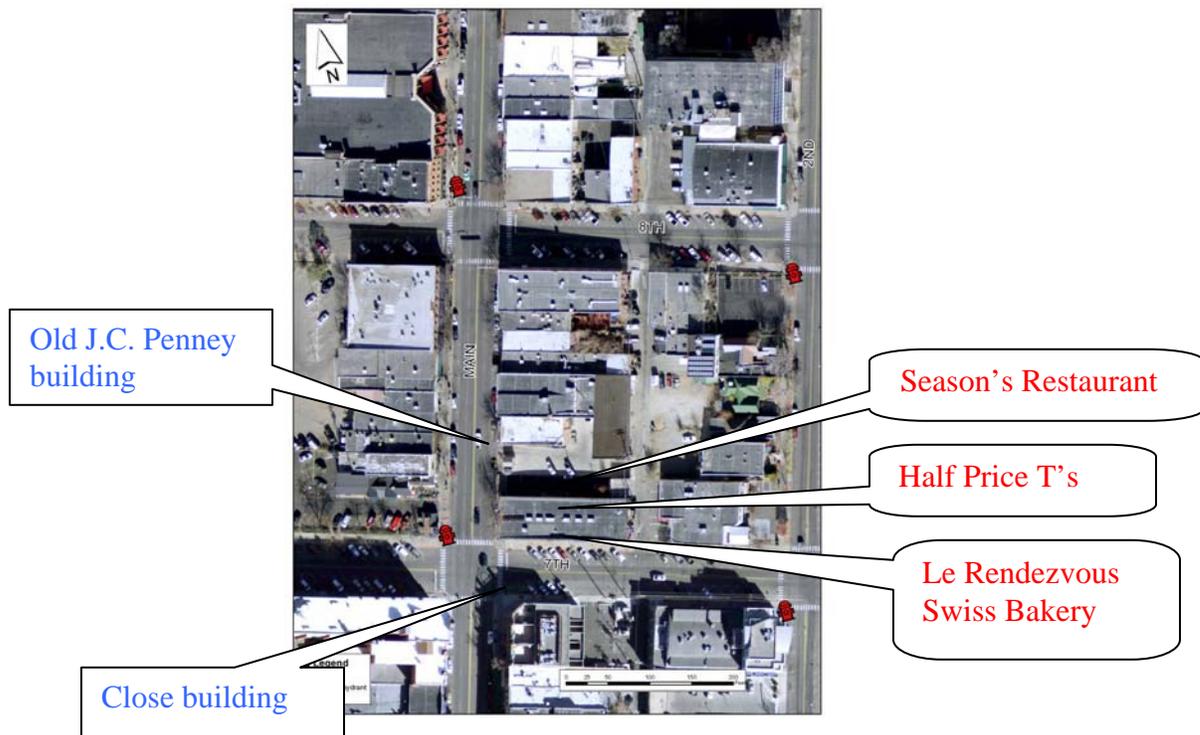


Figure 1: Overhead view of 700 block of Main

Chain of Events

In order to understand and analyze the events leading up to the explosion, the incident has been broken down into ten minutes intervals. The ten minute segments may not include all of the activities and events during each ten minute interval due to difficulty in determining exactly when the activity or event occurred. Notes taken by command staff during the incident did not include time frames and the incident had switched from the

main radio channel to a TAC channel which was not recorded. See Appendix B for time line charts that were created from dispatch tapes and command notes.

1340 to 1350 Hours on Feb. 22, 2008

911 Durango Dispatch Center received multiple calls regarding smoke and flames visible on the roof of the Seasons Grill located at 764 Main Avenue at approximately 1340 hours. Durango Fire & Rescue Authority is dispatched at approximately 1341 hours. Durango Police Department Officer arrives on scene at 1344 hours and reports flames visible on the roof of Seasons Grill and that Seasons Grill was being evacuated. At 1345 hours Fire 404 and Fire 4 arrive on scene and report light smoke only visible. At 1346 hours both Seasons Grill and ½ Price T's are evacuated. E2 arrives at this time with Engineer Sean Schmida, Acting Officer in Charge Larry Vaughn and Firefighters Donna Dignan and Jen Sokel. E2 begins deploying hose lines at 1347 hours. At 1348 E1 arrives on scene and catches a hydrant. The report at this time is that there is light to moderate smoke in Seasons Grill. At 1349 L2 arrives on scene and at 1350 hose is laid from E1 to L2 and E2. Medic 2 arrived on scene at 1348 hours and was assigned to the alley which became the C Side.

It is important to note that Durango Fire & Rescue Authority had multiple apparatus and personnel at a motor vehicle accident at the time of the page out. Ladder 2 was in route to fuel at the time of the page out as well which accounted for why there was only one personnel in the ladder at deployment.

There is what appears to be discrepancy in the reports during the initial ten minutes regarding smoke and flames. After evaluating photos that were taken prior to the fire departments arrival we find that the report of smoke and flames visible on the roof to be accurate and were of great assistance to the Cause and Origin Investigation performed by Fire Marshall Kaufman. See figure 2. Fire personnel were also accurate in their report of smoke only showing at the time of their arrival.



Figure 2: Ellis Photo from across street prior to Fire Department arrival

Ellis took the photo shown in figure 2 prior to the arrival of the Fire Department. She then ran across the street and took the photo shown in Figure 3 from the bathroom window in the Gardenschwartz building located at 780 Main Avenue.



Figure 3: Ellis photo of Seasons Grill roof

Figure 2 shows smoke and flames on the Seasons Grill roof in the area of the exhaust fan. Multiple reports from individuals both in Durango and in areas as far away as Kentucky have indicated that the smoke from Seasons Grill was seen up to one hour before Fire Department arrival on the downtown camera located on the building across the street. The camera output was displayed on a web site operated by Brainstorm Internet. The camera footage was not recoverable from the web. The calls to dispatch at 1340 hours were generally from individuals inside the restaurant when smoke became visible in the dining area with the exception of a meter reader who entered the building to tell them to evacuate because she could see smoke on the roof. At the time the fire department arrived the smoke column had decreased in size and the majority of the flames were no longer visible.

The Cause and Origin Investigation states that the fire originated “in the upper portion of the hood system in Season’s Restaurant” and subsequently involved the duct work over the wood fired grill. It was discovered that the hood suppression system had deployed. The fire then extended up the wall assembly and into the common attic with 758 Main Avenue. See Appendix A for the full Cause and Origin Investigation. Building construction in the 700 block of Main Avenue was found to have been completed in the late 1890’s and prior to 1905. 764 Main Avenue and 758 Main Avenue were used as one structure prior to their uses at the time of the fire. Each of the buildings had been renovated numerous times prior to the fire which assisted in the creation of vertical and horizontal void spaces. This is true for 750 Main Avenue as well.

Fire Captain Bob Harms produced a rough construction design of attic spaces in the destroyed buildings, see Figure 4. It can be seen in this drawing that there is a common

attic between 764 Main Avenue (Seasons Grill) and 758 Main Avenue (1/2 Price T's). The drawing does not show false ceilings in 764 and 758 Main Avenue as this evidence was consumed by fire following the explosion.

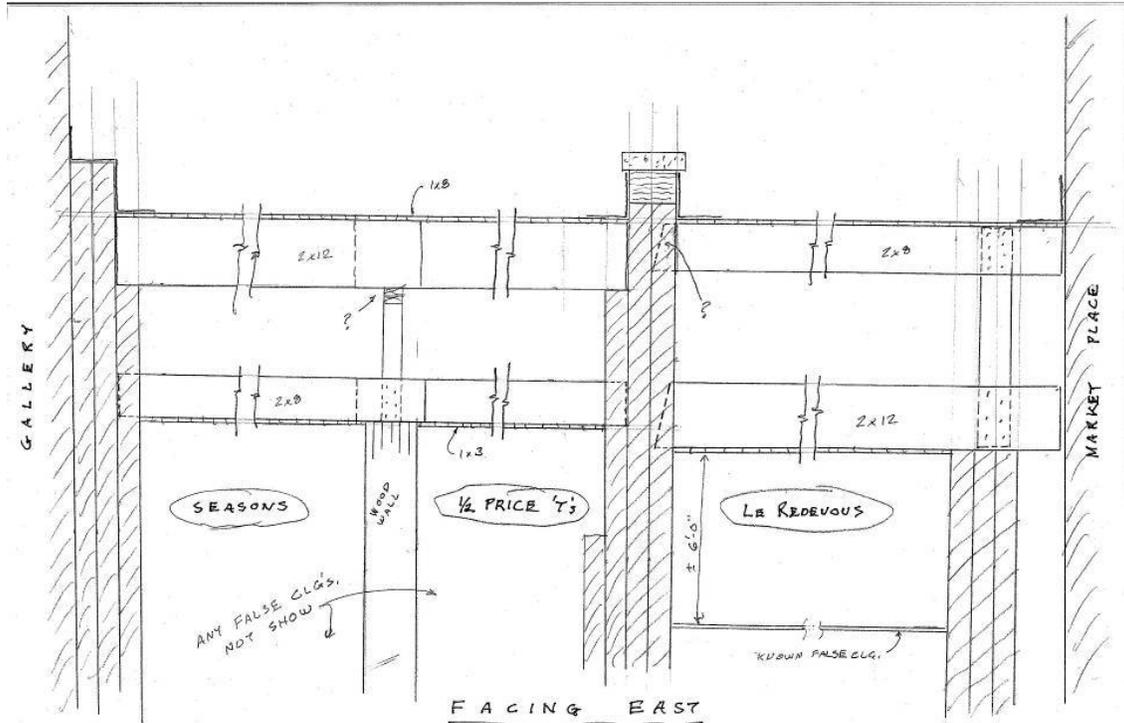


Figure 4: Drawing showing a rough construction design of attic spaces of destroyed buildings. Not drawn to scale by Fire Captain Bob Harms

It can be assumed at this point that the fire had a significant head start on firefighters. How far it had progressed prior to their arrival can be seen in the photo taken by Ellis in Figure 5. In Figure 5 heavy smoke can be seen emanating at the wall between 758 Main Avenue and 750 Main Avenue (Le Rendezvous).



Figure 5: Ellis photo of roof top of 764, 758, and 750 Main Avenue

This photo indicates that there is significant smoke in the vertical and horizontal void spaces in 764 and 758 Main Avenue. Both buildings at this time had minimal smoke at the main level.

1350 to 1400 Hours on Feb. 22, 2008

At 1350 hours E1, E2 and L2 had hose lines established. L2 began set-up of the aerial to the roof of Le Rendezvous. At 1352 Battalion Chief Stowers arrived on scene and assumed Command. Captain List became Operations. E2's crew was preparing to enter Seasons Grill and RIT operations were assigned to Sean McDonald. At 1355 hours an 1 $\frac{3}{4}$ " hose line is in place in front of Seasons Grill and $\frac{1}{2}$ Price T's with Firefighters McGrath and Buccowitz. L1 arrives at 1356 hours and is set up on the B side of the B exposure. The E2 crew exits Seasons Grill with a report of light smoke. They then enter $\frac{1}{2}$ Price T's where they once again report light smoke in the interior. At 1357 hours Firefighter Wickes, who had joined the E2 crew, exited $\frac{1}{2}$ Price T's and acquired a TIC to be used in the interior of $\frac{1}{2}$ Price T's. Chief Clay was on the roof of Seasons Grill at 1358 hours. In order to assist in venting Seasons Grill, he knocked what he thought was a cooler/ac unit over. He reports to command that the roof of Seasons Grill is starting to get soft. At 1359 hours the E2 crew exits $\frac{1}{2}$ Price T's. The TIC had shown heat across the ceiling to the wall that is contacting the Le Rendezvous wall just in front of the mezzanine in $\frac{1}{2}$ Price T's. They have not been able to access the fire. The fire is in the void space above the ceiling. Electricity is turned off in $\frac{1}{2}$ Price T's at approximately 1356 hours.

The fire has now ten more minutes without any direct intervention from the fire crews. Opening up the cooler/ac unit provided a small amount of ventilation but not enough for the amount of fire. The major issue for firefighting operations at this time is the inability to access the void spaces between the dropped ceilings and the roof in each building.



Figure 6: Seasons Grill Facade at 1359 hours

Figure 6 shows smoke at the facade and roof line of Seasons Grill. The smoke is not under extreme pressure and is gray in color. During this ten minute time period there were no additional reports of flame showing and no confirmation if the fire had progressed into the attic spaces of Le Rendezvous. No true ventilation has occurred at this time.

1400 to 1410 Hours on Feb. 22, 2008

At 1400 hours we have a single firefighter on the roof with a request for a saw to attempt to ventilate the roof of ½ Price T's as the Seasons Grill roof is too soft to operate on. Crews have cleared Seasons Grill and ½ Price T's and had not been able to reach the fire, which was in the void space above the ceiling in Seasons Grill and ½ Price T's. At 1401 hours, firefighter Wolf proceeds to the roof of Le Rendezvous with a saw to assist Chief Clay with ventilation efforts on ½ Price T's. The E2 crew is assigned to extend a hose line to the Le Rendezvous roof up the aerial. At 1402 there is a report of the natural gas being turned off to Seasons Grill. At 1404 hours, LPEA is responding according to their office and ventilation efforts on ½ Price T's are continuing. Exposure B (Gardenschwartz, 780 Main Avenue) is in the process of being evacuated by Fire 42 and Fire 13. Firefighter Mattison and Fiddler are communicating with ATMOS to get the natural gas turned off in both ½ Price T's and Le Rendezvous. Both gas meters are buried in ice and snow. A page out to recall off duty personnel occurs at 1405. E9 arrives on scene at 1409 and is assigned to the C side. Two 1 ¾" hose lines are pulled from E9. E9 is not connected to a hydrant. No flames are visible at this time on C side. At 1409 the roof crew has made the initial cuts for ventilating ½ Price T's but is having difficulty due to heavy smoke emanating from the cuts and not getting the cut section to rotate. ½ Price T's now shows heavy brown smoke in the interior. Chief Noonan arrives on scene and becomes Liaison.

Crews have been unable to reach the fire and/or ventilate the void spaces effectively. Electricity is off to the individual buildings but natural gas is only off in Seasons Grill. Additional staff is responding.



Figure 7: Crew taking hose to roof

Figure 7 shows light brown smoke emanating from the area between 758 Main Avenue and 750 Main Avenue. Smoke has been visible at this location for the last ten minutes. Light brown smoke on the roof is not coming from one location but along the entire wall separating 758 Main Avenue and 750 Main Avenue from A to C side. Natural Gas has not been shut off in either of these buildings.

1410 to 1420 Hours on Feb. 22, 2008

At 1410 hours smoke is getting heavier inside the occupancies and ventilation operations are encountering difficulties. L2 crew proceeds to Exposure B roof (780 Main Avenue) at 1411 hours. They report that the old chimney from Seasons Grill that is part of the wall that joins Seasons Grill with 780 Main Avenue is now venting light brown smoke. At 1414 hours Seasons Grill and ½ Price T's have heavy light brown smoke to the floor. This smoke turns to heavy brown smoke in the next minute followed by flames 4 to 5 feet high on the Seasons Grill roof. Seasons Grill self vented but it has vented through to the main floor. C side begins to cool the 780 Main Avenue wall in the area where Seasons Grill has vented. The roof crew is doing the same. The ventilation crew is still unable to vent ½ Price T's. At 1418 it is decided to close the doors on ground level on A side to try to give the roof crew more time to ventilate. C side doors are left open. The roof crew attempts to use hydraulics to control the smoke in the area they are attempting to ventilate on ½ Price T's. Smoke is heavy inside Seasons Grill and ½ Price T's. The windows which have been clear begin to discolor. At 1419 the smoke is rolling inside Seasons Grill and the glass is shaking. Glass breaks in the Seasons Grill front door at 1420.

Crews have been working on the roof now for 20 minutes with no success. Smoke levels in the interior of Seasons Grill and ½ Price T's have increased and dropped to floor level. Windows no longer have clear visibility. C side is connecting to a hydrant as they have used a large amount of water from E9 to protect 780 Main Avenue. Le Rendezvous now has light smoke in it. The natural gas has not been shut off in ½ Price T's and Le Rendezvous.



Figure 8: Door open to 1/2 Price T's

Figure 8 shows heavy smoke in ½ Price T's prior to closing the door. Figure 9 shows the dark windows in Seasons Grill and ½ Price T's. The windows in Le Rendezvous continue to have legible advertising in them.



Figure 9: Overview of smoke and flames at 1420

1420 To 1430 Hours on Feb. 22, 2008

At 1420 the glass in the Seasons Grill door has broken. The ½ Price T's door on A side is still closed and the Le Rendezvous interior team prepares to enter. The crew enters Le Rendezvous at 1421 hours approximately. They check the ceiling temperature as they enter and find nothing unusual (approximately 92 Fahrenheit). There is light smoke but the ceiling is still visible. At the same time a high rise pack is taken to the roof. Firefighter Dignan, a member of the roof crew, hears a large pop and Firefighter Sokel indicates to Firefighter Dignan that she is beginning to feel hot. This is about the same time at which ATMOS Energy has recorded that the natural gas is shut off to ½ Price T's. Smoke is heavier as the Le Rendezvous crew proceeds toward the back of the building. The roof crew breaks the sky light in Le Rendezvous. Smoke clears inside Le Rendezvous. The interior crew elects to not enter the basements in Le Rendezvous. They exit to discuss with command their next move. McGrath and Jakino set up outside the front door of Le Rendezvous while Lieutenant Tranum goes to talk to command. Chief Clay on the roof notices white smoke beginning to come from the vents on the rear of Le Rendezvous. He moves to the A side of the building where he is joined by Wickes. Dignan, Sokel and Wolf are at the wall between ½ Price T's and Le Rendezvous close to

the skylight. Firefighter Brennan, on the ground by the L2, hears a pop that sounds like someone popping gum but louder. There is an explosion at approximately 1427 hours, 47 minutes after the first report to dispatch regarding a fire at the Seasons Grill but perhaps up to 1 hour and 47 minutes after the fire started. See Figure 10.



Figure 10: Explosion from A side



Figure 11: A side of Le Rendezvous roof line at the upper void level after the explosion

Figure 11 shows the remaining roofing after the explosion and before the fire that followed the explosion. Crews were able to crawl across the roof and slide down to the aerial following the explosion. The explosion sent debris across Main Avenue which is 32 feet in width plus sidewalks. It did not break windows on the other side of Main Avenue although this may have been because the Ladder truck was in the middle of the street parallel to the buildings.



Figure 12: Following explosion and rescue

Figure 12 shows the upright table and chair in the corner of Le Rendezvous and glass, although broken, still in the door.

Investigation

The investigation began the following day at 764 Main Avenue with the Cause and Origin Investigation. I was then assigned to investigate the explosion thereby removing my activities from the Cause and Origin Investigation although we kept in close contact.

Onsite Investigation

The explosion investigation began with a walk around of the site beginning at the front and proceeding to the rear. It became obvious that the explosion occurred in the void spaces above the ceiling and therefore we would need to be able to recreate the layout of the ceiling up to the roof layer. Captain Bob Harms agreed to draw this out. The cross section of Le Rendezvous is seen in Figure 13. The drawing includes the roof layer, the original ceiling level, and the dropped ceiling. The drawing does not include the rear of the building.

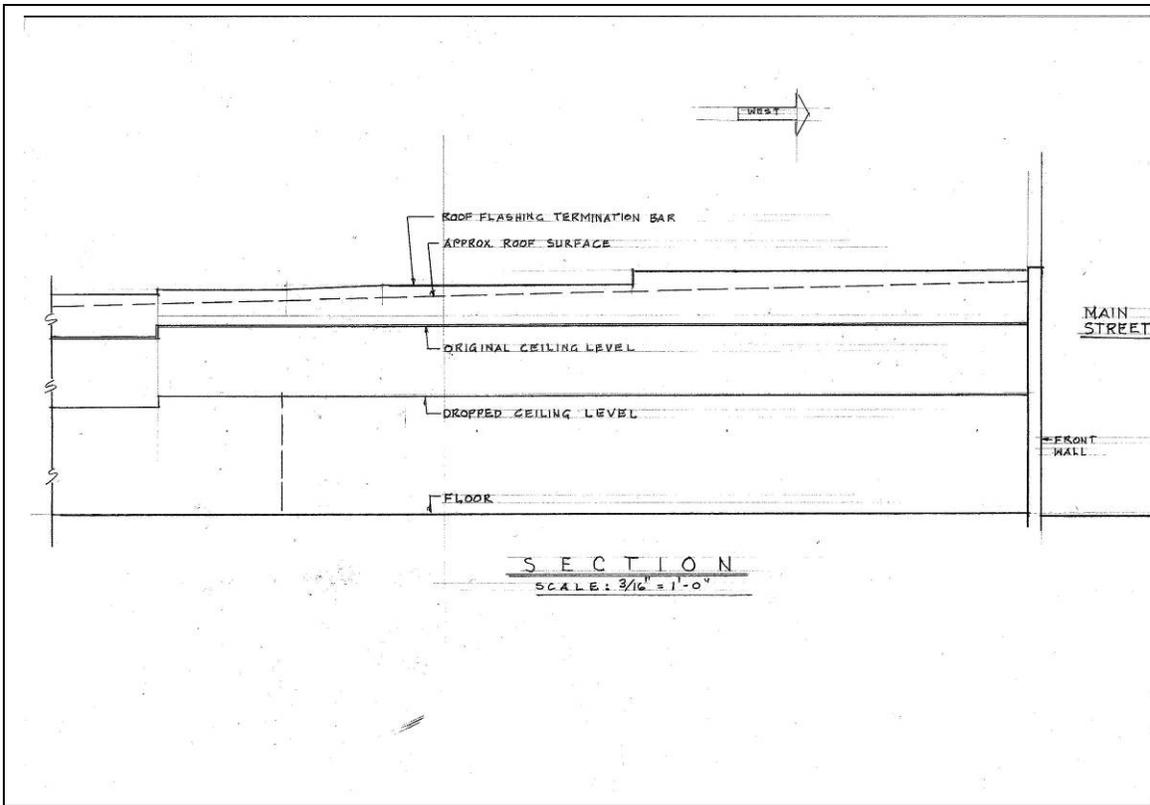


Figure 13: Cross Section of Le Rendezvous front area where explosion occurred

It is estimated to be 61 to 62 inches between the dropped ceiling and original ceiling. There is then approximately 47 to 48 inches between the original ceiling and the roof surface. The first drop in the roof line is 31 feet 2 inches from the A side of the building. The second drop in the roof line is 38 feet towards the C side from the first drop. The drop ceiling was composed of drywall, plaster and multiple layers of paint.



Figure 14: Aerial view after fire and explosion

Figure 14 was taken the evening of the fire and explosion. The bottom of the picture is Seasons Grill and the top is Le Rendezvous. Le Rendezvous was the only building to suffer the explosion and the explosion appeared to have occurred in one or more of the void spaces. This allowed for the elimination of a large portion of the building to explode for cause of the explosion.



Figure 15: View from kitchen toward the front of Le Rendezvous

Figure 15 indicates that the explosion most likely occurred in the void space between the roof and the original ceiling. The upper façade on A side (street side) is the portion of the wall that collapsed onto the firefighters below. Firefighter Wickes was standing on the original ceiling structure following the explosion. The natural gas lines that extended into Le Rendezvous were located in the space above the drop ceiling, not the space above the original ceiling. It is unknown what penetrations might have existed in the original ceiling that would have allowed for gasses to travel from above the original ceiling to below it or vice versa.

During the investigation we were aware of the issues regarding whether or not the natural gas had been shut off to this building. As we inspected the debris, we looked for broken natural gas lines that might have contributed to the spread of natural gas. A broken line was found in the space between the drop ceiling and the original ceiling. In examining this line we were able to determine that it had been sheared and that the nylon ball valve appeared not to have been exposed to flame. Whether or not this line was leaking prior to

the explosion is undetermined as we were unable to pressure test the line with a method that would indicate that the line was leaking prior to the explosion. The valve was taken by the NIOSH investigators. See Figure 16.



Figure 16: Broken natural gas line and the corresponding hangar

An investigation of the walls between Le Rendezvous and ½ Price T's showed numerous areas where smoke and heat could penetrate from one side to the other. These included areas where cuts were made during construction of both buildings to accommodate support timbers. These cuts were made into the brick. As the lots for the buildings all front the sidewalk area, the support structures for each building tend to line up with each other. This places the cuts into the brick adjacent to each other in many instances.

The mortar used in Durango during the 1890's and early 1900's used a sand/silt product from a gravel pit south of the town. It was used because "it spread like butter". This type of mortar does not withstand time as well as other types of mortar. Many of the bricks can be removed without finding any remaining mortar indicating that the entire wall in itself would have allowed smoke to spread from one building to another. Figure 17 shows the bricks and missing mortar.

As can be seen in Figure 17, the fire in ½ Price T's was in the assembly and smoke most likely penetrated into the void space above the original ceiling in Le Rendezvous filling the void with smoke and gasses. As we were unable to reconstruct possible penetrations

into the original ceiling, we were unable to prove or disprove that the smoke entered the void space above the drop ceiling as well.

At this point, we know that there were combustible fuels in the form of gasses and unburned particles in the void space between the roof and original ceiling of Le Rendezvous as there were multiple areas where the smoke could travel through the walls and ½ Price T's and Le Rendezvous had not been effectively vented. It is possible that natural gas mixed with all of the above.



Figure 17: Wall between Le Rendezvous and 1/2 Price T's above kitchen



Figure 18: 1/2 Price T's and Le Rendezvous Gas Meters

Figure 18 shows the gas meters after they were dug out of the snow and ice for ½ Price T's and Le Rendezvous. Firefighter Mattison who worked on these two meters during

the fire stated that neither one was ever turned off. ATMOS Energy says that the natural gas for ½ Price T's (the one on the left) was turned off at 1420 hours and the natural gas for Le Rendezvous was turned off at 1440 hours. The gas to Seasons Grill was turned off at 1355 hours. The Le Rendezvous meter read 56625 the day following the fire. The previous reading was February 11, 2008 and it read 56394. The meter was also read on January 13, 2008 and at the time read 55642. This data indicates that there was not a major leak in the building prior to the fire.

Ignition

Throughout the investigation we have continued to search for the answer to the question as to what ignited the combustible gasses and particles, if in fact that was the scenario as the evidence indicates. Two items of interest were noted by two different individuals. Approximately 5 minutes before the explosion, Firefighter Dignan heard a loud pop which she attributed firefighting techniques affecting the structure. The second is Firefighter Brennan who heard a loud pop right before the explosion. There are multiple possibilities for both of these. They may in fact have been a structural issue and/or they might have been small ignitions leading to the large explosion. It cannot be ruled out that the flames and/or embers penetrated the walls just as the gasses and particles did thereby igniting the gasses.

It also cannot be ruled out that the temperatures in the void spaces were much greater than the firefighters believed them to be. Temperature evaluations inside Le Rendezvous prior to the explosion were done with the TIC, which indicated the temperature of that surface to be 92 degrees Fahrenheit. Temperature assessment on the roof of Le Rendezvous was done by TIC temperature as well. It is important to note that weather conditions were in the 30 to 32 degree Fahrenheit range with snow off and on at the time of the fire. This would have affected the TIC readings on the exterior surface of the roof significantly.

Investigators were unable to identify a specific ignition source in the void space where the explosion occurred. All appliances were located below the drop ceiling. The cooking was mostly complete at the time Le Rendezvous was evacuated but it is possible that the hood and duct system extending through the roof might have contained heat that contributed to the explosion. The hood was intact in Le Rendezvous at the time of the investigation but the duct work suffered extreme damage. This damage may have occurred during the explosion and/or in the ensuing fire.

Observations of Media Submitted From the Public Following the Incident

The Fire Department requested that the public submit photos and videos that were taken during the fire. I reviewed all of the submitted photos and video. The following items shown in this data were of assistance:

- A. Flames and smoke were greater prior to fire department arrival;
- B. RIT teams were established early;

- C. Smoke conditions at ground level in the interior of all structures were initially clear enough to allow firefighters to enter structures without self contained breathing apparatus in place;
- D. Smoke was venting where the ½ Price T's and Le Rendezvous walls met at the time of firefighter arrival;
- E. Smoke had dropped to the floor in both Seasons Grill and Le Rendezvous prior to the doors being closed;
- F. Windows in Seasons Grill quickly became discolored and began shaking within a short time of the doors being closed;
- G. Smoke began to roll inside of Seasons Grill even though the building had self vented;
- H. C side crew was involved in protecting the wall of 780 Main Avenue and digging out the gas meters;
- I. Smoke was heavy enough at the gas meters that SCBA use was put in place;
- J. Firefighters were thrown upward 5 to 10 feet in height during the explosion;
- K. There was no flame in the explosion blast;
- L. The explosion cloud was grey to brown, **not** heavy black in color;
- M. Large pieces of debris did not travel horizontally a great distance;
- N. Small particles of debris carried as far as the opposite sidewalk;
- O. Fire began a few minutes after the explosion in the back of Le Rendezvous and appeared to be a natural gas fire;
- P. The fire in Le Rendezvous following the explosion was trapped below the roof midway between the A and C side.
- Q. Smoke changes immediately or in conjunction with explosion on the C side of 758 Main Avenue.

These photos and videos provided numerous clues as to what occurred prior to, during and following the explosion.

Analysis of Explosion

Fuels

The explosion occurred in an area of the structure that contained wood timbers and other combustible construction. It contained smoke from the adjacent structures which included gases and particles of combustible material. Gases from the timbers, etc. in the horizontal void space of Le Rendezvous were being released into the space as the fire continued to burn in the adjacent building. The fire in the adjacent building was gradually warming the void spaces of Le Rendezvous. This investigator cannot rule out that the area may have contained natural gas but evidence does not show the void area to be full of natural gas.

Ignition

This is unknown, but the following hypotheses do exist:

1. Flames and/or embers entered the Le Rendezvous horizontal void area through the same penetrations as the smoke and gases,
2. Heat from the ducting related to the stoves in the kitchen may have aid in the ignition,
3. The popping heard by Firefighter Brennan may have been a pre-explosion or flashover in a given area that may have penetrated the horizontal void area.

It is the opinion of this investigator that the most likely ignition source is the third one, but none of the three can be eliminated.

Hypotheses

There are two hypothesis as to the cause of the explosion that occurred at 750 Main Avenue at approximately 1427 hours on February 22, 2008 are:

First Hypothesis – smoke particles and gasses penetrated the walls separating 758 Main Avenue from 750 Main Avenue due to a lack of ventilation of the smoke in 758 Main Avenue. The smoke particles and gasses filled the upper void space in 750 Main Avenue until the levels were in the correct combination with oxygen. This environment was then exposed to an ignition source, most likely a flame or ember penetrating the wall. The ensuing result was the explosion

Second Hypothesis – smoke particles and gasses penetrated the walls separating 758 Main Avenue from 750 Main Avenue due to a lack of ventilation of the smoke in 758 Main Avenue. The smoke particles and gasses filled the upper void space in 750 Main Avenue until the fuels levels and heat levels were sufficient that the only item needed was oxygen. The oxygen was supplied when a structural break occurred allowing oxygen to penetrate into this area.

Third Hypothesis – smoke particles and gasses penetrated the walls separating 758 Main Avenue from 750 Main Avenue due to a lack of ventilation of the smoke in 758 Main Avenue. The smoke particles and gasses filled the upper void space in 750 Main Avenue. Smoke and heat fill the mezzanine level of 758 Main Avenue resulting in flashover which produced sufficient pressure and heat to penetrate the horizontal void space of 750 Main Avenue. An explosion ensues.

Figure 19 shows the differences between a flashover, cold smoke explosion and back draft. This investigator has not been able to disprove the first hypothesis but I have been concerned about the report of the pop that was heard by Firefighter Brennan. The first hypothesis does not take this account. The second hypothesis would require an influx of oxygen and I have not found evidence or firefighter activities that indicate that this occurred. The third hypothesis provides the most complete answer and is supported by photos and video that shows smoke changes on the c-d corner of 758 Main Avenue that occur virtually simultaneously with the explosion. It also explains why firefighters on the C side of the incident thought it was their side of the incident that had suffered an explosion.

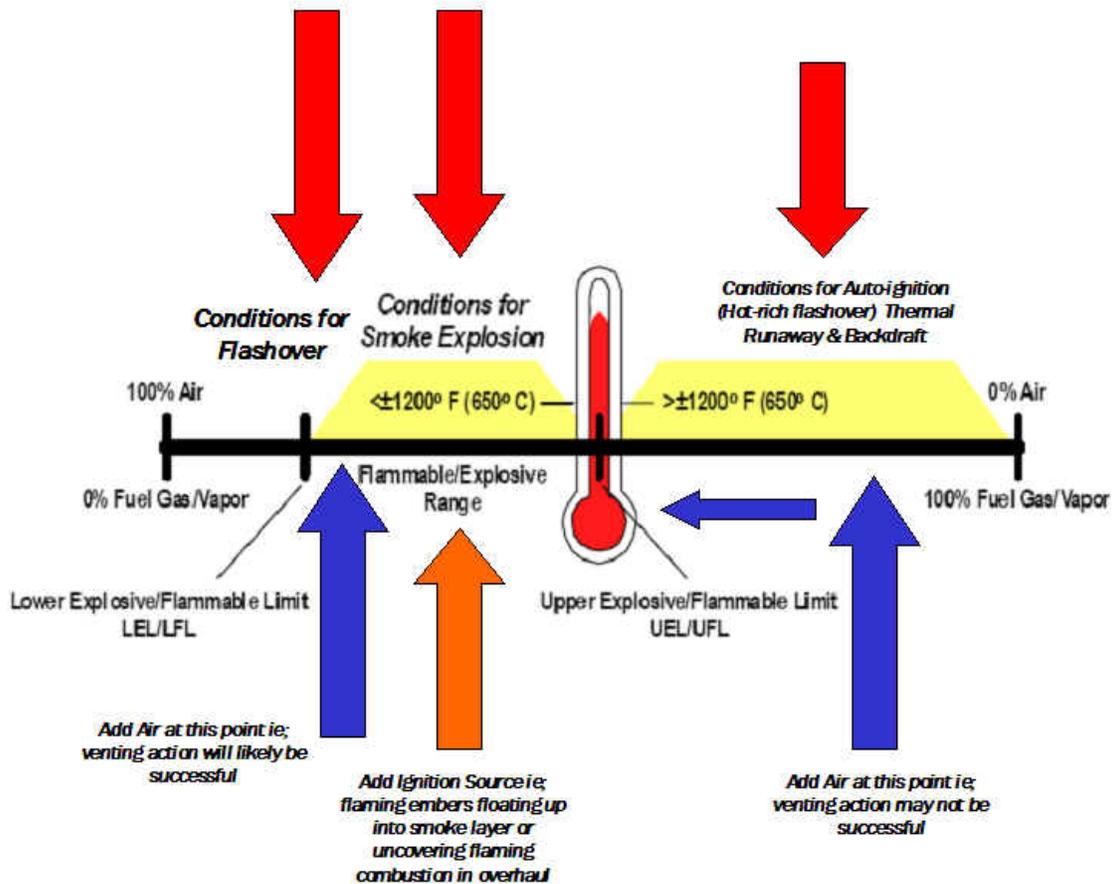


Figure 19: Cold Smoke Explosion

Final Opinion

It is this investigators opinion that the explosion that occurred at 750 Main Avenue was caused by a flashover that occurred in the Mezzanine area of 758 Main Avenue that caused flame and/or embers to penetrate into the horizontal void space in 750 Main Avenue. The void space had been filling with smoke and contained sufficient oxygen to form an explosion that raised the roof and extended out the A side just below roof level when the flames and/or embers penetrated the void area from ½ Price T’s. It is the opinion of this investigator that fire operations did not cause the explosion but may have caused the time of the explosion to be accelerated. Successful ventilation on 758 Main Avenue may have prevented the explosion. Closing the doors on 764 and 758 Main Avenue most likely increased the smoke levels in both of these buildings but a flashover would most likely have occurred in 758 Main Avenue regardless of the doors being open or closed as ventilation on the roof was not complete. It is important for firefighters to review cold smoke explosions as the temperatures within 750 Main Avenue void spaces would have most likely been in this range. The smoke analysis and events as they occurred at this location match the cold smoke explosion reports that have been found in old historic structures in the United States, Canada and England. It is the opinion of the investigator that natural gas was not the fuel source until after the explosion. If natural

gas had been the cause then the main floor where the appliances were would have suffered some explosion damage. The area between the drop ceiling and the original ceiling would also have suffered much greater damage than that exhibited in this instance. Burn patterns during the explosion would also have been different than that exhibited at this explosion. None of the injured firefighter personnel suffered what is known as heat or burn injuries. According to medical personnel at Mercy Medical Center, the injuries were all concussive and fall related. Medical reports have not been included in this report due to privacy laws.

The final opinion identified above is strictly the opinion of this investigator as there are two additional hypotheses that cannot be disproven. The cause of the explosion is accidental in nature unless additional information is provided that affects the conclusion of this report.