

Concow Fire
September 19-20, 2000

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INTRODUCTION

The Concow Fire burned uncontrolled for two days, September 19-20, 2000, near the unincorporated communities of Concow and Yankee Hill, Butte County, California, about 100 miles north of Sacramento. The fire destroyed 14 structures, 28 vehicles and 1845 acres while firefighters saved 46 structures. One resident died in her house at the fire. At one point, the fire threatened to jump Lake Oroville and burn into the Town of Paradise, population 25,000. Additionally, four noteworthy firefighter incidents occurred at the Concow Fire. The fire was characteristic of today's structure interface zone fires that not only require aggressive fire perimeter control actions but equally aggressive structural defense activities.

The California Department of Forestry and Fire Protection (CDF), Butte Unit, provides wildland fire protection for Butte County and parts of Plumas and Tehama Counties. CDF is a full service fire department. All other fire protection services including structural fire protection, pre-hospital basic life support/emergency medical services, hazardous materials response and technical rescue are provided by Butte County Fire Rescue which is administered under cooperative contract by the CDF. This cooperative relationship really simplifies fire protection as all command and control activities are centralized under the direction of one fire chief for both the CDF and Butte County Fire Rescue operations. All resources, whether CDF or BCFR, are managed as one organization maximizing emergency service delivery to the public at a very reasonable cost. Available CDF/BCFR resources include 42 fire stations, one fire center with three fire response crews and one training crew, one air attack base, five fire lookouts, 65 engine companies, 17 water tenders, two rescues and 15 squads, two dozer companies, one air tactics plane, one air tanker, 225 career and seasonal personnel, 250 volunteer firefighters, 80 California Conservation Corps fire crew members and 100 fire prevention volunteers.

The four firefighter incidents at the Concow Fire included a snag falling on a firefighter while making the initial attack, a fire shelter deployment by three firefighters, one successful rescue of two civilians and one attempted rescue of a victim who succumbed to the fire.

Two fire vector movements during the first 24-hours characterized the overall Concow Fire behavior. The fire, which originated near the Concow School about one mile north of State Route 70, first burned to the east. It was primarily driven by normal up-canyon, up-slope winds in very dry fuels and moderate topography. The first phase resulted in the destruction of 800 acres, lasted about seven hours and scorched two residences. The second, and most destructive phase of the Concow Fire, began due to high winds just after midnight on September 20. It burned an additional 1045 acres, destroyed 14 structures and 28 vehicles and killed one civilian.

The purpose of this paper is to analyze the fire history and behavior and to review the four firefighter incidents.

FIRE HISTORY AND BEHAVIOR

The Concow Fire started on September 19, 2000 at about 1300 hours. Investigators determined that the cause of the fire was a local resident's crawler tractor hitting a rock and causing a spark in dry grass. The fire began during a period of very hot, dry weather in an area of recent wild fires with very heightened public awareness of fire. The fire initially spread in two directions from the origin, although initial engine companies successfully stopped the initial westward movement.

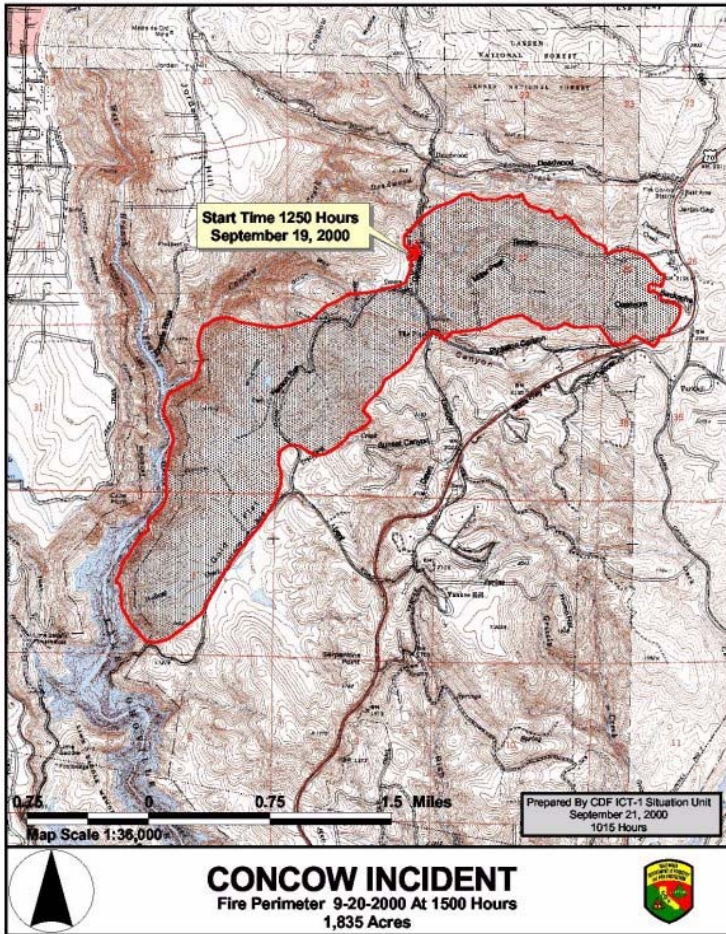


Figure 1. Map of the Concow Fire, August 19-20, 2002, showing both fire spread directions. The first spread direction was to the east from the origin. The second spread direction was from just southeast of the Concow School to the southwest (Concow Fire documentation report).



Figure 2. Picture of the Concow Fire taken September 19, 2000, 1418 hours. The picture was taken about four miles southwest of the fire. Note the fractured smoke column indicating an east wind aloft (Wilson 2000).

The first, destructive phase burned two miles from the origin to the east toward State Route 70 (800 acres burned). The second, more destructive phase burned a distance of five miles just southeast of the origin to the southwest all the way to Lake Oroville (1,100 more acres and 14 structures burned).

As it is with all wild fires, weather is often the most changing and dangerous of the three primary fire spread components (weather, fuel and topography). The Concow Fire was no different as it started during a time of the year when fire weather is the most dangerous. Two different weather effects occurred at the Concow Fire. The first weather effect involved hot, dry conditions and normal surface winds. A weather observation taken within one hour of the start of the fire showed the temperature to be 103°F, the relative humidity 16%, the surface wind southwest 5 to 10 MPH, and the gradient wind north to east at an estimated 20 MPH. With these conditions, the Ignition Component was near 100%. Rapid fire spread, including spotting, occurred until the conditions moderated at dusk (2000 hours). The incident commander felt that the fire could be contained by midnight if fire lines could be established and conditions held.



Figure 3. Picture of the Concow Fire, August 19, showing the initial fire spread to the east from the vicinity of the Concow School (Iverson 2000).



Figure 4. Picture of the Concow Fire, August 19, approximately 1500 hours as it ran over Miller Peak and towards Tim Tam Lane. The Concow School is visible just to the left of the rear of the fire (Iverson 2000).

Shortly after midnight, the gradient wind surfaced due to nighttime cooling. Earlier, the heat of the day had held the wind aloft due to the afternoon heating, buoyancy effect. The fire rapidly spread to the southwest with winds estimated at 20 to 40 MPH. Relative humidity remained very low throughout the night due to the Foehn Wind effect. The fire continued its rapid spread until the wind eased shortly after 0800 hours on September 20.

Natural fuels in the area included grass, brush (Manzanita and Ceanothus) and timber (Grey and Ponderosa pine, Douglas-fir, Incense-cedar and Black, Blue and Live oaks). Fire behavior analysts felt Fuel Model 4 best represented the predominant fuels. Grass and brush most influenced fire spread. The brush averaged six feet in height. Live fuel moisture was under 80% which is below the critical level for Manzanita. The Ten Hour Dead Fuel Moisture was estimated at 3% during the day and possibly 2% during the second fire phase that first night.

Structures and vehicles were non-natural fire fuels that affected the fire spread. Ignition of structures worsened burning conditions and caused more embers to be sent aloft, increasing overall fire suppression problems. The lack of adequate clearance of natural fuels and ornamental landscaping around structures compounded the fire fuel effect.

Topography was a major spread factor during the first phase of the fire. Particularly important topographic conditions included the elevation change, presence of numerous chimneys and aspect. The elevation ranged from about 1,600' at the origin to near 2,200' at the eastern end of the fire with a maximum elevation of 2,400' on Miller Peak. The fire started in a hollow area

just west of the Concow Road and about ¼ mile north of the Concow School. The initial fire run was 40% upslope. As soon as the fire started, it connected with a major drainage leading to the east. This drainage helped funnel the fire and cumulatively add to the other two major spread factors. During the first fire phase, the aspect was almost always south or west, favoring maximum fire spread for the time of day. At dusk, the first phase of the Concow Fire run had reached State Route 70 and slowed due to lessening spread influences after reaching a ridge near Tim Tam Lane and State Route 70.



Figure 5. Picture of the Concow Fire, August 19, approximately 1500 hours, near Miller Peak showing extreme burning conditions at the head and right flank of the fire (Iverson 2000).

With one major exception, topography was not a factor with the second phase of the fire spread. The fire burned rapidly downhill under the east wind, covering about five miles in less than four hours. The elevation decreased from about 1800' where the fire escaped the first spread fire perimeter to 900' elevation at Lake Oroville, an overall decrease of 900'.

The major topography factor during the second spread phase was the fire alignment with the North Fork of the Feather River. This drainage is huge and fully bisects the Sierras. As such, it is a wind tunnel every night for normal down canyon winds. When that normal diurnal occurrence with the additive presence of the east wind were coupled, the outcome was a serious, wind driven fire.

THE FOUR INCIDENTS

In addition to fire suppression problems, firefighters faced four major incidents at the Concow Fire. These included: (1) a snag falling on a firefighter and a fire engine during the fire

initial attack by the first arriving engine company; (2) a fire shelter deployment by an engine company performing structure protection during the first fire phase; (3) a rescue of two civilians by an engine company when fire conditions were very hazardous during the second phase and; (4) an attempted rescue of an older resident who was reluctant to leave when instructed by a fire officer and subsequently perished in her residence during the second phase.

The first incident (CDF Snag Accident Report and Heisey 2001) began when the initial attack Incident Commander and Fire Captain in charge of CDF Engine 2161 attempted to drive through a burned area (1515 hours). The Fire Captain developed a plan to stop both the upward spread of the fire to the west and to the east from its starting point in the hollow. The plan worked, and the fire spread to the west was stopped by the work of firefighters employing a progressive hose lay. The eastern spread continued with a rapid rate-of-spread. Shortly thereafter, the Fire Captain attempted to drive through the burned area at the north end of the eastward spread of fire. The route required that the Fire Captain walk ahead of the fire engine since the fire had burned through an area of trees including several Black oak trees. While scouting ahead of the fire, a large (20") Black Oak snag with a diseased area on the uphill, blind side of the tree, fell on the fire engine cab hitting a firefighter who was near the engine. The firefighter suffered a light concussion, was fully immobilized and was taken to the nearby Concow School play field where a medic copter transported him to a local hospital. An after action report indicated that the tree could not be easily seen from the unimproved dirt road, that lookouts should always be posted when there is danger, and that the combination structural and wildland fire helmet worn by the firefighter probably saved his life.

The second incident (CDF Fire Shelter Deployment Report) occurred during major structural protection efforts in the first phase of the fire. As stated earlier, the fire started at about 1300 hours. It crossed Concow Road headed east and uphill at about 1345 hours. At about 1400 hours, the Incident Commander recognized that the fire threatened structures on both Miller Peak Road and Tim Tam Lane about one mile east of the origin. Incident objectives at that point included structure protection as the first priority followed by perimeter control. Structure protection groups and task forces were organized for the structure interface zone (I-Zone) firefight. By 1500 hours, several task forces were in place on Miller Peak Road and Tim Tam Lane. The fire made a rapid, uphill run in a major drainage headed toward both roads. Structures in the area generally lacked required clearance.

At about 1500 hours, Butte County Engines 72 and 64R (both three person companies) set up for structure protection on a house on Tim Tam Lane. The house was located on a small ridge between two chimneys. One of the chimneys was the major drainage in which the fire had established itself and headed east toward the structures. It was very hard to see both drainages due to the vegetation height on both sides of Tim Tam Lane. Engine 72 stretched two hose lines to protect the structure. There was no vegetation clearance around the structure. The Fire Captain on Engine 72 successfully burned around the structure prior to the arrival of the main fire front.

The following activity description is quoted from the incident investigation report (CDF Fire Shelter Investigation Report):

There was no coordination of the firing operation with the Division Supervisor. The officer of Engine A (Engine 64R) took the lead putting down fire, on the south side of the roadway, approximately every twenty (20) feet. The firefighters burned out the vegetation between these spots. The firefighters only had one torch and no other tools were taken along. The extra firefighter was told to watch the progression of the fire, but was not specifically ordered to act as a lookout. Approximately 70 yards into the firing operation, the engine officer noticed two small spot fires to the southwest of their position, and that there was fire on the ridge behind the spot fires. The officer also noticed a small spot fire on a knoll approximately 200 yards

to the southeast of their position. The firing operation was proceeding well, with fire being carried slowly downhill, in the ground litter. Fire did not extend into the Manzanita canopy. After completing the firing to their objective, approximately 470 feet, the crew turned to go back to the engines. At that time, the engine officer realized the main fire had come up behind them and was moving in their direction. The officer ordered the drip torches be put down and the firefighters to start back toward the engines. The fire started to sheet across the roadway from the south cutting off their escape route to the engines. They turned to go in the opposite direction and noticed the fire had extended up the minor drainage, from the pond to their east, and was also sheeting across the roadway. The officer gave the order to deploy fire shelters. One of the firefighters had difficulty getting the shelter out of the carrying case, and then removing it from the plastic cover. The officer pulled the head and torso of the firefighter into the officer's shelter. The head of the firefighter was in the lap of the officer. The officer was in a sitting position. The second firefighter, who was also in his fire shelter, put his shelter over the first firefighter's legs. After the fire crossed the roadway from the south side the officer ordered the first firefighter who had trouble deploying to finish the deployment of his shelter. The crew then experienced an increase of heat from the north side of the roadway. During this time air support was requested, but due to the smoke obscured conditions, the water and retardant drops did not reach the sheltered crew. Two CDF Firefighters were injured. The first firefighter was treated for heat exhaustion, and received intravenous fluid replacement. The second firefighter suffered two, ½ inch diameter, second degree burns to the left forearm. Both were released after treatment at Oroville Medical Center.

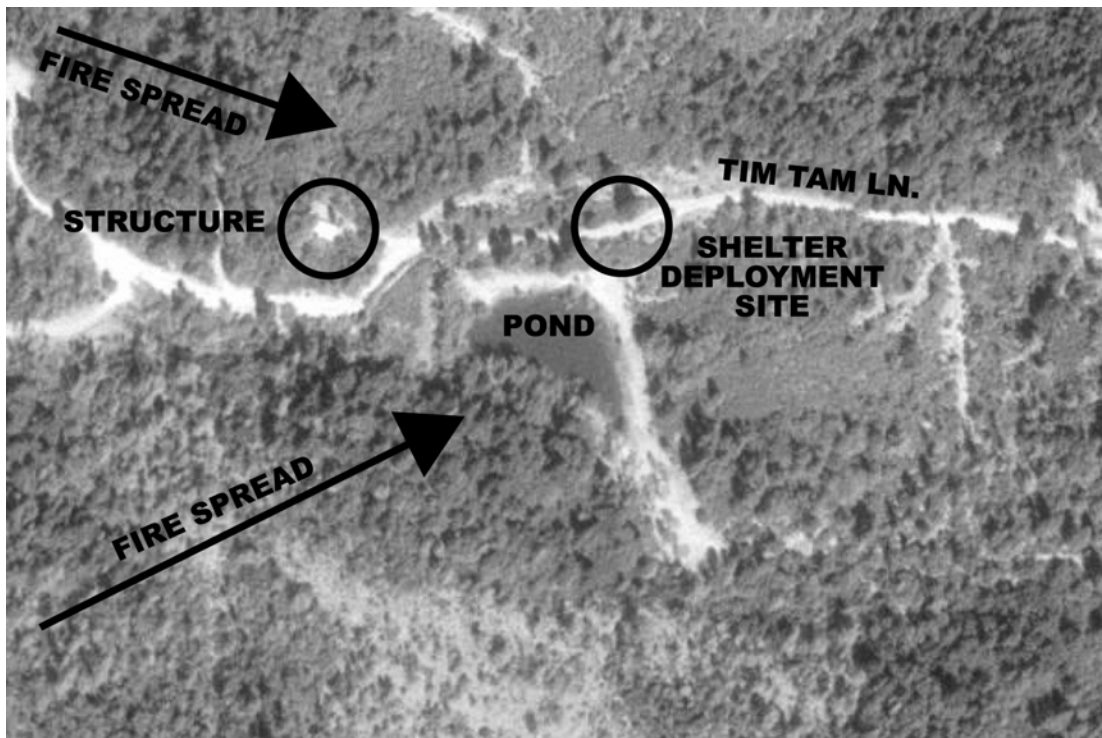


Figure 6. Graphically enhanced aerial photo of the Concow Fire, August 19, 1515 hours, where the fire shelter deployment occurred on Tim Tam Lane (MS Terraserver 2001).

The investigation report suggested the following safety issues for future firefighter review:

1. Post lookouts whenever working away from an established deployment area or safety zone.
2. Coordination between crews, leaders, and division supervisors has to be established prior to firing operations.
3. Crewmembers not actively putting down fire in a firing operation need to have a fire-fighting tool in their possession.

4. Be aware of dynamic fire behavior in the area of operation, and if the main fire is not seen, contact someone who can see the fire, or post a lookout.
5. Be aware of the surrounding topography and the effect of topography on fire behavior.
6. Identify the risk/benefit of firing out the down slope side of a mid slope roadway, while moving in an uphill direction.

The third and fourth incidents occurred nearly simultaneously just after 0200 hours on September 20, when the fire made its second run to the southwest burning 14 structures in its path. Just after midnight, the wind shifted to an east wind and increased. The fire escaped control efforts just southeast of the Concow School at about 0100 hours. The wind blew the fire to the west and southwest over a ridge just south of the School. Shortly after 0200 hours, the wind really increased in velocity. By then, fire engines were rapidly moving to protect structures west of the Concow School in the Nelson Bar Road, Stagecoach Lane and Lunt Road areas.

The third incident (Jeff Hawkins 2001) happened when Butte County Fire Rescue Engine 72 (three person company) was on Stagecoach Lane south of Nelson Bar Road. Initially, Engine 72 was solely assigned to protect Stagecoach Lane. Fire conditions at 0200 hours were calm at that location but rapidly changed with the wind, significantly increasing the fire coming over the ridge from the east and the fire spotting toward Engine 72's location. Engine 72 attempted to backfire Stagecoach Lane. Fire conditions worsened requiring Engine 72 to immediately cease the backfiring operation and proceed to the end of the lane to rescue two occupants of a mobile home. The fire was now on both sides of the lane and surrounding the house. The occupants initially resisted leaving and wanted to gather all of their 11 dogs. Without faltering, Engine 72 ordered the father and son with one dog to get into Engine 72. Once inside, the Fire Captain drove the engine through a tunnel of fire to Nelson Bar Road where all firefighters and civilians found safety with no injuries. Engine 72 conducted the rescue at great personal risk.

The fourth incident (CDF Rescue Investigation Report) began just prior to Engine 72 rescuing the two civilians. Engine 72 requested another engine to protect a second threatened residence on Stagecoach Lane. Butte County Fire Rescue Engine 71, a two-person company with a Fire Captain and firefighter, was assigned to assist Engine 72 on Stagecoach Lane.

At about 0225 hours, Engine 71 proceeded to a residence that was located on the west side of Stagecoach Lane about ¼ mile south of Nelson Bar Road.

The investigation report listed the following conditions:

The structure was a single story wood frame, wood sided dwelling with an aluminum roof. A detached garage was connected to the house by a roof, creating a breezeway of about 5 feet. The garage was used for storage and provided a heavy fuel load and excellent fuel bed on the fire-side of the structure. The structure sat on top of a knoll, with gentle slopes on the fire-side with pasture and star thistle. The fire was driven down a hillside of heavy fuel (grey pine, manzanita, probably over 90 tons per acre) until it crossed Stagecoach Lane. At this point the fire was driven by the now heated winds across the field of star thistle and into the structure.

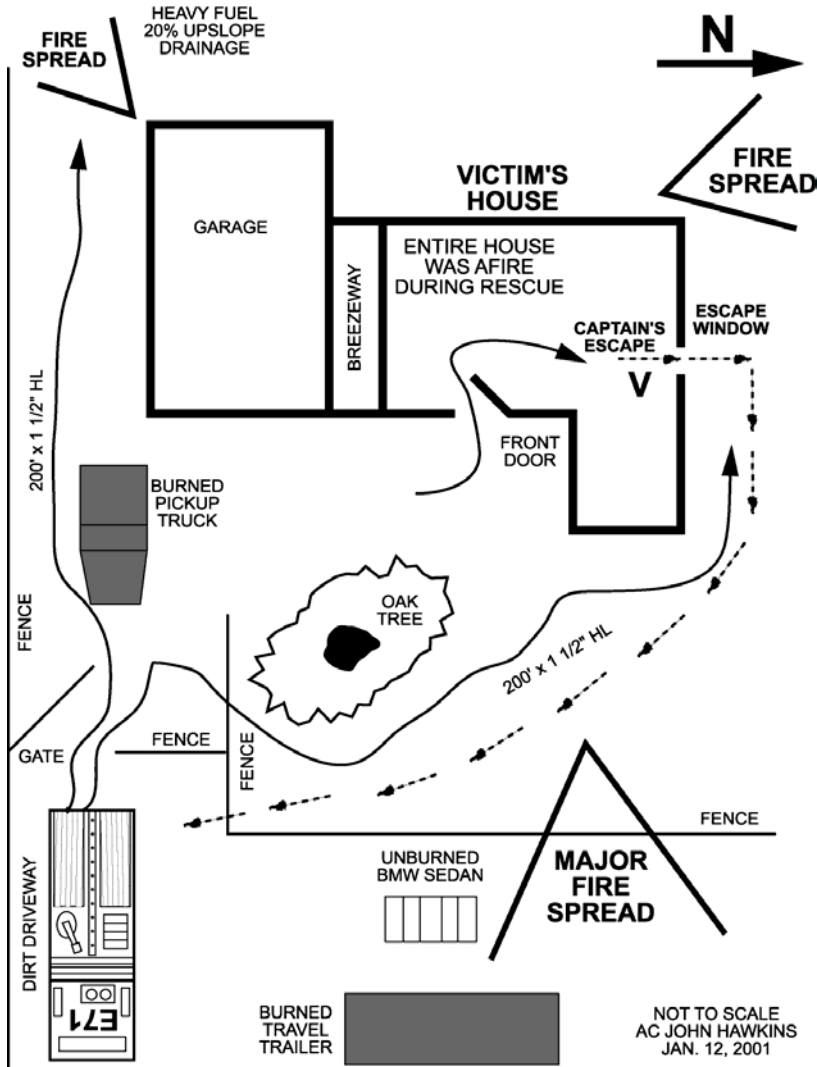


Figure 7. Sketch of the structure protected by Engine 71 where the attempted rescue occurred (John Hawkins 2001).



Figure 8. Picture of the driveway leading to the structure protected by Engine 71 where the attempted rescue occurred (John Hawkins 2000).

The Fire Captain (Sanford 2001) found no one awake at the residence and proceeded to awaken the 67-year-old female resident. While awakening the resident, the firefighter stretched two 1½” hose lines around the structure for I-Zone protection. The fire was running hard from the east and had crossed Stagecoach Lane just east of the residence. The Fire Captain determined that he did not have time to do anything but gather up the resident and take her away in Engine 71. The Captain ordered the firefighter to break the hose lines and prepare for a rapid exit. The resident resisted leaving due to pet dogs and returned into her house. The non-attached garage soon ignited followed by the residence. By now, the Captain knew that they had to immediately leave but could not convince the occupant to leave. She went back into her bedroom followed by the Captain who closed doors leading to the bedroom to prevent the fire from entering the rear of the house. Soon, the fire entered the bedroom and began to roll over the ceiling. The Fire Captain knew that his life was immediately threatened. He could not get the occupant to exit the small window so he jumped out the window receiving 11% second and third degree burns on his hands, face and back. He ran to the engine where the firefighter drove them away from the burning house. Soon, two Assistant Safety Officers removed the Fire Captain and firefighter to safety and initiated medical care. The resident succumbed to burns in the destroyed structure. Engine 71 conducted the rescue at great personal risk. The Fire Captain and firefighter received commendations from FIREHOUSE Magazine and the California State Firefighters Association for their life threatening actions.



Figure 9. Picture of the structure protected by Engine 71 where the attempted rescue effort occurred. Note the abandoned hose lines near the gate (John Hawkins 2000).



Figure 10. Picture of the structure protected by Engine 71 where the attempted rescue occurred. Note the discarded hose in the foreground. The Captain escaped from the right side of the structure (John Hawkins 2000).

The investigation report offered the following safety issues for review:

1. The fire engine was properly located with proper deployment of hose lines.
2. The Fire Captain was wearing a non-approved dust mask, which significantly reduced airway injuries.
3. Silk-screened ink on the Fire Captain's t-shirt may have added to burn injury severity.

CONCLUSION

The Concow Fire was very destructive in terms of human life and improvements. Fortunately, and due to prior training and experience, fire fighter injuries were minimal. There are lessons to be learned from the Concow Fire, which was a small fire by comparison to other fires that burned many more acres during Fire Season 2000. Firefighters must fully understand and employ LCES (Gleason 1991) at all incidents. Future fires will continue to test the safety awareness and operational execution of I-Zone actions by firefighters. Firefighters must also closely evaluate which structures they will attempt to protect or engage and which structures are not defensible. Fire officers, particularly incident commanders, must plan and execute combined perimeter and I-Zone actions at all wild fires where structures are threatened. Such actions occurred at the Concow Fire, minimizing loss of life and property. Firefighters that are cross-trained and proficient with both wildland and structural firefighting methods perform best at I-

Zone fires. The same is true for fire apparatus, which is multi-functional for both wildland and structural firefighting actions.

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