Rapid Lesson Sharing

Event Type: Firefighter Smoke Exposure

Date: July 2022

Location: Northern Rockies

Firefighter Smoke Exposure

Introduction

We have all been there at one time, surprised by something in hindsight we believe should not have been a surprise. That is the power of hindsight, it fools us into believing that outcomes are more predictable than they really are, and more sinisterly leads us to believe that we have more control over our world than we truly do.

"Be prepared for the unexpected" is a seemingly wise mantra to live by. Especially if you live in a world that is changing rapidly around you. But what does it really mean to "be prepared for the unexpected?" Does being prepared for the unexpected mean to accept that we can't always predict what will happen; or sometimes things will not play out as we initially thought or hoped?

Sometimes the wind blows from one direction for a while, only to turn around and come from the other way in the blink of an eye. The smoke that was blowing away from you earlier is now coming straight at you, and you are in the thick of it. This is just one more thing you are trying to stay ahead of in a world that is growing more chaotic by the minute. The uncertainty of the situations we sometimes experience in the urban interface can be similar to what military theorist Carl von Clausewitz notes as unexpected developments unfolding under the "fog of war".

Fog of War. iStock photo.

> *"It was in the heat of the moment that I needed to take a pause to make sure I had communicated the hazards effectively."*
>
> Engine Boss Trainee

Incident Summary

By the Engine Boss

As a wildland fire engine crew, we were assigned to initial attack efforts supporting neighboring land management agencies. Prior to this incident, the fire we had been working on had been contained and we were now in mop-up phase. We were using our engine to top off the water tanks of another engine on the fire when we all observed a plume of black smoke below us in an area not too far from the fire we were working.

Helicopter dropping water. Thom Bridge, Independent Record newspaper.

We were requested over the radio to respond to the new smoke. Upon arrival on scene, we saw that the fire was burning in a Wildland Urban Interface (WUI) setting with a nearby home and several outbuildings.

The fire appeared to have originated in an outbuilding that inhabited livestock and was now spreading into the wildland component.

After assessing the situation, I determined we could safely engage the fire away from the outbuildings and livestock area. I also told the crew to stay away from the structures and the smoke and not to engage in any structure suppression. The volunteer fire departments (VFD) would address those resources.

The wind direction was favorable. It was blowing consistently downslope at approximately 2-5 mph, pushing the smoke away from us, allowing us to engage the fire and prevent further spread to the wildland component. Utilizing the engine hardline, we began to knock down the flames and heat on the flank burning into the wildland component.

After a few minutes, other resources began to arrive on scene. It quickly became a cluster of equipment and personnel. There were two Type 3 VFD structure engines and brush trucks and a helicopter making bucket drops. The helicopter surprised us all. We were not aware that it had been ordered.

As we continued to work our area of the fire, there was a sudden wind shift. This caused the smoke that was coming off the burning outbuildings and livestock area to come directly at us. This event happened very quickly, with thick smoke and heat blowing directly into my face. I immediately felt the stinging in my eyes and began coughing violently and vomiting.

> *"There was a sudden wind reversal, and it blew hot air and smoke directly into my face, and I felt the effects of it immediately."*
>
> Engine Boss (Qualified)

Smoke. iStock photo.

I disengaged and returned to the engine. Next, another crew member complained of feeling ill and started vomiting after exposure to the acrid smoke. I then directed the rest of the crew to disengage and return to the engine.

I contacted the Incident Commander (IC) and made them aware of the smoke exposure and the condition of myself and the other crewmember that was affected. We received an evaluation by onsite medical personnel that were part of the VFD. After that initial evaluation, it was determined that due to the nature

of the exposure and the symptoms being experienced by the two of us, we should be transported to the local hospital for further evaluation. A driver from the VFD drove us to the hospital.

> *"In hindsight, I should have taken a moment to take a step back and truly assess the exposure that I was putting myself in front of."*
>
> Engine Crew Member

We received a medical evaluation and were released from the hospital that same day. I was advised to seek a follow-up evaluation from my local medical provider back home. We returned to our home unit the following day.

After a couple days back home, we were still feeling ill from the smoke exposure and sought further medical evaluation. This did not prove as easy as we initially thought, as our local medical providers would not accept Federal Office of Workers' Compensation Programs (OWCP). We therefore ended up driving several hours to a different town to get a medical evaluation.

The lingering symptoms—including residual cough, resistance in lungs while hiking, and burning in lungs like running when it is cold outside when engaged in prolonged cardio activity—after our exposure are concerning to other employees and supervisors. Particularly considering the smoke that impacted us when the wind shifted was from a burning outbuilding, trash, and livestock carcasses.

> *"I didn't recognize the severity (of the smoke) until we were told to disengage, and another person started puking".*
>
> Engine Crew Member

The follow-up medical evaluation did not reveal what the long-term effects of this exposure may be or whether the symptoms that both of us continue to experience will improve—or possibly reoccur in the future. It was also expressed by treating physicians in our follow up medical examinations that these symptoms could be long term.

Lingering Symptoms After the Exposure

The exposed crew members continue to experience the following symptoms a month after the exposure:

- A feeling of resistance in the lungs and difficulty breathing when running, hiking, and being exposed to smoke or poor air quality.
- Residual cough.
- Burning sensation in lungs when engaged in prolonged cardio or when exposed to smoke.
- Lung capacity feeling significantly less than prior to the exposure.
- Feeling like there is an obstacle or screen not allowing them to breath at 100 percent capability.

Lessons Shared

- It was good to have the EMTs on the fire assess the firefighters for their smoke exposure. Considering the nature of the smoke exposure, the two crewmembers appreciated being sent to the hospital for further evaluation.
- Be proactive and be ready to make your own calls on pulling out of the smoke, not just for you, but for the benefit of all.

- Getting follow up care/evaluation after you leave the initial treating hospital can be difficult due to some medical providers not accepting Federal OWCP.

Opportunities for Organizational Learning

The likelihood of a lesson influencing our behavior is greatly increased by how personal the source of the lesson is. It is easier for someone to take and apply lessons learned from their personal experiences, or from experiences of people close to them, but harder for an organization to take those same lessons and have the same impact across the broader community.

As leaders, we can utilize lessons shared by others to evaluate our organizational norms and processes to improve organizational performance with a bit of creative inquiry. Several topics you can use to get the conversation going are provided below.

Topics for Discussion

- When do you know to get checked out by a doctor for smoke exposure? Or know when someone else on your crew should go get checked out?
- How do you know when you need to "pull out of the smoke"?
- What kind of "field medical" training do we provide for "smoke exposure"? Do we cover this in first aid training for fire personnel?
- Is there a difference between smoke exposure and smoke inhalation? Or is it the same thing?
- What are other Wildland Urban Interface (WUI) respiratory hazards we should probably know more about?
- What hazards/exposures just come with the job (are accepted because they are "normal")?
- What are some of the things you can predict will likely happen in an WUI initial attack? (Not what should happen, but rather what will happen.)
- Do we accept more risk in a WUI initial attack than we would on a non-WUI event?
- Are medical providers available in your local area that accept Federal OWCP for follow-up medical care that may be needed?
- Are supervisors and leadership familiar with the OWCP process—as well as what they can do to help avoid potential challenges?

Digging Deeper

The following are some great resources related to smoke and wildland firefighter health that can raise awareness of occupational hazards of smoke to wildland firefighters. Even though smoke is a hazard that comes with the job, it is still a hazard that you should be informed about.

Take a few moments and dig deeper into the topic of smoke and take pride in being a student of fire.

WFSTAR Module – Smoke: Knowing the Risks

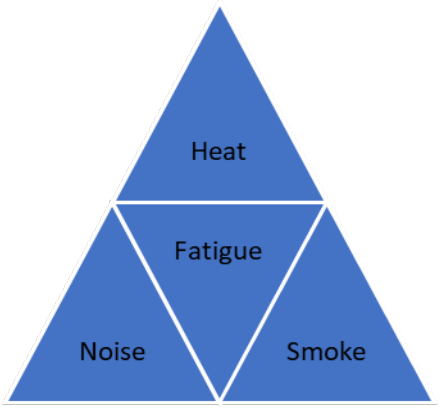
Learn about the chemical makeup of smoke, how it affects our bodies and what actions can be taken to reduce or avoid those affects.

Effects of Smoke Exposure – 6 Minutes for Safety

Wildland fire smoke is a complex mix of chemicals and particles, which varies depending on the fuels, soil, weather, fire intensity, and the burning phase of the fire. Some of the chemicals and particles that are present can pose a health risk, particularly with higher exposures or long-duration exposures. Wildland fire smoke can cause irritating respiratory symptoms and, over time, could possibly increase the risk of developing long-term illnesses.

Wildland Fire Lessons Learned Center's Two More Chains – Summer 2017

This triangle (courtesy of George Broyles) is heavy, and it will smash you. It's also pretty much invisible because we are so accustomed to its elements. Some of the points are sharp and will cut you down where you stand, others are rather dull, but insidiously incessant.



George Broyles, Travis Dotson – Two More Chains, Summer 2017.

You want to do some good for yourself and those around you? Put a pinch of practical in your tactical pause. Stop what you're doing to intentionally:

- Lower core body temperature.
- Lower heart rate.
- Relieve fatigue.
- Get out of the noise.
- Get out of the smoke.

Wildland Firefighter Health: Some Burning Questions

What is in Wildland Fire Smoke?

Wildland Firefighter Health NIOSH Science-Blog, 2020

"While burning vegetation is the primary exposure of concern for wildland and prescribed fires, when fires burn in the wildland urban interface (WUI, where wildland vegetation and urban areas meet) the smoke may contain compounds that are more similar to what structural firefighters encounter. Wildland firefighters will often suppress these fires and may be exposed to some of the hazardous compounds of WUI smoke such as volatile organic compounds (VOCs), flame retardants, and polycyclic aromatic hydrocarbons (PAHs). However, wildland firefighters do not have the benefit of wearing some of the personal protective equipment (PPE) typically used in a structural response (e.g., self-contained breathing apparatus [SCBA], turnout gear) that could provide protection from these compounds."

FINAL REPORT Wildland Fire Smoke Health Effects on Wildland Firefighters and the Public

This finding is from "Broyles, G. Wildland Firefighter Smoke Exposure, USDA, Forest Service. 2013": "*In our wild land smoke assessment (650 firefighters, 7,500 hours, 17 states, 80 fires), we found that firefighters exceed safe levels on all fire types for each established short and long-term metric (5-minute, 15-minute, 8-hour).*"

Wildland Firefighter Smoke Exposure and Risk of Lung and Cardiovascular Disease

From "Wildland Firefighter Smoke Exposure and Risk of Lung and Cardiovascular Disease, Navarro, K. M., Kleinman, M. T., Mackay, C. E., Reinhardt, T. E., Balmes, J. R., Broyles, G. A., Ottmar, R. D., Naher, L. P., and Domitrovich, J. W. 2019":

Wildland firefighters are exposed to health hazards including inhaling hazardous pollutants from the combustion of live and dead vegetation (smoke) and breathing soil dust, while working long shifts with no respiratory protection. This research brief summarizes a study analyzing long-term health impacts of smoke exposure for wildland firefighters (Navarro et al. 2019).

Holding line during firing operations on the 2019 Cow Fire, Malheur National Forest. Photo: Kathleen Navarro.

Key Findings from: Navarro, et al.

- Firefighters who worked both short and long seasons (49 days and 98 days per year, respectively) were exposed to increased lifetime doses of Particular Matter 4 across all career durations (5-25 years).

- Wildland firefighters were estimated to be at increased risk of lung cancer (8 to 43 percent) and cardiovascular disease (16 to 30 percent) mortality across season lengths and career durations.
- These findings suggest that wildland firefighters should reduce exposure to smoke in any way possible.

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And Most Importantly:
By the firefighters who shared their experience for the benefit of us all.

Do you have a Rapid Lesson to share?

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Share Your Lessons