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ANALYSIS OF WILDLAND FIRE PREVENTION AFFECTING CONSTRUCTION AND MAINTENANCE OF CRITICAL INFRASTRUCTURE

An examination of the underlying fire science, environmental impacts, cost recovery efforts and results, and a review of possible solutions for utility and other fundamental infrastructure companies.

By Jeffrey Meston

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1. **Introduction**
2. **What determines fire behavior?**
3. **Strategies to reduce the risk of high intensity fires**
4. **Typical environmental impacts**
5. **Cost recovery efforts**
6. **Acceptable risk**
7. **Possible mitigation solutions**
8. **Conclusions**

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1. Introduction

Wildfires pose a significant threat to infrastructure providers and contractors when doing construction, maintenance or operations. Most western states have now implemented cost recovery programs for both direct and indirect costs associated with accidental fires. These costs are significant issues for company shareholders or end users within a public utility system. This paper will attempt to outline the issues that currently exist, and offer some mitigation solutions. To understand about the risk one must have a basic understanding of wildland fires and the threat to human life and property in fire-prone ecosystems.

Several factors influence the intensity of wildfires and their potential to damage or destroy structures and natural resources. Developing a basic understanding of the factors that determine wildfire movement and intensity (collectively called fire behavior) will allow authors associated with environmental impact reports and those charged to mitigate the risks an understanding of the problem, and find cost effective solutions. Research has shown that the most important factors influencing building survival during a wildfire are fire intensity, vegetation characteristics, and building materials (especially roofing). Strategies for protecting homes from wildfires have been developed with these factors in mind. Generally, however, construction of infrastructure will have no control over what measures homeowners may have done to protect their dwellings from a significant wildland urban interface fire.

How Do Wildfires Spread? The Concept of Heat Transfer

An important aspect of fire behavior is the manner in which it moves. Fire requires the presence of oxygen, fuel, and heat. Oxygen is abundant in the atmosphere, and therefore it generally does not inhibit wildfire movement. Plants are the primary fuels during wildfires, and their arrangement greatly influences the transfer of heat. Three basic mechanisms of heat transfer are *convection, radiation, and conduction*.

- **Convection:** The transfer of heat by the movement of a gas or liquid is called *convection*. Because hot air rises, heat transfer through convection tends to move upward. During wildfires, burning materials on the forest floor create convection currents that preheat the leaves and branches of shrubs and trees above the fire. The vertical air currents can also lift burning materials. The floating embers, also called **firebrands**, can settle in unburned areas ahead of the fire and start small fires. This phenomenon is called spotting and can result in rapid advancement of the fire. Firebrands can also ignite homes directly if they land on flammable roofing or accumulations of leaves or needles in gutters or on roofs.
- **Radiation:** Burning objects release energy in the form of heat. In general, the size of the object determines the amount of heat generated. In most cases, radiant heat from a wildfire will not ignite materials on homes at distances greater than 30-50 feet from the house. During prescribed fires, fire professionals carefully monitor the amount of radiant heat being released from the flaming fire front. Prescribed fires are set intentionally and are used to meet land management objectives.
- **Conduction:** The last mechanism of heat transfer is from direct contact or *conduction*; an example is the heat that you feel when you touch a cup of hot water. Conduction carries heat through fuels, such as logs or house walls, and can raise their temperature to ignition points. Heat transfer through conduction can only occur within the same object or between objects that are touching.

With an understanding the fundamentals of heat transfer, one can see how the arrangement of plants can determine the movement of a wildfire. If flammable vegetation is abundant and continuous, all three mechanisms may interact to produce a rapidly advancing fire. Plants near the fire are dried, preheated, and even ignited through the effects of convection and radiation. Conduction preheats and dries larger fuels that are touching each other and may prolong the time those fuels burn by facilitating the internal transfer of heat.

2. What Determines Fire Behavior?

Multiple factors interact to determine the behavior of wildland fires. Fire behavior refers to the intensity at which a fire burns and how it moves. General descriptions of wildfire behavior focus on where the fire occurs in the vegetation: underground, on the surface, and in tree crowns. Ground fires are fires that burn below the surface. During surface fires, fuels at or near ground level, such as grass, shrubs, and/or fallen leaves, pine needles, duff and branches, carry the fire. Crown fires burn through the tops of trees. In general, the relative intensity, or amount of heat released, of the different types of wildfire increases from ground to surface to crown fires. Firebrands may originate from surface fires or crown fires. Structural fires, or burning homes or buildings, are another type of fire that can produce firebrands. Three factors interact to determine fire behavior in wildland fires: *fuels, weather, and topography*.

Fuels: The primary fuels in wildland fires are living and dead vegetation. During extended periods of warm and dry conditions, all plants will burn if exposed to enough heat. However, plants differ in how readily they ignite and how hot or long they burn. Flammability depends on plant size, arrangement of branches and leaves, and chemical properties of leaves, branches and bark. Both the horizontal and vertical arrangement of vegetation influences fire behavior. The arrangement of vegetation across a tract of land is influenced by the frequency of past disturbance. Wildfire is a natural disturbance that reduces the amount of dead plant material and light fuels at a site. A common firefighting technique for slowing or stopping an advancing wildfire involves creating breaks in the fuels by clearing all vegetation from strategic locations. Fire professionals have a few key terms that they use to describe wildland fuels.

- **Light fuels** include grasses, shrubs, and tree leaves or needles. They are referred to as light and flashy fuels because they ignite easily and burn rapidly. Light fuels affect the rate of spread of an advancing fire. They are the primary fuels that carry fires and ignite homes in many wildfire situations.
- **Heavy fuels**, such as large tree branches, downed logs, and buildings, require more heat energy to ignite, but they burn longer and produce more heat once ignited.
- **Ladder fuels**, such as shrubs or small trees of intermediate height, act as ladders carrying the flames from the forest surface up into the tops of trees.
- **Fuel breaks** are areas lacking vegetation or other fuels that stop or impede the horizontal movement of an advancing fire. Fuel breaks can be natural, such as rivers or streams, or artificial, such as roads, golf courses or plowed agricultural fields.

Weather: Precipitation, humidity, wind, and temperature are important weather variables that influence fire behavior. Precipitation and humidity, which is influenced by air temperature, directly influence the flammability of forest fuels by affecting moisture content of living and dead leaves, branches, and grasses. Plant materials dry out quicker and ignite more easily during hot, dry weather. Windy conditions increase the rate of spread of fires and may increase fire intensity.

Fire fighting professionals have developed classification systems that incorporate current weather conditions into an index to rate fire risk, called a fire danger index. Another tool fire professional utilize is the "red flag warning" system developed and issued by the National Weather Service.

Topography: Topography significantly affects fire behavior. Fires move faster uphill than downhill. Slope orientation also influences fire behavior. Forests on southern or southwestern slopes generally have lower humidity and higher temperatures than those on north or northeast slopes because of the path of the sun. Consequently, fire hazard is often higher on south and southwest facing hills.

Of the three factors affecting fire behavior, fuels are the easiest to manage by homeowners and land managers to lower fire hazard.

3. Strategies to Reduce the Risk of High Intensity Fires

Homeowners: Homeowners in high fire hazard areas can reduce the risk of high intensity fires affecting their property. An important concept for homeowners living in hazardous areas is that of defensible space. Defensible space is defined as an area of modified vegetation between wildland fuels and homes that allows firefighters to protect the home or, in absence of firefighters, allows the home to better survive on its own. The most extensive modification of vegetation should occur within an area extending at least 30 feet outward from the house and in some cases based on local fire prevention laws this could be up to 100 feet. Beyond this area, additional modification of wildland vegetation creates a larger buffer from an approaching wildfire and further decreases the risk of damage.

Infrastructure Construction and Maintenance Crews: Infrastructure construction and maintenance crews can implement a series of fire prevention practices which include not doing construction or maintenance during red flag days, the use of first aid firefighting contractors, or a combination of water trucks, firefighting hand tools and strict no smoking policies. To accomplish self fire prevention mitigation the construction or maintenance crews must receive annual firefighter training and practice those procedures so that emergency operations become second hand during an accidental fire start.

4. Typical Environmental Impact Relating to Accidental Fires

Quantifying Potential Impacts

The amount of impacts from the construction of infrastructure (transmission lines, rail lines, pipe lines) can be measured in several different ways. Useful methods of quantifying impact are measurements of area (acreage), distance (miles or feet), and the number of poles.

In woodlands, where trees must be cleared from a right-of-way (ROW), acreage is a better measure of impact than miles. In other types of areas where ROW clearing is not the primary impact mileage may be a better measure of impact.

Determining the Degree of Potential Impacts

In general the degree of impact of a proposed infrastructure is determined by the quality or uniqueness of the environment along the proposed route. The following factors determine the quality of the existing environment:

- The degree of disturbance that already exists
- The uniqueness of the resources
- The threat of future disturbance

The degree of disturbance that already exists in a location is determined by how close the area resembles pre-settlement conditions. For example, an area may have been logged, drained, developed, cultivated, or otherwise substantially altered. Then, the extent of the alteration must be assessed.

Proposed infrastructure routes are reviewed for species or community types that are uncommon in the region or in the state. Does the resource possess a feature that makes it unique, such as its size or species diversity? Does the resource play a special role in the surrounding landscape?

And finally, will surrounding uses threaten the quality of the resource over time? How is the resource valued by those who own or manage it?

Identifying the Duration of Potential Impacts

Construction of infrastructure involves both long-term and temporary impacts. Long-term impacts can exist as long as the line is in place and include land use restrictions and aesthetic impacts. Temporary impacts occur during construction or at infrequent intervals such as during line repair or ROW maintenance. Temporary impacts during construction can include fire ignition.

Minimum Proposed Mitigation for Accidental Fires

- During the construction phase the infrastructure company shall implement ongoing fire patrols during the fire season as defined each year by local, State, and federal fire agencies.

- During Red Flag Warning events, as issued daily by the National Weather Service all construction and maintenance activities shall cease.

- All construction crews and inspectors shall be provided with radio and cellular telephone access that is operational along the entire length of the approved route to allow for immediate reporting of fires.

- Each crew member shall be trained in fire prevention, initial attack firefighting, and fire reporting.

- No smoking will be allowed during work in a wildland environment.

5. Cost Recovery Efforts due to Accidental Fires

Cost Recovery for wildland fires has become such an intense topic that in 2007 a firm created an annual Wildland Fire Litigation Conference held in Reno, Nevada. There are several states within the Western United States that have implemented Wildland Fire Cost Recovery Programs. We will examine a few to understand the large amount of dollars that are involved not only with direct costs (suppression costs) but indirect costs (re-vegetation, loss of recreation, loss of timber sales, etc).

The following is excerpted from the State of Washington Department of Natural Resources cost recovery program.

Wildfires can be expensive to suppress. The severity of the fire, the terrain, the threat to forest lands, humans, wildlife, structures and other assets helps to determine the level and urgency of the suppression effort.

Of the 85 percent of wildfires that occur in Washington's state and private forests that are human caused, about 52 percent are determined to have been negligently or intentionally started.

If DNR investigators determine that the origin and cause of the fire is negligent and/or criminal, the responsible individual(s) will be notified by DNR of our intent to recover the suppression costs of the fire from them, as required by law. As a result, the recovery of costs associated with these wildfires often requires litigation at various levels. The department may pursue criminal charges against those individuals responsible for causing wildfires for violations of RCW 9A.48, RCW 76.04, WAC 332.24 or other statutes or ordinances where enforcement is necessary for the protection of state and privately owned forestlands and other property that falls under the department's wildfire jurisdiction. If criminal charges are pursued, DNR normally will request criminal restitution for the costs associated with the suppression of the fire.

In <u>California</u> the California Department of Forestry and Fire Protection has established a Cost Recovery Program.

A brief overview/summary of the Cal Fire Cost Recovery Program:

Wildland fires cost California taxpayers millions of dollars every year. If the California
Department of Forestry and Fire Protection's (CAL FIRE) investigation reveals a fire
was caused by a violation of law or negligence, the person responsible can be charged
criminally, civilly, or both.

CAL FIRE's civil cost recovery program is based on the following principles:

• Fighting fires is very costly to the state's taxpayers.

• The state legislature has determined that if a person causes a fire through willfulness, negligence, or violation of law, that person is responsible for their actions and may be liable for the fire suppression costs.

• Each year, CAL FIRE bills hundreds of responsible parties for fire suppression costs. Once the investigation is completed and the cost of fire suppression is determined, the responsible person is sent a "Letter of Demand" which outlines the act of negligence or violation of law that occurred and demands repayment of costs that were spent suppressing the fire. If the person responsible ignores the demand or denies responsibility, civil litigation is initiated and the matter is settled through the courts.

• It is the policy of the Department to actively and aggressively pursue those cases in order to recover those costs.

• The District Attorney in each county prosecutes criminal cases while CAL FIRE works with the State Office of the Attorney General to pursue civil cases.

The following outlines some of the success of the Cost Recovery Program:

- It was found that lack of adequate clearance near a power line in Butte County, not far from Lake Oroville, caused a fire that consumed over 8,000 acres in timber, brush and grass. The result was the destruction of 47 residences and which caused 15 injuries. The utility company and the tree trimming company ultimately reimbursed the State of California just over $10M.

- In 1996, a major southern California utility company was billed $7.9 million for fire suppression costs for the Calabasas Fire. This cost was reduced to $6.55 million in a settlement negotiated just prior to trial in 2003. CAL FIRE determined that the fire was caused when a eucalyptus branch was bent by the wind into a lightening arrester.

- In 1990, a major northern California utility company was billed $8.2 million by Cal Fire. The Campbell Fire burned over 125,000 acres and destroyed 27 structures in Tehama County. CAL FIRE determined that the fire was caused by a tree limb that made contact with a 500 kV power line. It was alleged that vegetation had not been properly maintained to the 10-foot clearance around the power line as required by law. The parties agreed to a negotiated settlement of $5 million.

- In Nevada County, a major utility company was the first to face criminal prosecution for violating the 1963 State statute requiring utility companies to maintain power line clearances up to 10 feet around high-voltage power lines. Their failure to maintain clearance around facilities was alleged to cause the 1994 Trauner Fire. Five percent of the company's overhead lines were consequently surveyed in 1995, and 5,093 instances of 'tree-line contact' in which branches were directly touching or within four feet of the power lines were documented.

CAL FIRE's Civil Cost Recovery Program helps offset the burden placed on the on the state's budget by returning recovered dollars to the state's General Fund.

The following statistics, as provided by Cal Fire, are instructional about wildfires size and their probable cause:

Infrastructure Fire

Date of event	**Name & Location of event**	**Cause of the fire**	**Acreage Buildings lost Fatalities**	**Costs or Settlement**
October 2007	Witch Fire San Diego, California	Power lines	197,990 A 1650 B 2 F	14.8 Million and 2 Million
August 1990	Campbell Complex Tehama, California	Power lines	125,892 A 27 B	Unknown

September 1970	Laguna San Diego, California	Power lines	175,425 A 382 B 5 F	Unknown
September 1970	Clampitt Los Angeles California	Power lines	105,212 A 86 B 4 F	Unknown
July 2003	Hunt Creek Blaze Idaho	Logging	640 A	2.5 Million
June 2002	Uinta Mountains Utah	Boy Scouts Camping	14,200 A	14 Million
February 2002	Gavilan Fallbrook, California	Clean up burn By owners	5,763 A	1.3 million paid by owners, total cost 42 Million
2004	Lonesome Lake Vancouver BC	Unknown	160 A 20 B	$325,000
September 6 2001	Yankee Hill Northern California	Power lines	8,000 A 167 B	5.9 Million
May 2001	Chisholm Alberta Canada	Rail line	286,642 A	18.6 Million
2006	Cohoe Loop Kenai, Alaska	Control Burn Escape	Unknown	$83,761
August 17, 2000	Storrie Fire Plumas County, California	Railroad welding	52,000 A	102 Million
April 2008	Carbondale Carbondale Colorado	Control Burn Escape	Unknown	Unknown Settlement
2002	Bishop California	Power lines	2560 A	2.8 Million
March 2006	Texas Panhandle	Faulty Electrical Equipment	1,000,000 A 12 F	Unknown Settlement
2008	Grayling Fire Michigan	Railroad Locomotive	1,300 A	$934,000
October 1999	Tahoe and Plumas Forest California	Power lines	11,721 A	14.7 Million
August 2001	University Fire Portland Oregon	Railroad Locomotive	Unknown A	$199,731
June 10,	Olympic Pipeline	Pipeline	Unknown A	112 Million

1999	Bellingham Washington	rupture and fire	3 F	75 Million (F) Unknown (F)
November 2004	Walnut Creek, California	Pipeline rupture and fire	Unknown A 1 F	6 Million
September 8, 2005	Squaw Creek Okanogan Washington	Power lines	1100 A 1 D	$161,000
2005	School Fire Columbia, Garfield Washington	Power lines	52,000 A 216 D	3.7 Million
April 1996	Filmore Fire Ventura County California	Power lines	11,000 A	1.8 Million
June 29, 2007	Neola North Fire Utah	Power lines	43,511 A 12 D 3 F	1.6 Million

(continued on next page)

20 Largest California Wildland Fires (By Structures Destroyed)

	FIRE NAME/*CAUSE*	DATE	COUNTY	ACRES	*STRUCTURES*	DEATHS
1	TUNNEL *(REKINDLE)*	October 1991	ALAMEDA	1,600	2,900	25
2	CEDAR *(HUMAN)*	October 2003	SAN DIEGO	273,246	2,820	15
3	WITCH *(UNDER INVESTIGATION)*	October 2007	SAN DIEGO	197,990	1,650	2
4	OLD *(HUMAN)*	October 2003	SAN BERNARDINO	91,281	1,003	6
5	JONES *(UNDETERMINED)*	October 1999	SHASTA	26,200	954	1
6	PAINT *(ARSON)*	June 1990	SANTA BARBARA	4,900	641	1
7	FOUNTAIN *(ARSON)*	August 1992	SHASTA	63,960	636	0
8	SAYRE *(MISC)*	Novermber 2008	LOS ANGELES	11,262	604	0
9	CITY OF BERKELEY *(POWERLINES)*	September 1923	ALAMEDA	130	584	0
10	HARRIS *(UNDER INVESTIGATION)*	October 2007	SAN DIEGO	90,440	548	8
11	BEL AIR *(UNDETERMINED)*	November 1961	LOS ANGELES	6,090	484	0
12	LAGUNA FIRE *(ARSON)*	October 1993	ORANGE	14,437	441	0
13	LAGUNA *(POWERLINES)*	September 1970	SAN DIEGO	175,425	382	5
14	HUMBOLDT *(ARSON)*	June 2008	BUTTE	23,344	351	0
15	PANORAMA *(ARSON)*	November 1980	SAN BERNARDINO	23,600	325	4
16	TOPANGA *(ARSON)*	November 1993	LOS ANGELES	18,000	323	3
17	49ER *(BURNING DEBRIS)*	September 1988	NEVADA	33,700	312	0
18	ANGORA (HUMAN)	June 2007	EL DORADO	3,100	309	0
19	SIMI *(UNDER INVESTIGATION)*	October 2003	VENTURA	108,204	300	0
20	SLIDE *(UNDER INVESTIGATION)*	October 2007	SAN BERNARDINO	12,759	272	0

Note that this list does not include fire jurisdiction. These are the Top 20 within California, regardless of whether they were state, federal, or local responsibility. Also note that "structures" is meant to include all loss - homes and outbuildings, etc.

11/4/2009

Federal Cost Recovery Efforts

The Federal Government has established through the Department of Justice a Fire Recovery Litigation Team. Here is some of the work that the team has accomplished:

Union Pacific Railroad Co. has agreed to a $102 million settlement for damages from the Storrie forest fire in Lassen and Plumas national forests in 2000, the largest-ever federal settlement for a forest fire.

Federal authorities allege Union Pacific employees failed to clear the area when they were using grinders and rail saws during repair work, sparking the fire on Aug. 17, 2000.

The Forest Service had about 2,600 federal, state and local firefighters, air tankers and helicopter crews to battle the fire that burned 52,000 acres over three weeks, Assistant U.S. Attorney Kendall Newman said in a news release. The federal government estimates the cost of the fire at $22 million.

The fire caused extensive damage to trees and destroyed 21,000 acres of wildlife habitat. The remaining $80 million of the settlement is earmarked for damages to natural resources, with the money used for the remediation of Lassen and Plumas national forests.

"The money will be quickly applied toward restoring the landscape and the ecological balance on National Forest lands damaged in the fire so that the public can once again enjoy these pristine forest regions." **U.S. Department of Agriculture** undersecrtary Mark Rey said in a news release.

Union Pacific will make three installments this year, with $35 million paid July 2. The remaining $67 million is due by Oct. 15.

Burlington Northern Santa Fe Railroad

In January 2009, eleven property owners near Marshall, Washington, just south of Spokane, have filed a multimillion-dollar lawsuit against BNSF Railway for allegedly causing a 365-acre fire in 2007. According to the Seattle Times, the suit…

…cites a state Department of Natural Resources investigation that concluded a carbon buildup in the stack of a BNSF locomotive spewed hot cinders, which started a series of fires along the railroad's right of way.

BNSF was negligent, the suit contends, because 36 similar fires caused by the railroad's locomotives broke out along the same right of way since 1970.

Several of the fires sparked on Aug. 11, 2007, merged, becoming what was called the Marshall Complex Fire, causing evacuations of homes between Marshall and Cheney.

Union Pacific Railroad

The U.S. Forest Service filed a lawsuit against the Union Pacific Railroad for the 2002 Price Canyon Fire in Utah. The fire burned 3,200 acres and the government is seeking $653,364 in restitution for suppression and rehabilitation costs. The suit also named the subcontractor MotivePower, the company hat installed and maintained the turbo charger which was blamed for starting the fire.

6. Acceptable Risk

The term "acceptable risk" describes the likelihood of an event whose probability of occurrence is small, whose consequences are so slight, or whose benefits (perceived or real) are so great, that individuals or groups in society are willing to take or be subjected to the risk that the event might occur. The concept of acceptable risk evolved partly from the realization that absolute safety is generally an unachievable goal.

The question which must be considered for most environmental impact analysis reports is whether there is an acceptable risk to the construction and/or maintenance of infrastructure that is found in highly vegetated areas. Is there a way to mitigate the risk to construction and maintenance projects? And, is there an acceptable risk to the neighboring terrain, vegetation, populated areas, protected architectural sites, public areas, thoroughfares, existing infrastructure in the ROW, and protection of the safety of the on-site crews? Mitigation of risk relates directly to fuel, heat and oxygen in the fire triangle. Oxygen cannot be altered, there may be some latitude in elimination of fuels based on local fire regulations and environmental issues. The infrastructure contractor may have the biggest influence over and the last clear chance for mitigation of the risks and threats of uncontrolled fire.

Of course, this mitigation responsibility has to be weighed with the near term project costs. What are those costs? What are the insurance ramifications? What solutions are readily available, and how easily can they be integrated into the normal work flow? In trying to determine the appropriate level of mitigation activity, the possible risk/reward ratio may have to be considered. The challenge of contemplating that ratio involves trying to quantify something that didn't happen. How much benefit is accrued from a fire that didn't happen? Because of the active cost recovery activities previously discussed, and the liberal claims and penalties being awarded in the courts charged against complicit parties, under the concept of ‘vicarious liability’, it would generally be prudent to over-provide for mitigation during fire season while high risk activities are occurring in fire prone terrain or vegetation.

7. Possible Mitigation Solutions

Prudent construction and maintenance firms have many choices to make about how to prepare and equip themselves to observe best practices in the field. Project management companies, authors of EIRs, regulators, and other compliance observers should take into consideration the relevance of some or all of these tools:

- On-site Fire Marshal
  - Morning briefing
  - Equipment inspections
  - On-site micro weather reports
- Emergency Communication Facilitator
- Fire Compliance Officer
  - Daily reports
  - After action reports
- Training Officer
- Heli-base Mgr
- Tools and equipment
  - Fire boxes strategically located
  - Dip tanks
  - Fire extinguishers including back pack pumps
  - Water trucks; spray bars, monitors, hose reels
  - Water buffalo trailers
  - Wildland fire engines
    - Water, gel, foam
  - Helo ground support
- First aid/EMT capabilities
  - First aid kits
  - Prep for transport kits
  - AEDs, other emergency lifesaving
- GPS/GIS capability in the field
- Early warning Fire detection tools/software

An Innovative new solution?

San Diego Gas and Electric Co, as described in the April, 2010 edition of Incident Prevention Magazine, has pioneered a promising solution. Although not requiring any particular new technology or practices, it may afford the most probable and practical solution to the risk of runaway wildfire.

In 2009, SDG&E implemented a pilot program to determine whether using a private contractor could simultaneously reduce the risk of runaway wildfires and provide on-site emergency medical care to utility crews working in the field. As many as eight private fire engines and crews, along with a strike team leader and a fire agency representative were deployed daily from early September through mid-December under the direction of SDG&E fire coordinators. The contractor provided the apparatus, equipment, staff, and supervision for the pilot program. SDG&E's fire coordinators worked with the utility's district managers and local fire officials to develop the scope and operational guidelines of the program. Each morning, an Incident Command System (ICS) Action Plan would be published and distributed to SDG&E, the on-site engine companies and local fire authorities to outline the assignments for the day.

Private Firefighting Resources

There are several companies that serve as private fire brigades or fire companies within the United States. Generally these firms are not affiliated with any governmental agency and commonly work for companies that require specialized fire protection (Petroleum Companies, Movie Companies), subcontractors to the United States Government (Department of Defense, U.S. Forest Service) or insurance companies. The advantage of a non-governmental agency is that they can serve a specific customer with no conflicts of interest to the citizens that pay for their services through tax dollars. They are also not bound by specific jurisdictional boundaries that a governmental fire agency is customarily bound.

The use of private resources should be viewed as a first aid fire prevention program that can offer on-the-spot reaction to unsafe conditions, and should not be viewed as a replacement to the governmental fire response.

Private Firefighting Training Standards

There are two major regulatory bodies within the United States that regulates firefighter training, equipment standards, and fire apparatus; they are the National Fire Protection Association (NFPA) and the National Wildfire Coordinating Group (NWCG).

The NFPA publishes and updates on a regular basis minimum qualification standards which include:

- NFPA 1051 Standard for Wildland Fire Fighter Professional Qualifications
- NFPA 1021 Standard for Fire Officer Professional Qualifications

The NWCG also publishes and updates on a regular basis the minimum qualification standards which include:

- 310-1 Wildland Fire Qualification System which outlines the training, experience and physical capabilities of each firefighter within the system.

Private Firefighting Equipment Standards

There are nationally recognized equipment standards outlined in the Incident Command System (ICS). ICS uses a standard set of equipment nomenclature as well as the "type" of resource describes the size or capability of a resource. Wildland firefighting equipment usually is classified as a Type 3 (larger engine) or a Type 6 engine (smaller). Type 6 engines generally offer the most flexibility for infrastructure protection.

Private Firefighting Interoperability

Interoperability is a property referring to the ability of diverse systems and organizations to work together (inter-operate). The term is often used in a technical systems engineering sense, or alternatively in a broad sense, taking into account social, political, and organizational factors that impact system to system performance. The system for interoperability for the fire service is the use of the Incident Command System. The basic premise of ICS suggests that the management of emergency incidents should integrate all incident personnel in a positive "command and control" environment. ICS is a time-tested successful way to manage emergencies. Some version of ICS is used by nearly every emergency management agency in the world and is now being studied and considered by larger design/build, infrastructure construction, and regulated utilities nationwide.

Governmental Firefighting Resources are broken into several classifications including fully career organization, volunteer organizations or a combination of career and volunteer organizations. They are made up of Federal, State, Tribal, City, County and Fire Districts. The breadth of each organization is based upon funding sources, hazards within the jurisdiction and the elected officials determination of what an "acceptable risk" is within each community. It is very common for governmental fire agencies to have mutual aid agreements which provide additional resources from neighboring fire agencies for large or multiple emergencies. Regardless of what type of governmental fire agency exist there is a sequence of events that must be considered for each and every emergency response. This is a critical factor when determining how long the fire agency having jurisdiction to respond to a wildland fire created by an infrastructure company.

Response Time Considerations

Event Initiation

The point at which factors occur that may ultimately result in an activation of the emergency response system; or the time period in which an individual has clearly identified that there is a threat to life and property and that remedial action must be taken immediately or there will be definable losses.
Precipitating factors can occur seconds, minutes, hours, or even days before a point of awareness is reached. A patient who ignores chest discomfort for days until it reaches a critical point, at which the patient makes a decision (point of Awareness) to seek assistance. Rarely is it possible to quantify the point at which event initiation occurs.

Emergency Event

The point at which an awareness of conditions exists that requires an activation of the emergency response system. Considered the Point of Awareness, it may be the recognition by an individual that assistance is needed. This is a point in which a infrastructure worker activates the 911 emergency system.

Alarm

Alarm is defined as the *period of time* in which a human being or mechanical device takes to detect a set of circumstances that require response on the part of public safety forces to locate, access and begin to communicate with a public safety agency that is required in order to mitigate the emergency. Alarm notification time includes the dialing of telephones, the completing of circuits and all elements that are required for the transmission of coded messages or electronic impulses in order for the receiving party to identify that a state of emergency exists. Alarm notification is distinguished from the normalcy state by virtue of the fact that the individual who is aware of the emergency realizes they must have extra assistance or that the mechanical device such as heat detectors, smoke detectors and sprinkler systems reach their minimum threshold and operate. This element also includes the activation of equipment to alarm receiving facilities such as Central Station and third-party providers. This is when the emergency is reported.

Notification

Commencement of notification is defined as the *point in time* when the first electrical impulse or indicator that can be identified and recorded by the public safety agency. This is the agency that is responsible to act/respond and start collection of hard data. In most fire protection systems the emergency calls first go to the PSAP (Public Safety Answering Point).

Alarm Processing or Dispatch Time

Alarm processing time is defined as the *period of time* that is required for the communications center to identify the fact that an emergency is in progress, collect the information pertinent to making the appropriate dispatch and access the methodology used by the agency to deploy its resources.
Alarm processing time is essentially the entire time interval between realization that an emergency is in existence up to the point that this information is retransmitted via the internal alarm system to the attention of the specific agency's resources. The benchmark for this element of response time is 95% of all alarms will be dispatched within a 60 second time frame.

Turnout Time

Turnout time is defined as the *period of time* that it takes for response personnel to discontinue the activities that they are engaged in, properly attire themselves, and board the vehicle in readiness for response. Turnout time shall include the elapsed time between notification alert of an emergency event in progress and the emergency vehicle actually beginning to respond to the identified address or location. The nationally recognized benchmark is 60 seconds.

Travel Time

Travel time is defined as the *period of time* between the vehicles beginning their *uninterrupted* response and the actual time that the emergency response vehicle arrives at the address or location to which it has been dispatched. Travel time includes driving distance and delays caused by misinformation in the dispatch, traffic obstruction and/or geographical obstacles. Travel time ends when the vehicle is declared on-scene by the first arriving unit officer. The national response standard is based on 35-mph average or 53.1 feet/second. Most fire stations are sited in populated areas within a County, City or Fire district. Most infrastructure accidental fires are located great distances from responding fire agencies, which allows the incident to grow before governmental fire agencies arrive. This element of distance plays a major role in determining the amount of risk that exists. High risk work in fire prone territory which is remote from existing emergency resources almost ensures a prolonged response time to even the smallest of ignition emergencies and therefore represents a major risk to the company performing the work. In dry, windy conditions, the rate of spread of an ignition can be hundreds of square meters in a few minutes. If response time from normal first responders is 45 minutes or more, a fire could be hundreds of acres and out of control before initial attack commences.

8. Conclusions

Every responsible company which operates in fire prone terrain performing high risk duties is aware of and has a fire safety and prevention program. EIR/EIS documents call out the risks, and respondents match the risk with some form of activity to mitigate. But, unfortunately, fires continue to ignite, fires continue to get away, damage is done to lives, property, and environment, and claims and cost recoveries are becoming larger and more extensive. Regulatory agencies are becoming more strident in their expectation that fire risks and mitigation activities get sufficient focus, and costs to the operators are not foremost as they almost surely are less than the cost of fines and settlements for an operator being found complicit in a run away fire. Fire suppression cost recovery is becoming a commonplace activity for fire agencies at all levels as a way to augment budgets.

As companies continue to seek ever more effective risk management techniques, one which is the most effective in the event of inadvertent fire ignition is simply to ensure that it is suppressed before it becomes a high risk incident. If the first rule, "don't start a fire" is breached, the second rule should be "put it out before it gets away". To that end, the cost of supplying professional fire prevention equipment and crews on-site during high risk projects is small compared to the potential costs of a runaway fire.

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