



BPA 2022 WILDFIRE MITIGATION PLAN

ABSTRACT

BPA's Wildfire Mitigation Plan covers end-to-end activities related to the mitigation of wildfires across the Federal Columbia River Transmission System.

Message from the Administrator

Wildfire frequency and severity continue to be a concern for utilities across the West. Climate change is driving most of the changing conditions and has caused BPA to designate May 1 as the start of wildfire season. This is a full month earlier than three years ago when BPA documented its wildfire mitigation efforts in this plan. The Pacific Northwest has experienced first-hand just how devastating and costly wildfires can be for our communities and to the essential services, like electric utilities, to safely serve them.

BPA aims to protect public safety and preserve the reliable delivery of electricity during destructive events, such as wildfires, through proactive and responsive measures included in this plan. Applying what we have learned, our evolving mitigation efforts have helped us effectively prepare and respond to these threats. Some of these efforts included collaborations to identify high-risk fire areas with the Pacific Northwest National Laboratory, equipment repairs and replacements, and world-class vegetation management in and near our transmission corridors.

In 2021, we added a Public Safety Power Shutoff (PSPS) procedure that strengthened our wildfire mitigation efforts. PSPS events are planned outages intended to protect the public and prevent a wildfire during severe weather. In 2021, BPA implemented its first PSPS. Afterward, we met with impacted utilities and applied lessons learned to improve the PSPS procedure, which is discussed in detail in Section 7.0 of this document.

We recognize the local impacts of PSPS implementations. The PSPS is a measure of last resort layered on top of our use of world-class vegetation management, strategic asset management and risk-based planning, consistent with our 2018-2023 Strategic Plan, that are the cornerstone of our mitigation efforts.

Through post-wildfire season lessons learned, benchmarking with industry peers and participating in wildfire forums, BPA continues to pursue broader knowledge of wildfire mitigation to continually improve its preemptive measures and planning. One of the key lessons learned was the need for additional staffing specific for wildfire mitigation. Although wildfire mitigation is nothing new to Bonneville, mitigation efforts were being addressed by staff with many other duties. We have addressed this matter by creating a new department consisting of a dedicated staff with the sole priority of wildfire mitigation. While wildfire mitigation continues to be part of the focus for everyone at BPA, we now have a staff that makes it their full focus.

BPA is taking the appropriate actions available to us to prevent, mitigate and quickly recover from the devastation wildfires bring to the people and communities we serve. This updated Wildfire Mitigation Plan reassessed our competencies in programs and activities that support ongoing wildfire prevention and mitigation. Routinely updating our WMP helps us to stay current on the new technology, equipment and industry standards surrounding wildfire mitigation. BPA intends to continue updating the WMP on a two-year cycle. As we learn more about the wildfire threat, we will incorporate that knowledge into future iterations of this plan.

I applaud our entire wildfire team on their efforts to expand and improve our mitigation program. It is another great example of the more than eight decades of public service BPA has provided to the Pacific Northwest.



John L. Hairston
Administrator and CEO
Bonneville Power Administration





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1.0 Introduction/Executive Summary

BPA's wildfire mitigation activities have evolved to include risk-informed business strategies and capabilities and are incorporated into this document. These risk-informed approaches will promote continuous improvement in wildfire mitigation that will allow BPA to deliver value and safely operate the transmission system that provides power and transmission service to utilities and other interconnection customers. This is vital to the flow of electricity across the Western Interconnection.

Fire = Fuel + Ignition Source. This Wildfire Mitigation Plan (WMP) addresses BPA's efforts to mitigate the risk of wildfire ignitions through the recognition of this industry wide fire equation. It is through this lens that we address the solutions included in this document. BPA's rights-of-way, materials, and equipment (our assets) are the key components of the fire equation. In addition to technical measures to address the materials and equipment we own and operate, BPA also employs communication and the assistance of local, state and federal partners that can impact its rights-of-way.

BPA has long standing operational practices that have directly or indirectly provided wildfire mitigation. This includes world class vegetation management, customer and community relations, our partnerships with fire experts like the Pacific Northwest National Laboratory (PNNL), and field service inspection and maintenance. These practices and relationships have served BPA, and its service territory well.

BPA's efforts to mitigate the risk of wildfires are growing. Significant progress is being made in Critical Health and Risk methodologies, inclusive of factors that address wildfire ignition or fuel in our asset base. BPA continues to consider and employ existing and emerging solutions that enhance our operational effectiveness in mitigating wildfire risk. We are also expanding our focus to take into consideration more local impacts to communities surrounding our PSPS decisions.

BPA has adopted the Institute of Asset Management's methodologies as its benchmark for asset management. By making asset management an element of BPA's strategic plan it enhances our ability to develop solutions that focus on asset life-cycle management which, in turn, improves risk reducing methodologies in reliability, resiliency, and wildfire mitigation.

BPA will continue to assess increasing impacts from climate change, community growth, and its assets' conditions, as its WMP evolves. This will ensure it applies cost-effective and risk-based solutions in a proactive way to best serve its customers.

The scope of the BPA's wildfire mitigation plan (WMP) includes vegetation management (VM) programs and asset management programs across the entire transmission system lifecycle, including:

- Operations and maintenance.
- Replacement.
- Disposal.
- Response and recovery.

Additionally, the WMP covers protocols and processes for restoring service after a wildfire. The WMP follows a 2-year refresh cycle, which is in line with BPA's Strategic Asset Management Plan, Transmission Asset Plan, and Integrated Program Review.

This plan includes many technical terms and a lot of dense information. Readers may be particularly interested in information in the following sections:

Section 5 – Wildfire Mitigation Initiatives: This section includes a history of methods and mechanisms BPA has employed to mitigate wildfires; describes risk factors associated with wildfires; details BPA's tools for mitigating wildfires to avoid its equipment sparking a fire or mitigating the effects of an already ignited wildfire; and explains how BPA uses tools such as its world-class vegetation management program and other activities to mitigate potential and existing wildfires.

Section 6 – Emergency Response and Preparedness: This section covers how BPA works internally with Security and Continuity of Operations, Communications and other entities to share information about its mitigation efforts and its real-time efforts to mitigate the impact of wildfires on its transmission system. The section also discusses coordination with local fire officials and other wildfire responders.

Section 7 – Public Safety Power Shutoff (PSPS): This section covers our policy on Public Safety Power Shutoff and describes how BPA field crews and dispatch staff work together to put lines compromised by wildfires back in service. It includes information on the work field crews do to monitor the effects of wildfires on BPA transmission lines and components. It also describes the various circumstances presented by wildfires and the steps BPA takes under each to put assets back in service after a wildfire – whether they were damaged by a wildfire or taken out of service to protect first responders or the BPA transmission system.

1.1 Bonneville Power Administration (BPA)

BPA is one of the nation's largest public utilities with transmission assets touching several Northwest states. BPA owns, operates, and maintains facilities and equipment critical to maintaining the flow of power from generating facilities via more than 15,000 circuit miles which occupies more than 8,500 miles of rights-of-way, and passing through more than 260 substations. Its service area includes Idaho, Oregon, Washington, western Montana and small parts of eastern Montana, California, Nevada, Utah and Wyoming. BPA's mission is to create and deliver the best value for our customers and constituents. BPA's vision is to continue being an engine of the Northwest's economic prosperity and environmental sustainability.

The terrain that encompasses BPA's transmission lines, telecommunication sites, and substations varies greatly, including coastal areas, rain forest and high desert. Each of these areas pose unique wildfire challenges, and require different mitigation solutions.

Most of the generating resources connected to the BPA transmission system provide electricity to retail customers many miles from their source. Because of this, BPA operates long transmission lines and equally long rights of way. Some of these lines are located in areas with extremely strong winds, such as the Columbia River Gorge where sustained

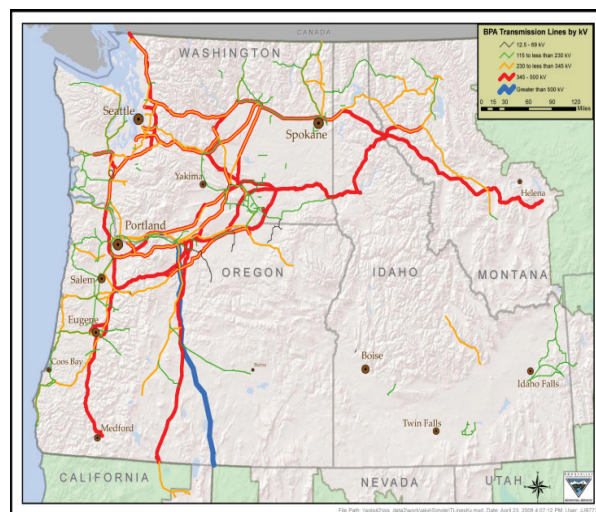


Figure 1: Asset Locations

wind speeds of 40 mph are not uncommon. Due to the diversity of its service territory with its varying climates and topography, BPA considers ignition variables such as wind, vegetation type, slope, temperature and humidity in the WMP.

1.2 Federal Columbia River Transmission System (FCRTS)

The expansive network described above covers an area totaling more than 300,000 square miles. BPA's history of providing reliable transmission at a competitive cost, has attracted a wide range of interconnection customers.

BPA provides transmission service to its preference customers (approximately 140 public and people's utility districts, municipal electric utilities and electric cooperatives), independent power producers, and investor-owned utilities (IOU). Interconnected resources include federal and other hydroelectric projects, fossil fuel generators, wind plants, solar plants, biomass and other generators.

As it created this plan, BPA performed a gap analysis using the Institute of Asset Management (IAM) methods to assess wildfire risk. BPA identified leading practice mitigation competencies including design and maintenance, operations, and situational awareness. BPA ranked each of those competencies with their corresponding maturity to baseline the current state of its wildfire risk mitigation capability. This analysis helped BPA recommend improvements to its physical assets, planning and operations, maintenance capability, and training.

Consistent with the Northern American Electric Reliability Corporation (NERC) regulatory direction on building resiliency into utilities asset management systems, the WMP aims to improve design and maintenance standards, and construction activities that allow BPA to rapidly and safely respond to a wildfire event.

The plan includes assessment of new industry practices and technologies that will reduce the likelihood of outage frequency in service and improve the restoration of service. In addition, BPA reviews and incorporates available ignition data for fires throughout the Northwest to build asset management plans targeting those probabilistic sources.

1.3 Policy statement

BPA's overarching goal is to provide safe, reliable, environmentally sustainable and affordable electric service to the region. To meet this goal BPA constructs, operates, and maintains its transmission system in a manner that minimizes wildfire risks. Iterations of this WMP will be coordinated with the bi-annual Strategic Asset Management Plan cycle.

1.4 Purpose

This WMP describes the range of programs, policies, processes, and activities to proactively mitigate any threats posed by its assets for starting or contributing to the spread of a potential wildfire. This includes policies and care of its transmission assets and management of vegetation in the transmission corridors that house BPA transmission lines and substations. This plan is subject to direct supervision from BPA's Transmission Services Senior Vice President (T-SVP) and primary accountability resides with the Chief Operating Officer (COO).

1.5 Objectives

The primary objectives of this WMP are to:

1. Mitigate the probability that BPA's Transmission assets may be the source of ignition or a fuel source of a wildfire, while continuing to provide reliable transmission service to our customers.
2. Implement a plan that prioritizes safety, situational awareness, preventative methods, and recovery.
3. Maintain a plan that aligns with utility best practice competencies and risk mitigation activities.

2.0 Accountability of the WMP

BPA's Chief Operating Officer has ultimate accountability for this plan. BPA's Senior Vice President of Transmission Services has overall responsibility for this WMP and its execution. Other BPA executives have substantive responsibilities in support of this plan, revised policies, principles and standards.

2.1 BPA responsibilities for components of this plan

The following officials and their organizations support the implementation of this plan.

- Chief Operating Officer
- SVP, Transmission Services
- VP, Transmission Planning and Asset Management
- VP, Transmission Field Services
- VP, Transmission Engineering and Technical Services
- VP, Transmission System Operations
- VP, Transmission Marketing and Sales
- Dir, Transmission Technology
- EVP and Chief Risk Officer
- Chief Administrative Officer

2.2 Metrics and assumptions for measuring WMP performance

BPA has developed, and is continuing to refine these transmission system capabilities through various initiatives as outlined in its Strategic Asset Management Plan (SAMP) or other directional documents that impact wildfire mitigation. Some of these enhancements will provide input to wildfire mitigation management such as CHR and reliability standards. Other enhancements come from third party vendors providing products and services such as fire mapping. And, BPA's collaborative relationships with other utilities and agencies, such as the PNNL (Pacific Northwest National Laboratory), provides forums to explore meaningful metrics. As industry wildfire mitigation program standards and measures continue to develop, BPA will identify relevant metrics to measure this plan's effectiveness.

BPA participates with a variety of peer utilities and organizations, in order to share knowledge, data, and process development information. We are a member of several organizations including:

- Electric Power Research Institute (EPRI)
- Centre for Energy Advancement through Technological Innovation (CEATI)
- North American Transmission Forum (NATF)
- International Wildfire Risk Mitigation Consortium (IWRMC)

2.3 Maintenance performance targets

BPA has a host of metrics that support its maintenance programs. It is BPA's target to complete 100% of the right asset maintenance at the right time. New capabilities like the Secondary Capacity Model (SCM), Transmission Portfolio Optimization Tool (TPOT), and Criticality Health & Risk (CHR) will improve BPA's targeting and execution of maintenance work while giving consideration to cost and risk. This means targeted patrols and maintenance intervals that are risk and value based instead of time based.



Figure 2: Addressing Barriers

2.4 System enhancement capital program

Transmission asset management's capital and maintenance plans are outlined in the SAMP and Asset Plan. These plans cover a long-term planning horizon for capital and the replacement/maintenance strategies per program for the entire portfolio of assets and are direct feeds into the Integrated Program Review (IPR). The SAMP covers the current state and describes planned asset management improvements, maturity and competencies needed to effectively and efficiently manage the entire lifecycle of BPA assets that deliver electric transmission and telecommunication services. The SAMP aims to provide alignment between the agency strategy, Transmission Business Model, stakeholder requirements, organizational objectives and resulting asset management objectives to ensure assets are managed and measured and creating and delivering value to the region. Capital projects

are approved on an annual basis at the programmatic level but are flexible enough to address unforeseen and immediate mitigation of system performance and risks.

2.5 Monitoring of the WMP

The WMP will be reviewed annually to update the plan as needed to reflect knowledge gained in the preceding year and will be modified accordingly. A more formal review will be done every two years in coordination with BPA's Strategic Asset Management Plan. BPA prepares for annual wildfire season in advance and utilizes this plan as strategic and operational guidance.

2.5.1 Responding to identified deficiencies

At any time, identified deficiencies in the plan will be addressed by the responsible parties governing the plan.

2.5.2 Processes and procedures

Operations are conducted via procedures, policies, regulations, and standards that ensure consistency, of work planned and executed in support of this WMP.

2.5.3 Inspection standards

Transmission Services utilizes various standards that ensure desired quality is achieved. These standards are embedded within inspection and maintenance program practices. These programs support or address wildfire risk and mitigation criteria.

2.5.3.1 Transmission system inspection and maintenance

A variety of industry practices are used to ensure transmission system assets are managed in a way that minimizes risks associated with wildfire. The following are examples of mitigating activities.

- Potential ignition sources are inspected through the following activities.
 - Line inspections and patrolling
 - System monitoring for abnormalities
 - CHR analysis and prioritization
 - Design and work standards
- Potential fuel sources are inspected through the following activities.
 - Vegetation management
 - GIS
 - Ground patrols
 - Design and work standards

2.5.3.2 Inspection and maintenance objectives

Through inspection activities, maintenance plans are developed and executed consistent with annual planning and emergency response call-outs. Plans are routinely updated and prioritized based on the most current information

available. These inspection and maintenance programs focus on the following objectives.

- Protect employee, contractor, and public safety
- Mitigate wildfire risks resultant of BPA transmission system assets
- Ensure compliance with a variety of regulatory provisions and BPA policies
- Protect and ensure the availability and reliability of the system
- Continually improve through learning, evaluating and implementing appropriate leading practices
- Manage system assets via life-cycle cost modeling
- Employ Institute of Asset Management standards to provide the best value from system assets

2.6 Lessons Learned

Each year a lessons learned exercise is conducted to gather information and recommendations from Subject Matter Experts (SME's) involved in the identification, response and restoration activities involving wildfires. The exercise consists of individual interviews, small group interviews, and a larger group discussion.

Key Takeaways are recommendations derived from the Wildfire SME feedback interviews and lessons learned group discussions. As described in the message from the administrator, one of the key takeaways from our previous year's lessons learned exercise was the need for a dedicated staff for wildfire mitigation. We now have that staff.

For ease in analyzing the feedback received from these interviews, the information is classified into six main categories. This included communication, coordination, decision-making, planning, support, and technology.

The category for Communication includes subject areas for Customer Outreach, Policy/ Procedures, and Reporting (process and systems). Communication is a large task in a major, wide-spread event.

The category for Coordination covers the interaction that occurred between numerous

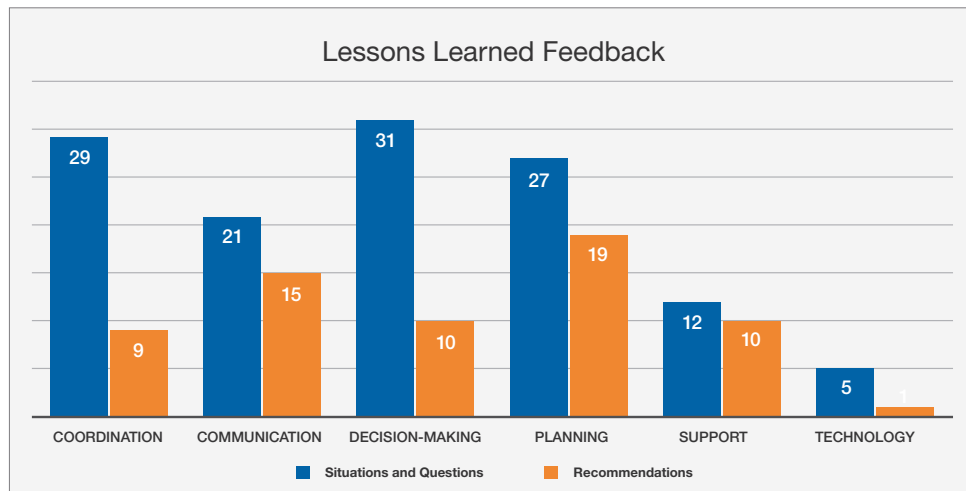


Figure 3: Breakdown of feedback received from lessons learned interviews

organizations involved with wildfire mitigation. Coordination is referring to the combination of all internal activities that operated and interacted during the Wildfire events to achieve unity of action in the pursuit of managing and restoring the Transmission grid.

The category for Decision-Making includes subject areas for prioritizing, data driven decisions, de-energizing, auto-reclosing, re-energizing, and authority for making decisions.

The category for Planning includes subject areas for the Wildfire Mitigation Plan, policies, data/assessments, training, and documentation.

The category for Support includes topics relating to resources without direct transmission responsibility such as supply chain, warehouse, materials procurement, access to locations (state of access roads, landowners, vehicles), fleet, equipment, real property, photogrammetry, logistics, and staffing levels.

The category Technology covers data and information systems used for situational awareness, communication, data analysis and decision-making.

When more conclusive analysis of lessons learned information is conducted and integrated with other wildfire mitigation priorities, these observations are used for continuous improvement efforts.

BPA's Wildfire lessons learned exercise provides important information to be used as one source of input to continuously improve our wildfire competencies, programs, and plans.

3.0 Risk analysis and trends

BPA uses data collected and analyzed by various federal agencies to identify and measure the threat of wildfire by location. It also has contracted with the PNNL to develop more detailed data layers to use to identify risks unique to its service territory. A few of the many variables considered in this analysis are: wind, humidity, vegetation species and fuel volume.

The probabilistic analysis of wildfires requires a fundamental planning assumption in its capital and maintenance activities. That assumption is that risk algorithm(s) and methodology requires a snapshot in the threat of wildfire by location. That snapshot in time needs to be close to the start of fire season and needs to be retaken when climatic conditions change significantly. An example of this would be with heavy rainstorms in the middle of summer changing the projected humidity and drought probabilities. Transmission continues to build internal controls to identify sensitivity analysis for specific zones on the system that have a higher margin of statistical confidence levels. These include BPA districts shifting planned activities in coordination with local, state and federal entities to allow for the most efficient deployment of critical resources.

BPA voluntarily maintains tools such as the fire GIS map, which add value as proactive measures to establish projected fire risk.

3.1 Risk Management

BPA uses its existing Enterprise Risk Management framework, under BPA policy 231-1, to identify and assess enterprise level risks. This framework is built on the ISO-31000 (International Standards Organization of Risk Management), which takes into consideration both quantitative and qualitative factors to determine the level of inherent and residual levels of a particular risk. An inherent risk level refers to the risk before any mitigations or controls are in place while the residual risk level refers to the risk after all mitigations and effective controls are considered. Figure 3. Trends in the number of large fires annually in the Western

U.S. These trends indicate significant increases in fire activity across the Western U.S. A notable exception includes the Snake Plan/Columbia Plateau.¹

3.2 Criticality, Health and Risk

Transmission Services' Criticality Health and Risk (CHR) methodology is a quantitative method to use varying sources of asset information to understand asset condition to inform probabilistic failure modes and projection of asset failures across the system by asset type. This health architecture is a one-for-one adoption of the Institute of Asset Management (IAM) risk and reliability engineering best practice and considers five risk dimensions of criticality with a 1–7 scale of consequence/impact. These dimensions of risk include financial, compliance, environmental, safety and reliability impacts.

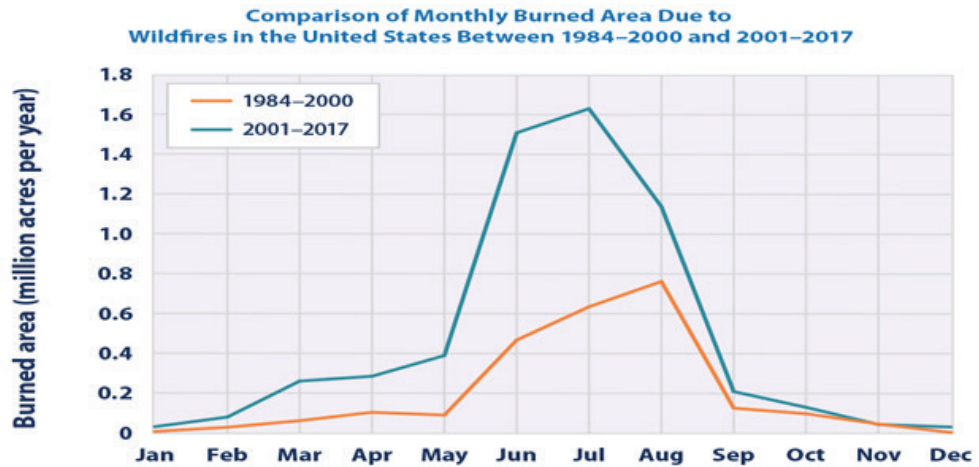
Transmission continues to develop and mature BPA's Criticality, Health and Risk methodologies and capabilities. CHR has advanced in its analytics, with comprehensive health scoring and the ability to apply the Reliability and Safety criticality dimensions at an asset level, for substation and line assets. Data is integrated into Cascade and this capability represents an advancement in AM maturity in 2021. We are utilizing CHR data to inform our decisions, discovering more, and continuing to add assets and aspects as appropriate for decision-making.

3.3 Contributing Factors and Trends

The frequency of large wildfires is influenced by a complex combination of natural and human factors including climatic conditions such as temperature, soil moisture, relative humidity, and wind speed; vegetation (e.g. fuel density); forest management practices; and fire suppression techniques.² Wildfires have been increasing in number and extent in the region and that trend is projected to continue.^{3&4} Wildfires have the potential to significantly impact the energy sector, as they can cause both significant infrastructure damage and disrupt electricity transmission. For example, in 2015, Oregon and Washington had their most severe wildfire season when more than 1.6 million acres burned.⁵ During that fire season, the Goodell Fire resulted in hydro generation shutdowns and de-energization of transmission lines for Seattle City Light⁶ and the Soda Fire resulted in significant transmission infrastructure damage for Idaho Power Company.⁷ According to the Northwest Interagency Coordination Center in 2020 over 4000 homes were destroyed by wildfires.

The wildfire season is also starting to last longer and start earlier. The following graph shows that in 1984 through 2000 the wildfire season peaked in August and from 2001 to 2017 it peaked in July.

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- 1 Dennison, Phillip E., Brewer, Simon C., Arnols, James D, and Moritz, Max A. Large Wildfire Trends in the Western United States, 1984-2011. 2014. *Geophyys. Rs. Lett.*, 41, 2928-2933. Available at: <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2014GL059576>
 - 2 USGCRP. U.S. Global Change Research Program. Fourth National Climate Assessment, Volume I: Climate Science Special Report. 2017. Available at <https://www.globalchange.gov/nca4>
 - 3 DOI. U.S. Department of Interior. 2017. 7 Burning Questions: Wildfires and Public Lands. Available at <https://www.doi.gov/blog/7-burning-questions-wildfires-public-lands>
 - 4 DOE. U.S. Department of Energy. Climate Change and the U.S. Energy Sector: Regional Vulnerabilities and Resilience Solutions. October 2015. Available at https://www.energy.gov/sites/prod/files/2015/10/f27/Regional_Climate_Vulnerabilities_and_Resilience_Solutions_0.pdf
 - 5 USGCRP. U.S. Global Change Research Program. Fourth National Climate Assessment, Volume II: Impacts, Risks, and Adaptation in the United States. 2018. Available at <https://www.globalchange.gov/nca4>
 - 6 SCL. Seattle City Light Climate Change Vulnerability Assessment and Adaptation Plan. Available at http://www.seattle.gov/light/enviro/docs/Seattle_City_Light_Climate_Change_Vulnerability_Assessment_and_Adaptation_Plan.pdf
 - 7 DOE. U.S. Department of Energy. Climate Change and the U.S. Energy Sector: Regional Vulnerabilities and Resilience Solutions. October 2015. Available at https://www.energy.gov/sites/prod/files/2015/10/f27/Regional_Climate_Vulnerabilities_and_Resilience_Solutions_0.pdf



Data source: MTBS (Monitoring Trends in Burn Severity). 2019. Direct download. Accessed November 2019. www.mtbs.gov/direct-download.

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climate-indicators.

In 2021, Washington State recorded both the driest and hottest year on record. This resulted in the state experiencing 674,249 acres burned with 44 of those fires burning more than 1,000 acres. The state's largest wildfire, the Schneider fires, burned a total of 107,118 acres.⁸ Oregon's Bootleg fire started on July 6th, 2021 and was not contained until October 1st after burning 413,717 acres.⁹

In recent decades the incidence of large forest fires has increased and is projected to continue increasing as temperatures rise. Projected warmer and drier summers and declining snowpack¹⁰ and correlated decreases in summer soil moisture will increase the risk of wildfires, particularly in forested areas where fuels are abundant.¹¹ Climate change is also likely to lead to increases in vegetative fuel. In the Pacific Northwest, the Cascade Mountains are one of the most at-risk areas for increasing wildfire activity while increasing risk for the interior of the region is more modest and uncertain. The chart below shows the increasing trend in large fires in the western US, and is believed to still be relevant due to the consistent slope of the trend. These trends indicate significant increases in fire activity across the Western U.S. A notable exception includes the Snake Plan/Columbia Plateau.¹²

These fires have been devastating. BPA is making a concerted effort to avoid further areas being burnt. NASA has stated that 11 percent of western lands have burned. They also reported that 3 percent of these lands have experienced a burn-on-burn event, so just because there has recently been a fire does not eliminate the possibility of a repeat event.

The figure below shows areas in the west that have experienced multiple fire events since 1950. It's noted that there are areas that have burned on average every 7 years.

⁸ WFPA. Washington Forest Protection Association. January 28, 2022. 2021 Wildfire Season Summary Available at [2021 wildfire season summary – Washington Forest Protection Association \(wfpa.org\)](https://www.wfpa.org)

⁹ NWCG. Incident Information System: Bootleg Fire Incident Overview. 2021 Available at [Bootleg Fire Information - InciWeb the Incident Information System \(nwcg.gov\)](https://www.nwcg.gov)

¹⁰ RMJOC. River Management Joint Operating Committee: Bonneville Power Administration, United States Army Corps of Engineers, United States Bureau of Reclamation. 2018. Climate and Hydrology Datasets for MRJOC Long-Term Planning Studies: Second Edition (RMJOC-II). Part I: Hydroclimate Projections and Analysis. Available at <https://www.bpa.gov/p/Generation/Hydro/hydro/cc/RMJOC-II-Report-Part-I.pdf>

¹¹ Gergel, Diana R., Bart Nijssen, John T. Abatzoglou, Dennis P. Lettenmaier, and Matt R. Stumbaugh. "Effects of Climate Change on Snowpack and Fire Potential in the Western USA. *Climatic Change* 141, no. 2 (2017): 287- 299. <https://doi.org/10.1007/s10584-017-1899-y>

¹² Source Dennison, et al. 2014 (p. 2,931)

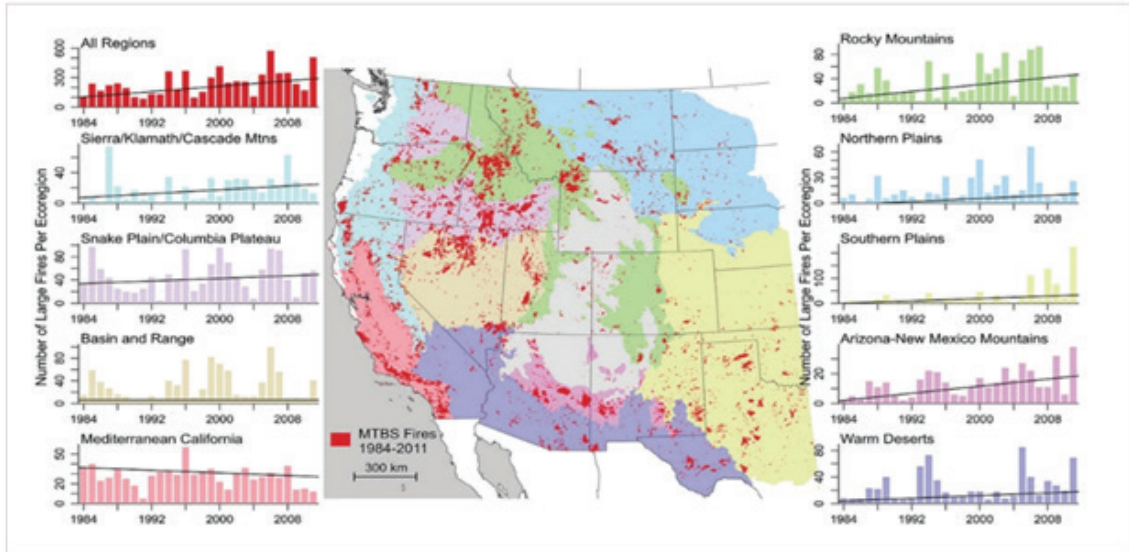


Figure 4: Trends in the number of large fires annually in the Western U.S. (Dennison, et al. 2014)

3.4 Transmission Risk Based Planning and Prioritization Process

The understanding of ignition and how climate drivers trend in time across the BPA system is a key input into the planning process and feeds how risk is quantified by asset location. These trends feed the probabilistic variables overlaid behind the asset locations to predict what assets cause the highest risk of a fire. The Transmission Services organization continues to enhance its capabilities through adoption of best practices including ISO-31000 methodologies to help understand all of the critical dimensions of risk including safety, reliability, and compliance, financial and environmental risk. This is done through the Criticality, Health and Risk initiative and will continue to enable risk-based decisions by those with proper training and expertise including what mitigation actions are taken and how actions are organized across BPA to invest in its asset management activities.

The implementation plan shown in Figure 6 reflects a phased approach to developing risk scores as automated system outputs. This plan allows multiple work streams of roughly 54 organizations inside of BPA to apply its learnings and deliverables as they are developed in real time. The plan showcases an initial operating capability where all assets recorded in the Cascade asset registry have risk scores with varying levels of statistical confidence.

A Risk score is the quantitative output where the assessment of asset health and the corresponding consequence of that asset failure are measured across the five dimensional categories of safety, reliability, compliance, environmental and financial impacts. The

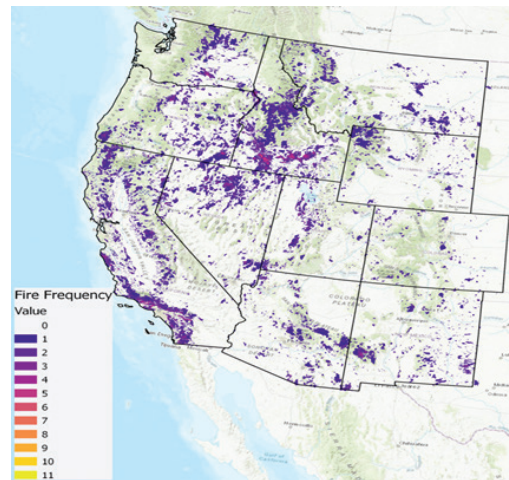


Figure 5: NASA RECOVER/ Keith Weber Map of Fire Frequency in Western States since 1950.

mathematics follow ISO-31000 and IAM Reliability Engineering best practices and the formula below shows how this is used to inform capital and maintenance activities associated with wildfire risk.

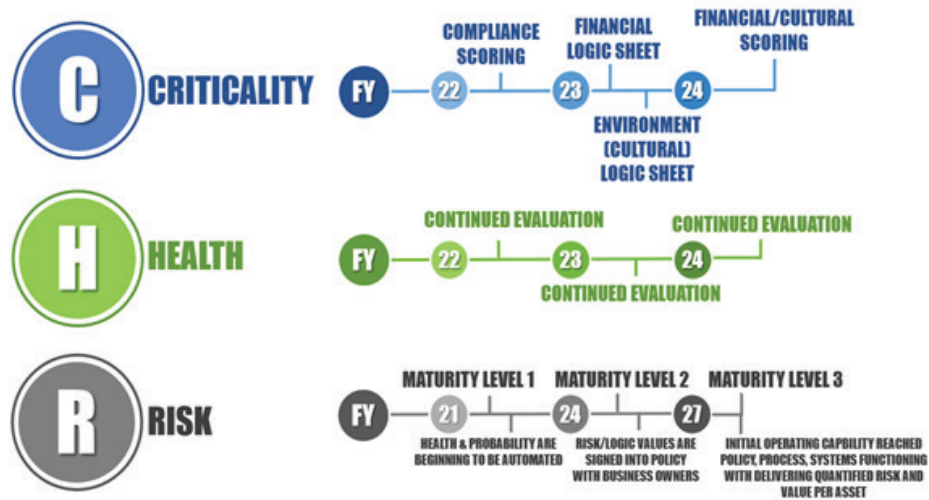


Figure 6: Criticality Health and Risk — Implementation Plan

$$\text{Risk Score (RS)} = \text{TEF} * \text{Cp} * 10 \text{ CI}$$

Terms:

TEF = Triggered event frequency: A probabilistic function of asset health, where the probability of failure of equipment (PoF) is between 0 – 1 and represents a predicted survival rate based upon the BPA Transmission Asset Health Methodology STD-D-27 through a series of mathematical architecture and steps..

Cp = Conditional probability: The probability the risk is realized at that location given the environment’s local nuances and configuration of the surroundings. For the purposes of wildfires, this would be the ignition probability data provided by PNNL and various Federal Agencies based upon humidity, wind and vegetation type. Cp is a numerical value between 0 – 1 in STD-D-000033 Transmission Asset Risk Policy.

CI = Consequence/Impact which is measured between 1 (Negligible) to 7 (Catastrophic) and is the indicator of criticality of the asset failure across the five dimensions of risk.

4.0 Overview of Preventive Strategies and Programs

This WMP integrates and interfaces with various operating policies and asset management and engineering principles, which are themselves subject to change. As such, this WMP reflects current policies, principles, and standards as of its publication date. BPA may revise or adopt new policies and standards between publications. Subsequent versions of the WMP will reflect changes made since the issuance of the last plan and identify new or revised policies, principles and standards.

4.1 Competency Assessment

The table below is a general summary of competencies BPA has employed or is considering employing in BPA's programs and activities that support ongoing wildfire prevention and mitigation.

Table 1: Mitigation Competencies

Design and construction
Light Detection and Ranging (LiDAR) Ortho, Oblique and Hyper Spectral Imagery for vegetation management/clearances
Increase overhead wire spacing to reduce wire to wire contact
Structure loading and placement
Transmission line rating remediation
Structure replacement and reinforcement
Wildfire resiliency design
Wood Pole Retardants
Substation perimeter fencing for security and protection
Inspection and maintenance
Transmission line aerial patrols (helicopter)
Transmission line ground patrols
Transmission line splice assessment program (observed condition only, not Infrared)
Transmission wood pole intrusive inspections
Transmission vegetation right-of-way maintenance
Transmission annual pole clearing program
Marker ball inspection and replacement program
LiDAR inspection of transmission facilities
Inspection and maintenance programs for lines and substations
Infrared inspection of energized overhead facilities and equipment
LiDAR inspection of vegetation
Detailed inspection of transmission facilities and equipment
Supplemental inspections of high fire risk areas
Incompatible vegetation management removal
On-ground routine inspection
Operational practices
Disabling reclosing during fire season (Initial Operating Capability)
Transmission system vegetation management
Special work procedures for complying with fire mitigation requirements during high fire risk periods (such as during Level 3 or 4 in the Industrial Fire Precaution Levels rating system)
Pre-emptive public safety power shutoffs
De-energization notifications (internal; field crews, Dispatch and A/E)

De-energization notifications (external; RC and OASIS)
Emergency Operations Planning: fire prevention plan
Hotline procedures
Mobilization for line and vegetation management crews ahead of storms
Collaboration with local governments and fire safety entities
Transmission encroachment program
Provide liaison to county offices of emergency services (OES) during fire event
Leverage existing relationships with local governments and fire departments
Targeted communications plan
Active environmental safety monitoring
Emergency Operations Center partners with local emergency responders for coordination prior to and during an emergency
High fire threat district vegetation management inspection strategy
Inspecting and removing trees within the minimum vegetation clearance distance
Expanded vegetation clearing around poles
Expanded clearance distances at time of maintenance
Patrol and pruning, quality assurance
Proactive vegetation management
Situational/conditional awareness
Weather monitoring in the BPA service area
Coordinate and collaborate with local firefighting districts or entities and county offices of Emergency Services throughout the year to prepare for high fire risk events
Requirements for contract worker safety training and orientation for transmission & vegetation management work
Monitors daily active fires in Pacific NW
Response and recovery
Critical event communications process and procedures
Strategy for minimizing public safety risk
Emergency response plan for wildfires
Field operations recovery procedures
Fire Season Lessons Learned
Re-Energization Strategy
Reliability Coordinator (RC WEST) wildfire communication coordination

Table 1: Competency for Wildfire Programs and Activities

BPA weighted these competencies, or best practices, to measure how well it is implementing them. BPA used the Institute of Asset Management (IAM) competency assessment methodology to assess its competency rating. The total aggregation of these rankings shows BPA has an average maturity of 2.76 out of 4 which indicates a strong awareness and appreciation of all the mitigation activities in the Table 1.0.

To put context to the rating, the scale used in the assessment is as follows:

In 2020, we capped our assessment at a rating of 3 which represents that BPA actively performs the task and can provide consistent documentation and evidence. The key requirement to be at a level 3 is for BPA to have documentation so that the policy, process, and procedure can be repeated. For this year, we also incorporated a rating of 4 to express a level of experience higher than just actively performing and documenting. A level 4 assessment is considered to go beyond industry best practices. We kept the level 2 rating indicating that BPA performs this work but lacks consistency in delivery or documentation and training. Finally, a rating of 1 still represents that BPA is aware of that work but does not yet have any process, policy, or procedure in place, or has limited exposure, such as a pilot project.

The spider diagram below is updated on a bi-annual maturity assessment and this year's assessment of 2.76 shows an improvement over 2022's assessment of 2.36.

4.2 Overview of Wildfire Mitigation Hierarchy

The Wildfire hierarchy depicted below reflects the holistic enterprise efforts surrounding how BPA is mitigating wildfire risk. This includes system hardening, situational awareness/monitoring, Wildfire season specific relay/control practices, extreme risk days with resources and finally Public Safety Power Shutoff (PSPS).

These activities reflect BPA taking proactive efforts through long-term planning and investment using new wildfire resiliency metrics that focus on system hardening. In addition, with situational awareness data/tools providing system condition visibility, BPA is able to scale resources as required if identified need meets specific criteria. Finally, as a last resort, during the most extreme risk days, BPA can decide to activate a PSPS.

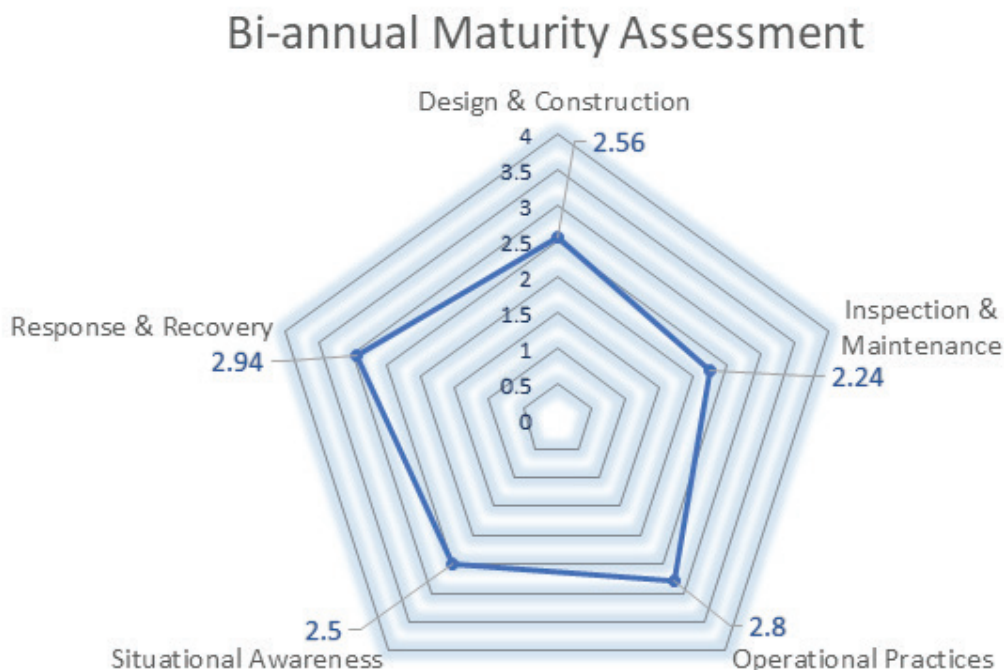


Figure 7: Spider Diagram of bi-annual maturity assessment

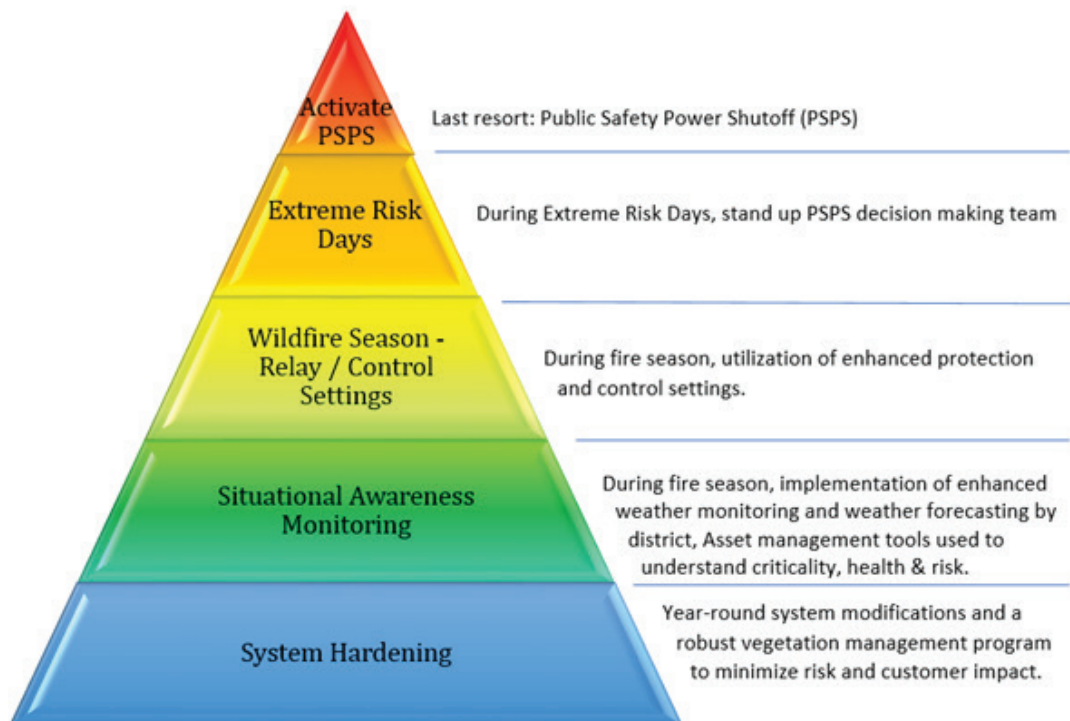


Figure 8: Wildfire Mitigation Hierarchy

5.0 Wildfire Mitigation Measures

BPA has a proven history of holistic measures to address potential wildfire risks. Some of the activities BPA engages in are listed below:

Risk Factor	Activity
Fuel	• Vegetation management
	• Fuels reduction
	• Piloting use of LiDAR and Multi-Spectral Imagery
Asset failure	• Routine maintenance
	• Focused design and construction standards to reduce ignition sources
	• Transmission line detailed inspections and annual patrol
	• No automatic reclosing during fire season on specific circuits
	• Non-expulsion fuses and arrestors
	• Intrusive pole testing and pole replacement
	• De-energization of lines during certain conditions

Risk Factor (continued)	Activity (continued)
Contact from object(s)	<ul style="list-style-type: none"> • Animal/Bird guards
	<ul style="list-style-type: none"> • Underbuilds phase to phase spacing
	<ul style="list-style-type: none"> • Proactive vegetation management
Wire to wire contact	<ul style="list-style-type: none"> • Line ratings and clearance analysis through LiDAR
Other	<ul style="list-style-type: none"> • BPA worker/contractor education on fire ignition sources from normal work activities
	<ul style="list-style-type: none"> • Fire watch after work completion in high risk areas or as directed
	<ul style="list-style-type: none"> • Pre-positioning fire suppression equipment (e.g. water trailers) for safety and to obtain waivers to work if activities are otherwise restricted

Table 2: Activities that address wildfire risk factors

Each year, BPA Transmission Field Services participates in interagency teams in response to fire events.

BPA vigilantly manages the trees, brush and other incompatible vegetation on its rights of way. It uses of LiDAR to help identify vegetation that encroaches into designed clearance distances. The LiDAR data and aerial photographs help us identify and clear vegetation that could inadvertently spark and cause a fire.

During wildfire season in areas where dry conditions conducive to wildfires exist, BPA selectively disables automatic re-closers as a preventative measure to avoid starting a fire. It then deploys field staff to visually inspect lines before reclosing; this is a best practice. BPA will continue to use, analyze, and modify this practice as necessary. BPA will describe this practice in its communications plans to ensure customers and other stakeholders appreciate why a line will stay de-energized until it can be visually inspected.

This best practice does increase the potential that the power maybe interrupted for longer than usual, but significantly decreases the risk of fire posed by auto reclosing, or manual testing.

5.1 Transmission asset overview

BPA Transmission Services provides power to the bulk electric system through its transmission assets. The following table depicts a high-level description of those asset types. Further details can be found in BPA's Strategic Asset Management Plan.

List of Major Assets

Asset	Description
Alternating Current Substations (AC Subs)	Over 260 substations with more than 32,000 major equipment items including high value, critical items such as transformers, reactors and circuit breakers.
High Voltage DC / Flexible AC Transmission Systems (HVDC/FACTS)	Specialized conversion and control equipment located at Celilo Converter Station, Maple Valley, Keeler and Rogue Static VAR Compensation sites, and numerous series capacitor installations on the high voltage alternating current intertie transmission lines.
Control Centers	Two redundant and geographically distributed control centers monitoring and controlling the grid and data systems. Over 85 automation systems.
Power System Control (PSC) and System Telecomm	732 sites and ~ 11,000 pieces of equipment, 3,500 miles of fiber optic cable, all vital to BPA's ability to control and monitor the grid.
System Protection and Control (SPC)	956 locations, approximately 28,000 major units of 33 equipment types, all critically important to protect the grid for reliability and safety.
Access Roads	11,860 miles of access roads with bridges, culverts and gates.
Land Rights	Approximately 80,000 tracts of easement plus fee-owned properties.
Wood Lines	Approximately 4,800 miles total in 336 separate transmission lines with 73,500 wood poles.
Steel Lines)	10,300 circuit miles with 43,500 lattice steel and engineered steel pole transmission lines and all associated towers, hardware and components.

5.2 Transmission Operations during wildfire season:

BPA Real-Time Operations uses all situational awareness tools at its disposal to respond appropriately to fire threats. It evaluates information such as on the ground reports, GIS data, CHR data from its field maintenance and planning organizations, fire weather reporting and other resources.

Actions are taken in accordance with established procedures and may include, but are not limited to

- Preventative Actions:
 - Disabling automatic reclosing.
 - Order no test orders on facilities.
 - Requiring onsite inspection before testing faulted equipment.
 - Pre-emptive public safety power shutoffs.

- Responsive Actions:
 - De-energize equipment due to fire.
 - Dropping load.
 - Curtailing transmission.

5.3 Transmission Line — Inspections and Observations

BPA has a multi-prong approach to inspecting its transmission lines and observing what is happening around its transmission lines. First and foremost, the safety and reliability of the line is inspected to assess the condition of BPA's facilities and any incompatible vegetation on or adjacent to rights-of-way or facilities. Additionally, BPA is working to identify and respond to threats created by landowners or public that could cause wildfires. There are many external factors which can create risks that can cause or contribute to fires. These external risks can arise when transmission lines cross over or near things such as retail businesses, suburban backyards, construction sites, agricultural land, rural homes, thick forests, trails and campgrounds, arid plains and deep canyons.

Even though public and private property owners, businesses and contractors take precautions, their equipment can come into contact with transmission lines. Routine activities can also contribute to wildfires; for instance, smoke from burning brush piles can conduct electricity and refueling vehicles under lines without proper precautions may cause arcing. While generally unintentional, these contacts or activities may cause damage to transmission lines, poles and other equipment or may cause sparks and trigger fires in the vicinity as well as cause public safety and electrocution risks. BPA equipment or rights of way can also be vandalized and damaged, which may cause sparks and fires.

BPA field staff conduct annual patrols to report incompatible uses and encroachments. It also has a land use review process so developers or landowners can get their planned activities reviewed in advance. BPA evaluates if they can be safely conducted under or near the transmission lines.

BPA's inspection plans include the following:

5.3.1 Infrastructure inspections and maintenance

Transmission Services maintains a multitude of time-based and risk-based inspections of its transmission assets. Engineering and technical services develops the work standards and guides. Transmission Field Services performs the inspections and assessments. Performance Level Guides (PLGs) are established to maintain its transmission lines as efficiently and cost effectively as possible while maintaining reliability. It is important that BPA meet its legal and environmental responsibilities while providing safe and reliable service to our customers. A description of the inspections and assessments are summarized in the following sections. These PLGs are described in great detail in Transmission Line Maintenance standard TLM-STD-3-1-8 TLM Performance Level Guides.

5.3.2 Transmission lines — working patrols

Working patrols are necessary to gather information to ensure the integrity and reliability of BPA's Transmission Line System. The working patrol inspects every component in the line section, including terminal spans and substation dead-end structures. The patrol also drives or walks the right-of-way between each structure. Imminent problems are

addressed while the patrol is on site. The information accumulated informs planning and scheduling future maintenance to avoid major faults. The working patrol augments the helicopter patrol, providing ground-level evaluation of structures, rights of ways, access roads and brush to conductor clearances. These patrols are described in great detail in TLM standard TLM-STD-4-1-10 Working Patrol.

5.3.3 Transmission lines — aircraft patrols

Aircraft are strategically located throughout the system with service focused on ensuring system reliability and resiliency. The Aircraft program works with BPA Aircraft Services, General Services Administration (GSA), and DOE Office of Aviation Management to provide optimized fleet configuration and recapitalization, in support of the Aircraft Services' mission.

BPA uses helicopters to perform aerial transmission line inspections. BPA and utility best practices have shown that the most effective and economical approach is to combine both aerial and ground patrols. The objective of routine aircraft patrols is to obtain information on facility conditions to determine actions necessary to maintain system reliability. Aerial patrols inspect BPA transmission lines twice a year, once in the spring and once before fall. These patrols are described in greater detail in TLM standard TLM-STD-4-2-3 Transmission Line Aircraft Patrol.

5.3.4 Transmission lines — inspection and treatment of wood poles

The TLM standard describes the inspection and remedial treatment methods routinely conducted on wood poles and their attachments during working patrols. Wood pole decay generally progresses at predictable rates, and its advance can be readily diagnosed in the field, except for in the very early stages. Early detection and treatment is by far the most important and successful step in extending pole service life. BPA's detailed wood pole inspection standard largely follows the Electrical Power and Research Institute (EPRI) field guide, "Visual Inspection of Wood Structures" No. 1018373. These inspections are described in great detail in TLM standard TLM-STD-5-4-3 Inspection and treatment of Wood Poles.

5.3.5 Transmission lines — visual inspection of steel structures

The standard is to visually inspect all towers and steel poles from the ground. Typically, a detailed climbing inspection is performed every 10 years. An alternative option to the detailed climbing inspection is an enhanced inspection using a high-powered spotting scope to inspect for obvious defects. When the inspection is complete a maintenance priority rating is assigned. These inspections are described in great detail in TLM standard TLM-STD-4-1-15 Visual Inspection of Steel Structures.

5.3.6 Transmission lines — conductor and accessories inspection criteria

There are numerous types of conductor component defects and damage that occur on transmission lines and accessories. These defects adversely impact the reliability of the transmission system. Thorough inspections, assigning appropriate maintenance condition ratings and making necessary repairs are critical to maintaining the integrity of the system.

This standard familiarizes maintenance personnel with the most common component defects observed on conductor and related accessories. However, it does not depict

every type of defective condition that may be found. Sound field judgment based on experience is the determining factor when assigning Maintenance Condition Ratings. Visual inspections are performed for all conductor and ground wire to identify any degradations that can lead to equipment failures.

Transmission inspects and records broken strands, abrasions, low conductor clearance impairments, noisy conductor, galloping, and other conditions that can lead to failures. It also records any damage to conductor related accessories i.e. dampers, spacers, mid span splices, dead end fittings and locations of repair rod. These inspections are described in TLM standard TLM-STD-4-1-11 Conductor and Accessories Inspection Criteria.

5.3.7 Transmission Lines — insulator inspection criteria

Insulators are an integral component of the transmission system. Glass and porcelain insulators provide years of reliable service life. Polymer insulators are rarely used except in areas subject to frequent vandalism, contaminated areas and as inter phase spacers. As BPA has many insulators nearing the end of their lifecycle, it is working to inspect and then replace them as needed. Occasional failures, both mechanical and electrical, have caused system outages that affect reliability. A thorough inspection plan can reduce the number of outages and potential sources of wildfire ignitions, hence improving reliability. BPA's detailed inspection criteria largely follow Electric Power and Research Institute's (EPRI) Field Guide: Visual Inspection of Porcelain and Glass Disc Insulators and Field Guide: Visual Inspection of Polymer Insulators No. 1018377 and No. 1018374.

Visual inspection of insulators is performed by working and aerial patrols. TLM patrols all lines annually. Most mechanical damage and vandalism can be seen from the ground, aided by field glasses. Enhanced inspections may be performed. Aircraft patrols identifying faults, such as flashed insulators, contaminants, etc., from the air. These inspections are described in great detail in TLM standard TLM-STD-4-1-13 Insulator Inspection Criteria.

5.3.8 Transmission lines — obstruction marking and lighting inspection

Aerial markings and lighting are applied to transmission structures or wires to improve the visibility of the structure and lines, thereby improving the safety of the public air space.

These aids are used to prevent accidents involving aircraft striking the structure or line. Lights are installed on the highest point of a structure, and aerial markers are installed on the highest wire.

Aerial lighting and markings are inspected during annual working patrols. These inspections are described in great detail in TLM standard TLM-STD-4-1-14 Obstruction Marking and Lighting Inspection.

5.4 Vegetation management

BPA manages, directly or by agreement, all vegetation on BPA Transmission Line Rights-of-Way (ROW), fee-owned lands and easements in order to establish and maintain the safety and reliability of its facilities. BPA's vegetation management program complies with applicable federal reliability standards. Its program uses cost effective methods to

proactively manage vegetation and to establish low-growing plant communities along the ROW to minimize the development of potentially threatening or incompatible vegetation. The goal of vegetation clearing in BPA ROWs is to manage vegetation that supports transmission reliability and reduces wildfire risks while also adhering to BPA's commitment to environmental stewardship.

BPA performs vegetation patrols annually, and this includes inspection and removal of vegetation within and outside of its rights of ways where tree or branch failure would potentially damage Transmission line assets. Our vegetation management program strives to ensure all vegetation on BPA rights of way, easements and fee-owned land is managed according to its legal rights and applicable standards in order to establish and maintain the safety and reliability of its facilities.

The program covers both routine scheduled maintenance of the transmission lines, access roads and other facilities as well as emergency or imminent threat vegetation removal.

The program sets clearance distances from any vegetation to the transmission line (a conductor). Since conductors move horizontally and vertically based on dynamics such as operating temperature, wind and loading, clearance is evaluated from all possible conductor positions. Clearance also accounts for vegetation that would grow into, bend into, swing into or fall into a clearance distance if not removed. BPA works to establish and maintain vegetation with a mature height or growth that is 25 feet from the Max Sag of the transmission lines. In situations where this standard cannot be achieved due to legal or physical constraints, it has subject matter experts set a maximum allowable clearance distance under the circumstances. BPA's vegetation management staff, Natural Resource Specialists, contractors and Transmission Linemen who conduct ground patrols, all work to minimize vegetation related fire hazards and remove flammable materials around wood structures. Proactive maintenance during routine operations and prompt action during emergency events maintain system reliability, a safe work environment, and mitigates the fire risk.

Natural Resource Specialists (NRSs) apply vegetation clearance standard STD-DT-000090 when planning and implementing their contract work for the initial treatment at the beginning of each scheduled vegetation management cycle. Transmission line maintenance (TLM) crews, NRSs, and helicopter observers apply TLM-STD-7-2-1, "Danger Tree and Brush Selection Criteria", to ensure that the transmission system is free of hazardous vegetation during the intervening period between scheduled vegetation management cycles.

BPA uses LiDAR (Light Detection and Ranging), aerial and ground patrols to monitor vegetation around Bonneville's facilities. LiDAR data is typically acquired on a portion of BPA's circuits annually and the data is provided to annual aerial or ground patrol staff.

Prior to the completion of a project, all vegetation clearances must be verified by a NRS or a contracted certified arborist to ensure the vegetation management activities meet BPA's standards prior to the line being released into service. There are targeted high risk areas that are double checked for encroaching or incompatible vegetation.

5.4.1 Incompatible Vegetation Management

Incompatible vegetation is vegetation that is likely to interfere with BPA's acquired rights, especially the right to access, construct, operate, and maintain transmission lines and related facilities. Clearing incompatible vegetation and its modified integrated vegetation

management strategy is essential to ensure the cost effective and reliable delivery of power across BPA's service area while promoting safe working conditions during maintenance or construction activities.

5.5 Emerging technologies and operational practices

BPA is committed to developing an industry leading asset management program consistent with its Strategic Plan. Part of that effort includes ongoing benchmarking and incorporating best practices that range from business transformation to new technologies that help inform asset-related decisions. BPA explores new capabilities and risk mitigation practices and when possible, incorporates them into its operations. These technologies include emerging weather sensory data, situational awareness data, satellite imagery, cameras and drone or UAS (unmanned aircraft systems) inspections to evaluate asset conditions, and machine learning analytical models to help inform decision making for investments

Areas of ongoing focus are listed below:

5.5.1 Fire mitigation construction

BPA has built and organized a structure of standards and specifications with review cycles to allow it to adopt best practice improvements and incorporate new technologies. These standards and guides include material specifications for construction and design. As BPA learns more about its system's highest risk fire areas, it will explore modifying design standards to include different transmission structure materials such as steel poles or lattice structures, rather than wood, which may add resiliency to those areas. Other options include fire retardant coatings and wraps that allow for continual maintenance and protection from low-land brush fires. These alternatives will be explored during the design process and during the standard review process allowing Transmission to modify metrics and internal controls to further mitigate the agency's wildfire concerns.

5.5.1.1 Fire mitigation construction

BPA has researched multiple mitigation measures for fire protection of wood pole structures and has identified potential solutions including both fire pole retardant coatings and fire pole wraps.

The selection process was based on evaluating alternatives using the following criteria: climb ability, potential to trap water, ease of installation, and ability to repair. An environmental review and cost analysis were also completed.

One of the recommendations included a heavy-duty coating designed to protect all wood species and treatments of wood utility poles from fire damage. Tests have proven that the latex-based formula provides excellent flame resistance and can withstand years of outdoor weathering.



Figure 9: Heavy-duty coating applied to wood pole

The application of these products are covered under TLM-GID-5-4-9 Fire Retardant Application for Wood Poles.

5.5.2 System capital improvements

BPA's ratepayers and stakeholders expect reliable service at the lowest possible transmission rates consistent with a sustainable business model. BPA's strategy dictates that it must balance the cost-effectiveness of its construction, and maintenance of its capital assets with risk management. To deliver on these requirements, Transmission must assess effective methodologies for investment evaluation and decisions. BPA is updating its total economic cost modeling tools to determine investment levels by asset type, and Transmission is investigating reliability engineering and portfolio optimization methods and tools to improve decision making over the full asset lifecycle.

5.5.3 Fire prevention strategies, regulations, restrictions, precaution levels and pre-suppression

Bonneville's federal statutory obligations require it to reliably operate and maintain its transmission facilities.¹³ Bonneville's modeling of wildfire threats¹⁴ in combination with its geospatial and CHR asset data will continue to inform its maintenance and construction work planning and scheduling strategies. Whenever possible given weather, environmental restrictions, and logistics of managing 15,000 line miles housed within 8,500 miles of rights-of-way, routine and non-emergency work will be scheduled during the lowest risk times of the year in high fire risk areas. When that is not possible, or when urgent, unplanned maintenance needs to occur, Bonneville is committed to being "fire safe". That means exercising fire safe practices and taking proper wildfire mitigation precautions while it maintains its transmission lines, and performs vegetation management actions.

Additionally, BPA's has adopted a Wildfire Smoke Exposure Program, backed by BPA policy 420-1 Occupational Safety and Health. Because smoke from wildfires is comprised of many components, including particulates small enough to enter the lungs. The Air Quality Index (AQI) considers the amount of particulates contained in the smoke and helps to identify stages where we must consider strategies to mitigate health issues. The purpose of the program is to establish guidance that managers shall consider prior to assigning employees to work in areas where smoke from wildfires is present. The program applies to all BPA Employees. Supplemental labor personnel and other contractor requirements are contained within applicable contract documents and are managed and implemented by the appropriate Contracting Officer.

This "fire safe" approach is part of its Situational Awareness, Operational Practices, Asset Management and Vegetation Management strategies and will be employed throughout the year for planning critical work but particularly during fire season. It will also be a part of its Stakeholder Cooperation and Community Engagement strategy.

Some Bonneville Transmission field employees and contractors operating and maintaining its transmission lines are trained on federal, state or local fire regulations on federal land as well as on private property and state or local public land (non-federal land). These regulations and restrictions are generally based on land ownership. Bonneville has acquired rights to construct, operate and maintain its transmission lines

¹³ 16 USC §838b (2018); 16 USC §824o (2018); NERC Reliability Standard FAC-003-4.

¹⁴ BPA has modeled the threat locational areas based upon the wind, humidity, vegetation species and fuel volume. See 4.1, *infra*.

through easements on private land and right-of-way permits or agreements on federal and state public lands. The need for enhanced wildfire mitigation and prevention training for all field staff is currently being evaluated.

Bonneville has over two thousand line miles of transmission on federal public lands administered by the United States Forest Service (USFS) or the Bureau of Land Management (BLM). Bonneville is required to follow federal fire regulations on these lands.¹⁵ The regulations require right of way holders to adhere to public use, industrial use and other wildfire precautions and restrictions. Except when responding to an emergency situation, Bonneville may request waivers or variances to undertake activities that would otherwise be restricted. Prior to making a request, it will evaluate the possible ignition risks of delaying the maintenance with any possible risk of starting a fire while the repair or maintenance is being conducted when high fire ratings are in place. A variance or waiver may be granted, at the discretion of the federal land manager, when appropriate criteria are met and mitigations are in place. Federal land managers routinely work with Bonneville to issue waivers to allow important maintenance work to be conducted with conditions and restrictions in place.

This wildfire mitigation modeling and analysis that supports this plan will help Bonneville explain to the federal land managers how timely maintenance of specific transmission line equipment will reduce the risk of fire. This will help demonstrate the importance of both timely preventative maintenance and urgent repairs getting done, even if the work requires issuance of waivers. If urgent work is identified that needs to be expedited, the wildfire risk analysis and modeling Bonneville has conducted will help it quantify any increased wildfire risks if the work is delayed.

Federal law requires Bonneville to conduct emergency work to restore power or remove vegetation or obstacles from contact with the line. It will however coordinate in advance with public land managers whenever time permits.

Notably, Bonneville's 2017 Memorandum of Understanding (MOU) with the USFS requires advance coordination on maintenance activities and includes a fire prevention and suppression plan designed to prevent and minimize wildfire. Bonneville also follows BLM's regulation that requires all ROW permit holders to do everything reasonable to prevent and suppress wildfires on or in the immediate vicinity of the right-of-way area.¹⁶

On nonfederal land, Bonneville, as a federal agency, is not covered by state or local fire regulations. However, it is committed to coordinate with the appropriate agencies and will generally follow advice and precautions recommended by state and local agencies.¹⁷ Notably, state and local agencies not only oversee lands owned by these agencies, but they may also oversee wildfire management on forest and rangeland primarily in rural areas outside the city boundaries. This fire prevention and suppression work is generally set forth in state law and administrative regulations. This state and local work is undertaken along with private forest and range landowners who are often required to either pay fire protection fees or assessment or provide their own fire protection plans and resources. This plan will also allow BPA to demonstrate to landowners that it is taking adequate precautions in planning and carrying out its work.

The Transmission Line Maintenance (TLM) crews and the Natural Resource Specialists are the primary owners of this "fire smart" operational strategy to maintain access to

¹⁵ The Federal Land Policy and Management Act (FLPMA) and other federal laws require Bonneville to follow the land managers' fire regulations on federal land.

¹⁶ 43 CFR §2805.12(4) (2022).

¹⁷ The prime difference is that it is not legally required to obtain a waiver permit, nonetheless it will assure these agencies and landowners that it will take appropriate precautions to conduct necessary maintenance on its transmission lines.



federal public land and to coordinate with nonfederal public and private landowners.¹⁸ Additionally, Bonneville staff who issue contracts for vegetation management, construction and maintenance work will assure these contracts provide adequate fire pre-suppression measures and require appropriate coordination with the applicable fire agencies.

5.6.4 Risk-Informed Vegetation Management

Bonneville will continue to evaluate its vegetation management program. It will examine industry best practices and identify any additional risk informed strategies that could advance its work to minimize wildfire risks. It will use risk assessment tools, including the CHR data, geospatial data, fire GIS mapping, and other risk-based evaluation tools Bonneville may acquire. This risk-informed approach may result in it reprioritizing or adding resources to address high risk fire areas; this work could include modifying the frequency of inspections or taking additional measures to reduce fuel levels.

6.0 Emergency Response and Preparedness

As a federal Power Marketing Administration, BPA follows federal guidance, including the North American Electric Reliability Corporation (NERC), the Federal Emergency Management Agency (FEMA), and Department of Energy (DOE) Directives and Orders for emergency response activities. Implementation of the National Incident Management System and Incident Command System are imbedded in the planning efforts and documentation followed by personnel when responding to wildfires and other incidents.

¹⁸ TLM Standard GID 3-1-9.

BPA interacts with other emergency management agencies within its service territory at multiple levels. General coordination of wildfire response efforts across the BPA service territory involve actions with our control centers to mitigate impacts to our customers and equipment. Our control centers dispatch resources from our Operations and Maintenance (O&M) Districts for local safety and alignment of efforts. Local responses are commonly performed by the relevant District employees. For larger or multiple impacts to BPA's transmission system in the same time period, BPA will elevate our response coordination level accordingly. This can mean coordination is raised from a local response to an agency wide response.

The local fire department or the National Wildfire Coordinating Group notifies BPA's control centers whenever a fire appears to be approaching BPA's infrastructure. BPA's weather and streamflow forecasting workgroup provides real-time weather data including Red Flag areas, thunder & lightning storms and also monitors wildfires in the service territory and provides notifications to the control centers. Dispatched BPA personnel act as agency representatives for the incident management team established to address the event. BPA also provides liaisons for federal, state, tribal, and local governments who regularly coordinate efforts and share information.

Safety is a BPA core value. Rerouting power as we experience outages and securing impacted equipment are BPA's primary means of reducing the risk of wildfires that can be started by BPA equipment or existing fires that threaten BPA's assets. BPA regularly communicates through many channels to customers and other stakeholders regarding possible curtailments and restoration timelines. BPA supports many customers, some that perform critical processes that can cost tens of thousands of dollars if power is disrupted. In some instance, BPA is the only entity capable of transmitting power to specific locations where outages can affect vulnerable entities and individuals. Extended power outages require active communication with customers and coordination with other responding entities.

BPA's Communications workgroup manages awareness via social media and provides communications products and assistance about ongoing and available resources for customers, federal, state, tribal, and local governments. BPA also coordinates with entities to prepare for and respond to potential emergency events. Vegetation management and other preventative measures are used to prepare for and reduce wildfire risk. BPA also modifies procedures to reduce fire risk during peak fire season. Interested individuals are also encouraged to increase their education by accessing Community and Outreach at bpa.gov.

BPA establishes and maintains contact with customers and other stakeholders to keep them informed when preparing for a potential or imminent public safety power shutoff. BPA has specific personnel assigned to contact federal, state, tribal, and local agencies as well as account executives assigned to all customers.

6.1 Continuity support for wildfires

BPA has adopted the Incident Command System to help coordinate response, restoration and recovery efforts. BPA's Continuity of Operations and Emergency Management staff participate in national, state and local transmission-related exercises and have a great deal of knowledge of BPA's transmission system and operating protocols.

Emergency Management Specialists are involved in BPA's general wildfire response and provide situational awareness during severe wildfire seasons and responds to wildfires as necessary.

During the Bootleg Fire, Emergency Management Specialists provided Regional Response Team Support. The Bootleg Fire impacted BPA operations near Sycan Compensation Station vicinity Summer Lake, Oregon in summer 2021.

In support of the Storm and Wildfire Incident Response Plan, Continuity of Operations and Emergency Management staff will continue to work with BPA Transmission Dispatch and Field Operations in support of wildfire mitigation and response.

6.2 Event Communications

When practical, BPA will provide notice to customers when interrupting load due to a fire. This is an unlikely event as the majority of BPA facilities are interconnected and de-energization of one facility does not generally result in interruption of load to customers. BPA will notify its transmission customers of curtailments of transmission due to wildfire through the normal reliability curtailment processes. It is our goal to provide advanced notice but often this is not practical when addressing safety and reliability issues.

BPA interacts with emergency management officials from federal, state, tribal, and local governments and agencies to keep them updated on wildfire mitigation efforts. BPA also works with stakeholders on collaboration and partnership opportunities when developing and implementing strategies.

The following measures can be taken to adapt to climate-driven increased risk of wildfire and to make the transmission system more resilient to this increasing risk:

- 1) Adapting to how projected changes in climate change are expected to increase the risk of wildfire. Increased focus on vegetation management practices. Climate change is expected to alter the range and abundance of vegetation and exacerbate the spread of invasive species, pests, and disease.¹⁹ These changes to ecosystems can then increase the risk of wildfire by throwing off the balance of an ecosystem and providing an abundance of fuel.²⁰ BPA may need to adapt and adopt different or more frequent practices in regards to inspecting and maintaining transmission right-of-ways.
- 2) Any foreseeable impact to line sag (and corresponding potential to spark and ignite something) with increasing temperatures that we may need to adapt for in design standards and construction.

7.0 Public Safety Power Shutoff (PSPS)

During fire season, which typically ranges from sometime in May to late October, there may be extreme conditions or weather triggers that require BPA to de-energize certain assets to reduce the risk of a potential uncontrolled ignition. These extreme weather triggers are designed using best practices on imminent fire danger and geospatial analysis of wind and humidity variables. BPA has decided that these extreme weather triggers are wind in excess of 60 mph wind combined with National Weather Service Red Flag Warning (RFW) and/or relative humidity < 20%. These variables have been calibrated to BPA's robust design standards which allow for heavy wind and loading conditions.

¹⁹ USGCRP. U.S. Global Change Research Program. Fourth National Climate Assessment, Volume II: Impacts, Risks, and Adaptation in the United States. 2018. Available at <https://www.globalchange.gov/nca4>

²⁰ DOI. U.S. Department of Interior. 2017. 7 Burning Questions: Wildfires and Public Lands. Available at <https://www.doi.gov/blog/7-burning-questions-wildfires-public-lands>

BPA uses data from internal and external sources to make a PSPS decision. Examples include: vegetation species data, urban density, asset density, asset health, ignition probability, fire behavior, wind, humidity and line/load criticality.

BPA recognizes the impacts to the region that come with a PSPS decision and is committed to making these decisions in a timely and data-informed manner. BPA reserves the right to de-energize any facility it deems high risk; however the analysis and focus has been predominantly lower voltage bulk energy system (BES) assets (115kV). Any PSPS decision will be a weighty one, and will be taken only as a last resort. If a PSPS decision is enacted BPA will initiate its communication processes to its impacted utility wholesale customers and regional outreach through the following channels.

BPA's constituent and tribal account executives will communicate this information to federal, state and local elected officials, tribes and other important stakeholders. We will try to avoid overlap with other utility outreach to state and local elected and emergency management officials and coordinate those efforts with the affected utilities.

As the event unfolds, BPA will work with impacted utilities and, if asked, augment customer utility outreach through providing information to local media in the area and on social media channels to ensure local residents and others are aware of the situation. BPA intends to provide information to local media in areas once it decides to implement a PSPS. BPA will not engage in any other outreach efforts to local residents, businesses and officials through social media or other communications channels unless a customer utility specifically requests it.

7.1 Re-Energization Strategy

If a transmission line has been de-energized because a wildfire is burning in close proximity of our transmission lines, BPA's TLM must perform additional steps prior to re-energization. In an event of a wildfire where transmission structures were burned, additional steps must be taken to rebuild the lines.

7.2 Steps to restoration of service

BPA work crews take several important steps prior to restoring electrical service after a wildfire event that may include:

- **Patrol** – BPA crews patrol the line by ground or by air to look for vegetation in lines and any obvious damage that may prevent safe energization. Depending on the length of the lines, and number of circuits, the patrols can take several hours.
- **Repair** – During patrol, crews look for potential damage to the lines and structures. Where equipment damage is found, crews use new materials to repair or replace damaged equipment. If needed, additional crews are dispatched to help. In some cases, Vegetation Management crews may be called in to help clear an area of downed trees or branches that have fallen into the transmission lines.
- **Test** – Once the lines and structures are safe to operate, the lines and equipment are re-energized by closing the fuse, or breaker to re-energize the line segment.
- **Restore** – Power is restored and the outage communication system provides notification of power restoration to customers.

7.3 Reconstruction after a wildfire

After fire officials have given BPA clearance, BPA work crews can proceed with the assessment and rebuilding effort.

- **Assessment** – BPA crews must patrol each line segment to determine the extent of damage that has occurred. The patrol involves assessing equipment damage, access issues, and any cleanup including debris removal issues. BPA works with the local agency in charge of the fire to access impacted areas as soon as the area is deemed safe by fire officials. During this phase the Vegetation Management team can be used to assess vegetation damaged by the wildfire that could impact BPA’s facilities.
- **Planning** – After the initial assessment, BPA supervisors, managers and engineers meet to plan the restoration. The team will work with system operations to prioritize the restoration efforts, targeting the circuits that serve the most critical infrastructure needs.
- **Mobilize** – Based on the size and complexity of the rebuild/restoration efforts, BPA will coordinate the crews and material needs internally if possible. Mutual aid and contractors may be used on an “as needed” basis to provide additional support. Vegetation Management crews can be used for clearing the ROW and any dangerous trees that pose a threat to the restoration crews. BPA maintains an emergency stock of critical materials; though in an instance of widespread catastrophic damage, necessary materials and labor could experience shortages that may delay work.
- **Rebuild** – The rebuild effort led by BPA will commence as soon as areas become safe and accessible. The lines will be rebuilt with a mix of temporary and/or permanent structures as determined during planning. The initial efforts will be to get the lines up and restore the damaged circuits. Depending on the extent of damage, demolition may be performed concurrently or after crews start installing new facilities. BPA will incorporate new materials and technologies as indicated and available.
- **Restore** – BPA, mutual aid, or contract crews will restore electric services to our customers as soon as possible after the wildfire. Depending on the extent of damages, customers may have to perform repairs on their facilities prior to having full electric service restored. These are coordinated on an as needed basis.



Appendix

List of Acronyms	
Acronym	Term
BPA	Bonneville Power Administration
CETI	Centre for Energy Advancement through Technological Innovation
CHR	Criticality, Health, and Risk
COO	Chief Operating Officer
DOE	Department of Energy
EPRI	Electric Power Research Institute
FCRTS	Federal Columbia River Transmission System
FEMA	Federal Emergency Management Agency
IAM	Institute of Asset Management
IOU	Investor-Owned Utilities
IWRMC	International Wildfire Risk Mitigation Consortium
MOU	Memorandum of Understanding
NATF	North American Transmission Forum
NERC	North American Electric Reliability Corporation
O&M	Operations and Maintenance
PNNL	Pacific Northwest National Laboratory
PSPS	Public Safety Power Shutoff
RFW	Red Flag Warning
ROW	Right-of-Way
SAMP	Strategic Asset Management Plan
SCM	Secondary Capacity Model
SME	Subject Matter Expert
TLM	Transmission Line Maintenance
TPOT	Transmission Portfolio Optimization Tool
USGCRP	U.S. Global Change Research Program
WMP	Wildfire Mitigation Plan



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