



**Portland General Electric Company**  
121 SW Salmon Street • 1WTC0306 • Portland, OR 97204  
portlandgeneral.com

December 30, 2021

***Via Electronic Filing***

Public Utility Commission of Oregon  
Attention: Filing Center  
P.O. Box 1088  
Salem, OR 97308-1088

RE: UM 2208 – PGE’s Wildfire Protection Plan

Dear Filing Center:

Please find attached the Portland General Electric Company (PGE) 2022 Wildfire Mitigation Plan (WMP) which is being submitted as required per Oregon Administrative Rule 860-300-0002(2).

PGE continues to evolve its approach to mitigating the risk of wildfires in response to changing conditions. For example, for 2022 we designated three new High Risk Fire Zones (bringing the total to 10) as a result of updating our risk assessment. In addition, PGE is expanding its situational awareness capabilities. For example, PGE is installing new remote automated weather stations, and deploying artificial intelligence-enhanced cameras to automatically notify PGE when they detect a fire, in real time. These efforts are in addition to the operational changes that occur during fire season, and our inspection and vegetation management activities. PGE anticipates that our wildfire mitigation plans will continue to evolve as our risk assessment and wildfire mitigation capabilities expand.

PGE appreciates Staff’s efforts to establish permanent rules regarding utilities’ wildfire mitigation plans. We look forward to continuing to work with Staff and parties to develop more comprehensive wildfire mitigation rules in AR 638, Phase II.

PGE looks forward to the independent evaluators review of the WMP. Please direct all formal correspondence and requests to the following email address [pge.opuc.filings@pgn.com](mailto:pge.opuc.filings@pgn.com).

Respectfully Submitted,

*/s/ W. M. Messner*

William M. Messner  
Director Wildfire Mitigation & Resiliency

Portland General Electric Company

# 2022 Wildfire Mitigation Plan



Revision Version: 1.0

Release Date: 12/30/2021



This Wild fire Mitigation Plan contains statements that relate to future plans, objectives, expectations, performance and events. These forward-looking statements represent PGE's estimates and assumptions as of December 30, 2021; because PGE is continually updating its wild fire data, information included in the Plan reflects the data available at the time of publication. The Company assumes no obligation to update or revise any forward-looking statement as a result of new information, future events or other factors.

These forward-looking statements are not a guarantee of future performance and any such forward-looking statements are subject to risks and uncertainties which may be difficult to predict or are beyond PGE's control. As a result, actual results may differ materially from those projected in the forward-looking statements.

## Executive Summary

Portland General Electric Company's (PGE's) Wild fire Mitigation & Resiliency (WM&R) organization plans and implements the Wild fire Mitigation Program, developing and coordinating wild fire mitigation activities across the company. The Wild fire Mitigation Plan is the strategic document that guides the Wild fire Mitigation Program.

PGE's approach to wild fire mitigation is evolving in response to both the changing conditions that have focused worldwide attention on West Coast wild fires, and to the newly-issued Public Utility Commission of Oregon (OPUC or Commission) wild fire rules. PGE's goal is to reduce the risk that electric utility infrastructure could cause a fire, while limiting the impacts of specific mitigation activities, such as Public Safety Power Shutoff (PSPS) events, on customers.

The OPUC wild fire rules provide specific guidance regarding risk modeling, wild fire-related engagement with Public Safety Partners and local communities, and PSPS-related communications and notifications. PGE is also committed to compliance with OPUC rules regarding inspection and repair, vegetation management and clearances, and inspection and patrol activities within the utility-identified High Risk Fire Zones (HRFZs).

PGE's risk model, referred to as the "Wild fire Risk Mitigation Assessment," is the foundation of the program, guiding activities within all six of the Wild fire Mitigation Program's major focus areas: operating protocols, asset management and inspections, vegetation management, community outreach and public awareness, PSPS events, and research and development.

For 2022, the updated risk assessment has led PGE to designate three new HRFZs (bringing the total to 10). PGE's HRFZ designations are for areas of PGE's service territory where vegetation, terrain, and wildland-urban interface increase the risks of fire and where PGE implements specific inspection and maintenance, vegetation management, and operational activities for wild fires, for prevention and for improved safety. In addition, PGE is expanding its situational awareness capabilities, including measures such as installing new remote automated weather stations, hiring additional full-time meteorological staff, and deploying artificial intelligence-enhanced cameras to automatically notify PGE when they detect a fire, in real time.

At PGE, wild fire-related planning and research are a year-round endeavor. PGE may update this Plan, and the Wild fire Mitigation Program throughout the year to address new findings, data and analysis. PGE will continue to work collaboratively with Public Safety Partners, local communities and other key stakeholders to prioritize the safety of people, property and public spaces. In 2022, PGE will continue to act with urgency to reduce the risk of wild fire ignitions from our assets, to respond to wild fire events and to efficiently recover from incidents.

# Revisions Log

The following table details the nature, date, and primary author of major revisions to this document. All impactful revisions - revisions that make significant changes to PGE Wild fire Mitigation strategies - will be described in the Revision Description column.

Date	Version	Revision Description

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## Section 1. Introduction

The Wild fire Mitigation Plan outlines PGE’s wild fire prevention and mitigations efforts and provides guidance regarding PGE’s response efforts in the event of a wild fire. The plan describes PGE’s wild fire preparedness and response activities for 2022, and will be used to guide an integrated approach to achieving PGE’s wild fire-related safety goals.

PGE will review its fire season operations and wild fire mitigation preparedness and response actions on an annual basis and update this plan as needed. PGE will also update the plan as required to comply with applicable regulatory requirements or changes in law. If PGE substantively updates the plan outside of the annual submission cycle, PGE will re-file the plan with the OPUC and post the most current version of the plan on PGE’s website.

## Section 2. Purpose and Scope

PGE’s Wild fire Mitigation Plan was developed to provide strategic direction to the programs and activities that seek to mitigate the potential for PGE equipment, facilities, or activities to become wild fire ignition sources, and to ensure PGE’s compliance with the OPUC’s implementation of Senate Bill 762. In implementing the Wild fire Mitigation Plan, PGE will be guided by this legislation, and by the following key principles:

- Prioritize public and employee safety
- Act with urgency to reduce the risk of wild fire ignitions, to respond to wild fire events, and to recover from incidents
- Provide effective guidance to PGE’s in-season wild fire operations
- Guide PGE’s system hardening activities, increasing the region’s resistance to wild fire impacts through a systematic, risk-based approach to identifying and prioritizing system hardening and resiliency efforts
- Communicate and collaborate with energy and Public Safety Partners (the OPUC’s Emergency Support Function 12 (ESF-12), local emergency managers, and Oregon Department of Human Services), local communities and community-based organizations, counties, Federal, State and local governments, owners of critical facilities, and customers
- Maintain reliable electric service, and
- Implement Public Safety Power Shutoff (PSPS) events with efficiency, only when absolutely necessary, and with broad public awareness.

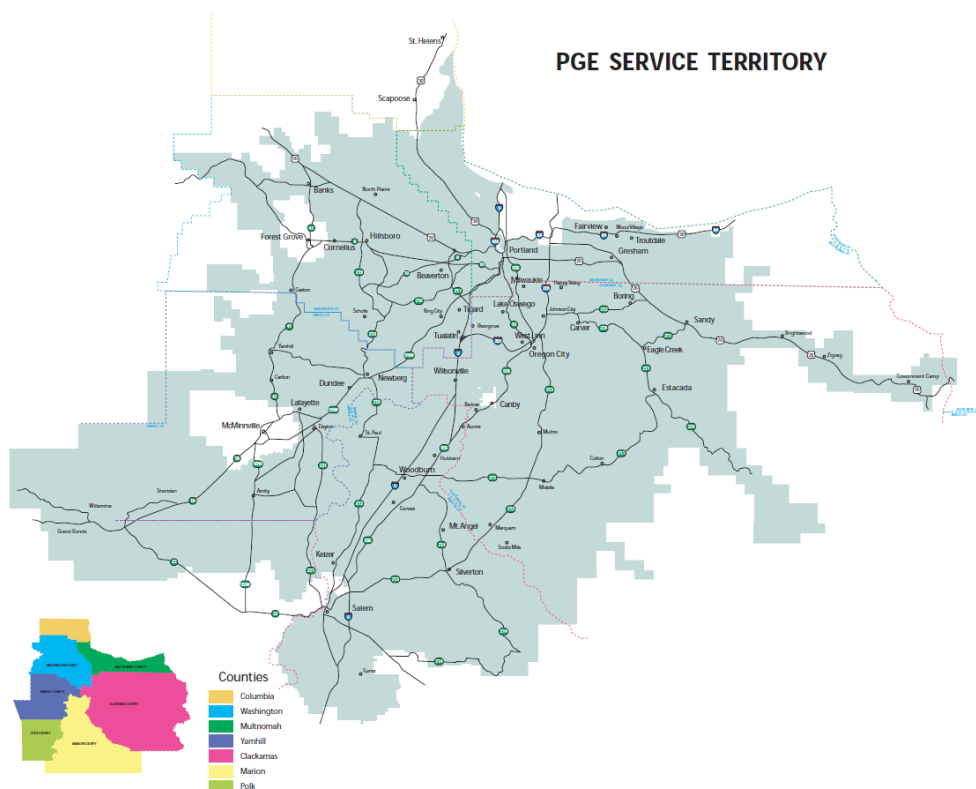
## Section 3. Operating Environment

Global climate change continues to rapidly alter the Pacific Northwest climate in ways that are difficult to model and predict. This reality will drive continuous evaluation and modification of wild fire mitigation plans for the foreseeable future. In addition, the effects of climate change on California and resulting wild fires have pulled the center of gravity of West Coast wild fire mitigation



to the south, increasing the competition for available fire suppression, inspection and vegetation management resources in the Northwest.

PGE's service territory is distributed over 4,000 square miles in a combination of forested, mountainous, urban and suburban environments. Much of the eastern and western portions of PGE's service area are forested, particularly in the Mt. Hood corridor along Highway 26, in the foothills of the Coast Range, and south toward Estacada. While the majority of PGE's service territory is located within the most densely populated area of the state, PGE's managed right-of-way (ROW) contains more than 2.4 million trees, with millions more off-ROW trees that present fall-in risk. PGE interconnects with multiple neighboring utilities, including the Bonneville Power Administration (BPA), PacifiCorp, West Oregon Electric Cooperative, Wasco Electric Cooperative, and Consumers Power, Inc.



## Section 4. Wildfire Risk Mitigation Assessment Program Overview

PGE's primary wild fire risk mitigation objective is to reduce wild fire risk from PGE infrastructure in the communities where PGE operates while limiting the impacts of specific mitigation activities, such as PSPS events, on customers. Other risk-related objectives of the program described in this plan include:

- Identify areas of heightened wild fire threat within the PGE service territory and mitigate the risk of utility-caused wild fire ignition in those areas

- Reduce the risk of wild fire ignition, prepare to respond to wild fire events, and plan for recovery from incidents
- Communicate with Public Safety Partners, operators of critical facilities, state and federal agencies, customers and communities before, during, and after wild fire season and PSPS events
- Implement a systematic, risk-based approach to identify and prioritize system hardening, vegetation management and resiliency measures
- Improve PGE’s wild fire-related risk management and situational awareness capabilities, and
- Reduce the risk of future wild fire events through learning and adaptation during and after wild fire-related exercises and incidents.

One objective of PGE’s Wild fire Mitigation Program is to find cost-effective ways to maximize wild fire risk reduction by applying risk assessment modeling to inform mitigation strategies. However, factors beyond PGE’s control are fueling rapidly-rising costs and/or delays to project timelines, including changing West Coast weather patterns driven by climate change, competition for limited contract resources for vegetation management and inspections, and bottlenecks in the global supply chains. Investor-owned utilities, the Commission and other stakeholders must strive to achieve a reasonable balance between affordable electricity rates and meaningful wild fire risk reduction. Delivering maximum risk reduction per dollar of investment so that PGE customers and the region receive the highest possible value for allocated resources is a key Program goal.

Climate change will continue to increase wild fire threats, requiring continual adaptation of asset management and other routine business practices. This challenging reality, combined with PGE’s responsibility to maintain reliable electric service, protect public safety and resources, and conscientiously steward Oregon’s natural environment, requires a careful balance between often-competing interests and system requirements. As the complexity of this analysis increases with each passing year, PGE is guided by the industry best practice of maximizing value. As defined by Institute of Asset Management (IAM) criteria encompassed in ISO 55000 standards, value is a function of lifecycle costs, performance and, ultimately, risk.

FIGURE 2: THE VALUE EQUATION



PGE factors in changing environmental conditions, unforeseen impacts to the public and the environment, quality assurance/quality control (QA/QC) on data quality, and new data sources to iterate and optimize its wild fire risk mitigation strategy. Future iterations will focus on decision support, governance, execution delivery, and internal controls. PGE follows the ISO-31000 risk framework as part of the evolution of the wild fire risk assessment process.

## Section 5. Wildfire Risk Mitigation Programs & Activities

### 5.1 Risk Management Overview

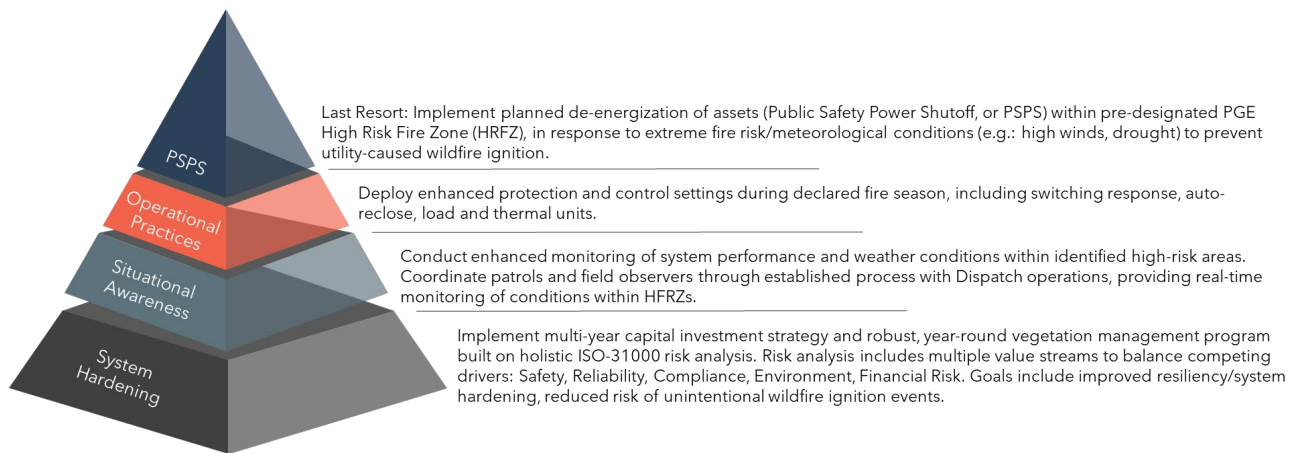
In 2019, PGE began a multi-phase wild fire risk assessment and modeling program to evaluate industry best practices, identify the highest risk fire zones within the PGE service territory, quantify the likelihood that individual PGE assets could contribute to ignition of large wild fires (>100 hectares for fires in timber; >400 hectares for fires in grass or rangeland), map their location, and apply a consequences model to determine where a potential wild fire ignition would be most significant. The annually-updated PGE statistical model enables PGE to identify the highest risk areas and prioritize wild fire mitigation actions. The model results are a key input to the development of PGE's 2022 Wild fire Mitigation Program.

Wild fire risk analysis allows PGE to assess susceptibility to the natural and human factors that contribute to utility-caused wild fire ignition and provides data-driven guidance for PGE's wild fire mitigation program. PGE's goal is to make communities, customers, employees, and facilities safer by reducing the probability of wild fires being ignited by electric utility equipment or activities, using an accurate assessment of asset-specific risk by location.

PGE's wild fire risk assessment incorporates a wide range of values, such as threats to life safety, property and financial exposure, and impacts to the environment and system reliability. This analytical approach impacts decision-making across the company, including system hardening decisions, operational and maintenance practices, and PSPS decision-making.

The following figure provides a visual representation of PGE's multi-layered approach to the complexities of wild fire risk mitigation:

FIGURE 3: PGE'S WILDFIRE RISK MITIGATION HIERARCHY



In 2022, PGE will evaluate engineering, maintenance, construction and operational strategies by leveraging the most current wildfire risk reduction model data, lessons learned from previous fire seasons, recommendations from regional Public Safety Partners, and Commission guidance and rulemaking, and by applying the following core concepts:

- Frequency of ignition events can be reduced through:
  - Vegetation management
  - Regular inspection and maintenance of poles and equipment; and
  - Engineering of reliable systems that experience fewer events that result in spark failure modes.
- When a fault event does occur, PGE can minimize the impact of the event through use of equipment and personnel to isolate and correct the problem, and
- Situational awareness and operational readiness are crucial to mitigating wildfire risk and its impacts.

## 5.2 Updates to 2022 Wildfire Risk Mitigation Assessment

PGE aims to improve its wildfire risk analytics and decision-making process through internal controls and feedback loops across the organization.

Following the ISO 31000 and 55000 frameworks, PGE engages external agencies in the development of new variables and inputs for consideration in the risk analysis process. In 2021, this engagement included field site visits with Oregon Department of Forestry (ODF) to look at vegetation and asset conditions that influence fire growth potential and response times to ignition events. In addition, PGE hosted virtual technical working sessions with local fire districts (Clackamas Fire District, Tualatin Valley Fire District, Multnomah Fire District) and ODF to understand fire response times, watershed boundaries and detection probabilities. These variables directly informed PGE’s decision to add new High Risk Fire Zones (HRFZs) in the 2022 plan, as well as PGE’s reassessment of the number and geographic boundaries of the HRFZs.

Through this post-fire season lessons learned process, PGE was able to refine its wildfire risk model outputs by introducing new variables layered on PGE’s existing risk model. These new variables include:

- Line of sight
- Access/egress road density
- Detection probability, and
- Fire response time/proximity.

PGE strives to improve its understanding of wild fire risk at a granular level. The unknown impacts of climate change mean that management and analysis of wild fire risk will be a dynamic and constantly evolving task. With continuous feedback from and engagement with external stakeholders, PGE can maximize the potential of the Wild fire Mitigation Program to reduce wild fire risk.

PGE continues to investigate improvements to data sets and analytical techniques to evolve its wild fire risk assessment and integrate fire risk into PGE’s overall asset and risk management frameworks. Following the 2021 wild fire season, PGE made the following changes to its baseline wild fire risk assessment:

- Began the development of a five-year wild fire risk mitigation roadmap, laying out planned mitigation activities through fiscal year 2026
- Significantly refined its HRFZ analysis, creating three new HRFZs in the western portion of the PGE service territory and eliminating portions of some 2021 HRFZs, and
- Introduced new variables to PGE’s GIS-based wild fire risk mapping through virtual technical work sessions with local fire districts and the OPUC, including line-of-sight, access/egress road density, fire detection probability and estimated response time.

### 5.3 High Risk Fire Zones (HRFZ)

PGE has identified areas of its service territory where vegetation, terrain, and the wild land-urban interface (WUI) increase the risks associated with utility-caused wild fire ignition. For the purposes of this plan, PGE refers to these areas as High-Risk Fire Zones (HRFZs). PGE may choose to implement a proactive Public Safety Power Shutoff (PSPS) within a given HRFZ during periods of extreme wild fire threat. For 2022, PGE has identified 10 HRFZs within its service territory (see figure 4 below):

HRFZ 1: Mt. Hood Corridor/Foothills

HRFZ 2: Columbia River Gorge

HRFZ 3: Oregon City

HRFZ 4: Estacada

HRFZ 5: Scott’s Mills

HRFZ 6: Portland West Hills

HRFZ 7: Tualatin Mountains

HRFZ 8: Central West Hills

HRFZ 9: North West Hills

HRFZ 10: Southern West Hills

PGE relied on the ISO-31000 wildfire risk analysis framework to identify the 2022 HRFZs, allowing PGE to incorporate new variables and refined boundary conditions to improve its understanding of:

- Wild fire risk
- Where those risks are highest within the PGE service territory
- The areas within the PGE service territory where a PSPS event could be required, and
- PGE's confidence level in its analysis.

The risk assessment factored in the likelihood that a given PGE asset could become an ignition source, as well as the likelihood that such an ignition could spread into a large, uncontrolled fire. Additional analytical factors included vegetation density, fuels dryness, the potential for extreme weather conditions, and the presence of structures and other infrastructure.

In conducting the risk analysis, PGE adjusted many variables, including temperature, humidity, fuel dryness and wind speed, and ran thousands of scenarios in a Monte Carlo simulation to identify the areas of the PGE service territory where the risks associated with a utility-caused ignition are highest. The results of this analysis provided the basis for PGE's 2022 HRFZ assessment.

The model leveraged data from PGE's Remote Sensing Pilot Project which used light detection and ranging (LiDAR) and other technologies to capture detailed topographical and vegetation measurement data for PGE's distribution system. This data allowed PGE to quantify the potential threat of wild fire ignition due to vegetation impingement and weather-caused outages. PGE calculated the probability of vegetation-caused outages using a statistical model built on historical outage data, characteristics of each distribution circuit, detailed information about the quantity, density and proximity of vegetation at a given location, as well as the expected consequence of ignition at that location.

Applying these refined risk variables, PGE identified a large geographic portion of the west side of its service territory as high-risk, resulting in the identification of three new HRFZs for 2022 (North West Hills, Central West Hills, Southern West Hills). The updated modeling also removed several highly concentrated customer areas from the 2021 PGE HRFZs, including areas in:

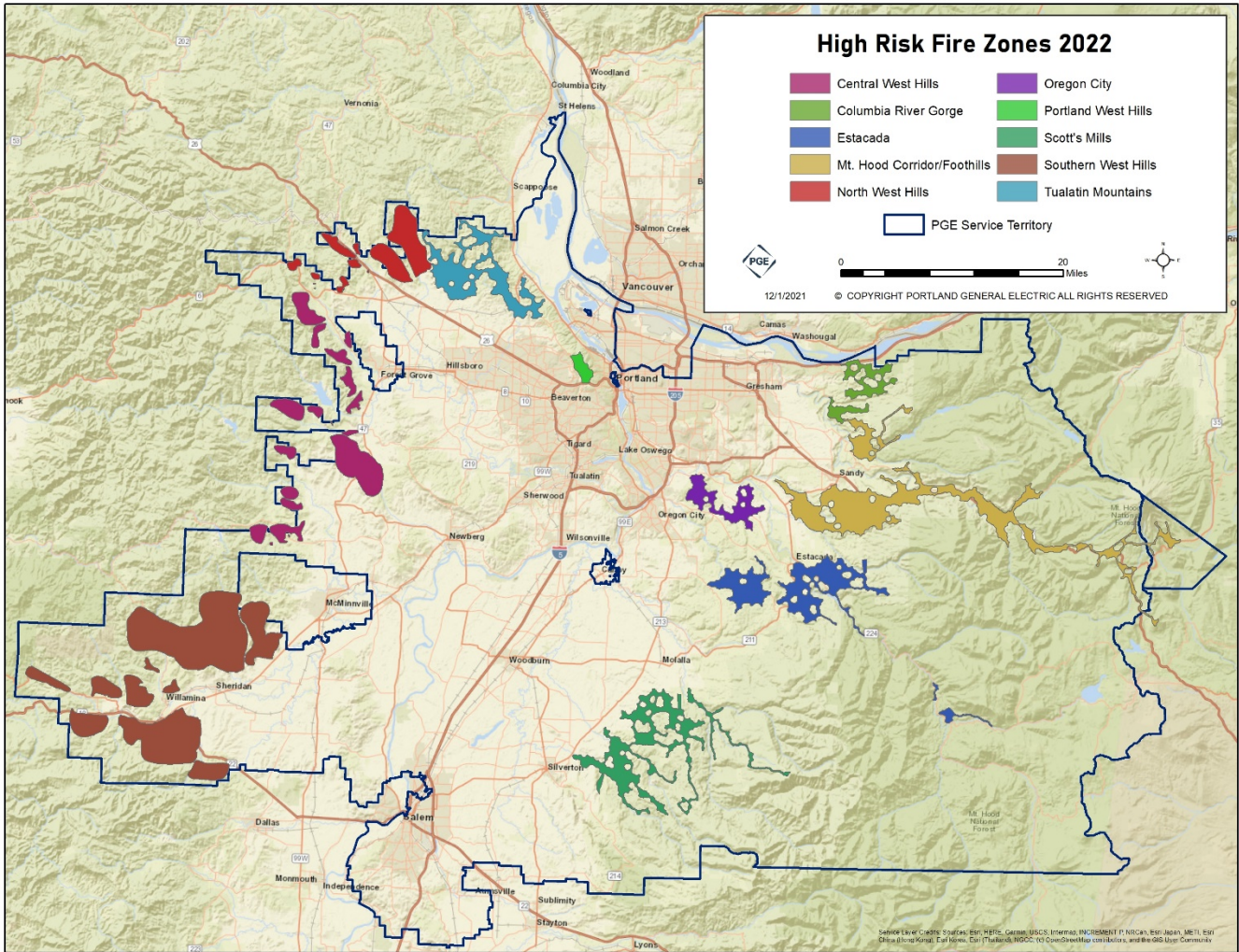
- Boring (South of Gresham)
- Sandy River Delta (Corbett Area)
- West Side Hills (West Portland)

These changes will reduce the total number of customers impacted by potential PSPS events during the 2022 fire season. An interactive, GIS-enabled map on the Wild fire Outages ([portlandgeneral.com/wildfireoutages](http://portlandgeneral.com/wildfireoutages)) and PSPS page ([portlandgeneral.com/PSPS](http://portlandgeneral.com/PSPS)) on PGE's website ([portlandgeneral.com](http://portlandgeneral.com)) allows customers to enter their address to determine whether their home or business is located within an active PSPS area. PGE will provide maps of its most current HRFZs, including GIS shape files, to OPUC Safety staff by April 1, 2022.

FIGURE 4: PGE HIGH RISK FIRE ZONES: 2021 VS. 2022



FIGURE 5: 2022 PGE HIGH RISK FIRE ZONES



## 5.4 Wild fire Risk Categories

PGE’s wild fire risk analysis specifically considers baseline wild fire risk and risks to residential property and life. PGE uses these assessments to inform wild fire mitigation strategies that provide location-specific reliability and resiliency benefits. PGE’s analysis also considers regional values such as cultural, historic, and habitat- and species-specific benefits, because these values matter to PGE, its customers and other stakeholders. PGE considers these factors to benefit the broadest possible spectrum of regional stakeholders. This holistic risk assessment approach helps PGE align specific solutions to required risk reduction areas.

This risk alignment theme is applied consistently across PGE’s wild fire mitigation program, from design standards to construction practices, vegetation management, and capital investment. PGE seeks to align activities and competencies with risk, referring to and integrating mitigation outcomes from its wild fire risk analysis in assessing capital investments, maintenance activities and operational strategy.



## Base line Wild fire Risk

PGE calculates baseline equipment risk in terms of ignition probability (the annual likelihood that a given piece of equipment could cause a wild fire ignition given its type, age, condition, and location) and the consequences of ignition. These consequences evaluate how a wild fire ignited at a given location may burn, as well as the potential magnitude of the damage it may cause. In most cases, probability values vary with age and condition, increasing as equipment ages.

## Seasonal Wild fire Risk, Risk to Residential Areas, and Risk to PGE Equipment

Seasonal risk and risk to residential areas are integral to PGE's wild fire risk assessment. In future iterations of PGE's wild fire risk analysis, risk to PGE equipment will also be considered, as PGE adds the capability to assess which items of equipment are most likely to be damaged if a fire occurs in a given area. PGE is developing the tools required to factor information of this granularity into its wild fire risk analysis.

## Georisk

In addition to the risk categories above, PGE also models geographic wild fire risk (georisk). Georisk represents wild fire risk due to vegetation encroachment on the conductor, and/or animal contact impacting the components of the structure. Georisk is distinct from asset risk, which is defined as risk due to failed equipment. This information will be integrated into an updated PGE structures model. PGE's structures model is still in draft form and will be formally published in Q2 2022. Once the model is formally published, it will be refined through PGE's annual QA/QC review process.

This structures model allows PGE to evaluate wild fire risk at a more precise level, by identifying the specific areas of the PGE service territory where there is an increased risk of ignitions from PGE equipment due to contact from foreign objects.

## 5.5 Risk Assessment Data Quality & Review Frequency

PGE uses multiple data sources in the statistical models used to determine where PGE's highest wild fire risks exist. PGE's risk modeling methodology is consistent with the ISO-31000 Monitoring & Review structure, which provides internal controls to enhance confidence while still considering the dynamic nature of risk.

PGE's QA/QC process for published Asset Risk Models identifies the cadence of updates and required review tasks. Table 1 below details PGE's current data source update cadence.

Required QA/QC tasks include review and affirmation of existing or updated data, validation of subject matter expert (SME) assumptions, review of mathematical formulas and variance testing of updates to confirm that updates are reasonable.

TABLE 1 : UPDATE CADENCE FOR KEY MODELING INPUTS

Data Sources	Inputs	Cadence of Updates
Annual Probability of Asset Failure	Weibull failure curve parameters	Annual review <ul style="list-style-type: none"> <li>Affirm/update SME assumptions/updated failure data</li> </ul>
	Health indexing	Annual review <ul style="list-style-type: none"> <li>Incorporate condition data (as available)</li> </ul>
	Demographics from database	Periodic updates as data becomes available-GIS/Maximo
	GIS data for components on structures	Annual update to address reconfiguration/replacement
Annual Probability of Asset Caused Ignition	Probability of equipment related outage is source of ignition	Annual review <ul style="list-style-type: none"> <li>Affirm/update SME assumptions</li> </ul>
	Probability of equipment in violation of PGE patrol/inspection guidelines	Annual review <ul style="list-style-type: none"> <li>Incorporate inspection data (as available)</li> <li>Incorporate updated SME assumptions</li> </ul>
	Equipment multipliers	Annual review <ul style="list-style-type: none"> <li>Affirm/update SME assumptions</li> </ul>
Intervention Costs	Capital cost estimates for wild fire mitigation	Annual review <ul style="list-style-type: none"> <li>Affirm/update SME assumptions</li> </ul>
Consequence of Wild fire	The wild fire consequence model developed by Pyrologix identifies structures in burnable locations and estimates the expected consequence of a large fire (i.e., min 400 hectare) started at each location.	Periodic updates as required

### Georisk Assessment Data Sources

PGE inputs asset and georisk data sources to the Pyrologix fire physics engine to create simulated probabilistic models that assess fire risk by location, for both long-term planning and real-time

decision support. PGE continues to refine variables in coordination with external agencies. This collaboration has led PGE to add new variables for consideration in its ongoing risk analysis process.

Table 2 details the data sources for the various inputs PGE uses to assess geographic wild fire risk, as well as the proposed cadence of updates to these data sources.

**TABLE 2 : GEORISK MODELING DATA SOURCES AND CADENCE OF UPDATES**

Data Sources	Inputs	Cadence of Updates
Wild fire Modeling	Fire Propagation and Fire Behavior	<ul style="list-style-type: none"> <li>• Annual review</li> <li>• Affirm/update SME assumptions/updated failure data</li> <li>• Land fire (geospatial layering program) calibration through Pyrologix proprietary adjustments</li> </ul>
	Elevation Data	<ul style="list-style-type: none"> <li>• Annual/semi-annual review</li> <li>• Affirm/update SME assumptions/updated failure data</li> <li>• National Survey Data</li> <li>• USGS</li> <li>• LIDAR</li> </ul>
	Meteorological Data	<ul style="list-style-type: none"> <li>• Annual/semi-annual review</li> <li>• National weather data</li> <li>• PGE weather stations</li> </ul>
	Burn Probability	<ul style="list-style-type: none"> <li>• Annual review</li> <li>• Affirm/Update SME assumptions/updated failure data</li> <li>• Land fire calibration through Pyrologix proprietary adjustments</li> </ul>

## 5.6 Ignition Probability Values and Historic Ignition Tracking

In 2021, in response to new OPUC requirements, PGE created an ignition management tracking database and process. This allows PGE to base the system hardening investments described in the Targeted Interventions to Reduce Wild fire Risk section, below, on the risk drivers that deliver an optimized risk/spend efficiency calculation. For example, if analysis shows that georisk represents a feeder’s only risk, but 99 percent of all the ignitions recorded at that site are caused by animal contact, then installing animal protection devices would likely be the appropriate risk mitigation outcome for that location.

As PGE collects risk assessment data and supplements it with lessons learned and industry best practices, it can refine its ignition probability values database to create more accurate risk

projections. These risk projections, based on quantifiable drivers, allow PGE to map risk velocity (risk forecasted through time) and link it to the various strategies described in Section 5.8, Targeted Interventions to Reduce Wild fire Risk, to deliver highest-value risk mitigations.

## 5.7 Prioritized Opportunistic Interventions

Generally, when repairs are needed on an asset and the cost of the repair is higher than the lifecycle value of the asset, the asset should be replaced. Once crews are mobilized, there may also be reliability and economic benefits to proactive asset replacement, particularly within HRFZs. Whenever possible, PGE applies its asset risk methodology to assess the cost/benefit of proactive asset replacement during planned improvement/maintenance activities on other nearby assets. This approach helps PGE maintain reliable electric service, supporting public safety.

PGE prioritizes capital investments and maintenance activities that provide multiple benefits to the system including minimizing outage duration, asset survival and other impacts to infrastructure beyond wild fire mitigation. This multi-dimensional view allows PGE to achieve the best-value risk reduction per dollar of investment.

## 5.8 Targeted Interventions to Reduce Wild fire Risk

### Risk Analysis for PSPS

Before and during fire season, PGE reviews regional National Weather Service forecasts, fire activity briefings, fire potential forecasts, and readings from PGE weather stations strategically located throughout the service territory daily. In 2022, PGE is deploying additional weather stations to increase situational and conditional awareness and provide visibility within the newly identify HRFZs on the west side of its service territory. PGE consulted with external meteorologists to identify locations that will provide the best overlap for wild fire risk coverage. PGE uses meteorological and outage data predictive analytics to better inform decisions regarding PSPS events, as well as outage/curtailment decisions related to transmission.

In 2022, PGE is developing the model architecture and sourcing the required data to implement a risk-based predictive analytical approach to meteorological modeling. The purpose of this project is to provide more granular and sophisticated inputs to PGE's PSPS decision analysis, as well as its system alarming.

### Risk Analysis for Vegetation Management

Primarily focused on inspection and maintenance activities in the high fire risk portions of PGE's service territory, as identified through PGE's HRFZ assessment process, PGE's Vegetation Management strategy includes both cyclical, routine inspections and maintenance of the entire PGE transmission system and Advanced Wild fire Risk Reduction (AWRR) activities driven by PGE's wild fire risk analytics. Specific, year-to-year vegetation management activities are guided by PGE's Risk Assessment Program, data from PGE's Remote Sensing Pilot Project (which uses LiDAR and hyperspectral imagery to precisely monitor vegetation density and proximity to PGE assets), and annual vegetation surveys. AWRR crews follow program trim specifications, which include increased

removal rates and enhanced vegetation control techniques, discussed in more detail in Section 9, Vegetation Management, below.

## Risk Analysis for System Hardening

PGE continues to leverage its Strategic Asset Management (SAM) utility wild fire risk methodology and Wild fire Construction Standards to harden the transmission and distribution (T&D) system within its HRFZs. PGE's system hardening activities are designed to accomplish three goals:

- Reduce the risk of potential wild fire ignition caused by PGE facilities
- Reduce the impacts of a wild fire on PGE's assets by installing system hardening technologies (fire mesh, ductile iron poles, fiberglass crossarms)
- Protect utility infrastructure during potentially disruptive natural and human-caused disasters, supporting PGE's ability to maintain and restore reliable electrical service to support disaster relief and public safety.

In working towards these goals, PGE will deploy additional reliability improvements within the HRFZs. PGE is guided by its Wild fire Construction Standards in conducting equipment replacement in HRFZs. As outlined in PGE's Wild fire Construction Standards, the company will evaluate the following assets, with input from PGE subject matter experts, for replacement or implementation when warranted:

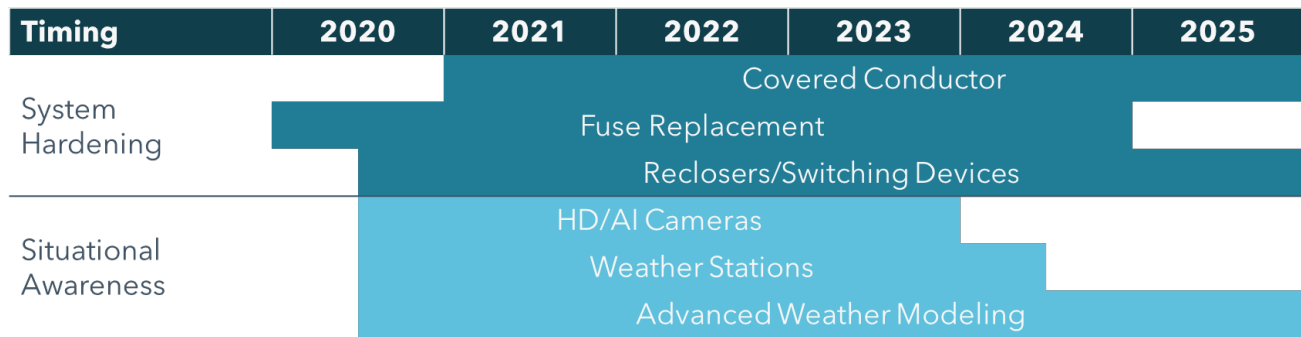
- Undersized/aging conductors in HRFZs
- Tree wire, an insulated overhead conductor designed to reduce service interruptions, which also reduces the potential for the conductor to become an ignition source
- Fuse replacement with non-expulsion fuses to eliminate a potential ignition source
- Viper reclosers and switching devices to increase operational flexibility and minimize customer impacts through the application of wild fire operational settings.

## Risk Analysis for Investment Decisions

PGE is also revising its capital investment strategy to align with its ongoing analysis of risk velocity over time. The goal of this effort is to create a multi-year investment framework to implement these separate but interrelated mitigation strategies, based on a risk profile that incorporates all wild fire risk drivers (such as vegetation contact). This multi-year investment strategy will help PGE balance system hardening mitigation measures with speed of execution.

Figure 6 below shows the multiple system hardening and situational awareness investment programs currently included in PGE's multi-year wild fire risk mitigation investment strategy, through 2025.

FIGURE 6: PLANNED WILDFIRE SYSTEM HARDENING & SITUATIONAL AWARENESS INVESTMENTS, 2020-2025



PGE’s multi-year investment strategy articulates a gradual increase in capital spending, distributed among multiple asset types. Table 3, below, describes PGE’s planned capital project investment types, together with estimated quantities. PGE will begin scoping these capital project investments in 2022. In addition to these asset replacements, PGE will begin scoping potential undergrounding areas. These investments (including undergrounding) will be prioritized in alignment with PGE’s wild fire investment strategy, which ranks system hardening and situational awareness projects identified as the highest value risk mitigation projects per dollar of investment.

TABLE 3: PLANNED WILDFIRE-RELATED CAPITAL INVESTMENTS, 2022

Asset	Quantity
Wild fire Cameras	10
Intelligent Reclosers	40
Weather Stations	23
Non-expulsion Fuses	480
Aluminum-Conductor Steel Reinforced Cable (ACSR)/Tree Wire	8 Miles

### Risk Analysis for Operations

PGE relies on a wide variety of weather and fuel models to obtain the granularity of information required to forecast hazardous fire weather conditions 7-10 days in advance of potential events. These models can provide decision-makers with a detailed understanding of the uncertainties and range of outcomes possible for a given weather pattern. In addition, PGE is in the process of developing a real-time wild fire weather risk tool that will incorporate weather data from across the PGE service territory. When completed, this tool will significantly improve PGE’s situational awareness capabilities. In addition, as part of its wild fire risk analysis, PGE annually reviews its HRFZs and updates its Community Resource Centers (CRC) Plan to reflect any changes to the list of HRFZs within PGE’s service territory.

## 5.9 Equipment and Design Standards

PGE conducts an annual review of the Wild fire Construction Standard, which describes the current PGE-standard methods and materials for poles, conductor, crossarms, insulators and cutouts located within HRFZs. This annual update process documents and implements any wild fire-related changes identified during the post-wild fire season review process. In the past, this process has resulted in changes to the PGE equipment and design standards governing the use of ductile iron poles, fiberglass crossarms, and wild fire-safe fusing.

## Section 6. Operating Protocols

### 6.1 Fire Season

Federal, Tribal, State and local authorities define fire season as the period(s) of the year when wildland fires are likely to occur, spread, and affect resource values sufficiently to warrant organized fire management activities. During this period, jurisdictional authorities regulate specific activities on public and private lands to mitigate the risk of human-caused ignitions. PGE declares its own fire season start and end dates and takes into account the State and Tribal fire season declarations.

PGE's fire season declaration and recession dates vary from year to year, depending on a variety of factors such as current and forecasted weather, drought status/timing and intensity, fuel availability and flammability, agency posture, and regional fire activity. PGE bases fire season timing decisions on data and information from multiple sources -- for example, the National Interagency Coordination Center (NICC), Northwest Coordination Center (NWCC), Climate Prediction Center (CPC), ODF, and Federal/Tribal Fire Management Officers and State District Foresters.

Fire season is divided into two "areas:" east of the Cascade Crest, and west of the Cascade Crest. This distinction is driven by historical differences in burning conditions such as weather patterns, fuel types and fuel moisture, in the two areas. This approach allows PGE to operate its system based on a more granular assessment of current and predicted fire danger, while maintaining system reliability in areas where fire risk is lower.

The historically fire-prone areas east of the Cascade Crest experience longer fire seasons, on average, than westside forests. On the east side, fuel differences, lower annual precipitation, and drought severity create favorable burning conditions from May through October. While decades of fire exclusion (management actions and policies designed to lower the risk of wild fire, such as understory clearing or dead tree removal) east of the Cascades have made them less resilient to fire, the westside forests are experiencing rapidly altering fire regimes. The region can no longer count on the brief summers and moist growing conditions during most of the year that produced reliably short-lived westside fire seasons.

PGE's fire season declarations:

- Change how the company operates the PGE system, initiating fire-season-specific settings within parts of the grid, including disabling reclosing/testing capabilities, where applicable

- Initiate fire season operational work practices in the field
- Increase monitoring and reporting on meteorological and operational conditions and use of other technologies to provide near real-time fire-related situational awareness, and
- Initiate notifications to key external stakeholders (Public Safety Partners, Federal, State, Tribal, and local officials, city and county emergency managers) in accordance with OPUC protocols.

## 6.2 System Operations During Fire Season

Once the start of fire season has been declared, PGE implements operational changes to reduce the risk of ignitions caused by PGE infrastructure and activities. These system changes include manually blocking non-remote controlled non-Supervisory Control and Data Acquisition (SCADA) distribution reclosing devices in the HRFZs from automatically test-energizing circuits following temporary faults, such as momentary tree branch contacts and lightning strikes with no damage. Prior to re-energizing, PGE will patrol the downstream circuit.

PGE may also change settings outside of fire season, when the risk of wild fire danger is elevated, or when a Red Flag Warning is in effect. In these instances, PGE will proactively block automatic reclosing on SCADA-controlled devices within PGE's HRFZs.

PGE annually reviews and updates settings for protection and control devices located within PGE HRFZs. In 2022, PGE will continue to implement circuit breaker and recloser protections to minimize fault energy and effectively reduce the risk of utility-caused ignitions during fire season.

Additionally, the distribution feeders servicing PGE's HRFZs (those equipped with Schweitzer Engineering Laboratories (SEL) relays and SCADA) can be set to operate in a specialized wild fire protective mode. Most can be set to one of three modes: Normal, Wild fire or Red Flag. 13kV feeders without SEL relays rely on electronic reclosers' necessary protection settings: Normal, Wild fire and Red Flag mode.

The following table shows the distribution system operations inside and outside of fire season that provide the necessary protection settings for Normal, Wild fire and Red Flag mode.



TABLE 4 : DISTRIBUTION SYSTEM OPERATIONS IN AND OUT OF FIRE SEASON

Mode	Description	Reason
Normal	The feeder will have two attempts of reclosing (an automatic test energization of the circuit following a fault event) and instantaneous (relay trips instantly when a fault occurs, with no preprogrammed delay)	Maximize reliability
Fire Season	The feeder or electronic recloser will have one attempt of reclosing and trip on definite time instantaneous (a programmed delay before the relay trips).	Minimize risk of ignition
Red Flag Warning (during fire season)	The feeder or electronic recloser trips on definite time instantaneous and reclosing is blocked.	Minimize risk of ignition

NOTE: Some of the transmission lines located east of the Cascades that traverse HRFZs do not have three specialized wildfire protective modes.

TABLE 5 : PELTON & ROUND BUTTE TRANSMISSION SYSTEM OPERATIONS IN AND OUT OF FIRE SEASON

Mode	Description	Reason
Normal	2 recloses at Pelton, 1 reclose at Round Butte	Maximize reliability
Fire Season & Red Flag Warning	Reclosing is blocked -- they open and lock out without testing the circuit by auto-reclosing.	Minimize risk of ignition

### 6.3 Situational Awareness, Enhanced Monitoring and Communication

During fire season, PGE monitors and communicates regional weather and wildfire situation/status to operational leadership. Situational and conditional awareness monitoring informs PGE’s

operational and system changes during fire season, increasing safety and operational efficiency, so that operational decisions are based on the most accurate information available.

Year-round, PGE hosts a Daily (M-F) Operations Call. Should weather or other related events warrant communications outside the normal schedule, PGE may decide to convene the Daily Operations Call on weekends. This daily briefing during fire season includes, but is not limited to:

- Fire weather forecasts and fire potential specific to PGE’s distribution and service territory
- Communicating any National Weather Service (NWS)-issued Fire Weather Watches and/or Red Flag Warnings
- Summary of regional fire activity, and
- Fuels status review by Fire Danger Rating Area (FDRA) or Predictive Service Area (PSA).

Additionally, PGE closely monitors changing or deteriorating conditions, regularly communicating critical updates to affected business units. To assist with this, PGE maintains working relationships with fire agencies, fire management officers, district foresters and dispatch centers at the Federal, Tribal, State and local level, including the Portland NWS. These partnerships provide PGE with specific, granular situational and conditional awareness, such as assistance with forecast modeling validation, fire suppression resource pre-positioning, and activity/growth updates for fires in proximity to PGE assets.

## 6.4 Communications and Field Operational Practices

With support from leadership, PGE field personnel are responsible for maintaining situational awareness of current fire weather conditions. PGE field crews and contractors working on behalf of PGE are required to brief on the daily fire weather zone forecast(s) during job-specific tailboard briefings.

PGE field crews are expected to understand and adhere to the statutes and standards set forth in relevant PGE procedures and guides. PGE crews and contractors working on behalf of PGE are also required to comply with or exceed requirements set by other authorities having jurisdiction, such as the Federal, Tribal, State and local agencies.

## 6.5 Enhanced Monitoring and Technology

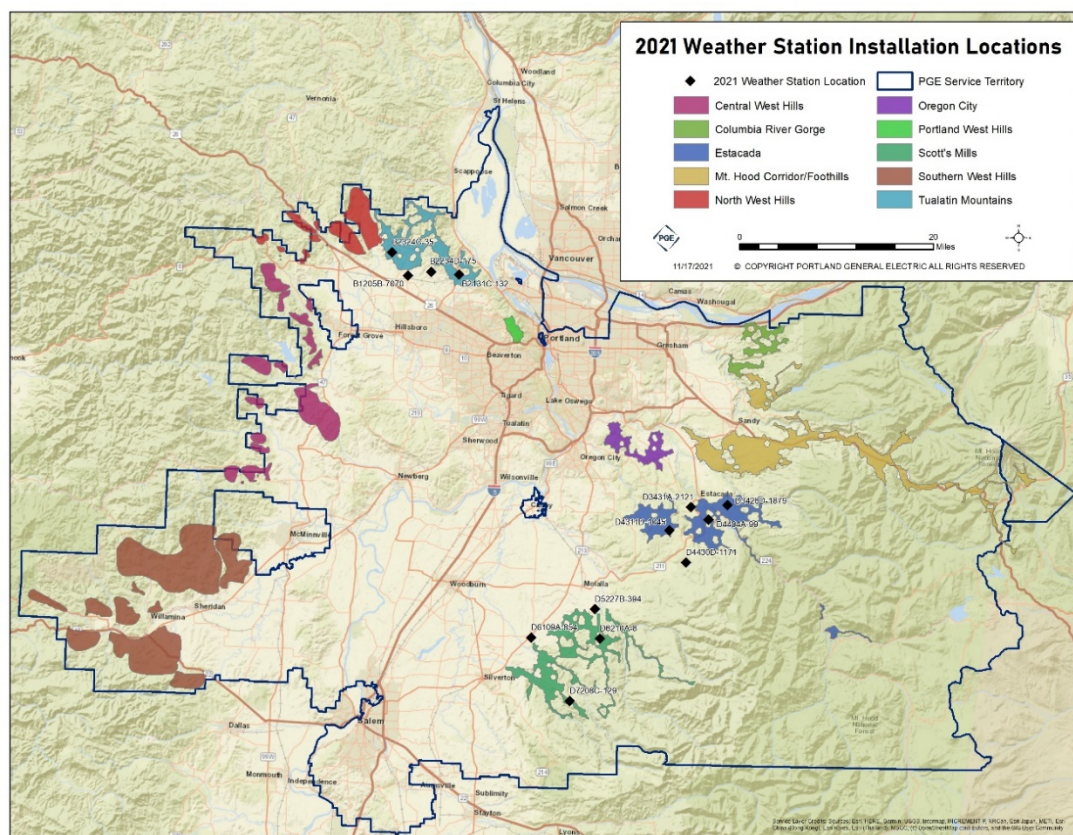
Declaration of PGE’s fire season activates internal 24x7 Wild fire Threat Alert Notifications (Threat Alerts). Threat Alerts are a GIS-triggered, near-real-time analytical tool that alerts PGE when:

- Any fire incident has been confirmed by the Integrated Reporting of Wildland-Fire Information (IRWIN) service within one mile of a PGE facility in the last hour (five miles for PGE Parks)
- A Red Flag Warning has been issued covering an area within one mile of a PGE facility within the last 24 hours (five miles for PGE Parks), and

- A confirmed fire perimeter is updated by the National Interagency Fire Center (NIFC) within one mile of a PGE facility in the last hour (five miles for PGE Parks) in the event of an expanding wild fire.

In 2022, PGE will improve its situational awareness through the installation of 23 new remote automated weather stations (RAWS) along with four mobile weather stations to be deployed within its HRFZs. In addition, PGE is continuously enhancing these capabilities through partnerships with industry peers, fire agencies, fire management officers, and district foresters at the Federal, Tribal, State and local level, including the Portland NWS.

FIGURE 7: 2021 WEATHER STATIONS WITH HRFZ OVERLAY



In a partnership with the Electric Power Research Institute (EPRI), PGE has begun to build out a network of connected, intelligent fire detection cameras equipped with artificial intelligence. These ultra-high-definition camera systems give PGE a hyper-accurate, 360-degree fire detection triangulation capability across its service territory - down to +/- 100 yards accuracy. The platform's machine learning algorithms automate fire detection, awareness and notifications, helping PGE stretch limited resources. These camera systems are part of a larger situational awareness strategy in which PGE coordinates with Federal, State, Tribal and local fire agencies, fire management officers, and district foresters at the Federal, Tribal, State and local level, including private landowners.

## 6.6 Preparedness and Training

Prior to fire season, PGE provides annual wild fire refresher training to employees whose primary work responsibilities take them into the field. Participants receive training on the use of fire suppression tools and equipment, as they will be required to carry and safely use this equipment in the field. Contractors who perform work in the field on behalf of PGE must also satisfy this training requirement and carry fire suppression tools and equipment. Refresher training topics for 2022 include (but are not limited to):

- How fuels, weather and topography impact the ignition and spread of wild fires
- What a fire weather zone forecast is, how to interpret key factors and validate in the field
- The suppression tools and equipment PGE, and those acting on behalf of PGE, are required to carry
- Basic suppression tactics for low-intensity ground and surface fires, and
- How to identify lookouts, communications, escape routes and safety zones (LCES) and how this critical life safety acronym applies to all PGE fire season operations.

## 6.7 Event Response & Management

Separate from its PSPS plans, PGE has established protocols for emergent de-energizations, which can occur both within and outside of fire season. Emergent de-energization events occur when PGE must de-energize a circuit to allow Public Safety Partners at the scene to work safely – for example, during a structure fire or vehicle accident where energized electrical lines or equipment pose a hazard.

PGE personnel on-site have the authority to de-energize that portion of the distribution system without requesting permission from or notifying PGE management (for example: to de-energize a downed power line). In addition, first responders may request an emergent de-energization from PGE via 911.

PGE closely monitors active wild fires in or near its distribution service territory and generation asset areas in Oregon and Washington. As an incident expands in size and complexity, PGE will contact the agency Incident Management Team (IMT) and offer to embed utility representatives at the incident command post. Utility representatives are delegated authority to make decisions that align with PGE's Corporate Incident Management Team (CIMT) and company leadership on PGE's behalf. The goal of this strategy is to enhance interoperability, share information and promote collaboration to achieve shared objectives to serve the community and affected customers.

Depending on the fire's complexity and incident management structure, the utility representatives may report to the IMT's Liaison Officer, Safety Officer, Operations Section Chief, or Incident Commander. Utility representatives possess subject matter expertise in PGE's electrical energy system/infrastructure and wildland fire operations, are proficient in the incident command system

(ICS), and can seamlessly navigate and integrate with the agency IMT. Utility representative responsibilities include:

- Answer questions and providing strategic and tactical updates from PGE's CIMT related to outage response, damage assessment and restoration at agency planning and cooperation meetings
- Liaise with agency IMT participants and coordinating information exchange between the agency IMT and PGE's CIMT
- Provide information to the agency IMT on incident impacts to PGE infrastructure and potential outcomes, based on the agency IMT's tactical planning/operational period objectives
- Provide strategic and tactical updates to PGE's CIMT to inform key decisions related to outages, system reliability, communications, and community outreach
- Coordinate joint planning meetings between the agency IMT and PGE's CIMT Incident Commander, as needed, and
- Facilitate the transfer of PGE GIS data layers to the agency IMT's GIS Specialist to assist with the team's strategic and tactical planning.

## 6.8 Ignition Reporting Requirements

PGE tracks potential ignitions caused by PGE equipment, as well as fires that may impact PGE facilities. Relevant tracking and reporting include documentation of the initial observation and recording of ignition events in the field, as well as the specific geographic and right-of-way location of any impacted PGE equipment.

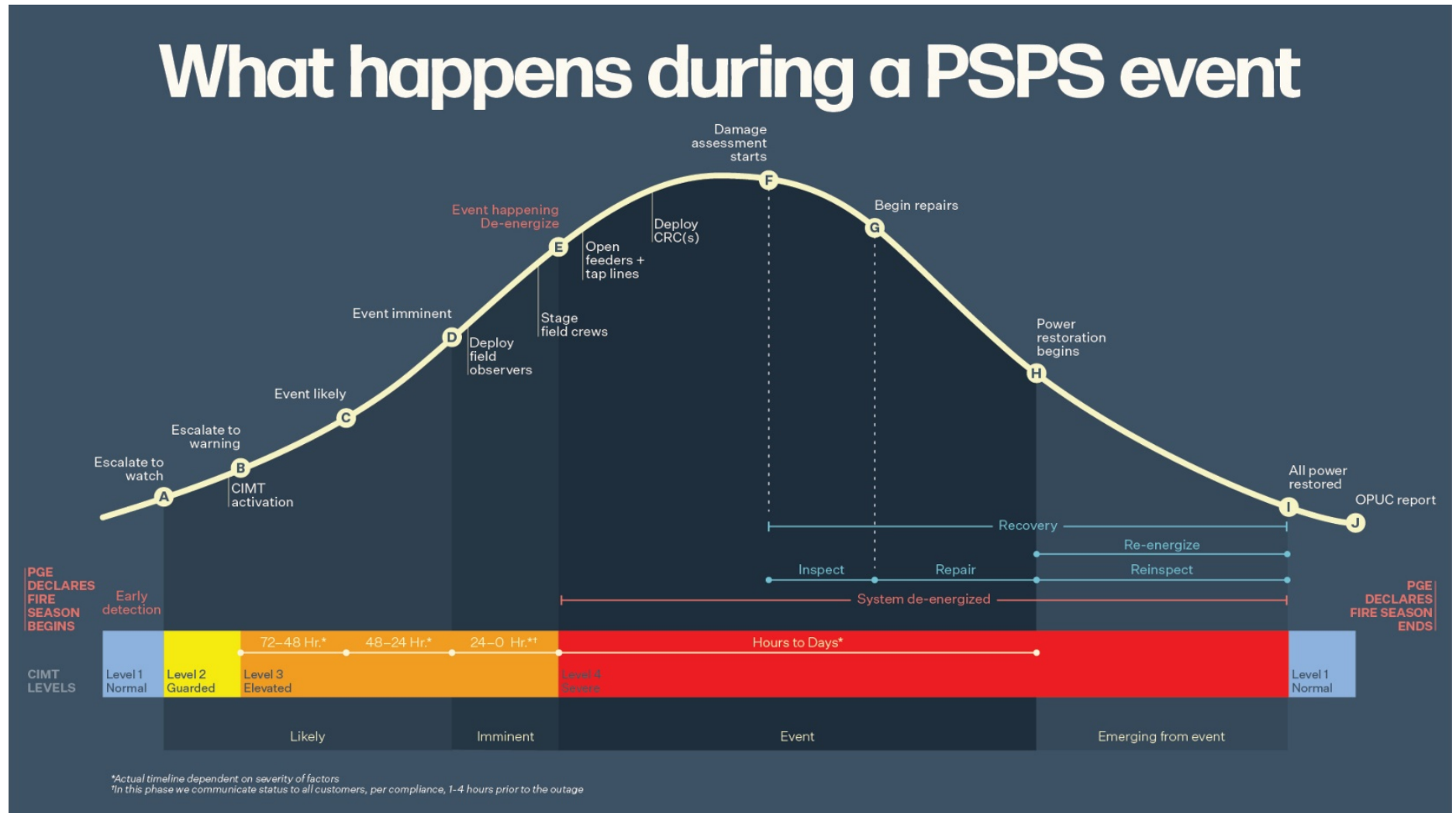
PGE conducts a review of any ignition events reported in the field, and documents relevant data for submission to the OPUC. In addition, PGE tracks and reports the progress of ignition event reports submitted to the OPUC and archives its OPUC ignition event reports for future compliance purposes. Historic ignition event data is used to inform strategic asset management decisions, including system hardening measures, with a more granular understanding of risk. PGE plans to continue to build out this ignition tracking/reporting database as a key component of understanding ignition events by drivers.

## Section 7. Operations During PSPS Events

This section provides a high-level overview of the stages of a PSPS event and the actions taken within each step. PGE's detailed operational protocols for PSPS events are detailed in the annual PSPS Plan.

The PSPS Process Flowchart (Figure 8) correlates these different stages with the PGE incident levels defined in PGE's Corporate Emergency Operations Plan (CEOP) to illustrate the concept of operations for a PSPS event. It is intended to provide a point of reference only, as PGE will consider other conditions in its PSPS decision-making.

FIGURE 8: PSPS PROCESS FLOW CHART



## 7.1 Protocols for De-Energization of Power Lines and Power System Operations During PSPS Events

PGE will proactively turn off power when conditions threaten the ability to safely operate the grid, as a last-resort safety measure to protect people, property and public areas. When PSPS events are declared, PGE takes steps to minimize the number of customers affected and the duration of the outage.

### 7.2 Stages of a PSPS Event

#### Level 1: Normal (Early Detection)

Once fire season has been declared, PGE assumes a more heightened situational and conditional awareness posture. For a detailed explanation of PGE's situational awareness, monitoring and communications activities, refer to Section 6.5, Enhanced Monitoring and Technology. PGE will issue a PSPS Watch in response to its assessment of factors indicating an increased risk of ignitions.

#### Level 2: Guarded (PSPS Watch)

If PGE determines that current and predicted fire danger and conditions warrant an escalation in planning and coordination, PGE shifts from Normal to PSPS Watch condition. When this occurs, PGE will activate the CIMT Wildfire Assessment Team to monitor conditions and be prepared to initiate the next phase of PSPS plans and procedures if conditions warrant. During this phase of response, PGE also conducts daily conference calls to assess conditions and issues a preliminary notification to internal stakeholders and ESF-12 OPUC Safety Staff that PGE has moved to PSPS Watch status. See the PSPS Notification Strategies section, below, for a more detailed description of PSPS notification protocols. Following the decision to issue a PSPS Watch notification, PGE will place the CIMT on standby.

#### Level 3 Elevated (PSPS Warning)

PGE's decision to escalate to PSPS Warning status initiates several activities. The extent to which these activities are performed is dictated by conditions on the ground, pace of onset and risk tolerance at the time.

Once this decision is made, PGE will activate the CIMT, PGE's crisis management hub. PGE will notify required internal and external stakeholders via email and/or phone that a PSPS event could be imminent. PGE will communicate with Public Safety Partners and operators of utility-identified Critical Facilities at prescribed intervals (72-48, 48-24, and 4-1 hours in advance of the PSPS event). PGE will notify all other affected customers/populations directly, through the PGE website and an array of media and social media platforms, at 48-24 and 4-1 hours, and again when de-energization is initiated.

If conditions remain as predicted or worsen, PGE will make a final determination as to whether to proceed with the PSPS event.

The CIMT develops Incident Action Plans (IAPs) for each operational period (or as determined by the Incident Commander), including situation-specific tactics and detailed instructions for field and support personnel. The CIMT also mobilizes Field Observers (FOBS) and assigns them to identified, high-exposure locations within HRFZs where weather and system condition visibility is limited or absent. During this phase, PGE also prepares to deploy Community Resource Centers (CRCs), if warranted.

PGE will consider requests for a de-energization delay from its Public Safety Partners on a case-by-case basis. PGE retains ultimate authority to grant a delay and is responsible for determining how a delay in de-energization impacts public safety.

#### Level 4: PSPS Event

Immediately prior to de-energization, PGE resources in the field will move into their ready positions or at the staging area until needed. PGE will then implement the PSPS according to the protocols outlined in department tactical procedures. PGE will announce the start of the outage via the “All PGE” Talk Group, as well as the channels required by the OPUC.

During a PSPS outage event, PGE follows the OPUC PSPS notification protocols, providing updates as required, no less frequently than once every 24 hours, until service is restored. PGE will use direct contact, the portlandgeneral.com website, and an array of media and social media platforms to communicate information about the PSPS outage event and its status, as well as information regarding any CRCs deployed for the event.

#### Demobilization and Recovery

Once hazardous conditions subside, PGE will direct field crews to begin inspecting transmission and distribution circuits and other PGE assets impacted by the event. Field resources will conduct inspections, report conditions to PGE leadership, and initiate any required repairs. As soon as it is safe to do so, PGE will begin power restoration. PGE will issue updates on re-energization progress at least once every 24 hours. Once power is fully restored, PGE will alert Public Safety Partners, operators of critical facilities, and all other affected customers.

## Section 8. Asset Management and Inspections

PGE conducts inspections of transmission and distribution assets in HRFZs and implements strategic replacement projects in accordance with the annual Wildfire Mitigation Plan. PGE maintains an inspection cycle for HRFZ areas, combined with PGE’s annual Facilities Inspection and Treatment to the National Electrical Safety Code (FITNES) inspection cycle, to inspect transmission and distribution circuits within PGE’s HRFZs annually.

The purpose of PGE’s asset inspections is to enhance the safety and reliability of PGE’s 12,000-mile system and the wildfire resilience of PGE’s transmission and distribution systems, through maintenance, asset replacement and upgrades.



## 8.1 Routine Inspections and Maintenance

PGE operates periodic and time-based inspection programs and a preventative maintenance program to meet OPUC compliance requirements.

In 2021, PGE did foundational work to enable a more efficient wild fire inspection program, which will help PGE achieve its goal of completing inspections in all HRFZs prior to July 31, 2022. This work includes:

- Establishing the 2022 HRFZs early enough to assign resources and develop a viable inspection schedule
- Transitioning to an Inspect-Correct approach using two-person crews to inspect and repair most corrections and mitigate risk in a single visit to the pole
- Utilizing a competitive bid process to select a union signatory Inspect-Correct vendor
- Hiring dedicated wild fire inspection program resources, including a project manager and QA/QC field personnel, and
- Building a robust technology tool that enables mobile inspections and dashboard creation to track inspection progress.

FIGURE 9: PGE INSPECT-CORRECT CREW REPAIRS AND INSPECTIONS USING HIGH-POWER SPOTTING SCOPE



## 8.2 Inspection Program Overview

PGE's longstanding FITNES program is designed to conduct detailed inspections of its overhead facilities to identify violations of OPUC Safety Rules. FITNES performs a detailed inspection of approximately 10 percent of PGE's poles and related overhead facilities each year. FITNES inspectors visually inspect structure and support systems (poles, crossarms, insulators, guys, anchors), grounding, conductor clearances and condition, among other parameters, as well as hammer sounding or measuring remaining pole shell from grade to six feet above grade. Poles older than five years also receive remedial internal treatment. The FITNES inspection is performed by contract inspection personnel who walk PGE's overhead electric supply lines.

PGE also conducts an annual safety patrol of 50% of the entire PGE system to meet OPUC requirements, including routine safety patrols of overhead electric supply lines and accessible facilities for hazards to the public at least every two years. The safety patrol is performed by PGE inspectors who observe overhead supply lines and related accessible facilities and inspect for conditions that may pose a hazard to the public. These conditions include, but are not limited to, broken poles, structures with external decay, broken or severely split cross arms, broken-down guys, vegetation such as ivy growing more than halfway up poles, low conductors, conductors off insulator, broken insulators, broken conduits and anchors pulled out of the ground.

In addition to wild fire mitigation inspections, PGE performs a variety of routine inspection and maintenance activities throughout the calendar year. PGE's annual 230kV and 500kV safety inspections are conducted via helicopters crewed by journeymen linemen, who look for any high-level hazards. PGE's 57kV and 115kV lines also undergo an annual safety inspection through a mix of air and vehicle patrols.

During the ground/infrared patrol process, PGE subjects its 230kV and 500kV lines to an intensive walking inspection of each structure, looking for any defects. During the infrared patrol, conducted on the same schedule, PGE uses infrared-cameras to examine all junction points (splices, switches, jumpers) on energized lines, looking for any thermal anomalies. PGE conducts non-scheduled troubleshooting patrols as needed to find the source of an outage or unexplained occurrence; whenever possible, crews will repair the cause of the outage on the spot.

TABLE 6: INSPECTION/PATROL FREQUENCY

Asset Type	Air Patrol (Safety)	Vehicle Patrol (Safety)	Ground Patrol / IR Patrol**	Wild fire Inspection****	FITNES Inspection
230kV and 500kV* Lattice/Steel	Semi-annually	Semi-annually	Every 5 years	Annually	N/A
230kV Wood*	Semi-annual	Semi-annual	Every 5 years	Annually	Every 10 years
115kV***	Annually	Annually	Every 10 years	Annually	Every 10 years
57kV***	Annually	Annually	Every 10 years	Annually	Every 10 years
* Two Safety patrols per year, can be a combination of vehicle or air patrols.					
** Ground patrols are scheduled on a 5-year offset from FITNES patrols where possible.					
*** One safety patrol per year. Can be either a vehicle or air patrol depending on access and flight restrictions.					
**** Only for those portions of the line that are identified to be within an HRFZ					

### 8.3 Enhanced FITNES Wild fire Mitigation Inspections for HRFZs

PGE’s Wild fire Mitigation Inspection program was established in 2019. Continuing in 2022, PGE will track Inspect-Correct progress within the HRFZs using a new geospatial platform, ArcGIS Online. Real-time metrics available via the ArcGIS Online dashboard include completed pole inspections by HRFZs, total completed pole inspections, and completed two-person inspections.

PGE documents its Inspect-Correct workflow through a master schedule, which also considers the coverage area of the annual FITNES inspection to avoid overlap. PGE’s goal is to complete as many inspections as possible in the HRFZs by July 31, 2022 in accordance with the following schedule:

- Inspect the three new 2022 HRFZs (HRFZs 8, 9 and 10) first, as this will be the first time they have been subject to the more intensive Wild fire Mitigation Inspect-Correct inspection process: during February-April 2022
- HRFZs 1 through 7 and transmission lines in elevated fire risk zones in Central Oregon: April-July 2022.

In 2022, PGE will inspect all overhead facilities within its HRFZs and has identified multiple transmission circuits within its HRFZs that will be subject to an enhanced inspection process because of their crucial importance to system reliability during PSPS events.

## Inspection Process

PGE's Wild fire Mitigation inspectors visually inspect structures, lines and equipment from the ground using binoculars or a spotting scope mounted on a tripod. In addition, PGE transmission patrolmen patrol and inspect the transmission lines in the Central Oregon HRFZ (which lies outside the PGE service territory but is subject to the same wild fire mitigation inspection criteria as PGE's other HRFZs) to identify potential vegetation management, structural or maintenance issues. Because PGE annually operates multiple separate asset and vegetation management inspection programs, assets located within PGE HRFZs may be inspected more than once a year.

PGE inspectors use a standardized form to consistently and repeatably capture target conditions during field inspections. This form is informed by both regulation and PGE equipment standards. The major categories PGE inspects for include:

- Damaged/ broken/missing/loose hardware and equipment
- Conductor clearances
- Bonding
- Damaged poles
- Broken lashing wire
- Potential ignition sources.

## Justified Enhanced Inspections

Inspections are most beneficial in cases where wild fire consequences are high, and the condition of equipment is uncertain. PGE's Risk Assessment model calculates the value of enhanced inspections using asset risk and condition data, as well as length of time since the equipment was last inspected.

## Wild fire Correction Criteria

PGE categorizes wild fire corrections as follows:

- An asset that poses an imminent danger to life or property will be repaired, disconnected, or isolated by the operator immediately after discovery
- An asset that poses a hazard will be corrected as soon as practicable but no later than 30 days after discovery, and
- PGE will address all other assets in accordance with OPUC requirements.

## Section 9. Vegetation Management

PGE's vegetation management strategy has two major components: PGE's Routine Vegetation Management program and the Advanced Wild fire Risk Reduction (AWRR) program. Due to the expansion of PGE's vegetation management work at the core of this Wild fire Mitigation Plan, and the increase in the number of 2022 HRFZs, which contain more than 250 additional circuit-miles of assets, PGE is taking a phased approach to implementation of its AWRR work within the HRFZs. One of the primary goals of PGE's vegetation management program is to complete the inspection and mitigation process within all HRFZs annually, prior to July 1.

### 9.1 Routine Inspection & Maintenance - Vegetation Management

Under the Routine Vegetation Management program, PGE manages approximately 2.4 million trees within its ROW of 12,000 miles of overhead power lines, and has expanded its vegetation management program to trim and remove vegetation that is dead, dying, diseased or displays growth habits or defects that could impact overhead power lines within the ROW and easement. About 10,000 line-miles of PGE's 12,000 line-mile overhead network require regular vegetation management inspection (the other 2,000 miles pass over areas with no potentially hazardous vegetation, such as water).

PGE inspects about one-third of its overhead transmission assets annually. Assets are inspected no less frequently than every three years. Routine inspection timing may change as PGE evaluates the effectiveness of its Vegetation Management cycles. Routine Vegetation Management inspections identify both P1 and P2 trees. A "P1" tree is a hazard/danger tree, while a "P2" tree is a tree that poses a grow-in or fall-in threat and displays arboricultural defects that could pose risk to PGE's facilities, both overhead and underground.

PGE conducts its routine vegetation management activities year-round throughout the PGE overhead system. PGE vegetation contractors trim identified trees to PGE specifications during the three-year Routine Maintenance cycle, to comply with Oregon Administrative Rules (OAR) Division 24 Safety Standards (Division 24), other state standards, and ANSI A300 guidance.

PGE subjects its vegetation management activities to a detailed QA/QC process to verify that vegetation management tasks have been completed to specification, and tasks are tracked through PGE's vegetation management technology platform, QuickBase. In addition, this work is field-validated by PGE forestry personnel, who work closely with the crews to confirm completion. To increase their effectiveness, PGE also coordinates its vegetation management activities closely with external stakeholders, including USFS, ODF and private landowners.

### 9.2 Advanced Wild fire Risk Reduction (AWRR) Vegetation Management Program for High-Risk Areas

Under the AWRR program, PGE performs annual vegetation inspections of all overhead line mileage that falls within HRFZ areas, optimizes vegetation management strategies based upon inspection results, performs QA/QC of vegetation management inspection and mitigation work completed by

crews, documents its vegetation management activities and coordinates vegetation management activities with counties, municipalities, and external agencies (e.g., ODOT, USFS).

PGE's AWRR has multiple components, providing annually occurring inspections/work templates of all designated overhead (OH) line mileage, as well as ongoing cyclical work aimed at providing more robust hardening of specific segments or spans of designated overhead line.

PGE follows ORS 758.280-758.286 to provide the operational framework for AWRR-related activities, as most of this work is occurring outside of designated PGE ROW, utility easements and annual maintenance schedules.

PGE manages the AWRR program, from work schedule to QA/QC of completed work. AWRR activities are in addition to PGE's annual vegetation management cycle; its vegetation prescriptions follow program specifications, which include more frequent inspection and maintenance cycles and enhanced tree removal guidelines than those required by OAR Division 24.

Tree removal practices associated with AWRR are applicable to any tree within striking distance, regardless of current tree health conditions. AWRR operations fall outside of PGE's routine maintenance and trimming operations as the scope, operational practices, inspection schedule and cadence are on escalated cycles. The AWRR program complements PGE's Routine Maintenance Program by focusing on results from PGE's Wild fire Risk Assessment modeling program.

FIGURE 10 : HELICOPTER VEGETATION MANAGEMENT



FIGURE 11 : FORESTRY BUCKET AND TREE-TRIMMING CREW ON AWRR DEPLOYMENT



### 9.3 Inspection & Maintenance Frequencies for AWRR

TABLE 7 : PGE HRFZ INSPECTION & MAINTENANCE STRATEGIES

AWRR Mitigation	Inspection or Maintenance?	Cadence	Description
Vegetation Inspection	Inspection	Once per year prior to fire season declaration	Verifies ongoing vegetation clearance compliance and identifies any vegetation that has encroached on PGE assets since the previous inspection. These AWRR inspections occur annually, outside of PGE’s standard 3-year vegetation maintenance cycle.
Cycle Buster Tree Trimming*	Maintenance	Once per year prior to fire season declaration	As PGE Vegetation Management inspectors identify “cycle-buster” vegetation through the AWRR program, off-cycle tree crews are dispatched to trim the vegetation back to specification.

Enhanced Vegetation Management (EVM) Techniques*	Maintenance	Annual	PGE often prescribes vegetation control techniques for AWRR projects that exceed standard line-clearance specifications. These prescriptions include greater side-clearance, overhang removal, selective removal of tree parts, and whole tree removal.
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\*NOTE: PGE plans to complete the AWRR Cycle Buster and Enhanced Vegetation Management work planned for 2022. Due to the recent increase in the number and scope of HRFZs for 2022, it may not be possible to complete all of this work in the newly identified HRFZs prior to July 1. PGE’s Vegetation Management, Cycle Buster tree trimming, and Enhanced Vegetation Management work will continue throughout 2022.

## 9.4 2022 Planned Vegetation Management in High-Risk Fire Zones

Due to the 2022 numerical and geographic expansion of PGE’s HRFZs and the time and effort required to prepare for fire season, not all work identified in this plan will be completed in advance of fire season. PGE expects that Enhanced Vegetation Management and inspection work will be ongoing throughout the year.

The following section describes wild fire mitigation work PGE plans to undertake in 2022:

- P1 inspection and mitigation of all HRFZ overhead line mileage.
  - P1 vegetation will be mitigated within 24 hours of identification, except in special circumstances (specialized equipment or line clearances needed). ASAP scheduling will occur under special circumstances should specialized equipment or specialized crews be needed
- 275 additional circuit-miles of P2 scoping (full AWRR scope – mitigation of P1, P2 and vegetation growth within 5 feet of conductor - in HRFZs 1,4,5) beginning in July and continuing through 2023.

NOTE: This scope and timeline may change once the State of Oregon’s fire map is made available.



## Section 10. Wildfire Program Costs

Budgeted development, implementation and administrative costs specifically for PGE's 2022 Wildfire Mitigation Program include the following:

2022 Wildfire-Related Operations & Maintenance (O&M) Forecasted Costs: \$22 million

Includes (but is not limited to):

- Additional wildfire-related vegetation management costs
- Community Resource Center costs
- Wildfire training
- Additional wildfire-related outreach and education costs, and
- Wildfire-related staff.

2022 Wildfire-Related Capital Forecasted Costs: \$10 million

Includes (but is not limited to):

- Additional asset inspection and repair contract costs
- Additional situational awareness tools, including weather station and AI-enabled UHD camera deployment, and
- Wildfire-related transmission maintenance and capital replacement work.

NOTE: The wildfire-related O&M and Capital budgets are in addition to the expenditures PGE makes annually to operate and invest in the grid.

PGE's Wildfire Program, as articulated in the Wildfire Risk Mitigation and Operating Protocols sections of this Plan, will influence the Wildfire program's resource allocation decisions. PGE understands that all cost category programs have varying levels of impact to wildfire mitigation, and that effectiveness has been well-captured through peer utility lessons learned and international forums related to wildfire. For example, the experience of other utilities might provide PGE with insights into the effectiveness of drone use in asset health inspections, their influence and timing on a utility's wildfire risk analysis, and some sense of the anticipated lifecycle costs for that activity, allowing PGE to make a comparative decision on this aspect of the wildfire mitigation program.

PGE's risk-based cost and benefit analysis connects the many components of PGE's wildfire risk management strategy, from system hardening to vegetation management to situational awareness. The comparative risk mitigation value of these actions can be measured using the ISO-31000 framework, allowing PGE to make investment prioritization decisions that deliver the most mitigation value to customers and the region.

## Section 11. Community Outreach and Public Awareness

PGE has an overarching wildfire outreach and public awareness strategy comprised of:

- Wildfire Mitigation Plan Engagement Strategy
- Wildfire Information and Awareness Strategy
- Public Safety Partner Coordination Strategy, and
- Public Safety Power Shutoff Notification Strategy.

FIGURE 12: 2022 WILDFIRE MITIGATION PLAN ENGAGEMENT STRATEGIES



Goals and objectives of PGE's Wildfire Outreach and Public Awareness efforts include:

- Protect people, property and the natural environment
- Engage and collaborate with Public Safety Partners, local communities, customers, and owners of PGE-identified critical facilities in an inclusive process to facilitate life safety and incident stabilization, and leverage Diversity, Equity and Inclusion (DEI) principles to ensure continuity of agency services
- Improve critical infrastructure resilience through planning and coordination with external agencies
- Improve coordination of emergency response, situational and conditional awareness
- Enhance PGE's wildfire planning, prevention and response through coordination, communication, and collaboration with external partners
- Improve understanding of external stakeholder vulnerabilities and values-at-risk (economic, social, and ecological resources that could be damaged because of a wildfire)
- Educate external stakeholders on wildfire preparedness and potential consequences to critical infrastructure from wildfires
- Promote learning and adaptation during and after exercises and incidents

- Facilitate the continuity of emergency services during grey and blue-sky events.

## 11.1 Wild fire Mitigation Plan Engagement Strategy

As part of the annual Wild fire Mitigation Plan update process, PGE engages and collaborates with Public Safety Partners and local communities in accordance with an inclusive engagement strategy. PGE works with Public Safety Partners as conduits to local communities, and pursues direct engagement in instances when a Public Safety Partner’s reach may not be sufficient. In 2022, PGE will host at least one public workshop to review and comment on the 2022 PGE Wild fire Mitigation Plan. Following the public workshop(s), PGE will distribute a survey to collect additional feedback regarding the Plan and engagement process. More information about PGE’s Wild fire Mitigation Plan engagement strategies is detailed in Table 8.

**TABLE 8 : WILDFIRE MITIGATION PLAN ENGAGEMENT STRATEGIES**

Partner Category by Activity	Public Safety Partners	Priority Partners	Local Communities and Customers
Outreach	Public Safety Partner-specific PGE team engagement <ul style="list-style-type: none"> <li>• OPUC Safety / ESF-12, County Emergency Managers, ODHS               <ul style="list-style-type: none"> <li>○ PGE presentations</li> <li>○ PGE workshop facilitation</li> </ul> </li> </ul>	Public Safety Partner-specific PGE team engagement <ul style="list-style-type: none"> <li>• Local Governments, Critical Facilities, Energy Providers               <ul style="list-style-type: none"> <li>○ PGE presentations</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Assess gaps in Public Safety Partner reach and engage Community-Based Organizations (CBO) or directly where appropriate</li> <li>• Prioritize ‘access and functional needs populations’, inclusive of medical certificate customers</li> </ul>
Communications	<ul style="list-style-type: none"> <li>• Develop education and awareness materials, informed by Public Safety Partners</li> <li>• Develop multi-modal, multi-lingual communications, informed by Public Safety Partners</li> </ul>		
Accommodation	<ul style="list-style-type: none"> <li>• Confirm via email the Public Safety Partners, Priority Partners and/or CBOs are willing and able to participate in this capacity</li> <li>• Provide accommodation to resource-constrained partners, where applicable</li> </ul>		
Protocols	<ul style="list-style-type: none"> <li>• Designate PGE staff who will call, email and capture learnings</li> <li>• Designate PGE staff backup if assigned PGE staff will be out of office during event</li> </ul>		

Assessment	<ul style="list-style-type: none"> <li>• Define metric tracking and reporting processes</li> <li>• Catalog learnings from pre, during, post-event activity</li> </ul>
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PGE is committed to applying an equity lens to promote accessibility and inclusivity and considers the needs of the populations it serves. As an example of PGE’s commitment to inclusivity and accessibility, PGE co-authored the USDOE Energy Modernization Laboratory Consortium’s white paper on “Advancing Equity in Utility Regulation,” which included the following guidance regarding wild fire impacts:

*“PGE’s obligation to both serve and acknowledge disproportionate impact is realized, for instance, in our application of an equity lens to our wild fire mitigation efforts, and in particular the practice of proactively shutting off power in high-risk areas as a last-resort measure to protect communities against potential wild fire ignitions, called Public Safety Power Shutoffs (PSPS). PGE acknowledges that effective and inclusive communication with our vulnerable populations requires an approach that honors different modes, languages, and partnerships. As PGE is still learning where these customers live, we are seeking out and deferring to those with expertise and tenured relationships to serve as a two-way conduit for PSPS awareness and preparation.”*

The paper notes that to achieve these goals, PGE has developed PSPS toolkits and communications in various modes (web, email, newsletter, social media) and languages - English, Arabic, Chinese (simplified), Chinese (traditional), Farsi, Japanese, Korean, Rohingya, Russian, Somali, Spanish, Swahili, and Vietnamese - to inform these populations as to how best to plan for a potential extended outage. Over 250 community partners were proactively contacted in mid-July 2021, provided the toolkit and asked if they were willing to serve as a conduit to their communities.

## 11.2 Wild fire Information & Awareness Strategy

PGE will engage with Public Safety Partners to develop/update a Wild fire Information and Awareness Strategy that is informed by local needs and best practices. Prior to the start of fire season, PGE will design and host an interactive workshop to elicit feedback from Public Safety Partners and their public information and outreach subject matter experts to ensure that the following activities are presented consistently and effectively across PGE’s service area, and are responsive to the needs of each jurisdiction and their communities:

- Information about PSPS events: what a PSPS is, the factors PGE considers in determining whether or not to implement a PSPS and what to expect before, during and after a PSPS event
- Wild fire-related emergency kits, plans and checklists
- Wild fire-related educational and preparedness materials and messaging
- Messaging for meetings, fairs and workshops to discuss wild fire preparedness
- Assessment of most effective media channels to deliver strategic messaging.

PGE’s messaging during PSPS events is provided in both English and Spanish, as is the messaging for PGE’s email and direct mail wild fire/summer outage education and preparation campaign. These mailings are an essential part of PGE’s Wild fire Information and Awareness Strategy; the materials direct customers to the portlandgeneral.com Wild fire Outages page (available in English and Spanish), PGE’s primary educational and preparedness media platform. In addition, during PSPS events, PGE Customer Resource Centers distribute fliers in multiple languages, with the following message: “We speak your language. Our customer service advisors can assist you in 200+ languages. Call us at 503-228-6322.”

FIGURE 13 : “WHAT IS A PUBLIC SAFETY POWER SHUTOFF “– SPANISH VERSION

**¿Qué es una Interrupción del Suministro Eléctrico por Motivos de Seguridad Pública?**

La seguridad de nuestros clientes y la comunidad son siempre la máxima prioridad. Cuando exista un riesgo alto de incendio, tal vez interrumpamos la energía como último recurso de seguridad. Estos apagones, también conocidos como “Interrupciones del Suministro Eléctrico por Motivos de Seguridad Pública” (PSPS), podrían durar entre algunas horas y varios días.

**¿Cuánto tiempo estará interrumpido el suministro eléctrico?**  
Trabajamos para que este apagón por seguridad sea lo más breve posible. Debido a que se realiza para protegerlo a usted y a su comunidad, el suministro permanecerá interrumpido hasta que sepamos que ya no hay una amenaza para la seguridad de las personas o de nuestro sistema.

**A continuación, describimos los 7 pasos que seguimos para restablecer el suministro después de una PSPS:**  
Cuando sea seguro, nuestros equipos inspeccionarán visualmente las líneas eléctricas, milla por milla, y repararán los daños para garantizar que no haya riesgos al restablecer la energía de las líneas.

- 1** Evaluación y priorización de servicios comunitarios esenciales e infraestructura indispensable
- 2** Verificación de estaciones de generación eléctrica
- 3** Inspección visual y reparación de líneas de transmisión
- 4** Inspección visual y reparación de líneas de distribución
- 5** Inspección visual y reparación de líneas de distribución
- 6** Inspección visual y reparación de líneas de media tensión
- 7** Conexión de clientes particulares

CIFRA PROMEDIO DE CLIENTES CON ENERGÍA RESTABLECIDA EN CADA ETAPA

100,000+      1,000 - 3,000      20-30      Clientes particulares

Agradecemos su paciencia durante estas circunstancias adversas y seguimos trabajando lo más rápido posible, sin poner en riesgo la seguridad, para restablecer el suministro de todos los clientes. Puede mantenerse actualizado sobre esta PSPS y nuestros esfuerzos de restauración en [portlandgeneral.com/pspsespanol](http://portlandgeneral.com/pspsespanol) o en las redes sociales.

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During fire season, the Wild fire Outages page on the portlandgeneral.com website provides information on the following topics:

- What is a Public Safety Power Shutoff?
- An interactive map of PGE’s service territory and pre-identified PSPS areas, showing which zone (if any) is currently active. The map allows users to enter a service address to see whether it’s located within the active zone
- How to prepare a home or business for a PSPS event

- A high-level overview of PGE’s wild fire preparation/mitigation strategy
- Information regarding how PGE’s HRFZs were identified
- PSPS FAQs
- Information regarding backup generators for use during a potential outage
- Planning recommendations for medically vulnerable customers.

PGE also provides PSPS preparedness checklists translated into multiple languages, available via the PGE website during fire season, as well as PSPS preparedness one-pagers to community-based organizations throughout the PGE service territory.

In addition to email and direct mail, PGE uses a full range of available communications channels to disseminate its wild fire and PSPS-related messaging: telephone/texts, social media, radio, television, and press releases. In 2022, PGE plans to build on its 2021 communications, education and preparedness campaigns, using these existing communications and educational channels as a baseline and working collaboratively with community leaders and Public Safety Partners to refine and update the direction and content as required to keep customers informed.

In 2022, PGE will perform information and awareness activities prior to and during the 2022 fire season to reach customers, Critical Facilities, local, State and Federal governments and elected officials, agencies, and Public Safety Partners.

### 11.3 Assessing Effectiveness of PGE Engagement Efforts

In 2022, PGE, in partnership with its Public Safety Partners, will seek equitable outcomes in its wild fire outreach activities. Those equitable outcomes include:

- Deliver wild fire mitigation information and awareness in an approachable and accessible manner.
- Empower Public Safety Partners with access to actionable information
- Engage and collaborate with Public Safety Partners and local communities in an inclusive and equitable way to help inform the WMP.

### 11.4 Public Safety Partner Coordination Strategy

PGE defines Public Safety Partners as the OPUC’s Emergency Support Function (ESF)-12, Local Emergency Management, and Oregon Department of Human Services (ODHS). PGE’s Public Safety Partner Coordination Strategy is divided into three phases: prior to, during, and after fire season. By working in partnership with each Public Safety Partner, PGE can maximize the effectiveness of its outreach efforts and the size of the audience receiving these communications, and improve operational coordination and information sharing.

#### Prior To Fire Season

Before fire season, PGE will engage in joint planning processes and deliver presentations to Public Safety Partners at existing information sharing and preparedness coordination forums, as needed. PGE will include wild fire preparedness topics in one of the PGE-hosted all-hazards quarterly summits with Public Safety Partners. PGE will work with Public Safety Partners to implement the Wild fire Education and Awareness Strategy to inform first responders and other critical service providers of PGE's coordination methods based on the National Incident Management System (NIMS).

PGE will also host at least one annual pre-fire season tabletop exercise with Public Safety Partners on a range of topics related to wild fire preparedness and response in accordance with Homeland Security Exercise and Evaluation Program (HSEEP) principles and guidelines.

When possible, PGE will engage in exercises developed by other Public Safety Partners to improve interoperability during an actual event.

### During Fire Season

Once PGE declares Fire Season, the company will inform various Public Safety Partners regarding in-season operational modifications to the PGE system.

Additionally, PGE enhances situational awareness monitoring and maintains a state of operational readiness. Should a new fire start or expanding fire threaten PGE infrastructure, a company representative will contact the agency and/or Incident Management Team (IMT) identified point of contact to coordinate appropriate utility response. For all incidents, PGE acts as a cooperating partner when company infrastructure is at risk or has been impacted by a wild fire.

If an incident requires the activation of the PGE CIMT, PGE will notify impacted stakeholders and initiate in-person and virtual coordination activities. As required, PGE will deploy dedicated utility representatives to jurisdictional Emergency Operations Centers (EOCs), Emergency Coordination Centers (ECCs) or Incident Command Posts (ICPs).

Following wild fire incidents, PGE will conduct an After-Action Review (AAR) process that is consistent with HSEEP and utility sector best practices, reviewing incident response and identifying continuous improvement action items. Throughout the process, PGE will invite feedback from Public Safety Partners.

### After Fire Season

When the 2022 fire season ends, Public Safety Partners will have the opportunity to participate in PGE's post-season review process. This process assesses progress towards the goals and objectives set out in the Wild fire Mitigation Plan. The lessons learned become an input to the annual Wild fire Mitigation Plan update.

TABLE 9 : PUBLIC SAFETY PARTNER COORDINATION ELEMENTS

Activity	Execution Timing
Presentations to Public Safety Partners at existing information sharing and preparedness coordination forums	Prior to fire season
PGE-hosted tabletop exercise regarding wild fire preparedness and response	Prior to fire season
Direct communications to Public Safety Partners regarding current operations and collaboration needs	During fire season
Joint planning process with Public Safety Partners of PGE Wild fire Program and engagement strategy	After fire season
Post-season review participation by Public Safety Partners	After fire season

## 11.5 PSPS Notification Strategies

During periods of extreme weather, PGE may initiate a temporary PSPS event. The purpose of a PSPS is to reduce the risks of wild fire ignition within PGE’s service territory and in areas adjacent to PGE critical infrastructure throughout the Northwest through proactive de-energization. Due to the disruptive nature of a power outage, PGE will execute PSPS events only when necessary.

### Priority PSPS Notification to Public Safety Partners, Operators of Utility-Identified Critical Facilities and Adjacent Public Safety Partners

PGE recognizes the importance of effective communication to stakeholders during a PSPS event. PGE will, to the extent practical, provide priority notification to the following stakeholders 1) Public Safety Partners 2) operators of utility-identified Critical Facilities (including communications facilities), and 3) adjacent local Public Safety Partners. PGE will communicate to each of these respective stakeholders, at a minimum, the information indicated in the tables below.

### PSPS Notification Channels

PGE will use owned and earned channels to inform customers and stakeholders throughout the PGE service area in line with the defined OPUC requirements, with special attention to those within the affected HRFZ. PGE will deliver notifications in multiple formats across multiple media channels that may include, but are not limited to, phone calls, text messages, reverse 911 partnership, social media posts, media advisories, emails, and messages to agencies that service other community populations. Details of the notifications are outlined in Table 10.



TABLE 10 : PSPS NOTIFICATIONS

# PSPS notifications to partners, customers and other stakeholders

	<b>Warning</b>	<b>Likely</b>	<b>Imminent</b>	<b>Happening*</b>	<b>Restoration begins*</b>	<b>Restoration complete*</b>
<b>When:</b>	<b>48–72 hours</b> before a PSPS	<b>24–48 hours</b> before a PSPS	<b>1–4 hours</b> before a PSPS	<b>During</b> a PSPS	<b>When it's safe</b>	<b>PSPS is over</b>
<b>What:</b>	We haven't made a final decision yet, but it's looking like a PSPS is possible.	We haven't made a final decision yet, but it's looking increasingly likely a PSPS will be necessary.	To protect lives and property, we expect to call a PSPS very soon. Now's the time to activate your emergency plan and be sure to keep your outage kit handy.	Power is being shut off. PGE may open a Community Resource Centers to provide essential resources like information, water, ice and a place to charge electronic devices.	Crews are patrolling and will respond to downed lines, repair damage and visually inspect equipment to make sure it's safe to restore power.	The immediate threat has passed and power has been restored. But we'll continue to monitor conditions so we can keep our customers and communities safe.
<b>How you'll hear:</b> (From us and emergency partners)	We will notify our partners (e.g. public safety partners, key government officials and critical facilities) via: <ul style="list-style-type: none"> <li>• <b>Email/Phone</b></li> <li>• <b>Other appropriate communication channels</b></li> </ul>	We, and our partners, will notify impacted customers, stakeholders and community-based organizations via: <ul style="list-style-type: none"> <li>• <b>Email</b></li> <li>• <b>Emergency Alert System</b></li> <li>• <b>Text message</b></li> <li>• <b>Social media</b></li> <li>• <b>Updates on the PGE website</b></li> <li>• <b>Media updates</b></li> </ul>	We, and our partners, will give impacted customers an estimated time when their power will be shut off via: <ul style="list-style-type: none"> <li>• <b>Email</b></li> <li>• <b>Emergency Alert System</b></li> <li>• <b>Text message</b></li> <li>• <b>Social media</b></li> <li>• <b>Updates on the PGE website</b></li> <li>• <b>Media updates</b></li> </ul>	We know this is challenging, so we'll do everything we can to stay in touch with impacted customers via: <ul style="list-style-type: none"> <li>• <b>Email</b></li> <li>• <b>Emergency Alert System</b></li> <li>• <b>Social media</b></li> <li>• <b>Updates on the PGE website</b></li> <li>• <b>Media updates</b></li> </ul>	As crews work on restoration, we'll share any new or relevant information to make sure you're kept up to date via: <ul style="list-style-type: none"> <li>• <b>Email</b></li> <li>• <b>Emergency Alert System</b></li> <li>• <b>Social media</b></li> <li>• <b>Updates on the PGE website</b></li> <li>• <b>Media updates</b></li> </ul>	When conditions stabilize and power has been restored, we'll notify impacted customers via: <ul style="list-style-type: none"> <li>• <b>Email</b></li> <li>• <b>Emergency Alert System</b></li> <li>• <b>Social media</b></li> <li>• <b>Updates on the PGE website</b></li> <li>• <b>Media updates</b></li> </ul>

\*PGE will provide status updates at least every 24 hours

## Section 12. Participation in National and Regional Forums

Emergency managers from PGE, PacifiCorp, Northwest Natural Gas, and BPA collaborate throughout the year as part of an Energy Emergency Management Team (EEMT). Annually, the EEMT exchanges contact information with the Northwest Coordination Center (NWCC) for emergency communications during fire season. Dispatch/Control Center numbers provided by the energy companies are for dispatch-to-dispatch communications. Emergency management contacts are provided for both NWCC and fire dispatch center personnel to assist with strategic decision-making and incident coordination.

In addition, PGE annually participates in a variety of industry forums that may discuss wild fire-related topics, including:

- International Wild fire Mitigation & Resiliency Consortium: PGE participates with utilities from across the Western U.S., South America and Australia to benchmark and share best practices for wild fire mitigation
- Electric Power Research Institute (EPRI): PGE engages with its research partners at EPRI through multiple programs to address wild fire mitigation research, and is leveraging EPRI-led programs such as the Incubate energy Network to gain knowledge of new technologies and start-ups in wild fire-related disciplines. As a result of its collaboration with EPRI, PGE deployed the Early Fault Detection pilot project in 2021
- Oregon Joint Use Association (OJUA): PGE is active in the OJUA, a non-profit industry workgroup whose mission involves building trust, cooperation, and organization between utility pole owners, users, and government entities to promote the safe, efficient use of the right-of-way. The OJUA has featured educational presentations at its meetings on the topic of Wild fire Mitigation
- Other National and Regional Forums: PGE is actively engaged with industry research partners at the Western Energy Institute, Edison Energy Institute (EEI), and the U.S. Department of Energy
- Regional Disaster Preparedness Organization (RDPO): PGE actively participates in the RDPO, which encompasses five Portland metro region counties – Multnomah, Washington, Clackamas, Columbia, and Clark - as a utility/energy sector participant and steering committee member. In this role, PGE provides the RDPO insights and a utility perspective on issues. In addition, PGE has garnered information related to regional disaster resilience and preparedness initiatives and to enhance regional partnerships.
- Oregon Conservation Corps: PGE sits on the Oregon Higher Education Coordinating Commission's Oregon Conservation Corps Advisory Committee, established through SB 762. The Oregon Conservation Corps Program grants funding to organizations across the state to aid in reducing wild fire risk to communities while also providing workforce training for youth and young adults.

Additionally, PGE serves as Co-Chair of EEP's Electricity Subsector Coordinating Council (ESCC) Wild fire Working Group (WWG). The ESCC is the principal liaison between the federal government

and the electric power industry. In the fall of 2021, the WWG leadership team launched a new Wild fire Strike Team to address the most critical issues affecting successful wild fire land management and mitigation on federal lands. The Team includes representatives from PG&E, PacifiCorp, Idaho Power and Southern California Edison, BPA, USFS, EEL, the National Rural Electric Cooperative Association (NRECA) and the American Public Power Association (APPA) and PGE in a key leadership role.

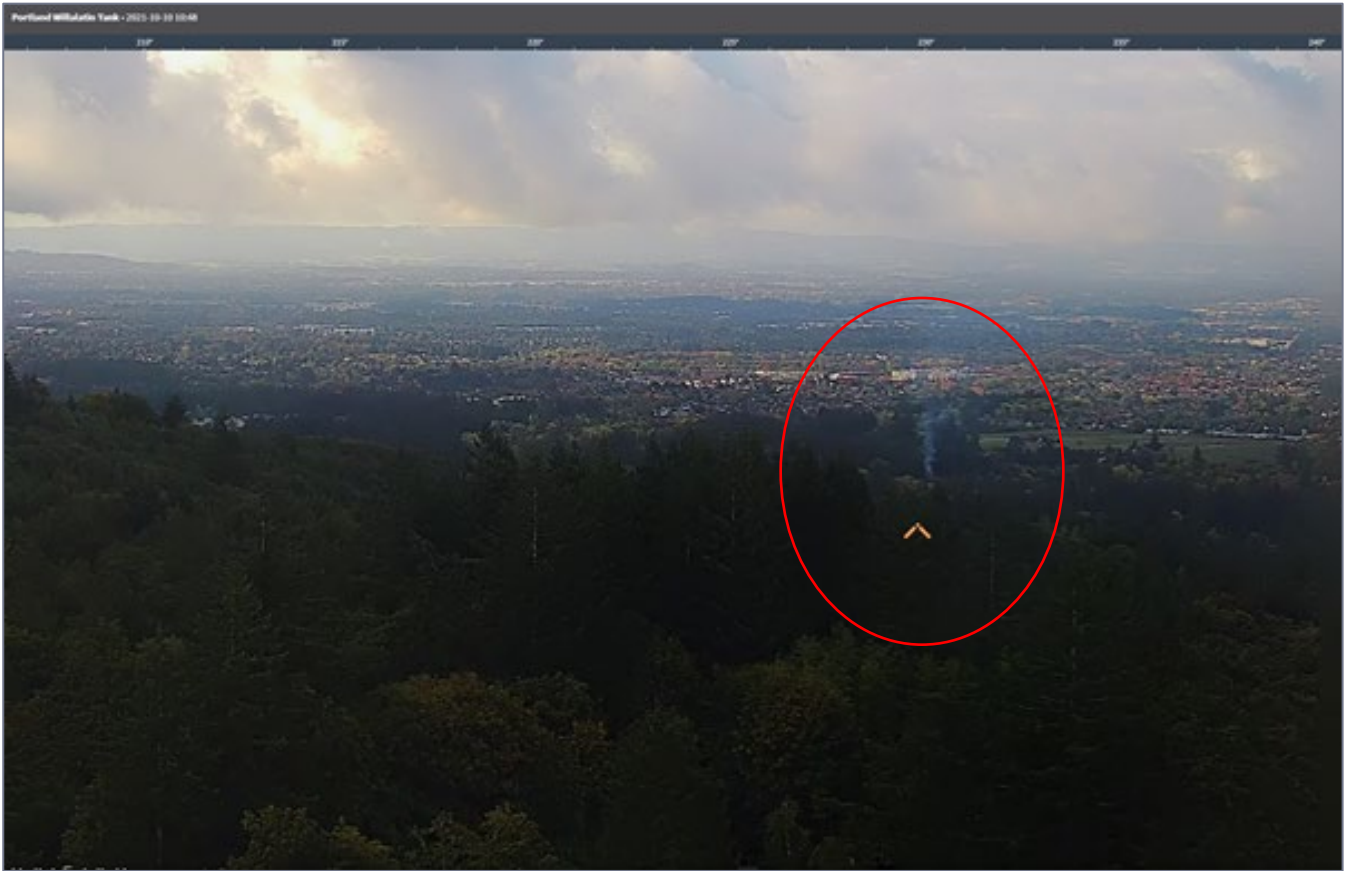
PGE is also working with Federal partners to support the Wild fire Strike Team’s interdisciplinary and interagency efforts. PGE represented the utility sector in the President’s 2021 wild fire meetings with cabinet secretaries to emphasize the need for continued leadership at the federal level on wild fires and shared responsibility on the matter, among other issues.

## **Section 13. Research & Development**

PGE is undertaking a variety of wild fire-related research projects with public and private research institute and industry partners.

In 2021, PGE, in partnership with EPRI’s Incubatenergy Network and the City of Portland, completed a demo project deploying two cameras equipped with artificial intelligence within PGE HRFZs. These cameras can detect and identify smoke through ultra-high-definition video imaging, and notify PGE if it detects a fire, in real time. The cameras are operational and detected multiple fires (not wild fires) in 2021. This technology shows promise in reducing response time and increasing situational awareness of any fires in the vicinity of PGE infrastructure, enhancing PGE’s operational decision-making. In 2022, PGE plans to expand this technology to additional HRFZ locations, in collaboration with public and private agencies.

FIGURE 14: SMOKE DETECTED BY AI-EQUIPPED CAMERA SYSTEM



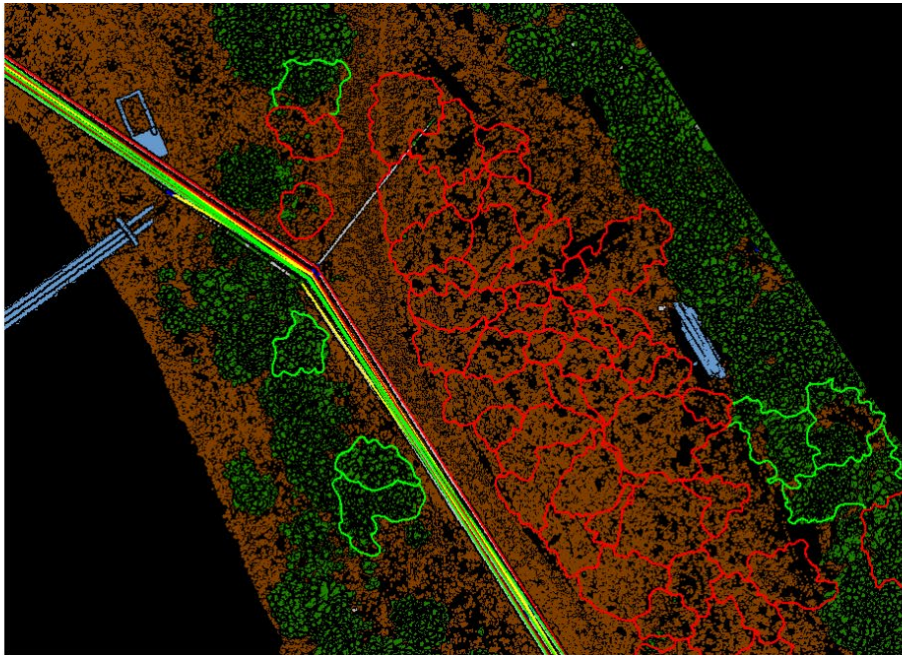
PGE is also conducting a Remote Sensing data acquisition project for the HRFZ feeders, to support wild fire and resiliency preparedness and operational design and engineering work beginning in 2022. The project will give PGE a more granular and precise understanding of vegetation risk, clearances to poles and wires, and right-of-way accessibility within the HRFZs than previous surveys have been able to provide. The Remote Sensing Pilot Project will also be used to inform PGE’s capital planning work, which guides its wild fire investment strategy, and will help PGE understand how much risk has been mitigated through previous years’ AWRR (vegetation management) efforts.

PGE’s Remote Sensing Pilot Project also provides:

- GIS-enabled analyses of vegetation clearance and vegetation health
- A consolidated pole/span inventory
- A pole/span change detection analysis (2019-2021)
- A consolidated tree threat inventory (2019 and 2021)
- A tree change detection analysis (2019-2021).

When complete, the Remote Sensing Pilot Project will provide PGE with precise mobile and aerial LiDAR, spherical imagery and satellite multispectral imagery surveys of 774 circuit-miles of conductor and nearly 15,000 poles within the PGE HRFZs. It will be used to inform and refine PGE’s asset and vegetation risk management activities beginning in 2022.

FIGURE 15 : SAMPLE AERIAL LIDAR IMAGERY FROM REMOTE SENSING PROJECT



*Areas outlined in red show trees identified as a threat in 2019 that have since been removed.*

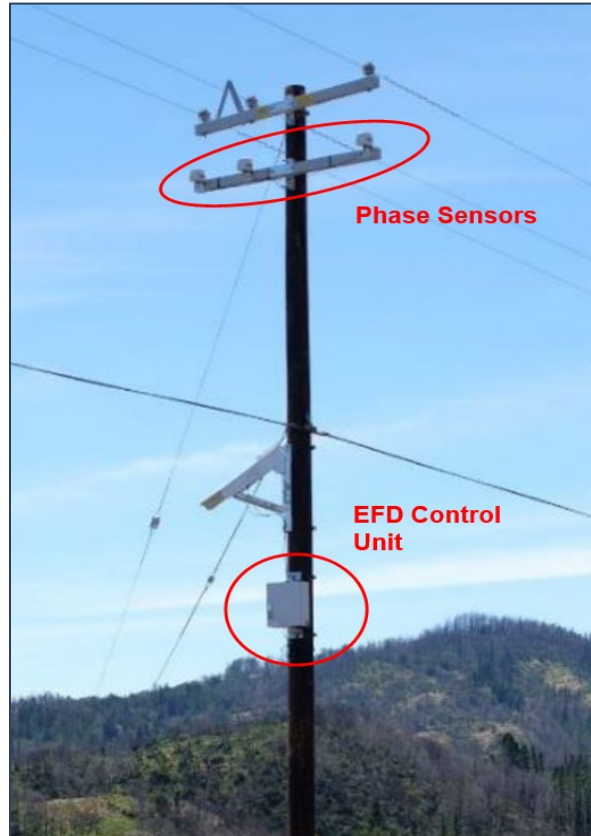
PGE is also leading the 5G PGE Energy Lab, focused on the development of innovative wild fire mitigation technologies. The collaboration is evaluating use cases and developing business cases for wild fire-related surveillance, sensing and data collection, and cloud storage technologies, laying the groundwork for the use of artificial intelligence-driven analysis in these disciplines. The group is also working on the creation of a 5G-enabled mobile network to improve mobile data collection and reporting. Field testing of the network began in November 2021; the group expects to complete field testing and identify which technologies to move forward with for deployment in December 2021.

In addition, results from its 2021 R&D pilot programs for intelligent faulted circuit indicators and smart reclosers have encouraged PGE to scale these technologies for additional field deployments in HRFZs in 2022 to improve system operations during fire season.

### 13.1 R&D Technology Under Evaluation – Early Fault Detection

In 2021, PGE deployed an Early Fault Detection (EFD) system that uses radio frequency signals to detect and pinpoint potential distribution system failures in PGE HRFZs. This technology, if successful, will pinpoint potential failure before traditional methods such as physical inspection. In 2022, PGE plans to complete deployment of the EFD pilot program and evaluate the suitability of EFD as a capital project, potentially expanding EFD deployment in HRFZs in 2022. PGE is developing processes to execute on alerts and data from the EFD systems, and to automatically create work orders.

FIGURE 16: EXAMPLE OF AN INSTALLED EFD SYSTEM



## Section 14. Quality Control & Continuous Improvement

Following its end-of-fire-season declaration, PGE reviews fire season activities and events, collects and analyzes findings, produces a year-end report and tracks action items. This review is crucial to PGE's continuous improvement and documentation update processes and involves both internal and external stakeholders.

PGE assigns action items to the appropriate task owner, tracks action item progress through to completion, and reports progress to PGE's Executive Committees.

### 14.1 Post-Fire Season Review

PGE will conduct a review of this Plan with internal and external stakeholders following the annual end-of-fire-season declaration, as part of its formal post-fire season review process. This process typically includes, but is not limited to, the following objectives:

- Identifying aspects of the program (e.g., training, preparedness measures, operational strategies and documentation) that worked well

- Identifying opportunities to improve preparedness, operational strategies, training, work instructions, communication and other program elements
- Development of a narrative description of any changes to PGE’s baseline wild fire risk analysis relative to the previous year’s plan, as well as any specific actions PGE took in response to changes in baseline wild fire risk, seasonal wild fire risk and near-term wild fire risk
- Encouraging collaboration with Public Safety Partners and local communities in the annual review and update of the Wild fire Mitigation Plan, and in the identification of wild fire mitigation-related investments and activities
- Evaluating new ideas, improvements and observations identified by the team for future implementation
- Assigning task owners and target completion dates for corrective actions
- Identifying de-energization lessons learned, including a narrative description of each PSPS event that occurred during the previous year
- Identifying “next season” opportunities to improve collaboration with external stakeholders through planning, training and exercises, and
- Establishing baseline goals and objectives for the next fire season.

When an After-Action Review (AAR) is conducted due to the occurrence of a wild fire event, PGE will integrate any outstanding corrective actions into its post-fire season lessons learned review.

PGE will follow all relevant OPUC protocols in filing an annual report on de-energization lessons learned, providing a narrative description of all PSPS events which occurred during the fire season, by no later than December 31.

## 14.2 Monitoring & Audit

PGE’s Internal Audit Services organization may provide assurance or advisory services related to this program in accordance with their annual audit plan as approved by the Audit and Risk Committee.

## 14.3 Annual Lessons Learned Process

At the end of each year, PGE conducts a wild fire review/lessons learned process that includes:

- Annual post-fire season review workshops involving both internal and external stakeholders
- Documentation and distribution of post-fire season lessons learned; identification of comments and recommendations to improve PGE’s wild fire preparedness, system hardening and operational readiness
- Annual post-season review of PGE’s wild fire mitigation performance metrics and targets
- Incorporation of lessons learned findings into the annual report, used to update PGE’s Wild fire Mitigation Program and documentation, and
- Documentation of each year’s lessons learned and year-end review findings, as well as performance metric outcomes, in PGE’s Wild fire Program SharePoint library, for future reference.

## Section 15. Contact PGE

For information regarding PGE's wild fire mitigation program, wild fire-related emergency kits, plans, and checklists, and wild fire-related education and preparedness information, please visit PGE's Wild fire Outages page or the PGE homepage (<https://portlandgeneral.com>) or call us at 1-800-542-8818. Current situational updates, outage status and wild fire information are also available via social media platforms (Facebook, Twitter, Instagram, and LinkedIn).





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## Appendix 3. Glossary and Acronyms

**AAR:** After-Action Review

**ANSI:** American National Standards Institute

**APPA:** American Public Power Association

**AWRR:** Advanced Wild fire Risk Reduction

**Blue Sky/Grey-Sky Events:** A Blue-Sky event occurs when normal daily operations are executed for the community when natural disasters aren't occurring. A Grey-Sky event refers to events when a disaster occurs and all hands are on deck assisting with clients (victims of said disaster).

**BPA:** Bonneville Power Administration

**CEOP:** Corporate Emergency Operations Plan

**CIMT:** Corporate Emergency Management Team

**CPC:** Climate Prediction Center

**CRC:** Community Resource Center

**Cycle Buster:** Vegetation that will not make it through the routine trim cycle without encroaching on the required minimum clearances and, therefore require pruning midterm before the routine cycle is completed. PGE trims “cycle-buster” trees to increase clearances whenever they are encountered during the inspection cycle.

**DEI:** Diversity, Equity & Inclusion

**ECC:** Emergency Coordination Center

**EEI:** Edison Energy Institute

**EEMT:** Energy Emergency Management Team

**efd:** Early Fault Detection

**EOC:** Emergency Operations Center

**EPRI:** Electric Power Research Institute

**ESCC:** Electricity Subsector Coordinating Council

**ESF-12:** Refers to Emergency Support Function-12 and indicates the Public Utility Commission of Oregon's role in supporting the State Office of Emergency Management for energy utilities' issues during an emergency, per OAR 860-300-0002(1).

**FDRA:** Fire Danger Rating Area

**Fire Season:** Period(s) of the year during which wild land fires are most likely to occur, spread, and affect resources sufficiently to warrant organized fire management activities

**Fire Weather:** Weather conditions that influence fire ignition, behavior and suppression

**FITNES:** Facilities Inspection & Treatment to National Electrical Safety Code

**GIS:** Geographic Information System

**High Risk Fire Zone (HRFZ):** Geographic areas at elevated risk of wild fire ignition identified by PGE in its risk-based wild fire plan

**HRFZ:** High-Risk Fire Zone

**HSEEP:** Homeland Security Exercise & Evaluation Program

**IAM:** Institute of Asset Management

**IAP:** Incident Action Plan

**ICP:** Incident Command Post

**IMT:** Incident management Team

**IRWIN:** Integrated Reporting of Wildland Fire Data

**ISO:** International Organization for Standardization

**LCES:** Lookouts, Communications, Escape Routes and Safety Zones

**LiDAR:** Light Detection & Ranging

**Local Community:** Any community of people living, or having rights or interests, in a distinct geographical area, per OAR 860-300-0002(2)

**Local Emergency Management:** Refers to city, county, and Tribal emergency management entities, per OAR 860-300-0002(3)

**NICC:** National Interagency Coordination Center

**NIFC:** National Interagency Fire Center

**NIMS:** National Incident Management System

**No-Test Policy:** PGE will disable auto-reclosing and not manually close-in a faulted circuit

**NRECA:** National Rural Electric Cooperative Association

**NWCC:** Northwest Coordination Center

**NWS:** National Weather Service

**OAR:** Oregon Administrative Rule

**ODF:** Oregon Department of Forestry

**ODHS:** Oregon Department of Human Services

**ODOT:** Oregon Department of Transportation

**OH:** Overhead (transmission or distribution circuit)

**OJUA:** Oregon Joint Use Association

**O&M:** Operations and Maintenance

**OPUC:** Public Utility Commission of Oregon

**P1:** Hazard/danger tree

**P2:** A tree that poses a grow-in or fall-in threat and displays arboricultural defect that poses risk to PGE facilities

**PGE:** Portland General Electric Company

**PSA:** Predictive Service Area

**PSPS:** Public Safety Power Shutoff

**Public Safety Partners:** Includes the ESF-12, Local Emergency Management, and Oregon Department of Human Services (ODHS), per OAR 860-300-0002(6)

**QA/QC:** Quality Assurance/Quality Control

**RAWS:** Remote Automated Weather Station

**Red Flag Warning:** A term used by fire-weather forecasters to call attention to limited weather conditions of particular importance that may result in extreme burning conditions. Red Flag Warnings are issued during ongoing events, or when the fire weather forecaster has a high degree of confidence that Red Flag criteria will occur within 24 hours of issuance. According to the National Weather Service, Red Flag Warnings will be issued whenever a geographical area has been in a dry spell for a week or two, or for a shorter period, if before spring green-up or after fall color, and the National Fire Danger Rating System (NFDRS) is high to extreme and all of the following weather parameters are forecasted to be met:

- Ten-hour fuels (moisture content of small vegetation that take only about 10 hours to respond to changes in moisture conditions) of 8 percent or less
- A sustained wind average 15 mph or greater.
- Relative humidity less than or equal to 25%.
- A temperature of greater than 75 degrees Fahrenheit.

In some states, dry lightning and unstable air are criteria. A Fire Weather Watch may be issued prior to the Red Flag Warning.

**ROW:** Right-of-way

**SAM:** Strategic Asset Management

**SCADA:** Supervisory Data Control & Acquisition

**SEL:** Schweitzer Engineering Laboratories

**SME:** Subject Matter Expert

**Supervisory Control and Data Acquisition (SCADA):** The control system architecture comprising computers, networked data communications and graphical user interfaces (GUI) for high-level process supervisory management, while also comprising other peripheral devices like programmable logic controllers (PLC) and discrete proportional-integral-derivative (PID) controllers to interface with process plant or machinery.

**Striking Distance:** A measurement that shows that a tree has the ability to fall into PGE's equipment, especially power lines

**T&D:** Transmission and Distribution

**Tier 1 Risk:** Describes an area where there is not an elevated or extreme risk of wild fires

**Tier 2 (Elevated) Risk:** Describes an area where there is an elevated risk (including likelihood and potential impacts on people and property) of utility-associated wild fires

**Tier 3 (Extreme) Risk:** Describes an area where there is an extreme risk (including likelihood and potential impacts on people and property) of utility-associated wild fires

**USDOE:** U.S. Department of Energy

**USFS:** U.S. Forest Service

## Appendix 4: OPUC Phase 1 Wildfire Mitigation Rules In the WMP

AR 648 Phase 1 Wildfire Mitigation Rule Language	Where Addressed in PGE Wildfire Mitigation Plan
<p><i>(a) Identified areas that are subject to a heightened risk of wild fire, including determinations for such conclusions, and are:</i></p> <p style="padding-left: 40px;"><i>(A) Within the service territory of the Public Utility, and</i></p> <p style="padding-left: 40px;"><i>(B) Outside the service territory of the Public Utility but within the Public Utility's right-of-way for generation and transmission assets.</i></p>	<p>Section 5 (Wildfire Risk Mitigation Assessment Program Overview), pp. 10-22</p> <p>Section 5.3 (High Risk Fire Zones), pp. 12-15</p>
<p><i>(b) Identified means of mitigating wild fire risk that reflects a reasonable balancing of mitigation costs with the resulting reduction of wild fire risk.</i></p>	<p>Section 5 (Wildfire Risk Mitigation Assessment Program Overview), pp 10-22</p>
<p><i>(c) Identified preventative actions and programs that the Public Utility will carry out to minimize the risk of utility facilities causing wild fire.</i></p>	<p>Section 5 (Wildfire Risk Mitigation Assessment Program Overview), pp. 10-22</p> <p>Section 6: Operating Protocols, pp. 22-28</p> <p>Section 7 (Operations During PSPS Events), pp. 28-31</p>
<p><i>(d) Discussion of outreach efforts to regional, state, and local entities, including municipalities regarding a protocol for the de-energization of power lines and adjusting power system operations to mitigate wild fires, promote the safety of the public and first responders and preserve health and communication infrastructure.</i></p>	<p>Section 7 (Operations During PSPS Events), pp. 28-31</p> <p>Section 11 (Community Outreach &amp; Public Awareness), pp. 41-48</p>
<p><i>(e) Identified protocol for the de-energization of power lines and adjusting of power system operations to mitigate wild fires, promote the safety of the public and first responders and preserve health and communication infrastructure.</i></p>	<p>Section 7 (Operations During PSPS Events), pp. 28-31</p>
<p><i>(f) Identification of the community outreach and public awareness efforts that the Public</i></p>	<p>Section 11 (Community Outreach &amp; Public Awareness), pp. 41-48</p>



AR 648 Phase 1 Wildfire Mitigation Rule Language	Where Addressed in PGE Wildfire Mitigation Plan
<i>Utility will use before, during and after a wild fire season.</i>	
<i>(g) Description of procedures, standards, and time frames that the Public Utility will use to inspect utility infrastructure in areas the Public Utility identified as heightened risk of wild fire.</i>	Section 8 (Asset Management & Inspections), pp. 31-35
<i>(h) Description of the procedures, standards, and time frames that the Public Utility will use to carry out vegetation management in in areas the Public Utility identified as heightened risk of wild fire.</i>	Section 9 (Vegetation Management), pp. 36-39
<i>(i) Identification of the development, implementation, and administrative costs for the plan, which includes discussion of risk-based cost and benefit analysis, including consideration of technologies that offer co-benefits to the utility's system.</i>	Section 10 (Wild fire Program Costs), p. 40
<i>(j) Description of participation in national and international forums, including workshops identified in section 2, chapter 592, Oregon Laws 2021, as well as research and analysis the Public Utility has undertaken to maintain expertise in leading edge technologies and operational practices, as well as how such technologies and operational practices have been used develop implement cost effective wild fire mitigation solutions.</i>	Section 12 (Participation in National & Regional Forums), pp. 49-50, and Section 13 (Research & Development), pp. 50-53



PGE Corporate Headquarters  
121 SW Salmon Street  
Portland, Oregon 97204  
[portlandgeneral.com](http://portlandgeneral.com)