

Jesusita Fire Burnover
CA-LPF-001479 / CA-CSR-000031
Spyglass Ridge Road Burnover
Personal Protective Equipment (PPE) Report

Overview

On Tuesday, May 5, 2009, at 1:45 PM, a wildland fire was reported burning in the foothills north of the City of Santa Barbara along the “Jesusita” hiking trail within the Los Padres National Forest – Santa Barbara Ranger District.



Photo taken before the blow up on Wednesday, May 6, 2009

On the afternoon of Wednesday, May 6, 2009 several engine companies assigned to structure protection on the Jesusita Fire, north of the City of Santa Barbara experienced extreme fire behavior related to the surfacing of strong down slope (sundowner) winds typical of the area. This sudden increase of fire behavior resulted in the burnover of a Ventura County engine company, causing burns and smoke inhalation to the engine crew members, and major damage to the fire engine.



Photo of VNC E54 taken after the burn over.

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Photo showing structure and fuel conditions taken by VNC E54 prior to burnover.

Two hose lines were pre-positioned around the main house by VNC E-54. A 100' 1 ½" hose was placed along the west side of the main house, and a 100' 1 ¾" was placed at the bottom of the driveway near the northwest corner of the main house. Both hose lines were connected to a gated wye for connection to the water supply when needed. FC-54 was advised by STEN-1580A to pre-positioned three (3) Self-Contained Breathing Apparatus (SCBA) inside the main house. No other structural ensemble elements (coat, pants, boots, etc.) were pre-positioned.

At approximately 14:00, VNC E-42, located at the adjacent residence to the West, observed and documented a shift in the wind direction and speed. The winds changed from upslope south-southwest to across the slope (as shown below) from the northwest. Fire activity began to increase on the ridge above their position. The northwest wind continued to increase, and the fire began to move downslope at a faster rate toward Spyglass Ridge Road.



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At approximately 3:35 P.M., FC-54 noticed a spot fire above the location of E-54. At the same time, FF-54 pointed out another spot fire near the southeast corner of the main house. A 200' 1 3/4 hose line was then connected from E-54 to the gated wye to charge the pre-positioned hose lines. FC-54 then radioed STEN 1580A and advised that another fire engine was needed. E-30 moved to assist, and backed in next to E-54.

At approximately 4:00 p.m. the fire made extreme advances towards the Spyglass Ridge Road area. Numerous spot fires caused a condition similar to area ignition around 1495 Spyglass Ridge Road. FC-54 told FF-54 to protect the rear of the main structure. After several minutes of firefighting, FC-54 took FF-54 into the structure, entering through the back door on the southwest side to wait for the fire to pass.

While inside the structure, in preparation for their exit out of the house Both FC-54 and FF-54 removed their N95 masks. FF-54 tried to don his SCBA over his department issued web gear (Wolfpack Low Profile Web Gear pictured below). FF-54 was unable to don his SCBA over his web gear and chose to discard his web gear (including his fire shelter) which allowed him to successfully don his SCBA. FF-54 indicated that the hydration system (integrated bladder system in the small of his back) was full and did not allow the donning of the SCBA. FC-54 indicated that he was successful in donning the SCBA because his hydration system was nearly empty.. He was able to don his SCBA over his web gear and fire shelter. No other structural ensemble elements were utilized. FF-54 stated that at the time he discarded his web gear and donned his SCBA, he made the mental switch from the wildland fire environment to the structural fire environment.



As the fire intensity increased, FC-54 radioed STEN-1580A and advised that the FC-54 and FF-54 were in the structure and needed immediate aircraft support. The main

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house began to burn, and FC-54 and FF-54 moved to various rooms in the house as the fire progressed through the structure.

F AE-54 had remained at E-54 in the driveway, he used the engine protection line to protect the engine from the advancing fire. F AE-54 was trying to make radio communication with FC-54 and FF-54 but no contact was made. F AE-54 again radioed FC-54 and advised him E-54 was out of water. As the fire advanced towards the location of E-30 and E-54, E-30 dropped their hoselines, donned their SCBA's, and took refuge in the cab. When E-30 ran out of water, FC-30 told F AE-54 to get in the cab of E-30. With concerns for E-54's crew, he reluctantly jumped into the cab of E-30. With F AE-54 now inside the cab with E-30's crew, they attempted to drive down the driveway to safety but were halted by a wall of flames. E-30 waited for a break in the flaming front then drove down the driveway dragging all their hose and nozzles.

With the majority of the main house burning, FC-54 instructed FF-54 to remove the fire shelter belonging to FC-54. FC-54 was going to use it as a heat shield while exiting the structure; FF-54 stated that he did not understand why FC-54 wanted to do with the fire shelter. Before the fire shelter could be fully opened, the sliding glass door shattered, and a rush of heat entered the room. FC -54 and FF-54 made a hurried escape leaving the shelter behind.

As they exited the structure, both instantly felt their skin burning. FF-54 fell to the ground as FC-54 ran up the driveway toward E-54. FF-54 removed his SCBA harness with air bottle, leaving the mask and regulator connected. He began to roll on the ground as he thought he was on fire. FC-54 thought FF-54 was attempting to deploy the fire shelter. FC-54 yelled at FF-54 to continue to the fire engine. FC-54 arrived at the engine and climbed into the back seat on the passenger side, still wearing his SCBA. FC-54 could not locate FF-54, and his low air warning device was sounding on his SCBA

While in the engine, FC-54 radioed to STEN-1580A and told him that he had returned to the location of E-54. STEN-1580A radioed back and told him that he would come and get him. FF-54 then radioed that he was also back at E-54. STEN-1580A arrived at E-54 and the STEN (T)-1580A placed FF-54 and FC-54 into the rear seat of the vehicle. STEN-1580A drove the injured FC-54 and FF-54 to the residence located at 2845 Spyglass Ridge Road where Paramedic Engine 32 initiated treatment.

Both victims were assessed by the Paramedic. A medivac helicopter was requested due to their extensive burn injuries, but it could not make access due to the conditions. Branch I arrived, and was preparing to transport FF-54 along with the Paramedic when a paramedic ambulance escorted by a law enforcement officer arrived. The paramedic ambulance with the injured FC-54 and FF-54, assisted by a FF-Paramedic from ME-32, transported both patients to Cottage Hospital for evaluation. They were subsequently flown to Grossman Burn Center. STEN (T)-1580A was transported by Branch I to Santa

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Barbara County Fire Station #15 for smoke inhalation injuries. A paramedic ambulance transported STEN (T)-1580A to Cottage Hospital for initial evaluation. STEN(T)-1580A was subsequently flown to Grossman Burn Center. FAE-54 sought treatment for smoke inhalation on May 9, 2009. All structures at 1495 Spyglass Ridge Road were destroyed.

Personal Protective Equipment Analysis

This equipment report is based on both inspection of equipment and interviews of Engine 54 personnel (one Captain and one firefighter) and the Strike Team Leader (trainee) who were entrapped by the Jesusita fire on May 6, 2009 at 1495 Spyglass Ridge Road.

Note: Human skin begins to burn when the temperature of the skin reaches 131 degrees F. The Society of Fire Protection Engineers Handbook indicates that exposure of bare skin to any type of heating greater than 0.23 Btu/ft²-s (2.5kw/m²) for a long period will result in burn injury. As a point of comparison, the maximum energy that a person could receive by exposure to the sun is less than 0.09 Btu/ft²-s (1kw/m²). Exposure of unprotected skin to heating levels greater than 4.5 Btu/ft²-s (50kw/m²) will result in severe burns in less than 15 seconds.

INJURIES:

VNC Strike Team Leader-Trainee (STEN-T) Fire Captain:

- Smoke inhalation

VNC Engine 54 Fire Captain (FC-54):

- 1st and 2nd degree burns to both ears, sideburn areas, and forehead.
- 1st and 2nd degree burns to both arms, from the wrist to just above the elbow.
- 1st and 2nd degree burns to the back of right hand
- 1st and 2nd degree burns to left calf
- FC-54 was single layered in the back of legs between the sock line on his calves and thigh to his cotton gym shorts. FC-54 was also wearing a short sleeve t-shirt and thus had only a single layer of clothing between the wrist and the area just above the elbow. FC-54 sustained burns primarily to the arms where he was single layered.

VNC Engine 54 Fire Apparatus Engineer (FAE-54)

- Smoke inhalation

VNC Engine 54 Firefighter (FF-54)

- 1st and 2nd degree burns to forehead
- 1st and 2nd degree burns to left side of neck

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- 2nd and 3rd degree burns left ear
- 3 ½ inch laceration to right side of neck below jaw
- 2nd and 3rd degree burns to both shoulders and upper back
- 1st, 2nd, and 3rd degree burns to triceps area of both arms
- 2nd and 3rd degree burns to palm of right hand
 - o Includes palm side of all fingers
- FF-54 was double layered in all areas except in the arm area between the end of the short-sleeved t-shirt - just above the elbow, and the wrist. FF-54 sustained burns to the arms where he was single layered as well as to areas of his body (upper back and shoulders) that were protected by double layers.

Clothing and Line Gear – The clothing and web gear showed some signs of heat, as described below.

Note: Dye sublimation occurs when heat “cooks” the dye from the material and leaves a gray or tan color in the yellow aramid material. This occurs when the material reaches 450 degrees F. Generally, asphalt starts to melt when it reaches 250 to 300 degrees F.

Contents:

Bin 1 – Clothing FF-54:

Items: Flame-resistant (FR) pants (double layer on front of legs from upper thigh to shin) and shirt (single layer sleeves), FR station pants, cotton t-shirt and undershorts, structure hard hat with wildland shroud (single layer), wildland gloves, and structure SCBA.

- Pants:
 - o Area of dye sublimation on left cargo pocket
 - o Left hip pocket has dye sublimation and asphalt adhered to cloth
 - o Melted asphalt adhered to pants while the firefighter was rolling on the ground
- Shirt:
 - o Area of dye sublimation and melted asphalt adhered to the shirt on the upper left side of back and left arm.
 - o Smaller area of dye sublimation on the right side of the back and right arm is present.
 - o Inside of lower back has melted asphalt adhered indicating bottom of shirt was crumpled up leaving the cotton undershirt exposed.
 - o The lower back of cotton undershirt also has melted asphalt adhered to it.
- Helmet and Shroud:
 - o The helmet shows discoloration to the outer shell mostly on the left side.

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- Shroud shows dye sublimation mostly on the left side. Lines of dye sublimation shows that the shroud was crumpled during heat exposure most likely due to SCBA mask.



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Bin 2 – FC-54

Items: FR pants (double layer on front of legs from upper thigh to shin) and shirt (single layer sleeves), cotton t-shirt, gym shorts, socks and undershorts, wildland hard hat with goggles, wildland gloves, fireline gear harness and structure SCBA. The wildland shroud was used but it was not recovered.

- Shirt:
 - Dye sublimation on both sleeve cuffs,
 - Dye sublimation on both shoulder areas
 - Dye sublimation on upper right arm and elbow area.
- Pants: No significant signs of heat.



Bin 3 – Strike Team Leader (trainee):

Items: FR pants and shirt, cotton long sleeve t-shirt, cotton undershorts, structure hard hat with wildland shroud, and wildland gloves.

- Shroud: Shows an area of dye sublimation on the right side.
- Pants and shirt: show no significant signs of heat.



Fire Shelters:

Two fire shelters were found inside the house. One of the shelters was accordion folded in the same shape in which it was packaged. The second fire shelter that was next to the “escape” sliding glass door was slightly unfolded. Much of the aluminum foil of the shelter had melted away. Much of the fiberglass and silica cloth in the shelter was brittle. The conditions of the fire shelters indicate exposure to an environment that would be expected inside a burning structure – long duration of very high temperatures.

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Wolfpack Gear:

The line gear worn by FC-54, showed areas of melted nylon cloth, buckles, webbing and hook and loop fastener. Most melting occurred on the left side of the gear. The amount of melted material shows that the high temperature and duration of the exposure was enough to raise the temperature of the nylon to over 450 degrees F. FC-54 removed his gear and SCBA when he was inside the rear seat compartment of E-54. When the gear was recovered from E-54 it was discovered that part of the melted material had adhered to a metal component of the engine cab



SCBA:

- The Ventura County Fire Department does not have Standard Operating Procedures (SOP's) or any training policy or procedures that cover the use of an SCBA in the wildland environment.
 - Both FF-54 and FC- 54 had never participated in informal training or discussion on the use of SCBA's in the wildland environment.
 - The use of SCBA's in this burn over was an impromptu use of the tool without formal guidelines.
- While seeking refuge inside the house, FC-54 and FF-54 donned the SCBAs that had been previously placed there.
- When FC-54 and FF-54 exited the structure they reported running through intermittent flames for about 2 to 3 seconds.
 - It is estimated the temperature of yellow flames is 1,500 degrees F.
- FC-54 ran out of air in his SCBA while still entrapped within E-54. While taking refuge next to E-54; FF-54 was able to connect another full bottle of air to the original bottle that was close to being empty.
 - Breathing air that is hotter than 300 degree F can cause fatal damage to a firefighter's airway. Both FC-54 and FF-54 felt that using the SCBA saved their lives.

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Discussion:

- VNC E-54 personnel were utilizing department issued PPE.
- Wildland PPE is in no way capable of offering protection sufficient to survive a burnover or burning structure. Escape routes and safety zone must be the priority over “hunkering down” while using an SCBA.
- Both Fire Captain (FC) 54 and Firefighter (FF) 54 utilized a department issued particle mask style N95. The N95 masks were worn under the helmet shroud until the moment of entrapment.
 - N95 particle masks are not part of the VNC Wildland PPE Ensemble nor are there Standard Operating Procedures / Policy (SOP) for the use of the N95 particle mask as part of the Wildland PPE Ensemble.
 - VNC provides N95 masks for responses in a “dust” environment for which the N95 particle masks are designed.
 - N95 masks may filter larger particles like smoke, but do not filter carbon monoxide (CO). In reducing the discomfort caused by smoke, it may increase the firefighter’s duration of exposure to CO, which can result in headache, dizziness, mental confusion and even death.
- California Code of Regulations (CCR), Title 8 requires employers to identify hazards employees face in the workplace. Additionally, CCR Title 8 requires employers to provide PPE commensurate with the level of exposure and train employees to the capabilities and limitations of the PPE provided.
- Ventura County Fire Department (VNC) is in the process of conducting an assessment to determine the most appropriate protection level of the wildland ensemble. Specifically, VNC is considering the risk associated with internal heat stress injuries compared to risk associated with burn injuries. Currently, some VNC firefighters are utilizing single layered wildland ensembles that provide a reduced risk of heat stress injuries while some are utilizing a double layered ensemble which provides a greater degree of thermal protection and reduced risk for burn injury.
- FC-54 stated that although he supports the concept of single layering to reduce internal heat related injuries he also supports the concept of providing a double layered sleeve to better protect the arms.
- Both FF-54 and FC-54 appeared to have received some protection from burns where their skin was covered by double layers of cloth. While this event may seem to recommend the use of double layers, it should also be recognized that heat stress injuries are more likely when using double layers. Both factors should be considered when decisions are made regarding PPE requirements for wildland fire fighting.

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- SCBA bottles usually hold 30-45 minutes of air, this burnover lasted longer. Some entrapments/burnovers can last more than one hour.
- The planned use of an SCBA may lead firefighters to stay in more risky positions longer, which may compromise the ability of firefighters to escape.
- Sheltering within a structure is risky, like fire shelter deployment sites, structures must be evaluated for survivability.
- Having an SCBA in one direction and an escape route in another may cause confusion and delay in firefighters making a choice between escape and staying in place.
- If it is determined that the use of an SCBA is warranted in a wildland fire environment –
 - Should the rest of the structural ensemble be used as well?
 - Further evaluate the level of commitment – is risking my life worth (blank)?

Recommendations

1. N95 style particle masks should not be used in the wildland fire environment.
2. Wildland PPE is designed with limited protection capabilities; firefighters must be aware of these capabilities.
3. Firefighters should make escape routes and safety zone a priority over the planned use of an SCBA.
4. Review the policy for inter-mixing wildland and structural PPE components.
5. Firefighters should not abandon their fire shelter in the wildland fire environment.

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Date

Tony Petrilli
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Date