January 1, 2025 Issue
(Updated December 8, 2025)

Wildfire Catastrophe Model Checklist

The purpose of this checklist of technical guidelines, associated disclosures, and test cases is to provide information for evaluating whether modeled aggregate loss projections for wildfire losses by catastrophe models used within rate filings are reliable and based upon established concepts, data, equations, and principles, as well as best available scientific information and data, insurance claim expertise, and other assumptions appropriate for wildfire risk.

Instructions:

- **Pre-Application Required Information Determination (PRID) Procedure:** In a PRID procedure this checklist, including the appendix of preliminary test cases, serves as a scoping document for the types of information that will be provided. A modeler may be required to provide the information during the PRID procedure through: 1) their standard client documentation, 2) presentations and verbal questioning, 3) written responses, and/or 4) any other form/mechanism requested by the Model Advisor. In this case, the Expert Certification forms will not be required and "Disclosures for End-Users' Use of Wildfire Catastrophe Models" section, which requires insurer-specific information, serves only as a reference for what information the modeler may need to be able to produce for a client insurer in a final report for use in a complete rate application (in addition to any Required Model Information).
- **Complete Rate Application for model that has not received a PRID determination:** The checklist, completed in its entirety including the appendix of preliminary test cases and "Disclosures for End-Users' Use of Wildfire Catastrophe Models" section, must be submitted upfront as part of a complete rate application.

Date	Section	Update Description
December 8, 2025	Appendix of Test Cases	Preliminary Appendix replaced with final appendix of test cases
December 8, 2025	Glossary Guidelines H-3 Disclosure H-3 Disclosure S-2 Disclosure S-5 Disclosure A-1 Disclosure A-6 Guideline CI-4 Disclosure CI-7	Glossary: Clarifying edits Guideline H-3: modeler no longer determines low, average, and highly active fire seasons; Disclosure H-3 #1: removed disclosure related to methods for calculating fire severity year; Disclosure S-2: clarifying edits; Disclosure S-5: Combined with S-6 for a avoidance of duplication and edited for clarity; Disclosure A-1 #8: Edited for clarity and specificity; Disclosure A-6: removed disclosure related to ecoregion delineation for avoidance of duplication; Guideline CI-4: Removed an ambiguous/unclear paragraph;

		Disclosure CI-7 #2: Provided additional specificity based on corresponding guideline

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Glossary

General Modeling Terms

***The General Modeling Terms below are defined within the context of general modeling terms applicable to all topic areas addressed by these Guidelines. These terms and definitions are not intended and may not necessarily be a comprehensive distillation/representation of all relevant scientific literature.*

- **habitational structures / buildings**: refers to main structures that serve as the primary dwelling structure used by its occupants to live and contain their personal belongings, and secondary structures such as gazebos, outbuildings, and sheds are additional structures located on the same parcel but separate from the primary structure. Such secondary structures are included in the loss curves for the main, primary structures.
- **commercial residential property(ies) / commercial residential building(s)**: refers to structures or buildings that are used in part or in whole for habitational purposes and insurable under a commercial insurance policy. Insured losses may include those for contents to the extent included in the coverages, but may be covered under a separate insurance policy.
- **personal residential property(ies) / personal residential building(s)**:refers to structures or buildings that are used solely for habitational purposes and insurable under a personal dwelling insurance policy. Insured losses may include those for contents to the extent included in the coverages.
- **downscaled/downscaling**: refers to the methods for obtaining high-resolution inputs (*i.e.* weather inputs) from coarser-resolution global or regional models by developing a relationship between the historic observed global or regional patterns and data and the locally observed responses for the same historical period.
- **end-user/entity:** refers to the specific insurer/insurance company that is submitting a rate filing containing modeled loss projections derived from their use of a catastrophe model through the use of their own data (claims, trend, portfolio) as an input into the model.
- **model:** refers to a simplified or generalized representation of reality, which in the context of catastrophe models refers to a comprehensive set of formal structures, algorithms, equations, data, and components that capture processes associated with the effects of a peril (in this case wildfires) and its impact on personal residential and commercial residential properties leading to insured losses.
    - The relationship between a "**model**" and "**sub-model**" shall be understood with the specific context and architecture of the overall catastrophe model and a specific module within it. A model may be a standalone component or it may be composed of two or more sub-models with varying hierarchical relations to each other.

Hazard Terms

***The terms below are defined within the context of incorporating certain parameters related to fire characteristics within the hazard module of a catastrophe model (including as part of any wildfire hazard models within the hazard module) and are not intended and may not necessarily be a comprehensive distillation/representation of all relevant scientific literature. In general, wildfire-related terms are intended to be consistent with their definitions and usage per the NWCG Glossary of Wildland Fire. Usage of "fire" below is understood to be in relation to wildfire.*

- **area burned / burned area**: represents the final fire size (*e.g.* number of acres) within the final fire perimeter of a specific, individual incident or simulated wildfire event, including unburned and unburnable fuel islands.
- **Base Wildfire Set**: refers to the selection and creation of a reference wildfire database to represent historical fire regimes in California whose individual events were originally contained in one or more

historical wildfire databases (*e.g.* **historical wildfire dataset**), which can be subsequently modified with additional data or by statistically adjusting certain parameters, including to incorporate potential impacts from climate change, and which is used to calibrate and validate modeled wildfires and to create large number of simulated events (*e.g.* **wildfire stochastic events set(s)**).

- **fire (fireline) intensity**: The rate of heat release per unit time per unit length of fire front. Numerically, it is the product of the heat yield, the quantity of fuel consumed in the fire front, and the rate of spread.
- **fire occurrence frequency**: The quantification of the probability that a fire will ignite within a particular area.
- **fire regime**: Description of the patterns of fire occurrences, frequency, size, severity, and sometimes vegetation and fire effects as well, in a given area or eco-system/eco-region. A fire regime is a generalization based on fire histories at individual sites. Fire regimes can often be described as cycles because some parts of the histories usually get repeated, and the repetitions can be counted and measured, such as fire return interval.
- **fire severity**: Degree to which a site has been altered or disrupted by fire; loosely, a product of fire intensity and residence time.
- **historical wildfire dataset:** refers to a reference dataset of historical wildfires compiled from unmodified, historical data contained in one or more historical wildfire databases created by academic or governmental authorities.
- **Reference California Historical Wildfire Dataset:** refers to the unmodified dataset for fire perimeters and burned area for historical California wildfires from 1970 to 2020, extracted from CAL FIRE's FRAP FOD 9 database (published Aug. 3, 2021), and intended to be used for purposes of complying with and reporting disclosures where expressly referenced. It may comprise a subset of a larger **historical wildfire dataset** used by the modeling organization to create a **Base Wildfire Set**.
- **wildfire hazard model/sub-model**: a set of physics and/or empirical equations that form a mathematical representation of the behavior of fire in uniform wildland fuels, most notably simulating fire spread. (*See* **sub-model** definition in *General Modeling Terms*).
    - **fuel model**: a simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.
- **wildfire stochastic events set**: refers to the creation of a catalog of simulated events (*e.g.* database of scenario events for a specific peril, in this case wildfires) to represent a wide range of plausible scenarios for a specific peril, including to incorporate potential impacts from climate change. Each event is typically characterized by a location, path, or specific strength, intensity or size (as appropriate for the peril), and annual probability of occurrence (also known as event rate). Catastrophe Models (Property) (naic.org).

Statistical Terms

*** The terms below are defined within the context of incorporating various statistical methods and statistical models throughout the various components and routines in catastrophe models, such as fitting probability distributions to historical data (or historical data adjusted to climate change) to generate stochastic wildfire events. Usage of "fire" below is understood to be in relation to wildfire.*

- **sensitivity analysis (SA)**: represents the quantification of the magnitude of the output by identifying and quantifying the input variables that impact the magnitude of the output when the variables are varied simultaneously or individually through individual test cases. The objective is to systematically manipulate the parameters and inputs to compare and measure the impact such changes have on the model's output from one test case to another.
- **uncertainty analysis (UA)**: represents the quantification of the uncertainty in the outputs that accumulate from each of the uncertainties related to every underlying parameter, data source, sub-

model, and process in a catastrophe model. Although there is a relation between the sensitivity and uncertainty in a model and the same test cases may be used to analyze both, SA and UA are not the same as the variables that contribute the most to uncertainty may be different than the variables to which the model is more sensitive.

Vulnerability Terms

***The terms below are defined within the context of incorporating certain parameters related to characteristics of structures/buildings and surrounding areas within the engineering/vulnerability module of a catastrophe model (including as part of any vulnerability models or sub-models within the engineering/vulnerability module) and are not intended and may not necessarily be a comprehensive distillation/representation of all relevant scientific literature.*

- **damage functions / vulnerability functions**: refers to mathematical equations/algorithms that describe the relationship between the relevant characteristics of the hazard (such as defined "intensity measures" (IMs) or intervals of **fire intensity**) and the degree of damage (*e.g.* structural /physical damage) for specific assets/structures based on relevant construction and surrounding area characteristics. Some models' damage functions do not measure the differences in intensity. It directly relates the hazard intensity to the resulting damage, not to the probability of damage.
- **vulnerability**: represents the localized conditions and characteristics of buildings/structures and immediate surrounding areas being modeled that impact the probability that such buildings/structures and their inner contents will be destroyed or damaged to varying degrees by various events (*e.g.* wildfires), often quantified through damage / vulnerability functions. Vulnerability is typically comprised of three components: (i) the extent of damage to the building/structure, (ii) the extent of damage to their inner contents based on occupancy or other justifiable, relevant factors, and (iii) the extent of time such building/structure will remain unusable until repaired or rebuilt.

Actuarial Terms

***The terms below are defined within the context of incorporating certain parameters related to the treatment of insurance-related data, including from end-user input data, within the financial module of a catastrophe model.*

- **catastrophe/ic**: a relatively infrequent event or phenomenon that produces unusually large aggregate losses.
- **Catastrophe/ic loss**: damage to an insured asset attributed to a catastrophic event that results in a financial loss.
- **demand surge**: a sudden and usually temporary increase in the costs of materials, services, and labor due to the increased demand for them following a catastrophe.
- **exceedance probability (EP) curve**: An exceedance probability (EP) curve calculates the loss for each event in the portfolio, produced either by the sum of all losses each simulated year (aggregate loss) or the largest event in each simulated year (occurrence loss) and ranks each event by the probability of the event exceeding the aggregate or occurrence-based loss amount. (NAIC COE Catastrophe Models; *see* Exceedance Probability in Catastrophe Modeling - CAS 2021 for mathematical derivation)
- **average annual losses (AAL) / wildfire loss costs**: derived from the exceedance probability curve and equals the sum of the periodic losses from every simulated period (typically a year), each period varying the frequency and intensity of events (perils), all divided by the total number of periods in the catalog, which represents a long-term average of possible losses; a positive AAL is not correlated with an expectation that an insurer will sustain a loss in any given period (typically a year). (*See* Exceedance Probability in Catastrophe Modeling - CAS 2021 for an example of mathematical derivation).
- **Probable Maximum Loss / Return Period Loss**: It is an amount that is expected to be exceeded with a

given probability by an event or in a year. For example, a 100-year occurrence PML of $6 million ($6M) means that there is a 1-in-100 (1 percent) chance of a loss of at least $6M in a given year. (Probable Maximum Loss – CAS 2021).

Computational Information Terms

*** The terms below are defined within the context of understanding computing system design and architecture.*

- **module:** with the context of scientific computing and software design, a module is a self-contained, independent unit of code that performs logically discrete functions by encapsulating related functionality, data structures, and implementation details and that interacts through defined interfaces with other modules performing other functionalities, for the purpose of organizing the overall software code and to make the programming modular and reusable. Within the context of catastrophe models, it can also be defined as a major organizational unit, component, or structure of an entire system, which may be subdivided into additional sub-units or sub-components such as models and sub-models. Many current catastrophe models have three or four modules, depending on the architecture, whose name may vary, but whose underlying functionality remains the same: Hazard, Vulnerability, and Exposure/Financial. Insurance Topics | Catastrophe Models (Property) | NAIC

End-Users' Use of Model Terms

***The terms below are defined within the context of selecting, modifying, or adjusting certain input data and model settings, and are not intended and may not necessarily be a comprehensive distillation/representation of all relevant scientific and industry standards.*

- **Primary Amount of Insurance (AOI)**: is defined as the coverage A amount for homeowner policy types, coverage C amount for renter or condominium owner policy types, and aggregate property structure limits (across all structures listed on the policy's declarations page or listed on a schedule attached to the policy) for commercial policy type.
- **Total Amount of Insurance Years (AIY)**: The total combined limits (dwelling, additional structures, personal contents, and loss of use/business interruption) pertaining to the property coverages underlying each policy.

General Guidelines For Wildfire Catastrophe Models

Purpose: The purpose of the guidelines contained in this section is to promote consistent performance of wildfire catastrophe models for **habitational buildings** and **habitational structures**. Specific guidelines include those that provide a high-level view of the scope of the **wildfire catastrophe model** (G-1), and ensure that: the model was developed and is maintained by professionals with the requisite experience (G-2), the geographic insured exposure locations are accurate and appropriate (G-3), the components of the model are independent and logical (G-4), and the documentation of the model is maintained and quality controlled (G-5).

Guideline G-1. Scope of the Wildfire Catastrophe Model and Its Implementation

The wildfire catastrophe model shall project loss costs and average, aggregate, and probable maximum loss levels for damage to insured residential and habitational property from wildfire events.

A documented process shall be maintained to assure continual agreement and accurate correspondence of databases, data files, and computer source code to presentation materials, scientific and technical literature, and modeling organization documents.

All software, data, and flowcharts (1) located within the wildfire catastrophe model, (2) used to validate the wildfire catastrophe model, (3) used to project modeled wildfire loss costs and wildfire average, aggregate, and probable maximum loss levels, and (4) used to create forms required by any Guideline, shall be considered within the scope of the Computational Guidelines.

A subset of the forms shall be produced through an automated procedure or procedures if indicated in the form instructions.

Vintage of data, code, and scientific and technical literature used shall be justifiable.

Guideline G-2. Qualifications of Modeling Organization Personnel and Consultants Engaged in Development of the Wildfire Catastrophe Model

Wildfire catastrophe model construction, testing, and evaluation shall be performed by modeling organization personnel or consultants who possess the necessary skills, formal education, and experience to develop the relevant components for wildfire loss projection methodologies.

The wildfire catastrophe model should be reviewed by modeling organization personnel or consultants in the following professional disciplines with requisite experience: engineering (documented with appropriate advanced engineering degree), statistics (advanced degree or equivalent experience), actuarial science (Associate or Fellow of the Casualty Actuarial Society), wildfire-specific expertise (documented with appropriate advanced science or engineering degree), meteorology (advanced science or engineering degree), and computational science (advanced degree or equivalent experience and certifications).

Guideline G-3. Location / Geospatial Information for Data Inputs

Location and geospatial information used in all aspects of the catastrophe model shall be of appropriate granularity and up to date, including but not limited to, the following constraints:

- *ZIP Codes, when used in the wildfire catastrophe model, shall not differ from the United States Postal Service publication date by more than 24 months at the date of submission of the wildfire catastrophe model. ZIP Code information shall originate from the United States Postal Service.*
- *Centroids, when used in the wildfire catastrophe model, shall be based on population data and/or other wildfire-relevant criteria.*
- *Geospatial information purchased by the modeling organization shall be verified by the modeling organization for accuracy and appropriateness.*
- *If any wildfire catastrophe model components are dependent on geospatial databases, a logical process shall be maintained for ensuring these components are consistent with the recent database updates.*
- *Geocoding methodology shall be clearly justified.*

Guideline G-4. Independence of Wildfire Catastrophe Model Components

The hazard, vulnerability, and actuarial components of the wildfire catastrophe model shall each be theoretically sound without compensation for potential bias from other components.

Where missing data exist, an explanation shall be given for how models interpolate, average, exclude, or estimate missing data.

Guideline G-5. Editorial Compliance

If submitted without a PRID, the submission and any revisions provided throughout the review process shall be reviewed and edited by a person or persons with experience in reviewing technical documents who shall certify on the relevant Form and on Form G-1, General Modeling Guideline Expert Certification, that the submission has been personally reviewed and is editorially correct.

General Disclosures For Wildfire Catastrophe Models

Disclosure G-1 Scope of the Wildfire Catastrophe Model and Its Implementation

1. Specify the wildfire catastrophe model version identification and, if relevant, the third-party vendor that produced the model. If the wildfire catastrophe model is implemented on more than one platform, specify each platform identifying the primary platform and the distinguishing aspects of each platform. Specify whether there is a more recent version of this model available from the vendor and, if so, why this more recent version is not being used.

2. Provide a comprehensive summary of the wildfire catastrophe model, including without limitation the wildfire behavior model (also known as wildfire hazard model) and any other aggregate or actuarial model that uses the results from the wildfire hazard model. This summary should include a technical description of the wildfire catastrophe model and all of its modules, submodules, and each major component (including their spatiotemporal resolution) used to project loss costs and probable maximum loss levels for damage to insured residential and habitational property from wildfire events causing damage in California. Describe the theoretical basis of the wildfire catastrophe model and include a thorough description of the methodology

and input data used for the model and its modules, particularly on components of the wildfire hazard model such as, (without limitation as applicable), fire and wind interactions, ignition locations, climate/meteorological and terrain inputs and parameters, and the wildfire fuel mode (e.g. fuel type and fuel moisture); the vulnerability components; and the insured loss components used in the wildfire catastrophe model. The description should be complete and must not reference unpublished work. Additionally, with each version of the model, description of comprehensive validation and verification studies conducted according to the American Institute of Aeronautics and Astronautics (AIAA G-077-1998 Guide for the Verification and Validation of Computational Fluid Dynamics Simulations) and/or other comparable modeling industry standards on model components must be included.

3. Provide a flowchart that illustrates interactions among the major wildfire catastrophe model components.

4. Provide a diagram defining the network organization in which the wildfire catastrophe model is designed and operates.

5. Provide detailed information on the wildfire catastrophe model implementation on more than one platform, if applicable, through completion of Test Case forms showing no differences between platforms. **These forms are contained in the Appendix.**

6. Provide a comprehensive list of complete references pertinent to the wildfire catastrophe model by guideline grouping using professional citation standards.

7. **The following disclosure is only applicable if the wildfire catastrophe model has been used for determination of the projected aggregate losses in a prior rate filing, and previously provided responses to these guidelines and disclosures:** If model components, input data or parameters, or version have been changed, provide the following information related to such changes.

   A. Wildfire catastrophe model changes:

      i. A summary description of changes that affect the residential properties' wildfire loss costs or wildfire probable maximum loss levels for personal lines, commercial lines, or both;

      ii. A list of all other changes; and

      iii. The rationale for each change.

Disclosure G-2 Qualifications of Modeling Organization Personnel and Consultants Engaged in Development of the Wildfire Catastrophe Model

1. Modeling Organization Background

   A. Describe the ownership structure of the modeling organization engaged in the development of the wildfire catastrophe model. Describe affiliations with other companies and entities and the nature of the relationship, if any. Indicate if the modeling organization has changed its name and explain the circumstances.

B. If the wildfire catastrophe model is developed by an entity other than the modeling organization, describe its organizational structure and indicate how proprietary rights and control over the wildfire catastrophe model and its components are exercised. If more than one entity is involved in the development of the model, describe all involved.

C. If the wildfire catastrophe model is developed by an entity other than the modeling organization, describe the funding source for the development of the model.

D. Describe any services other than wildfire modeling provided by the modeling organization.

E. Indicate if the modeling organization has ever been involved directly in litigation or challenged by a governmental authority where the credibility of one of its wildfire catastrophe model versions for projection of wildfire loss costs or wildfire probable maximum loss levels was disputed. Describe the nature of each case and its conclusion.

2. Professional Credentials

A. Provide in a tabular format (a) the highest degree obtained (discipline and university), (b) employment or consultant status and tenure in years, and (c) relevant experience, publications, and responsibilities of individuals currently involved in the acceptability process or in any of the following aspects of the wildfire catastrophe model:
   i. Hazard
   ii. Statistics
   iii. Vulnerability
   iv. Actuarial Science
   v. Computer/Information Science

B. **The following disclosure is only applicable if the wildfire catastrophe model has been used for determination of the projected aggregate losses in a prior rate filing, and previously provided responses to these guidelines and disclosures:** Identify any new employees or consultants (since the previous submission) engaged in the development of the wildfire catastrophe model or the model-related information for this submission.

C. Provide visual business workflow documentation connecting all personnel related to wildfire catastrophe model design, testing, execution, maintenance, and decision-making.

3. Independent Peer Review

A. Provide reviewer names, qualifications, affiliation, and dates of external independent peer reviews that have been performed on the following components as currently functioning in the wildfire catastrophe model:
   i. Hazard
   ii. Statistics
   iii. Vulnerability
   iv. Actuarial Science
   v. Computer/Information Science

B. Provide documentation of independent peer reviews directly relevant to the modeling organization responses to the current guidelines, disclosures, and forms for wildfire catastrophe models. Identify any unresolved or outstanding issues as a result of these reviews.

C. Describe the nature of any on-going or functional relationship the modeling organization has with any of the persons performing the independent peer reviews.

Disclosure G-3 Insured Exposure Location

1. Provide a description of the geographic information system (GIS) software and tools used for geocoding.

2. List the current geospatial databases used by the wildfire catastrophe model and the model components to which they relate. Provide the effective (official United States Postal Service) dates corresponding to the ZIP Code databases, if applicable.

3. Describe in detail how invalid geospatial locations (including ZIP Codes if applicable) are handled.

4. Describe the data, methods, and process used in the wildfire catastrophe model to convert among street addresses, geocode locations (latitude-longitude), and eco-regions or relevant wildfire spatial areas designated by the modeling organization, as well as conversion to ZIP Codes if applicable.

5. List and provide a brief description of each wildfire catastrophe model eco-regions and relevant wildfire spatial-based database, including any ZIP Code-based database, if applicable, and centroids.

6. Describe the process for updating wildfire catastrophe model eco-region and relevant wildfire spatial-based databases, including ZIP Code-based databases if applicable.

Disclosure G-4 Independence of Wildfire Catastrophe Model Components

1. Describe the process used to ensure that the primary components of the wildfire catastrophe model (hazard, vulnerability, and actuarial components) operate independently and do not compensate, calibrate, or adjust for any bias or deficiencies arising from any other component.

Disclosure G-5 Editorial Compliance

1. If relevant given the provided instructions, describe the process used for document control of the submission. Describe the process used to ensure that the paper and electronic versions of specific files are identical in content.

2. If relevant given the provided instructions, describe the process used by the signatories on Expert Certification Forms G-1 through G-7 to ensure that the information contained under each

set of Guidelines and Disclosures is accurate and complete.

Hazard Guidelines For Wildfire Catastrophe Models

Purpose: The purpose of the guidelines under this section is to enable verification that the wildfire events used in the **wildfire hazard model** are realistic by reflecting the range of variation of fire characteristics with respect to their **fire occurrence frequency**, **fire intensity**, **fire severity**, seasonality, and **area burned** representing diverse historical **fire regimes** across California (Wildfire Hazard Guideline-1, abbreviated below as H-1). It will also ensure these events are generated using established concepts, data, equations, and principles as well as best available scientific information and data for determining the fire input parameters, model algorithms, and model assumptions (H-2), such that the probability of fire occurrence, fire intensity, and fire severity of the wildfires in an events catalog or similar data set reasonably reflects the historical record with respect to those fire regimes and geographic locations (H-3). It will ensure that the drivers of fire occurrence frequency and behavior are represented in a way that is scientifically sound and appropriate for the modeling approach taken (H-4). It will demonstrate appropriate consideration for weather considerations and climate change (H-5 and H-6). Finally, each of the individual components of the wildfire hazard model including associated **sub-models** shall be validated (H-7).

Guideline H-1. Base Wildfire Set

*The **Base Wildfire Set** should be developed based on past wildfire events using existing historical wildfire dataset(s) such as the National Interagency Fire Occurrence Sixth Edition (or later, incorporating 1992-2020 for ignitions), CAL FIRE's FRAP FOD 9 (incorporating 1950 – present for fire perimeters and area), and the interagency MTBS (incorporating relevant periods from 1984 to present for past fire occurrence, burned area boundary, and burn severity). Different data sets may be used and combined, but justification must be provided, for instance, including fire severity data for the largest fires (MTBS) with a wider range of fire perimeters (CAL FIRE FRAP FOD 9).*

A wildfire hazard model may be constructed in any scientifically sound and defensible fashion, including through appropriate, scientifically-sound climate change-related weather input adjustments and through justified adjustments to the Base Wildfire Set. However, annual frequencies used in wildfire hazard model/sub-model validation shall be based upon the Base Wildfire Set chosen, allowing for modifications if justified. The model's characteristics, assumptions, and sensitivity to spatiotemporal resolutions should be transparent and disclosed for each version.

Guideline H-2. Wildfire Hazard Model Inputs, Parameters, and Characteristics

Wildfire inputs, parameters, and characteristics in this section are specifically those that relate to physical conditions to simulate the range of possible ignitions and fire spread. Methods for depicting all modeled wildfire parameters and characteristics both spatially and, if applicable, temporally, shall be based on information documented in current scientific and technical literature. This pertains to fuel type, loading, and fuel moisture content (live and dead, if used), ambient temperature, soil and air moisture content, windspeeds and directions, topographical features, conversion factors, climate-related adjustments, and any other parameters and characteristics. Model-specific variables, including *ember distribution adjustments, crown fire transition and fire acceleration, must be denoted and justified for each version of the model. If fires in urban areas (structures, etc.) are represented in the model, provide details on applied inputs and characteristics used in urban conflagration models to represent their combustion, fire spread,*

and abatement, including the impact of mitigation measures such as defensible space, home hardening, and surrounding fuel treatments, if appropriate.

Representation and treatment of ignition sources, natural and human, including utility sources, shall be consistent with current state-of-the-science and shall be implemented with appropriate geographic-information-system data, accounting for empirically determined probabilistic spatial distributions. Specific detail of the ignitions used, including their spatial extent and variations due to, at a minimum, population, roads, and power infrastructure should be detailed. Modifications to ignition risk because of mitigation and resiliency efforts, such as due to utility and other infrastructure mitigation efforts, should be detailed if incorporated. The ideal treatment of ignition sources would be probabilistic and account for the spatial patterns of both lightning and human caused ignitions. Wildfire hazard models shall use clearly described methods for fire spread simulation and/or determining output parameters and characteristics including fire intensity, flame length, ember deposition, and/or any other relevant fire behavior outputs from the model. Incorporation of the effects of fuel treatments, prescribed burning, and other wildfire-related landscape and fuels management, whether in the model or underlying fuels layers, should be justified and clearly described.

Guideline H-3. Wildfire Probability Distributions

Modeled probability distributions of wildfire occurrence and burned area shall be shown to be consistent with the chosen historical wildfire dataset(s) in California. Frequency distributions of fire occurrence, burned area, and inter-annual variability should be compared between model outputs and the historical database for eco-regions and/or other relevant, justified spatial areas that are fire prone, and take into account changing fire regimes across the State. Fire severity or other relevant exposure metrics should be compared if model outputs and input historical databases with this data are applicable. Output comparisons should also be provided for selected low, average, and highly active fire seasons. Seasonality impacts should also be addressed in some comparisons.

Modeled wildfire frequency distributions shall reflect the Base Wildfire Set used for different return period for wildfires and shall be consistent with those observed for each wildfire-prone segment of California. Deviations from the Base Wildfire Set should be discussed and quantitatively compared with physical justifications and, if appropriate, additional data to justify provided results.

Wildfire sub-models shall be calibrated to or consider observed wildfire frequency distributions within California's border and wildfires that may spread across California state lines including through urban conflagration.

Any functions required to adjust the Base Wildfire Set or its outputs in order to develop frequency distributions as a function of location should be detailed and justified. This includes functions to adjust ember distribution and spread into developed areas.

Guideline H-4. Wildfire Fuel Model

*A spatial fuel map incorporating a current version of LANDFIRE or an alternate appropriate dataset shall be used for the full range of chosen conditions in support of a **fuel model** simulating fire occurrence frequency, intensity, severity, and area burned. Use of alternate datasets, modifications to LANDFIRE, or other chosen datasets for fuel treatments, past fire occurrence, or other appropriate changes shall be justified with details provided on resolution, methodology, and update frequency.*

Data used to represent vegetation and vegetation management for fuel loading shall be regularly updated with methods and data sources clearly indicated. If urban fuel data is used similar information shall be provided. Details should be provided on resolution, methodology, and update frequency.

The translation of land use and land cover or other source information into fuel loading and wildfire spread shall be consistent with current state-of-the-science and shall be implemented with appropriate geographic-information-system data.

Representation of topography, including slope, and translation to wildfire rate of spread across the landscape shall be consistent with current state-of-the-science and shall be implemented with appropriate geographic-information-system data.

Landscape area fuel treatments and forest management actions shall be represented in the model for the full range of simulated fire-weather conditions, including extreme events and worst-case scenarios.

Guideline H-5. Weather inputs

*Input weather conditions (such as wind speed, wind direction, wind gust, temperature, and humidity) used to initialize wildfire hazard models shall be clearly defined and cited. The spatial and temporal resolution of the weather inputs shall be specified. Any processing applied to input data to generate value-added weather inputs (e.g., **downscaled** or bias corrected) such as weather modeling (e.g., dynamical modeling) and **downscaling** (e.g. WindNinja, use of artificial intelligence methods), shall be described in detail. In cases where value-added approaches are used, details of the original forcing data used shall be specified.*

While there is no standard or benchmark for weather inputs, sufficient justification shall be provided on how the weather inputs are used to both reflect localized weather specific to fire hazards in the state and to account for sufficient variability in capturing fire weather conditions, including extreme events commensurate with observed or modern climatology.

Weather inputs shall be validated against reference 'observation' datasets. These data may include in-situ data from Remote Automated Weather Stations (RAWS), output from NOAA's Real-Time Mesoscale Analysis (RTMA), among others. Validation shall consider issues related to station siting and quality control for in-situ observations, where appropriate, and span a representative portion of the state. Validation efforts should at minimum include statistics related to mean, variability, and extremes for individual meteorological variables.

Guideline H-6 Present Day Climate Change Adjustments

Describe efforts for modernizing weather datasets to account for ongoing changes in climate. Justification for the methods used in codifying climate change adjustments should be consistent with Established concepts, data, equations, and principles as well as best available scientific information and data. Weather data should target contemporary conditions for the rate period. As such, relying exclusively on historical data or very short records (e.g., last five years) may not be well suited to assess current hazard. Efforts to account for present day climate change adjustments can include statistical incorporation of recent trends or incorporation of output from climate model simulations. Uses of climate model output in present day climate change adjustments shall consider uncertainty in selection of climate model(s), climate forcing scenario(s), and use of ensembles. Details of the datasets and approaches used to augment the weather inputs and how such adjustments alter the distribution (e.g.,

means and variance of individual weather variables). This includes specifying which variables were or were not adjusted, and the justification for doing so.

Climate change adjustments shall be quantified through the depiction of changes in attributes of individual variables. Likewise, models that calculate and use weather inputs to calculate fuel moisture should articulate how fuel moisture changes due to present day climate change adjustments.

Guideline H-7. Wildfire Hazard Model Validation

*All individual components of the wildfire hazard model (including the sub-models or components for fire spread, crown fire transition, ember transport and other components referenced in H-1 to H-6) shall be fully justified and, where appropriate, validated in accordance with each such section against existing comparison points such as analytical models, the **Reference California Historical Wildfire Dataset**, individual wildfire event data, and/or other scientifically-accepted methods.*

The sensitivity of the overall wildfire hazard model to model inputs, especially those that have limited existing justification (such as ember parameters and fire acceleration) should be provided. Existing scientific literature used to develop the model, adjustments made to the model to fit to specific datasets, and any "tuning" or adjustments of the model to fit specific outputs or metrics should be explicitly detailed.

Hazard Disclosures For Wildfire Catastrophe Models

Disclosure H-1 Base Wildfire Set

1. Specify the historical wildfire dataset(s) release date and the time-period used to develop and implement fire occurrence frequency and behavior characteristics, such as fire intensity, fire severity, and fire perimeters, into the wildfire hazard model.

2. If the modeling organization has made any modifications to the historical wildfire dataset(s) or to the Base Wildfire Set related to fire occurrence frequency and behavior characteristics, provide justification for such modifications.

3. Include a flowchart illustrating how changes in the historical wildfire dataset(s) and Base Wildfire Set(s) database are used in the calculation of wildfire distribution, including with respect to both fire occurrence frequency and area burned.

4. If the wildfire hazard model and/or any associated sub-models incorporate systematic modification of the historical data leading to differences from the historical wildfire dataset(s), describe how this is incorporated and provide comparisons to the Base Wildfire Set and modeled wildfire events (stochastic event set), including fire occurrence frequency and area burned.

5. If the modeling organization has accounted for climate change in either developing stochastic events set(s) based on the historical record or modifying other components in the wildfire hazard model development, (i) specify additional data, databases, and modifications used and (ii) justify their use and explain their impact in modeling California fire occurrence frequency and behavior characteristics in view of the peer-reviewed scientific literature and in relation to the model's assumptions and sensitivity to spatiotemporal resolutions.

6. If the modeling organization has accounted for changes in fuels or other input variables to account for changes **not** related to climate change in the wildfire hazard model development, such as the impact of fuel treatments, (i)specify additional data, databases, and modifications used and (ii) justify their use and explain their impact in modeling California fire occurrence frequency and behavior characteristics in view of the peer- reviewed scientific literature and in relation to the model's assumptions and sensitivity to spatiotemporal resolutions.

Disclosure H-2 Wildfire Hazard Model Inputs, Parameters, and Characteristics

1. Identify the wildfire inputs and parameters related to physical conditions referenced in the corresponding guideline that are used in the wildfire hazard model to simulate the range of possible ignitions and fire spread, and provide justification, including with respect to: the dataset basis for fitted distribution; the methods used, including to represent spatial parameters and temporal parameters if applicable; any smoothing techniques employed; and citations to relevant peer-reviewed scientific literature as applicable.

2. Describe the method, reason, and supporting material for selecting wildfire parameters, including with respect to urban conflagration (such as building materials) to represent combustion, fire spread, and abatement in urban areas.

3. Identify whether wildfire parameters are modeled as random variables, functions, or fixed values for the stochastic events set. Provide rationale for the choice of parameter representations.

4. Describe if and how any wildfire parameters are treated differently in the Base Wildfire Set and stochastic events set(s) and provide rationale.

5. Describe the spatiotemporal treatment of fire intensity, flame length, crown fires, ember deposition and any other relevant fire behavior parameters (which alternatively can be disclosed in conjunction with the treatment of fuel loads and weather in H-4 and H-5 below).

6. Describe whether and how fuel moisture content is calculated from the weather inputs. Provide specific equations or methods and how these data are used in the fire model (e.g., does the model account for dynamic fuel moisture driven by changing weather conditions?).

7. Describe the representation and treatment of ignition sources (natural and human), including utility sources, consistent with current state-of-the-science and empirically determined probabilistic spatial distributions. Describe, if incorporated, modifications to ignition risk because of mitigation and resiliency efforts, such as due to utility and other infrastructure mitigation efforts. Describe any adjustments to ignition risk depending on weather (e.g., as it affects power infrastructure ignition risk).

8. Describe and justify the incorporation of the effects of fuel treatments, prescribed burning, and other wildfire-related landscape and fuels management, whether in the model or underlying fuels layers.

9. Describe the historical wildfire dataset(s) used as the basis for the Base Wildfire Set, including resolution. Discuss the appropriateness of the wildfire stochastic events set with reference to the historical wildfire dataset(s).

10. If the Base Wildfire Set is partitioned or modified, describe how the wildfire parameters are affected.

11. Describe any evolution over time of the functional representation of wildfire parameters during an individual wildfire life cycle, such as fire-weather interactions and fuel moisture modifications.

Disclosure H-3 Wildfire Probability Distributions

1. Provide a complete list of the assumptions used in creating the wildfire stochastic events sets or other datasets based on the Base Wildfire Set.

2. Provide a map and the criteria used by the modeling organization to delineate appropriate wildfire eco-regions/pyromes/wildfire-specific spatial areas for the State of California.

3. Provide a brief rationale for the probability distributions used for all wildfire input parameters and characteristics, including to develop frequency distributions as a function of location and temporal variability and, if specifically modeled, inclusive of wildfires that spread across state lines including through urban conflagration. Demonstrate the quality of fit.

4. **The following disclosure is only applicable if the wildfire catastrophe model has been used for determination of the projected aggregate losses in a prior rate filing, and previously provided responses to these guidelines and disclosures:** If changes are subsequently made to the model or any input parameters, describe and justify any changes made and how the new wildfire stochastic events set relate to the Base Wildfire Set from the previously reviewed wildfire hazard model. Describe the methodology used to make such changes.

5. Provide one or more graphics that compares the distribution of modeled wildfire occurrence frequency and burned area with the Base Wildfire Set, including with respect to seasonality.

Disclosure H-4 Wildfire Fuel Model

1. Describe the source and specific spatial fuel map(s) used for the full range of simulated fire-weather conditions. If they change dynamically, describe the methods for this change and show examples. If spatial fuel maps were modified, detail and justify every modification and provide examples of the modified spatial fuel map(s).

2. Describe dataset(s), methodology, resolution and update frequency used to account for variation of fuel loading in the wildfire hazard model where applicable, including with respect to fuel treatments and any other forest management actions, as well as past fire occurrence frequency. Document and justify any difference in the methodology for treating historical and stochastic events sets.

3. If wildland-urban interface (WUI) fuels, urban fuels, or both are accounted for in the model, describe how they are parameterized and included.

4. Identify all non-meteorological variables (including topography, slope, and fuels) that affect fire intensity estimation or wildfire rate of spread.

5. Provide the collection and publication dates of the land use and land cover data used in the wildfire hazard model and justify their timeliness for California.

6. Describe the methodology used to convert land use and land cover information into a spatial distribution of fuel loading in California if used to generate the fuel layers.

7. Describe any variations in the treatment of weather and ignition in relation to fuel and fuel moisture in the wildfire hazard model for stochastic versus historical events and justify this variation.

Disclosure H-5 Weather Inputs

1. Describe and cite the source(s) of all the weather data used. Include all the variables that are used, their spatial and temporal attributes, and, as applicable, methodology related to create means, variability, and extremes for individual meteorological variables.

2. Provide a rationale for how the selected weather inputs reflect localized weather specific to fire hazards for the timespan being simulated.

3. Provide a rationale for how the selected weather inputs account for sufficient variability in extreme fire weather conditions commensurate with modern climatology.

4. Describe any methodology used to process the weather data (e.g., bias correction, downscaling efforts). Provide justification and citations to existing literature where relevant.

5. Detail how air moisture and fuel moisture content is calculated from weather inputs. Provide specific equations or methods of how this is accomplished.

6. Demonstrate the consistency of the weather inputs with observed data, including for extreme fire weather conditions. Comparisons of the weather inputs should at least be shown for wind speed and relative humidity. Describe and justify the appropriateness of the weather inputs taken from weather databases used in the weather validation to represent annual and seasonal variations as well as to appropriately capture extreme fire events that drive losses.

Disclosure H-6 Present Day Climate Change Adjustments

1. Describe the approach used to account for ongoing changes in climate in adjusting weather inputs to present day conditions. Specify any ancillary datasets (e.g., climate models) used to account for

such changes and any statistical processing used.

2. Specify which variables were adjusted in cases where only a subset was changed and provide justification.

Disclosure H-7 Wildfire Hazard Model Validation

1. Please provide a schematic or diagram that represents the overall architecture of the wildfire hazard model, including all components (inputs, parameters including other sub-models/model components, and outputs).

2. For each sub-model or model component, specify the sub-model or model component; how it is modified and validated, including, but not limited to, by comparing trends or with past fires; and cite papers and sources. Provide a justification for any specific sub-model or model component that is not validated.

Statistical Guidelines For Wildfire Catastrophe Models

Purpose: The purpose of the guidelines under this section are to ensure that the statistical models underpinning the wildfire catastrophe model are implemented using established concepts, data, equations, and principles as well as best available scientific information and data, insurance claim expertise, and other assumptions appropriate for the risk or peril being modeled such that: the various models and sub-models contained within the wildfire catastrophe model, including the wildfire hazard model, are reasonably and methodically designed (Statistical Guideline for Wildfire Catastrophe Models 1, abbreviated below as S-1); the outputs from models and sub-models within the wildfire catastrophe model are appropriately sensitive to input parameters and result in reasonable overall loss outputs (S-2); the statistical models properly analyze and quantify uncertainty throughout the catastrophe model (S-3); and the probabilistic catastrophe model is interpretable and has been run enough times such that the standard error of the wildfire output range is appropriately bounded and can be considered negligible and any differences between historical and modeled annual average statewide wildfire losses are statistically plausible and explainable (S-5). Many aspects of wildfire catastrophe model development and implementation involve fitting a probability distribution to historical data, for example, in generating stochastic events that comprise the wildfire stochastic events set in the wildfire hazard module. These fitted statistical models need to be rigorously checked to ensure that the distributions reflect the current and projected state of the climate and wildfire related inputs and that the sensitivity of the outputs to perturbations are reasonable and interpretable.

Guideline S-1. Modeled Results and Goodness-of-Fit

The use of historical data in developing the wildfire catastrophe model and other models and sub-models shall be supported by rigorous and reproducible methods published in current scientific literature and relevant technical documents.

Modeled and historical results shall reflect reasonable statistical agreement using current scientific and statistical methods for the academic disciplines appropriate for the components and characteristics of the various models and sub-models, including the wildfire hazard model.

Guideline S-2. Sensitivity Analysis for Wildfire Catastrophe Model Output

The modeling organization shall have assessed the sensitivity of temporal and spatial outputs throughout the various models and sub-models with respect to the simultaneous variation of input variables using current scientific and statistical methods in the appropriate disciplines and shall have taken appropriate action so that interactions and correlations among the input variables result in reasonable and justifiable overall model loss outputs and loss projections.

Guideline S-3. Uncertainty Analysis for Wildfire Catastrophe Model Output

The modeling organization shall have performed an uncertainty analysis on the temporal and spatial outputs of the wildfire catastrophe model using current scientific and statistical methods in the appropriate disciplines and shall have taken appropriate action to identify those variables that contribute to the uncertainty so as to reduce uncertainty in the outputs and *result in reasonable and justifiable overall model loss outputs and loss projections. The analysis shall identify and quantify the extent that input variables impact the uncertainty in wildfire catastrophe model output as the input variables are simultaneously varied.*

Guideline S-4. Aggregation & Convolution Levels

At all spatial convolution and temporal aggregation levels, the contribution to the error in wildfire loss cost estimates attributable to the sampling process shall be plausible and explainable, and shall have taken appropriate action to significantly minimize divergence due to sampling differences so that the contribution to the error in wildfire loss estimates is negligible.

Guideline S-5. Replication of Known Wildfire Losses

*The wildfire catastrophe model shall estimate incurred wildfire losses in an unbiased manner on a sufficient body of past wildfire events, which represents the diversity of observed event types and losses, from more than one company or source (at least three), including open-source community-driven datasets spanning a full range of housing densities that include the Wildland Urban Interface (WUI) zones (e.g. DINS dataset), and with narrative explanations of how the dataset is sufficiently robust and comprehensive, including the most current data available to the modeling organization. This guideline applies separately to **personal residential property** losses and, to the extent data are available, to **commercial residential property** losses. Personal residential property wildfire loss experience may be used to replicate commercial losses for the habitational structure-only and contents-only portion of the wildfire losses. The replications shall be produced on an objective body of wildfire loss data by eco-region and/or other relevant, justified spatial areas.*

Guideline S-6. Comparison of Projected Wildfire Loss Costs

The difference due to uncertainty between historical and modeled annual average statewide wildfire loss costs shall be statistically plausible, explainable, and justifiable using scientific literature and statistical methods that are consistent with the body of data and established statistical expectations and norms.

Statistical Disclosures For Wildfire Catastrophe Models

Disclosure S-1 Modeled Results and Goodness-of-Fit

1. Identify the framework that governs the spatiotemporal statistical modeling approach used for the wildfire loss estimates and the overall model outputs including the inference and diagnostic methods, and reasoning for computation of posteriors.

2. Identify details of the statistical methods used for data analysis, including: characterizing any correlations or statistical dependence between the relevant model inputs at each stage or sub-model (*e.g.* by providing linear or nonlinear correlation coefficients, or joint probability distributions of the relevant parameters that goes into, for example, the wildfire hazard model, the vulnerability model(s), the actuarial and financial model(s)); and documenting the effects or influence of the inputs on those model's output(s) and on the overall inferred outcomes (*e.g.* if applicable, conducting feature importance or similar analysis).

3. Describe the name, type, and purpose of the tests performed to validate the generated loss outputs/ results of the wildfire catastrophe model. Additionally, elaborate on the details of the test statistics such as degrees-of-freedom, confidence statement, level of significance, and power of the test.

4. Provide the dates and location of wildfire loss of the insurance and wildfire claims data used for

validation and verification of the wildfire actuarial and financial model.

5. Provide an assessment of uncertainty in wildfire **probable maximum loss** levels and **wildfire loss costs** for wildfire output ranges at the appropriate spatiotemporal scales using confidence intervals or other scientific characterizations of uncertainty.

    - Characterize the selected error metrics (e.g., if applicable, RMSE, L-Infinity, MAE) between the modeled wildfire losses and the observed or known wildfire losses for different scales of aggregations through space and time.

6. Justify any differences between the historical and modeled loss outputs/results by demonstrating statistical agreement using current scientific and statistical methods relevant to the academic disciplines associated with the various wildfire catastrophe model components or modules.

7. Provide graphical comparisons of modeled and historical data and goodness-of-fit tests for the wildfire hazard model, the vulnerability model(s), the actuarial/financial model(s), and the overall wildfire catastrophe model (Examples to include are fire occurrence frequencies, area burned, and physical damages.) The following items may be included:

    - For final model outputs: Difference between individual incurred historical losses and modeled losses at different spatial and temporal aggregation levels.

    - For fire models, if variables and outputs exist in the modeling pipeline, the following may be used, for example:

        - Difference between observed and modeled area burned at different spatial and temporal scales.

        - Difference between observed and modeled number of habitational structures damaged (found in the burnt area) at different spatial scales.

        - Difference between reported and modeled fire arrival times at different spatial scales.

Disclosure S-2 Sensitivity Analysis for Wildfire Catastrophe Model Output

1. Identify the most sensitive aspect of the wildfire hazard model, the vulnerability model(s), the actuarial/financial model(s), and the overall wildfire catastrophe model and the basis for making this determination.

2. Identify any variables with imposed constraints on their range and justify the range as realistic and plausible based on scientific and academic research and principles.

3. Identify the aspect or parameter of the wildfire catastrophe model with the greatest contribution to the outputs under full range of model runs and the basis for making this determination. Describe the degree to which these sensitivities affect output results and provide illustrative examples.

4. Describe how other aspects of the wildfire catastrophe model may have a significant impact on the sensitivities in output results and the basis for making this determination.

Disclosure S-3 Uncertainty Analysis for Wildfire Catastrophe Model Output

1. Identify the major contributors to the uncertainty in wildfire catastrophe model outputs, the basis for making this determination, and the quantification for each of those major contributors. Provide a full discussion of the type and direction (forward propagation, inverse propagation) of the uncertainties and the degree to which they affect output results and illustrate with relevant examples.

2. Describe how other aspects of the wildfire catastrophe model or their combined effects may have a significant impact on the uncertainties in modeled loss outputs and loss results and the basis for making this determination. In case of a multicomponent catastrophe model, provide characterization of uncertainty for each component or module (*e.g.* hazard module, vulnerability module, and the actuarial/financial module), and describe the input and output uncertainties once all components are connected.

3. Describe and justify any action or inaction as a result of the uncertainty analyses performed.

Disclosure S-4 Aggregation & Convolution Levels

1. Describe and justify the sampling, aggregation plan, and the adopted spatiotemporal resolution used to obtain the average annual wildfire loss costs and wildfire loss output ranges. For example, for a Monte Carlo simulation, indicate steps taken to determine sample size. For an importance sampling design or other sampling scheme, describe the underpinnings of the design and how it achieves the required performance.

2. Document and describe the influence of the sampling and aggregation methods used in the sensitivity analysis section.

3. Describe and justify any action or inaction as a result of the sampling analyses performed.

Disclosure S-5 Comparison of Projected Wildfire Loss Costs

1. Describe the name, purpose, details and results of the analyses and statistical tests performed to validate the wildfire loss projections generated separately for personal and commercial residential property wildfire losses. Include analyses for the multiple wildfire seasons and sample population that represents the diversity of the observed event types and losses, including representative of the various eco-regions or other relevant wildfire-specific spatial areas, to the extent data are available.

2. Identify and justify differences, if any, in how the wildfire catastrophe model produces wildfire loss costs for specific historical events versus wildfire loss costs for events in the wildfire stochastic events set.

Vulnerability Guidelines For Wildfire Catastrophe Models

Purpose: The purpose of the guidelines under this section are to ensure that the data and **models** used to estimate **vulnerability** for **personal** and **commercial residential buildings** are developed and documented appropriately and support the downstream impact on modeled losses (**average annual losses** and **probable maximum loss** levels) including from the treatment of uncertainties. This includes ensuring that appropriate methodology and relevant factors (including, but not limited to, building design, features, and materials; wildfire-related building codes; building elements; and characteristics and separation from other surrounding habitational structures and secondary and appurtenant structures) are incorporated into building wildfire **vulnerability functions** (Wildfire Vulnerability Guideline-1, abbreviated below as V-1). It also includes ensuring that wildfire vulnerability functions and estimated damages are appropriately affected by habitational building contents characteristics in relation to characteristics of the wildfire and relevant habitational building structure(s) (V-2), and that the time element of wildfire vulnerability functions is appropriately developed, informed by historical damage assessment, claims, and economic data, and documented (V-3), in addition to consideration of the potential impacts of smoke if it is explicitly modeled. These vulnerability guidelines are developed to ensure that the relative influence of wildfire mitigation measures; defensible space and any other potential hazards surrounding the habitational structure that are associated with wildfire structure damage; and other secondary characteristics of the **habitational structure/building**, on the probability of habitational structure damage are appropriately accounted for within the vulnerability model, to the extent not already accounted for in the hazard module or other components of the catastrophe model. Fire mitigation actions associated with the **Safer from Wildfire Framework** should be incorporated in a manner that reasonably reflects analyses using empirical data (V-4).

Guideline V-1. Derivation of Habitational Building Wildfire Vulnerability Functions

Development of the habitational building wildfire vulnerability functions shall be based on evidence found in the scientific literature quantifying the relative importance of different factors associated with structure damage, and at least two or more of the following: (1) insurance claims data, (2) laboratory or field testing, (3) fire dynamics and/or structural modeling and analysis based on experimental and/or empirical research, and (4) post- event site investigations. Any development of the habitational building wildfire vulnerability functions based on structural analysis using experimental and/or empirical research, post-event site investigations, and laboratory or field testing shall be supported by empirical data such as CAL FIRE's Damage Inspection Program (DINS) dataset.

The derivation of the habitational building wildfire vulnerability functions and the treatment of associated uncertainties shall be developed following methods accepted in the scientific literature with appropriate references and justification for the approach taken. Results from the vulnerability functions should be consistent with evidence found in the scientific literature quantifying the relative importance of different factors associated with structure damage.

Habitational building stock classification shall be representative of California construction for personal and commercial residential buildings. To the extent not already accounted for in the hazard module or other components of the catastrophe model, treatment of structure density and separation shall be described and justified.

The derivation and application of wildfire vulnerability functions should account for the relevant

habitational building design, features, and materials; wildfire-related building codes; structural/building elements; and the primary characteristics of and separation from other surrounding habitational buildings and secondary and appurtenant structures, including but not limited to those listed in V-4 below such as: roof type, siding material, vent screens, eaves, windows panes and construction materials, neighboring sheds/outbuilding, flammable decks, and fences. However, to the extent a feature or element is incorporated and considered as part of the primary characteristics of the building/structure when developing the wildfire vulnerability function(s), it should not be cumulatively considered in developing the portion(s) of those vulnerability function(s) that account for wildfire mitigation measures pursuant to V-4 below. If information on building elements is unavailable, year of construction may also be considered as a proxy for building materials and structural elements to the extent supported by empirical data.

Wildfire vulnerability functions shall be separately derived for commercial residential building structures (including the impact from appurtenant structures), personal residential building structures (including the impact from appurtenant structures), and manufactured homes (including mobile homes), as well as differentiating among different building occupancies.

Building wildfire vulnerability functions shall include damage as attributable to ember exposure, radiant heat exposure, direct flame contact and relevant residence time element. The weighting of each should reflect the relative likelihood of each causing structure ignition, based on empirical and historical data in similar ecoregions of California. For example, in most cases, embers are the most common source of structure ignition, followed by radiant heat and direct flame contact.

Guideline V-2. Derivation of Building Contents Wildfire Vulnerability Functions: loss and smoke

Development of the wildfire vulnerability functions for the contents insured within buildings shall be based on data and factors from at least two or more of the following: (1) insurance claims data, (2) laboratory or field testing, (3) fire dynamics and/or structural modeling and analysis based on experimental and/or empirical research, and (4) post- event site investigations.

The relationship between the building and building content wildfire vulnerability functions shall be consistent with, and supported by, the relationship between the occupancy and structure types and the observed historical data. Consideration of the potential impacts of smoke damage may also be included within the building contents vulnerability functions or as separate vulnerability functions if it is explicitly modeled.

Guideline V-3. Derivation of Time Element Wildfire Vulnerability Functions

Development of the time element wildfire vulnerability functions shall be based on the scientific literature, fire dynamics and/or structural modeling and analysis based on experimental and/or empirical research, and supported by at least one of the following: (1) insurance claims data, (2) post-event site investigations and, (3) if justified, relevant economic data and factors such as demand surge. Any development of the time element wildfire vulnerability functions based on post- event site investigations, and fire dynamics and/or structural modeling and analysis based on experimental and/or empirical research, shall be further supported by historical data.

Calculations for the Time Element Wildfire Vulnerability Functions should be based on appropriate and relevant spatiotemporal data with relevant resolutions according to peer-reviewed scientific literature, valid claims data, or other appropriate data sources.

The relationship between the building wildfire vulnerability functions and time element wildfire vulnerability functions shall be consistent with, and supported by, the relationship observed in historical data and relevant insurance claims data as applicable to personal and commercial property residential buildings, including as related to additional living expenses (housing, food, and transportation) and other relevant business interruption losses.

Time element wildfire vulnerability function derivations shall consider the estimated time required to repair or replace the habitational structure/building.

Time element wildfire vulnerability functions shall include time element wildfire losses associated with damage to the infrastructure caused by a wildfire.

Guideline V-4. Wildfire Mitigation Measures and Buildings' Secondary Characteristics

To the extent not already accounted for in the hazard module or other components of the catastrophe model, modeling of wildfire mitigation measures used to improve a building's wildfire resistance, the corresponding effects on wildfire vulnerability, and associated uncertainties shall be theoretically sound and consistent with evidence found in the scientific literature -- including structural modeling, experimental research and/or empirical research- -quantifying the relative importance of different factors associated with structure damage as well as fire dynamics. These measures shall include wildfire-specific construction techniques and mitigation measures that affect the performance of the building and the damage to contents.

The modeling of specific mitigation measures should be multivariate and account for unique combinations of factors characteristic of different properties in different ecoregions, including without limitation, relevant property-level and surrounding vegetation both within and beyond defensible space zones that have been documented as significantly associated with structure damage and destruction; and wildfire-relevant primary and secondary characteristics of buildings and surrounding structures, including but not limited to those listed in below. For example, some structures do not have eaves and some properties have minimal land for creating defensible space. Examples of wildfire mitigation measures to account for include those referenced by the Safer form Wildfires framework and in CCR 2644.9 (d)(1)(A) and (d)(1)(B), but are not limited to those if justified. However, to the extent a feature or element is incorporated and considered as part of the primary characteristics of the building/structure when developing the wildfire vulnerability function(s) pursuant to V-1 above, it should not be cumulatively considered in developing the portion(s) of those vulnerability function(s) that account for wildfire mitigation measures.

The relative ranking and modeled effect of different parcel-level and neighborhood-level mitigation measures should reflect the best available science and should account for nonlinear relationships and interactions with other environmental factors that influence vulnerability, such as slope, topographic position, neighborhood characteristics (like building density, land use, and proximity and continuity), and to the extent incorporated into the vulnerability analysis, moisture content of immediate and surrounding vegetation.

The modeling organization shall justify all wildfire mitigation measures and other secondary characteristics of buildings considered by the wildfire catastrophe model. Application of wildfire mitigation measures that affect the performance of the building and the damage to contents shall be justified as to the impact on reducing damage whether done individually or in combination. Treatment of individual and combined secondary characteristics of buildings that affect the performance of the

building and the damage to contents shall be justified.

Vulnerability Disclosures For Wildfire Catastrophe Models

Disclosure V-1 Derivation of Habitational Building Wildfire Vulnerability Functions

1. **The following disclosure is only applicable if the wildfire catastrophe model has been used for determination of the projected aggregate losses in a prior rate filing, and previously provided responses to these guidelines and disclosures:** Describe any modifications to any of the building vulnerability components of the model since the last version previously submitted.

2. **The following disclosure is only applicable if the wildfire catastrophe model has been used for determination of the projected aggregate losses in a prior rate filing, and previously provided responses to these guidelines and disclosures:** Describe any new insurance company wildfire claims datasets, including catastrophe claims, or other relevant data sources reviewed since the last model version previously submitted. For each new wildfire claims dataset and new data source, indicate if they have been incorporated into the newly submitted model version.

3. Provide a flowchart documenting the process by which the wildfire vulnerability functions for habitational buildings for personal and commercial residential properties are derived and implemented.

4. Describe the nature, source, and extent of any wildfire claims data used to develop the personal and commercial residential building wildfire vulnerability functions, including, as applicable, summarizing laboratory or field testing and post-event site investigations; provide a brief description of the resulting use of these data in the validation of the wildfire vulnerability functions. Describe in detail the breakdown of data into categories such as number of policies, number of insurers, dates of wildfire loss, amount of wildfire loss, number of exposures, and amount of dollar exposure, including treatment of incomplete and missing values; separated into personal residential building structures, commercial residential building structures, and manufactured homes. If the end-user's wildfire claims data can be used in the development of the vulnerability functions or if the end-user can make adjustments to property value or insurance-to-value (ITV) assumptions to the base claims data, identify and justify the range of possible adjustment to the base claims data, including insurance-to-value (ITV) assumptions, assumptions made due to incomplete wildfire claims data, and adjustments for depreciation. Justification for all actual adjustments made for modeling losses for a specific rate filing will need to be submitted with such filing, including a comparison of how those actual adjustments fall within the range of possible adjustments.

5. Describe the assumptions, data other than end-user's wildfire claims data (including Cal Fire damage inspection or insurance industry claims data), methods (*e.g.* statistical modeling using historical data, and fire dynamics and/or structural modeling and analysis based on experimental and/or empirical research), and processes, and justifications for such, used for the development of the building wildfire vulnerability functions and cite the scientific literature supporting the chosen methodology and assumptions. Discussions of assumptions shall include, without limitation, those related to creation of baseline average property values or other property value

indices.

6. Describe the sources, quantification, and treatment of uncertainties associated with the building wildfire vulnerability functions.

7. Describe the categories of the different building wildfire vulnerability functions for personal and commercial residential buildings. Specifically, for every unique building wildfire vulnerability function, include descriptions and consideration in the development of: the building types, building construction elements (including, as applicable, statewide and county wildfire-related building codes and enforcement) and primary building characteristics; structure separation and density, ecoregions or other justified, relevant delineation of distinctive fire regimes within the state of California; year of construction; and occupancy types. Describe and justify assumptions made based on year of construction alone or together with other factors. Provide the total number of building wildfire vulnerability functions available for use in the catastrophe model for personal and commercial residential classifications.

8. Describe the process by which local and statewide fire-fighting practices, or other active fire-suppression strategies are considered in the development of vulnerability functions, if applicable. If any of these factors are also considered in the hazard modeling, describe the process by which their effects are apportioned between hazard and vulnerability analysis.

9. Describe the relationship between wildfire vulnerability functions for habitational buildings/structures and secondary and appurtenant structures, and their consistency with insurance company wildfire claims data, including description and justification for any assumptions regarding the characteristics and treatment of secondary and appurtenant structures.

10. Describe the assumptions, data (including both industry and end-user's insurance wildfire claims data), methods, and processes used to develop building wildfire vulnerability functions when:
    A. residential construction types are unknown.
    B. one or more primary building characteristics are unknown, but one or more wildfire-relevant or secondary characteristics of buildings are known.
    C. one or more wildfire-relevant or secondary characteristics of buildings are unknown.
    D. building input characteristics are conflicting.

11. Identify the direct flame contact, radiant heat exposure, ember exposure or deposition rate, and relevant residence time (e.g., the duration of direct flame contact, radiant heat exposure, and ember exposure) at which the wildfire model begins to estimate damage; if different wildfire behavior-related factor(s) are used to estimate when damage begins (for example, flame height, fire intensity), or if functions are instead based on statistical analysis of historical loss data, describe and provide justification.

12. If relevant, describe the threshold of damage (*e.g.* percentage of damage) at or above which the wildfire catastrophe model assumes a total building loss.

Disclosure V-2 Derivation of Building Contents Wildfire Vulnerability Functions:

loss and smoke

1. **The following disclosure is only applicable if the wildfire catastrophe model has been used for determination of the projected aggregate losses in a prior rate filing, and previously provided responses to these guidelines and disclosures:** Describe any modifications to the content vulnerability component of the model since the last version previously submitted.

2. Provide a flowchart documenting the process by which the contents wildfire vulnerability functions are derived and implemented.

3. Describe the assumptions, data, methods, and processes used to develop and validate the contents wildfire vulnerability functions. Describe and justify assumptions made based on occupancy alone or together with other factors citing scientific literature supporting the chosen methodology and assumptions.

4. Provide the total number of contents wildfire vulnerability functions. Describe whether different and multiple contents wildfire vulnerability functions are used for personal residential building structures, commercial residential building structures, and manufactured homes and the basis for such, including without limitation as applicable, unit location for condo owners, multiplexes, and apartment renters and differentiation between various habitational building and unit classes. Describe as well whether building occupancies are accounted within each such content vulnerability functions.

5. If smoke damage is explicitly modeled, describe the assumptions, data, methods, and processes used to develop and validate the contents smoke-related vulnerability functions and their relationship to the structure and contents wildfire vulnerability functions; if smoke damage is not explicitly modeled, describe the treatment of smoke damage within all of the wildfire vulnerability functions for contents, including with respect to different habitational building and unit classes.

6. Describe the sources, quantification, and treatment of uncertainties associated with the contents' wildfire vulnerability functions.

Disclosure V-3 Derivation of Time Element Wildfire Vulnerability Functions

1. **The following disclosure is only applicable if the wildfire catastrophe model has been used for determination of the projected aggregate losses in a prior rate filing, and previously provided responses to these guidelines and disclosures:** Describe any modifications to the time element vulnerability component of the wildfire catastrophe model since the last version previously submitted.

2. Provide a flowchart documenting the process by which the time element wildfire vulnerability functions are derived and implemented.

3. Describe and justify the assumptions, data, methods, and processes used to develop and validate the time element wildfire vulnerability functions, including time to repair or replace damaged habitational structures and treatment of relevant spatiotemporal data and selection of resolution,

citing scientific literature supporting the chosen methodology and assumptions.

4. Describe how time element wildfire vulnerability functions take into consideration the damage to local and regional infrastructure.

5. Describe the relationship between the different building classes and time element wildfire vulnerability functions.

7. Describe the sources, quantification, and treatment of uncertainties associated with the time element wildfire vulnerability functions.

Disclosure V-4 Wildfire Mitigation Measures and Buildings' Secondary Characteristics

1. **The following disclosure is only applicable if the wildfire catastrophe model has been used for determination of the projected aggregate losses in a prior rate filing, and previously provided responses to these guidelines and disclosures:** Describe any modifications to the treatment of wildfire mitigation measures and secondary characteristics of buildings in the wildfire catastrophe model since the last version previously submitted.

2. Describe the procedures used to calculate the impact of wildfire mitigation measures and secondary characteristics of buildings, including statistical or simulation software, its identification, and current version, and code or scripts if applicable. Describe whether or not such procedures have been modified since the last version previously submitted.

3. Describe how different landscaping features (e.g., defensible space) related to wildfire mitigation measures on the property are considered in the development of the wildfire vulnerability functions and how their treatment compares to other factors in the model. Explain which characteristics of landscaping functions are considered. If any of these factors are also considered in the hazard modeling, describe the process by which their effects are apportioned between hazard and vulnerability analysis.

4. Provide a description of the wildfire mitigation measures and secondary characteristics of buildings used by the vulnerability model.

5. Describe how wildfire mitigation measures and secondary characteristics of buildings are implemented in the vulnerability model. Identify any assumptions.

6. Describe how the effects of multiple wildfire mitigation measures (different building elements, materials, defensible space, and immediate and surrounding vegetation up to 100 feet) and secondary characteristics of buildings are combined in the model and the process used to ensure that multiple wildfire mitigation measures and secondary characteristics of buildings are correctly combined.

7. Describe how building and contents damage are affected by performance of wildfire mitigation measures and secondary characteristics of buildings. Identify any assumptions.

8. Describe how Wildfire mitigation measures and secondary characteristics of buildings affect the uncertainty of the vulnerability. Identify any assumptions

Actuarial Guidelines For Wildfire Catastrophe Models

Purpose: The purpose of the guidelines under this section are to ensure: that the treatment of historical loss data used to calibrate the wildfire catastrophe model and of input data originating from the **end-user** (e.g. insurers) is used throughout the model appropriately and any adjustments or assumptions are explained (A-1); that the losses represent only losses incurred as a result of wildfire and smoke (A-2); that the treatment of insurance coverage is based upon generally accepted actuarial methods (A-3); that **wildfire loss costs** and wildfire **probable maximum losses** are appropriately calculated and incorporate appropriate adjustments (A-4); that the model treatment of policy conditions is based upon generally accepted actuarial methods (A-5); and that modeled wildfire loss costs vary logically according to risk and data (A-6).

Guideline A-1. Loss Data and End-User Input Data

*The modeling organization's use of historical insurance claims data and other post-disaster loss data, including treatment of missing values, to define **catastrophe losses** and to calibrate modeled wildfire losses shall be based upon generally accepted actuarial, underwriting, and statistical procedures.*

All modifications, adjustments, assumptions, end-user inputs and end-user input file identification, and defaults necessary for the end-user to use the wildfire catastrophe model shall be documented and shall be included with the wildfire catastrophe model output report. Treatment of missing values or other edits, inclusions, or deletions for end-user inputs required to run the wildfire catastrophe model shall be documented and described with the output report. All such modifications, adjustments, and assumptions shall additionally be based upon generally accepted actuarial, underwriting, and statistical procedures, and justified and reported.

Guideline A-2. Wildfire Events Resulting in Modeled Wildfire Losses

Modeled wildfire loss costs and wildfire probable maximum loss levels shall reflect all insured damages from wildfires.

The modeling organization shall have a documented definition of wildfire and wildfire-related losses, and specify what other types of loss, if any, are considered and included in the modeled wildfire catastrophe losses and modeled wildfire loss costs, including but not limited to losses from smoke, landslide, debris flow, water damage from the fire suppression, and tree damage.

Guideline A-3. Wildfire Coverages

*The methods used in the calculation of **habitational building** wildfire loss costs, including the effect of law and ordinance coverage, shall be based upon generally accepted actuarial methods.*

The methods used in the calculation of commercial building wildfire loss costs shall be based upon generally accepted actuarial methods

The methods used in the calculation of appurtenant structure wildfire loss costs shall be based upon generally accepted actuarial methods.

The methods used in the calculation of contents wildfire loss costs shall be based upon generally accepted actuarial methods.

The methods used in the calculation of time element wildfire loss costs shall be based upon generally accepted actuarial methods.

Guideline A-4. Modeled Wildfire Loss Cost and Wildfire Probable Maximum Loss Level Considerations

Wildfire loss cost projections and wildfire probable maximum loss levels shall not include expenses, risk load, investment income, premium reserves, taxes, assessments, profit margin, or any other type of loading.

Wildfire loss cost projections and wildfire probable maximum loss levels shall be capable of being calculated from exposures at the model's finest level of resolution (such as geocode or latitude-longitude level of resolution). The spatial resolution shall be defined and documented by the modeling organization.

Demand surge *and/or post loss amplification shall be included in the wildfire model's calculation of wildfire loss costs and wildfire probable maximum loss levels using relevant data, generally accepted actuarial and economic methods, and reasonable assumptions.*

Guideline A-5. Wildfire Policy Conditions

Generally accepted actuarial methods shall be used in the development of mathematical distributions to reflect the effects of deductibles and policy limits.

The relationship among the modeled deductible wildfire loss costs shall be reasonable.

Guideline A-6. Wildfire Loss Outputs and Logical Relationships to Risk

For each of the logical relationships listed below, the methods and assumptions used in the estimation of wildfire loss costs and wildfire probable maximum loss levels in relation to those variations shall be based upon generally accepted actuarial methods and generally accepted practices covered by one or more of the Guidelines in other sections of this guidance.

A. *Unless justified by (1) scientific literature, (2) laboratory or field testing, (3) fire dynamics and/or structural modeling and analysis based on experimental and/or empirical research, and/or (4) post-event site investigations and historical data, wildfire loss costs shall exhibit a logical relation to risk, varying in an appropriate and proportionate manner in relation to changes in the risk factors, such that wildfire loss costs shall not exhibit a significant change when the underlying risk does not change significantly and likewise only exhibiting a significant change when there is justification for a significant change in the assessment of the underlying risk.*

B. *Wildfire loss costs produced by the wildfire model, or changes in wildfire loss costs due to increase in localized risk, shall be positive and non-zero for all valid and impacted localized areas (appropriate geospatial area), and shall not be negative for all other non-impacted California areas.*

C. *Wildfire loss costs cannot increase as the quality of construction type, materials, and workmanship increases, all other factors held constant.*

D. *Wildfire loss costs cannot increase as the presence of fixtures or construction techniques designed for hazard mitigation increases, all other factors held constant.*

E. *Wildfire loss costs cannot increase as both the presence of individual structure and property-level mitigation and/or the presence of community hazard mitigation measures increases, all other factors held constant.*

F. *Wildfire loss costs cannot increase as the fire-resistant design provisions and materials increase, all other factors held constant.*

G. *Wildfire loss costs cannot increase as the amount of structure separation increases within the defensible space and the extent of mitigation actions within the defensible space increases, all other factors held constant.*

H. *Wildfire loss costs cannot increase as wildfire-related building code enforcement increases (e.g., Chapter 7-A of the California Building Code and any further modifications and NFPA-1144), all other factors held constant.*

I. *Wildfire loss costs shall decrease as deductibles increase, all other factors held constant.*

J. *The relationship of wildfire loss costs for individual coverages (e.g., habitational building, appurtenant structure, contents, and time element) shall be consistent with the coverages provided.*

K. *Wildfire output ranges shall be logical for the type of risk being modeled and apparent deviations shall be justified.*

L. *For wildfire loss cost and wildfire probable maximum loss level estimates derived from and validated with historical insured wildfire losses, the assumptions in the derivations concerning (1) construction characteristics, (2) policy provisions, (3) coinsurance, and (4) contractual provisions, shall be appropriate based on the type of risk being modeled.*

Actuarial Disclosures For Wildfire Catastrophe Models

Disclosure A-1. Loss Data and End-User Input Data

1. Describe the data, methods and assumptions used to calibrate modeled wildfire losses based on historical insurance claims or other post-disaster loss data, including how wildfire catastrophe losses were defined, ascertained, and apportioned from such claims or post-disaster loss data.

2. Detail and justify how insurance-to-value (ITV) assumptions to end-user's input data and exposures that are being modeled regarding property values, depreciation, and actual cash value impact the resulting modeled wildfire damage and loss. If relevant, provide example calculations showing the impact of varying ITV assumptions (e.g., 100% vs. 80%). This disclosure and justification are in addition to and distinct from the disclosure in Vulnerability Disclosures, V-1(4).

3. Detail what policy form types (residential such as homeowners, dwelling property, manufactured homes, tenants, and condo unit owners; habitational commercial such as building and personal property, condominium association, and business income) are supported by the model.

4. Detail what deductible options (e.g., percentage, dollar) are supported and how deductibles and coverage limits are used by the catastrophe model. Provide example calculations for each type of deductible showing the interaction between damage, deductible, limits, and insured loss.

5. Provide a copy of the end-user input form(s) used by the wildfire catastrophe model with the options available for selection by the end-user for the California wildfire catastrophe model under review. Describe the process followed by the end-user to generate the output(s) produced from the input form. Include the wildfire catastrophe model name, version identification, and platform identification on the input form. All items included in the input form should be clearly labeled and defined.

6. Disclose the specific inputs required to use the wildfire catastrophe model. Provide an example of the wildfire catastrophe model output report including the wildfire catastrophe model name, version identification, and platform identification. All items included in the output report should be clearly labeled, highlighted, and defined.

7. Provide a list of all options available (including, but not limited to, demand surge and vulnerability functions) to the end-user.

8. Describe actions performed to ensure the validity of the end-user or other input data used for wildfire catastrophe model inputs or for validation/verification. Describe the actions recommended to users for ensuring the validity of the end-user input data used and validation/verification and provide relevant documentation.

9. Disclose if and how changing the order of the wildfire catastrophe model input exposure data produces different modeled output or results.

10. Disclose if removing or adding policies from the wildfire catastrophe model input file affects the modeled output or results for the remaining policies.

Disclosure A-2. Wildfire Events Resulting in Modeled Wildfire Losses

1. Disclose the definition or parameters/distinctions used to categorize wildfire losses as catastrophic or to segregate wildfire losses from other fire-related losses, including with respect to partial losses.

2. Describe how damage from wildfire model generated fires is excluded or included in the calculation of wildfire loss costs and wildfire probable maximum loss levels for California, including the treatment of wildfires originating outside California that spread across state lines including through urban conflagration.

3. Identify any and all components of wildfire-related damage (including without limitation fire, smoke, landslide, debris flow, water damage from fire suppression, and tree damage) and describe how each such component is treated in the calculation of wildfire loss costs and wildfire probable maximum loss levels for California.

Disclosure A-3. Wildfire Coverages

1. Describe the methods used in the wildfire catastrophe model to calculate wildfire loss costs for habitational building coverage associated with personal and commercial residential properties.

2. Describe the methods used in the wildfire catastrophe model to calculate wildfire loss costs for appurtenant structure coverage associated with personal and commercial residential properties.

3. Describe the methods used in the wildfire catastrophe model to calculate wildfire loss costs for contents coverage associated with personal and commercial residential properties.

4. Describe the methods used in the wildfire catastrophe model to calculate wildfire loss costs for time element coverage associated with personal and commercial residential properties.

5. Describe the methods used in the wildfire catastrophe model to account for law and ordinance coverage associated with personal residential properties and, as applicable, commercial residential properties.

Disclosure A-4. Modeled Wildfire Loss Cost and Wildfire Probable Maximum Loss Level Considerations

1. Describe the method(s) used to estimate wildfire loss costs and wildfire probable maximum loss levels and the treatment of associated uncertainties. Identify any source documents used and any relevant research results.

2. Identify all possible resolutions available for the reported wildfire loss output ranges. Identify the finest level of resolution (i.e., the most granular level) for which wildfire loss costs and wildfire probable maximum loss levels can be provided.

3. Describe how the wildfire catastrophe model incorporates demand surge and/or post-loss amplification in the calculation of wildfire loss costs and wildfire probable maximum loss levels and provide ratios of wildfire loss costs and wildfire probable maximum loss with and without demand surge and with/without each other post loss amplification mechanisms. Provide the range of demand surge used.

4. Provide citations to published papers, if any, or modeling-organization studies that were used to develop how the wildfire catastrophe model estimates demand surge and/or post-loss amplification.

5. Describe how and to what degree wildfire loss costs and wildfire probable maximum loss levels have been validated (e.g., comparisons to past insurance experience, independent reviews, and studies).

Disclosure A-5. Wildfire Policy Conditions

1. Describe the methods used in the wildfire catastrophe model to treat deductibles (both flat and percentage), policy limits, and insurance-to-value criteria when projecting wildfire loss costs and wildfire probable maximum loss levels. Discuss data or documentation used to validate the method used by the wildfire catastrophe model.

2. Describe if and how the wildfire catastrophe model treats policy exclusions and loss settlement provisions.

3. Describe if and how the wildfire catastrophe model treats hours clauses.

Disclosure A-6. Wildfire Loss Outputs and Logical Relationships to Risk

1. **The following disclosure is only applicable if the wildfire catastrophe model has been used for determination of the projected aggregate losses in a prior rate filing, and previously provided responses to these guidelines and disclosures:** Describe and detail modifications to the financial module/component of the wildfire catastrophe model since the last version previously submitted.

2. Describe the calculation of uncertainty intervals.

3. Describe how the wildfire catastrophe model produces wildfire probable maximum loss levels.

4. Provide citations to published scientific and technical literature, if any, or modeling-organization studies, that were used to estimate wildfire probable maximum loss levels.

5. Describe how the wildfire probable maximum loss levels produced by the wildfire catastrophe model include the effects of personal and commercial residential property insurance coverage.

6. Provide an explanation for all wildfire loss costs that are not consistent with the requirements of this guideline.

7. **The following disclosure is only applicable if the wildfire catastrophe model has been used for determination of the projected aggregate losses in a prior rate filing, and previously provided responses to these guidelines and disclosures:** Provide an explanation of the differences in wildfire loss output ranges between a previously submitted wildfire catastrophe model and the wildfire catastrophe model under current review.

8. Identify the assumptions used to account for the effects of coinsurance on commercial residential property wildfire loss costs.

Computational Information Guidelines For Wildfire Catastrophe Models

Purpose: The purpose of the guidelines under this section are to ensure that: the wildfire catastrophe model is appropriately and comprehensively documented along with the sources for input data and third-party databases and models (CI-1), that the executable model components and services had thorough specification of requirements (CI-2), was designed according to those requirements (CI-3), and is implemented based upon those requirements (CI-4). The guidelines of this section are also to ensure that the model was appropriately verified through verification tests (CI-5), that the interfaces for the model are state of the art and useable with no ambiguity for the user (CI-6), and that there is a formal procedure for identifying, organizing, and maintaining model versions (C-7). Finally, this section also includes guidelines to ensure that the wildfire catastrophe model is secured against unauthorized access, that any data associated with the model or its inputs are secure and cannot by accessed without authorization, is protected against viruses, and is backed up and redundant (C-8).

Guideline CI-1. Wildfire Catastrophe Model Documentation

Wildfire catastrophe model functionality and technical descriptions shall be documented formally in an archival format separate from the use of correspondence including emails, presentation materials, and unformatted text files. The documentation should include the constraints of the use of the model (i.e., how not to use it) and the proper scope of its use situationally, temporally and spatially.

A primary document repository shall be maintained, containing or referencing a complete set of documentation specifying the wildfire catastrophe model architecture, detailed model description, scientific basis with references, and functionality within its implementation. Documentation shall be indicative of current model development and software engineering practices.

All computer software (i.e., user interface, scientific, engineering, actuarial, data preparation, and validation) relevant to the wildfire catastrophe model shall be consistently documented and dated with versions.

The following shall be maintained: (1) a table describing all changes in the wildfire catastrophe model from the previously reviewed wildfire catastrophe model to the initial submission this year, and (2) a table of all substantive changes since this year's initial submission.

Documentation shall be created separately from the source code.

A list of all externally procured or licensed, currently used, wildfire modelling-specific software and data assets shall be maintained. The list shall include (1) asset name, (2) asset version number, (3) asset acquisition date, (4) asset acquisition source, (5) asset acquisition mode (e.g., lease, purchase, open source), and (6) length of time asset has been in use by the modeling organization.

Guideline CI-2. Wildfire Catastrophe Model Requirements

A complete set of requirements for each executable model component and services, as well as for each database or data file accessed by a component, shall be maintained. Requirements shall be updated whenever changes are made to the wildfire catastrophe model.

Guideline CI-3. Wildfire Catastrophe Model Organization and Component Design

The following shall be maintained and documented: (1) detailed control, benchmark and data flowcharts

and interface specifications for each software component, (2) schema definitions and vocabulary (e.g., data dictionaries) for each database and data file, (3) flowcharts and scientific workflows illustrating model-related flow of information and its processing by modeling organization personnel or consultants, (4) network connectivity and organization, microservices and computing environment, and (5) system model representations associated with (1)-(4) above. Documentation shall be focused on transparency and communication of all components that contribute to the wildfire catastrophe model output.

All flowcharts (e.g., software, data, and system models) in the submission or in other relevant documentation shall be based on (1) a referenced industry guideline (e.g., UML, BPMN, SysML), or (2) a comparable internally-developed guideline which is separately documented.

Guideline CI-4. Wildfire Catastrophe Model Implementation

A complete procedure of coding guidelines consistent with accepted software engineering practices shall be maintained.

Network connectivity and organization, microservices and computing environment documentation shall be maintained.

A complete procedure used in creating, deriving, ingesting or procuring and verifying databases or data files accessed by components shall be maintained.

Provenance of all components shall be traceable, through explicit component identification in the wildfire catastrophe model representations (e.g., flowcharts) including and specific implementation approaches for including physical environment.

A table of all software components actively contributing to wildfire loss costs and wildfire probable maximum loss levels shall be maintained with the following table columns: (1) component name, (2) pseudocode and number of lines of code, minus blank and comment lines, and (3) number of explanatory comment lines.

Each component shall be consistently commented at a quality level for a software engineer unfamiliar with the code to be able to comprehend the component logic at a reasonable level of abstraction.

Wildfire catastrophe model code and data shall be accompanied by documented maintenance, testing, and update plans with their schedules. The vintage of the code and data shall be justified using transparent documentation of the provider and version.

Guideline CI-5. Wildfire Catastrophe Model Verification

General: For each component, procedures shall be maintained for verification, such as code inspections, reviews, calculation crosschecks and benchmarks, and walkthroughs, sufficient to demonstrate code correctness to the extent private source code audits can be made possible when required. Verification procedures shall include tests performed by modeling organization personnel other than the original component developers.

Component Testing:

A. *Testing software shall be used to assist in documenting and analyzing all components.*

B. *Unit tests shall be performed and documented for each updated component.*

C. *Regression tests shall be performed and documented on incremental builds.*

D. *Integration tests shall be performed and documented to ensure the correctness of all wildfire catastrophe model components. Testing shall be performed to ensure that all components have been executed at least once to verify their functionality.*

Data Testing:

A. *Testing software shall be used to assist in documenting and analyzing all databases and data files accessed by components.*

B. *Integrity, consistency, and correctness checks shall be performed and documented on all versions of all databases and data files accessed by the components.*

Guideline CI-6. Human-Computer Interaction

Interfaces shall be implemented as consistent with accepted principles and practices of Human-Computer Interaction (HCI), Interaction Design, and User Experience (UX) engineering in compliance with California accessibility requirements.

Interface options used in the wildfire catastrophe model shall be easily distinguishable, explicit, and distinctly emphasized.

Guideline CI-7. Wildfire Catastrophe Model Maintenance and Revision

A clearly written development cycle and refresh policy shall be implemented for review, maintenance, and revision of the wildfire catastrophe model and network organization, including verification and validation of revised components, databases, and data files.

A revision to any portion of the previously submitted wildfire catastrophe model that results in any change in any California residential wildfire loss cost or wildfire probable maximum loss levels across any geospatial segments/areas shall result in a new wildfire catastrophe model version identification. New version identifications are not intended to be limited solely for this reason.

Issue tracking (e.g., with version control) software shall be used to identify and describe all errors, as well as modifications to code, data, and documentation.

A list of all wildfire catastrophe model versions since the initial submission shall be maintained. Each wildfire catastrophe model description shall have a unique version identification and a list of additions, deletions, and changes that define that version maintained by a formal version control platform.

Guideline CI-8. Wildfire Catastrophe Model Security

Cybersecurity procedures shall be implemented and fully documented for (1) secure access to individual computers where the software components or data can be created or modified, (2) secure operation of the wildfire catastrophe model by clients, if relevant, to ensure that the correct software operation cannot be compromised, (3) anti-virus software installation for all machines where all components and data are being accessed, and (4) secure access to documentation, software, and data in the event of a catastrophe.

Computational Information Disclosures For Wildfire Catastrophe Models

Disclosure CI -1 Wildfire Catastrophe Model Documentation

1. Provide a list and brief description of the software engineering methodologies, including wildfire-specific, (*e.g.* Kanban, Scrum, Agile, etc.) utilized for the software lifecycle.

Disclosure CI-2 Wildfire Catastrophe Model Requirements

1. Provide a description of the wildfire catastrophe model and platform(s) documentation for interface; human factors; functionality; system documentation; network organization; data, human, and material resources; system models; security; and quality assurance.

Disclosure CI-3 Wildfire Catastrophe Model Organization and Component Design

1. Provide a schematic illustrating key model components and subcomponents, and their hierarchical relationship.

Disclosure CI-4 Wildfire Catastrophe Model Implementation

1. Specify the hardware, operating system, and essential software required to use the wildfire catastrophe model on a given platform.

Disclosure CI-5 Wildfire Catastrophe Model Verification

1. State whether any two executions of the wildfire catastrophe model with no changes in input data, parameters, code, and seeds of random number generators produce the same wildfire loss costs and wildfire probable maximum loss levels, or comparable loss levels within the bounds of explainable standard error of prediction or standard explainable error.

2. Provide an overview of the component testing procedures.

3. Provide a description of verification approaches used for externally acquired data, software, and models.

Disclosure CI-6 Human-Computer Interaction

1. Identify procedures used to design, implement, and evaluate interface options.

Disclosure CI-7 Wildfire Catastrophe Model Maintenance and Revision

1. Identify procedures used to review and maintain code, data, and documentation.

2. Describe the rules underlying the wildfire catastrophe model and code revision identification systems. Include a table of version. Include a list of all wildfire catastrophe model versions since the initial submission. Each wildfire catastrophe model description shall have a unique version identification and a list of additions, deletions, and changes that define that version maintained by a formal version control platform. Identify any known issues, current or resolved, with the model version submitted.

Disclosure CI-8 Wildfire Catastrophe Model Security

1. Describe methods used to ensure the security and integrity of the code, data, and documentation. These methods include the security aspects of each platform and its associated hardware, software, and firmware.

Guidelines For End-Users' Use Of Wildfire Catastrophe Models

Purpose: The purpose of these guidelines is to ensure that the specific use of a catastrophe model by the **end-user** (*i.e.* insurers submitting rate applications) within the rate filing is appropriate and fit for the intended purpose. This includes ensuring that the exposure data (U-1) and policy information (U-2) used as input to the model in the rate filing is quality controlled and meets the best practices set by the model provider. It also includes guidelines to ensure that the model settings used to develop the loss projections and any other information are appropriate and fit to use for the rate filing with respect to the model design (U-3) and that the model itself is appropriate for the wildfire hazard, including geographic and meteorological, economic, and social context for which the rate filing is submitted (U4).

Guideline U-1. End-Users'/Insurers' Wildfire Exposure Data

Wildfire exposure data from the end-user (i.e. insurer) used as input to the model for contribution to a rate filing shall be quality controlled and provided in a form that meets the best practices required by the model and in accordance with actuarial standards of practice.

Any alterations to, including extrapolation, adjustment factors, or filtering of, the exposure data before input into the model must be explained, and justified.

Information on the distribution of various characteristics of the exposure data must be provided to the California Department of Insurance as it was input into the model and in accordance with the relevant wildfire exposures characteristics specified in the Vulnerability Guidelines.

Guideline U-2. Wildfire Insurance Policy Information

Wildfire insurance policy information data used as input to the model for contribution to a rate filing shall be quality controlled and provided in a form that meets the best practices required by the model and in accordance with actuarial standards of practice.

Any alterations or adjustments to the wildfire insurance policy data before input into the model must be explained and justified.

Information on the distribution of various characteristics of the wildfire insurance policy information used as input to the model must be provided to the California Department of Insurance as it was input into the model.

Guideline U-3. Settings of Wildfire Catastrophe Model

The model settings and parameters used to produce any wildfire catastrophe model output used in a rate filing must be in accordance with the most accurate and justifiable use of the model for the specific rate filing.

Guideline U-4. Wildfire Catastrophe Model Used

The wildfire catastrophe model chosen for use in the rate filing must have been developed in such a way that it is appropriate for California's geographical, meteorological/hazard, economic, environmental conditions, building codes, and social context.

Actuarial services used to design, develop, select, modify, or use (including any combination thereof) catastrophe models or incorporate modeled losses for purposes of a rate filing must be performed in

accordance with the applicable standards set forth by the Actuarial Standards Board, Actuarial Standards of Practice with respect to catastrophe models and with respect to data quality.

Disclosures For End-Users' Use Of Catastrophe Wildfire Models

Special Instructions: End-users of the model may be required disclose specific information for Disclosures U-1 through U-4 in a Complete Rate Application. Model vendors need not disclose specific information these disclosures within a PRID Procedure but must demonstrate capability to provide this information to end-users in a final report.

Disclosure U -1 End-Users'/Insurers' Wildfire Exposure Data

1. Describe the process used to validate wildfire exposure data from the end-user (i.e. insurance company / insurer) used as an input, including the use of specific checks, reference information, or any other process in conformance with the applicable standards set forth by the Actuarial Standards Board, Actuarial Standards of Practice.

2. Describe the wildfire exposure data used as an input, including without limitation:
   A. all the sources, the type(s) of exposures, and the dates of evaluation; and
   B. the extent the data is specific/exclusive to the insurance company (*i.e.* end-user) or to the Group making the rate filing.

3. Detail the percentage distribution within the actual exposure data used to derive the modeled losses based on the primary AOI related to:
   A. geographic level of detail for the insured structures:
      - Latitude/Longitude (in addition and separately include the percentage of policies verified)
      - street address (in addition and separately include the percentage of policies verified)
      - ZIP Code (in addition and separately include percentage of policies verified)
      - County
      - Other (Specify)
      - Unknown
      - Total = 100% including rounding
   B. Fire Policy Form - residential (4 dwelling units or less):
      - Homeowners HO-3 or equivalent (ISO HO-1,2,5,8)
      - Dwelling Owner-Occupied Policies
      - Dwelling Tenant-Occupied, including Landlord Protection Policies
      - Lender/Forced-Placed and Real Estate Owned (REO), Occupied and unoccupied
      - Condominium HO-6 or equivalent (owner and tenant combined)
      - Mobile Homes (owner and tenant combined)
      - Renters contents-only
      - Unknown
      - Total = 100% including rounding

C. Fire Policy Form - commercial:
- Habitational (5 or more dwelling units)
- Retail
- Mixed habitational/retail (5 or more dwelling units)
- Office
- Construction
- Industrial
- Farm/Agricultural
- Other (Specify)
- Unknown
- Total = 100% including rounding

D. wildfire-related construction:
- year structure built categorized within bands:
  - Pre- 1905: Prior to first national unified building code
  - 1905-22: Pre-enactment of State Housing Act
  - 1923-52: State Housing Act, pre-enactment of State Building Standards Law
  - 1953-78: State Bldg. Stds. Law, pre-enactment of CBC Title 24
  - 1979-96: CBC Title 24
  - 1997-2007: CBC Title 24 revised based on 1997 Uniform Building Code fire
    - safety standards
  - 2008-now: Post CBC Chp. 7A
- Compliant with wildfire-related building codes (CBC Chp. 7A)
- presence of wildfire safety actions by category as described by CCR §2644.9 Mitigation in Rating Plans and Wildfire Risk Models (see Vulnerability Form V-2)
- Unknown attributes regarding compliance with CBC Chp. 7A
- Unknown attributes for **all** of the wildfire safety actions in (iii) above.

Total = 100% including rounding

Disclosure U -2 Wildfire Insurance Policy Information

1. Detail the percentage distribution within the actual exposure data based on the primary AOI related to (including the percentage of policies missing data for each field):
   A. coverage amount,
   B. coverage types (A, B, C, D or all)
   C. coverage limits for each coverage type (actual cash value, replacement cost, extended replacement cost with percentage limit, guaranteed replacement costs), and
   D. deductibles

2. Describe any limitations of the input data (such as missing exposure or location information) and justify how these limitations were overcome.

3. If relevant, describe the level of damage at which the end-user considers a loss to be a total loss.

Disclosure U -3 Setting of Wildfire Catastrophe Model

1. For each catastrophe model used in a rate filing, describe what are the model developer's standard settings and for each separate run using that model, describe and justify every deviation from each of those standard settings, including but not limited to:

A. Base Wildfire Set or to wildfire stochastic events set(s)
   - Frequency
   - Burned Area
   - Extreme fire weather conditions
   - Extreme wildfire events, frequency and burned area
   - Seasonality of wildfires
   - **Climate Change adjustment (if not considered already)**

B. Modeled Financial Losses
   - Demand surge
   - Smoke Damage
   - List other perils beyond wildfire coverage that the model settings and thus projected loss output assumes is covered. If there are none, explicitly state that.
   - Scaling or multiplicative modification of loss estimates other than 1.00
   - Alternative vulnerability curves

C. Wildfire Mitigation / Safety Actions / Resiliency
   - Wildfire Mitigation Levels – parcel level
   - Wildfire Mitigation Levels – community level
   - Wildfire Mitigation Levels – utilities
   - Wildfire Mitigation Levels – prescribed burn treatments/fuel load treatments
   - Correlation of damage across exposures for different Wildfire Mitigation Levels

Disclosure U -4 Wildfire Catastrophe Model Used

1. If more than one wildfire catastrophe model was relied upon to derive the model output (*i.e.* modeled loss projections) in a rate filing, justify the methodology used to generate combined/composite outputs, including weighting assigned to each model or to each model's contribution towards a specific loss metric such as to develop separate rate level indications by category for personal and commercial residential properties such as homeowners, condominiums, mobile homes, and content-only policies.

2. For each wildfire catastrophe model used, describe the process used to validate model output (*i.e.* modeled loss projections), including the use of specific checks, reference information, or any other process in conformance with the applicable standards set forth by the Actuarial Standards Board, Actuarial Standards of Practice.

3. For each wildfire catastrophe model used, describe and justify any adjustments made to the model output prior to its use in the rate filing, including for all indications (including those that apply to class plan variables, discounts, and surcharges)

4. Describe and justify if the following were applied to ***input*** data:
   A. Trend Adjustments (Specify type and associated date) - annualized percentage applied
   B. Any other adjustment

5. Describe and justify if the following were applied to ***output*** data:
   A. Loss adjustment expense (LAE) adjustments – annualized percentage applied
   B. Trend Adjustments (Specify type and associated date) – annualized percentage applied

C. Any other adjustment

6. Provide the amount of insurance, in dollars, in total and separately for coverage types (A-dwelling, B-additional structures, C-contents, and D-loss of use or business interruption) used in the model for the appropriate policy form.

7. Provide a reconciliation between amount of insurance in total used in the model **and total Amount of Insurance Year (AIY)** used in the Standard Exhibits underlying the complete rate application. The reconciliation should be consistent with the policy forms in the rate filing.

8. Provide a reconciliation between number of exposures by form and coverage type used in the model and in the Standard Exhibits underlying the complete rate application.

Form G-1: General Modeling Guidelines Expert Certification

Purpose: This form identifies the signatory or signatories who have reviewed the current submission for compliance with the General Modeling Guidelines for Wildfire Catastrophe Models (G-1–G-5) in accordance with the stated provisions.

I hereby certify that I have reviewed the current submission of (Insert Name of Wildfire Catastrophe Model)_____Version (Insert Version) _____for compliance with the General Modeling Guidelines adopted by the California Department of Insurance and hereby certify that:

1. The wildfire catastrophe model meets the General Modeling Guidelines (G-1–G-5);
2. The disclosures and forms related to the General Modeling Guidelines section are editorially and technically accurate, reliable, unbiased, and complete;
3. The disclosures and forms related to each and every one of the Guidelines and Disclosures (i) are editorially accurate and contain complete information and any changes that have been made to the submission during the review process have been reviewed for completeness, grammatical correctness, and typographical errors; and (ii) there are no incomplete responses, charts or graphs, inaccurate citations, or extraneous text or references;
4. My review was completed in accordance with the professional standards and code of ethical conduct for my profession;
5. My review involved ensuring the consistency of the content in all sections of the submission; and
6. In expressing my opinion, I have not been influenced by any other party in order to bias or prejudice my opinion.

Name	Professional Credentials (Area of Expertise)
Signature (final submission)	Date

An updated signature and form are required following any modification of the wildfire catastrophe model and any revision of the original submission. If a signatory differs from the original signatory, provide the printed name and professional credentials for any new signatories. Additional signature lines should be added as necessary with the following format:

Signature (revisions to submission)	Date

Note: A facsimile or any properly reproduced signature will be acceptable to meet this requirement.

Form G-2: Wildfire Hazard Guidelines Expert Certification

Purpose: This form identifies the signatory or signatories who have reviewed the current submission for compliance with the Wildfire Hazard Guidelines (H-1 to H-7) in accordance with the stated provisions.

I hereby certify that I have reviewed the current submission of (Insert Name of Wildfire Catastrophe Model) _____ Version (Insert Version) _____ for compliance with the Wildfire Hazard Guidelines adopted by the California Department of Insurance and hereby certify that:

1. The Wildfire Hazard Model and Module meets the Wildfire Hazard Guidelines (H-1 to H-7);
2. The disclosures and forms related to the Wildfire Hazard Guidelines section are editorially and technically accurate, reliable, unbiased, and complete;
3. My review was completed in accordance with the professional standards and code of ethical conduct for my profession; and
4. In expressing my opinion, I have not been influenced by any other party in order to bias or prejudice my opinion.

Name	Professional Credentials (Area of Expertise)
Signature (final submission)	Date

An updated signature and form are required following any modification of the Wildfire Hazard Model and Module, and any revision of the original submission. If a signatory differs from the original signatory, provide the printed name and professional credentials for any new signatories. Additional signature lines should be added as necessary with the following format:

Signature (revisions to submission)	Date

Note: A facsimile or any properly reproduced signature will be acceptable to meet this requirement.

Form G-3: Statistical Guidelines Expert Certification

Purpose: This form identifies the signatory or signatories who have reviewed the current submission for compliance with the Statistical Wildfire Guidelines (S-1 to S-6) in accordance with the stated provisions.

I hereby certify that I have reviewed the current submission of (Insert Name of Wildfire Catastrophe Model)_____ Version (Insert Version)_____ for compliance with the Statistical Guidelines for Wildfire Catastrophe Models adopted by the California Department of Insurance and hereby certify that:

1. The wildfire catastrophe model meets the Statistical Wildfire Guidelines (S-1 to S-6);
2. The disclosures and forms related to the Statistical Guidelines section are editorially and technically accurate, reliable, unbiased, and complete;
3. My review was completed in accordance with the professional standards and code of ethical conduct for my profession; and
4. In expressing my opinion, I have not been influenced by any other party in order to bias or prejudice my opinion.

Name	Professional Credentials (Area of Expertise)
Signature (final submission)	Date

An updated signature and form are required following any modification of the wildfire catastrophe model and any revision of the original submission. If a signatory differs from the original signatory, provide the printed name and professional credentials for any new signatories. Additional signature lines should be added as necessary with the following format:

Signature (revisions to submission)	Date

Note: A facsimile or any properly reproduced signature will be acceptable to meet this requirement.

Form G-4: Wildfire Vulnerability Guidelines Expert Certification

Purpose: This form identifies the signatory or signatories who have reviewed the current submission for compliance with the Vulnerability Wildfire Guidelines (V-1 to V-4) in accordance with the stated provisions.

I hereby certify that I have reviewed the current submission (Insert Name of Wildfire Catastrophe Model) _____ Version (Insert Version)_____ for compliance with the Vulnerability Guidelines for Wildfire Catastrophe Models adopted by the California Department of Insurance and hereby certify that:

1. The wildfire catastrophe model meets the Vulnerability Guidelines (V-1 to V-4);
2. The disclosures and forms related to the Vulnerability Guidelines section are editorially and technically accurate, reliable, unbiased, and complete;
3. My review was completed in accordance with the professional standards and code of ethical conduct for my profession; and
4. In expressing my opinion, I have not been influenced by any other party in order to bias or prejudice my opinion.

Name	Professional Credentials (Area of Expertise) State:_____ Expiration Date:_____ Professional License Type:_____
Signature (final submission)	Date

An updated signature and form are required following any modification of the wildfire catastrophe model and any revision of the original submission. If a signatory differs from the original signatory, provide the printed name and professional credentials for any new signatories. Additional signature lines should be added as necessary with the following format:

Signature (revisions to submission)	Date

Note: A facsimile or any properly reproduced signature will be acceptable to meet this requirement.

Form G-5: Actuarial Guidelines Expert Certification

Purpose: This form identifies the signatory or signatories who have reviewed the current submission for compliance with the Actuarial Guidelines (A-1 to A-6) in accordance with the stated provisions.

I hereby certify that I have reviewed the current submission of (Insert Name of Wildfire Catastrophe Model)_____ Version (Insert Version)_____ for compliance with the Actuarial Guidelines for Wildfire Catastrophe Models adopted by the California Department of Insurance and hereby certify that:

1. The wildfire catastrophe model meets the Actuarial Guidelines (A-1 to A-6);
2. The disclosures and forms related to the Actuarial Guidelines section are editorially and technically accurate, reliable, unbiased, and complete;
3. My review was completed in accordance with the Actuarial Standards of Practice and Code of Conduct; and
4. In expressing my opinion, I have not been influenced by any other party in order to bias or prejudice my opinion.

Name	Professional Credentials (Area of Expertise)
Signature (final submission)	Date

An updated signature and form are required following any modification of the Wildfire model and any revision of the original submission. If a signatory differs from the original signatory, provide the printed name and professional credentials for any new signatories. Additional signature lines should be added as necessary with the following format:

Signature (revisions to submission)	Date

Note: A facsimile or any properly reproduced signature will be acceptable to meet this requirement.

Form G-6: Computational Information Guidelines Expert Certification

Purpose: This form identifies the signatory or signatories who have reviewed the current submission for compliance with the Computer/Information Wildfire Guidelines (CI-1 to CI-8) in accordance with the stated provisions.

I hereby certify that I have reviewed the current submission of (Insert Name of Wildfire Catastrophe Model)_____ Version (Insert Version) _____ for compliance with the Computational Guidelines adopted by the California Department of Insurance and hereby certify that:

1. The Wildfire Catastrophe Model meets the Computational Guidelines (CI-1 to CI-8);
2. The disclosures and forms related to the Computational Guidelines section are editorially and technically accurate, reliable, unbiased, and complete;
3. My review was completed in accordance with the professional standards and code of ethical conduct for my profession; and
4. In expressing my opinion, I have not been influenced by any other party in order to bias or prejudice my opinion.

_____	_____
Name	Professional Credentials (Area of Expertise)
_____	_____
Signature (final submission)	Date

An updated signature and form are required following any modification of the Wildfire model and any revision of the original submission. If a signatory differs from the original signatory, provide the printed name and professional credentials for any new signatories. Additional signature lines should be added as necessary with the following format:

_____	_____
Signature (revisions to submission)	Date

Note: A facsimile or any properly reproduced signature will be acceptable to meet this requirement.

Form G-7: End Users' Use of Model Certification

Purpose: This form identifies the signatory or signatories who have reviewed the current submission for compliance with the Guidelines for Use of Wildfire Catastrophe Models, in accordance with the stated provisions.

I hereby certify that I have reviewed the current submission (Insert Name of Wildfire Catastrophe Model)_____ Version (Insert Version) _____for compliance with the Guidelines for End-Users' Use of Catastrophe Wildfire Models, and hereby certify that:

1. The wildfire catastrophe model submission complies with the Guidelines for End-Users' Use of Wildfire Catastrophe Models (U1 to U4);
2. The disclosures and forms related to the End-Users' Use of Wildfire Catastrophe Model Guidelines section are editorially and technically accurate, reliable, unbiased, and complete;
3. My review was completed in accordance with the professional standards and code of ethical conduct for my profession; and
4. In expressing my opinion, I have not been influenced by any other party in order to bias or prejudice my opinion.

Name	Professional Credentials (Area of Expertise)
Signature (final submission)	Date

An updated signature and form are required following any modification of the Wildfire model and any revision of the original submission. If a signatory differs from the original signatory, provide the printed name and professional credentials for any new signatories. Additional signature lines should be added as necessary with the following format:

Signature (revisions to submission)	Date

Note: A facsimile or any properly reproduced signature will be acceptable to meet this requirement.

Appendix I:Additional Forms and Test Cases For Wildfire Catastrophe Models

FORM G-8: Wildfire Catastrophe Model Settings and Input

Purpose: This form is used to document the model setting options and expected input to the model.

A. Use the template tables below to document the options available to the user of the wildfire catastrophe model, the standard settings of the wildfire catastrophe model expected to be used in the ratemaking context, and summaries of the exposures input to the model. The table should indicate which features the user must include in the data that is imported, and which are automatically filled in the model if a user does not import them.

B. Include annotated examples of a data import log and an analysis log. In the "Import/Analysis log location" column of each table include a letter reference for where the relevant user choice is indicated in the logs.

C. Along with this form, submit a recorded video that serves as guidance for the import and analysis log. This video should focus only on the options and features that are anticipated in the context of a rate filing. This video should demonstrate what error flags are possible and how to interpret summary statistics from the data import. For example, how many exposures included mitigation features details, geospatial granularity of imported data, and level of geocoding.

D. The tables below are to be completed by the user of the model prior to submission with a Complete Rate Application and submitted as both cleanly formatted xlsx and pdf files. Include the number and percentage of unknown values for each characteristic. The file should be named "[PRID_issue_number]_PRID_Template_[PolicyFormType].[pdf/xlsx]"

E. For the event loss table, the insurer is expected to fill the AAL and indicated return period losses by policy type and loss perspective using their own exposure data.

F. For the Top 5 location level loss table, the insurer is expected to report the information for the top 5 losses of each policy type. This information includes, but is not limited to, the primary and secondary building characteristics, geocoding information, loss information, and policy information.

SHEET 1

Submission Summary	
Required Field	**Description**
Company	
Contact Name	
Email	
Phone	
Submission Description	
Submission Date	
Exposure Summary As Of Date	
Total # of Location Records	

Total TIV	

SHEET 2

Summary of Analysis Options				
Model Version				
Platform Version				
Analysis Settings		**Selection**	**Notes**	**Standard setting(s)**
[Multiple standard option setting]	[option 1] [option 2]		Additional comments should be included here or in section AdditionalNotes.1 if lengthy	
[binary setting]	On/Off		# If diverge from standard additional comments should be included here or in section AdditionalNotes.3 if lengthy	
[Multiple standard component Setting]	Component 1			
	Component 2			
	Component 3			
[Multiple customizable component setting]	Component 1		#If diverge from standard, additional comments should be included here or in Section AdditionalNotes.4 if lengthy	
	Component 2		#If diverge from standard, additional comments should be included here or in Section AdditionalNotes.5 if lengthy	
	Component 3		#If diverge from standard, additional comments should be included here or in Section AdditionalNotes.6 if lengthy	

Additional Notes & Assumptions	
Note #	**Additional Notes/Assumptions**
1	
2	
3	
4	
5	
6	

Appendix C Analysis Options		
Analysis Option	**Setting**	**Notes**

SHEET 3

Geocoding Summary					
Source	**Match level**	**# of Location Records**	**% of Location Records**	**% of Total Risks**	**% of TIV**

Catastrophe Modeling Exposure Limits Summary						
Policy Type	**Exposure Count**	**Limit Building**	**Limit Other**	**Limit Contents**	**Limit Time**	**Total Insured LImits**
Homeowners						
Renters						
Condos						
Total						

Catastrophe Modeling Exposure Replacement Value Summary						
Policy Type	**Exposure Count**	**Replacement Value Building**	**Replacement Value Other**	**Replacement Value Contents**	**Replacement Value Time**	**Total Replacement Value**
Homeowners						
Renters						
Condos						
Total						

Summary of Exposure Characteristics						
Primary Characteristic	**Field**	**Code**	**# of Location Records**	**% of Location Records**	**% of Total Risks**	**% of TIV**
…						
…						
…						
Secondary Characteristic	**Field**	**Code**				
…						
…						

Example: Primary Characteristic: Roof Cover; Field: Asphalt Shingle; Code: 2….

Note: Year built record should include a row for summaries of continuous year built, and a separate section with a summary of records within the year built ranges/bands used by the model. If the "Unknown" has a default assumed field/code for California, put the default assumed code in parenthesis; for example, if the Unknown for the "Roof Cover" primary characteristic is coded as 0 but is effectively assumed to be asphalt shingles (code 2) it should be included as Primary Characteristic: Roof Cover; Field: Unknown [Asphalt shingle]; Code 0 [2].

Appendix A Primary Characteristics Definitions		
Field	**Description**	**Required (Yes/No)-why?**

Code	**Category**	**Construction Class**

Code	**Category**	**Occupancy Class**

Appendix B Secondary Characteristic Definitions		
Field	**Description**	**Inputs**
		Format: Code – unknown Code-option1 Code-option2

SHEET 4

Event Loss Table															
Policy Type	**Settings**	**Loss Perspective**	**Peril**	**AAL**	**SD**	**5**	**10**	**20**	**50**	**100**	**200**	**250**	**500**	**1000**	**Exceedance Probability**
						20.0%	**10.0%**	**5.0%**	**2.0%**	**1.0%**	**0.5%**	**0.4%**	**0.2%**	**0.1%**	**Return Period**
Home-owners	Default Demand Surge & Smoke	Ground up	FFEQ												
			Wildfire												
		Gross	FFEQ												
			Wildfire												
Renters	Default Demand Surge & Smoke	Ground up	FFEQ												
			Wildfire												
		Gross	FFEQ												
			Wildfire												
Condo	Default Demand Surge & Smoke	Ground up	FFEQ												
			Wildfire												
		Gross	FFEQ												
			Wildfire												

Make copies for each variation and fill in the fields below if your filing includes model runs with any of: No Demand Surge / Custom Demand Surge / No Smoke

Event Loss Table															
Policy Type	**Settings**	**Loss Perspective**	**Peril**	**AAL**	**SD**	**5**	**10**	**20**	**50**	**100**	**200**	**250**	**500**	**1000**	**Exceedance Probability**
						20.0%	**10.0%**	**5.0%**	**2.0%**	**1.0%**	**0.5%**	**0.4%**	**0.2%**	**0.1%**	**Return Period**
		Ground up	FFEQ												

Home-owners			Wildfire												
		Gross	FFEQ												
			Wildfire												
Renters		Ground up	FFEQ												
			Wildfire												
		Gross	FFEQ												
			Wildfire												
Condo		Ground up	FFEQ												
			Wildfire												
		Gross	FFEQ												
			Wildfire												

SHEET 5

Top 5 location level losses					
Homeowners					
	Characteristics				
Rank	**Stories**	**Year Built**	**Limit A**	**Limit B**	**Limit C….**
1					
2					
3					
4					
5					

*** Characteristics continue:** Limit D, Limit Total, Replacement Value A (..B..C..D..Total), Geocoding Level, Occupancy Code, Construction Code, EventCount, TotalGrossLoss, TotalGroundUpLoss, TotalRetainedLoss, GrossAAL, GroundUpAAL, BuildingValue, OtherValue, ContentsValue, TimeElementValue, DeductibleType, BuildingDeductible…

Form H-1: Annual Occurrence Frequency & Burned Area

Purpose: This form illustrates the differences among statewide and regional frequencies of fire occurrence and areas burned in California wildfires for historical and modeled wildfires. The historical events are derived from the Reference California Historical Wildfire Dataset with possible adjustments in the Base Wildfire Set by the modeling organization as specified in Wildfire Hazard Guideline H-1, Annual Occurrence Frequency & Burned Area.

A. Provide modeled wildfire occurrence and area burned versus the Reference California Historical Wildfire Dataset in csv files using Table H-1A below. The data for the California Historical Wildfire Dataset will be provided. Output comparisons should be presented aggregated statewide (Table H-1A), and based on pyromes with each such pyrome separately contained in its own chart (Table H-1B). Output comparisons should be provided for low, moderate, high, and very high fire severity year as defined below. Any processing, factor weighting, and averaging should be described in an addendum to the tables requested. Indicate the length, in years, of the event catalogue. The period from 2010 to 2023 should be compared to the model dataset separately from the full CA Reference Dataset record for the statewide comparison. For individual pyromes, only the comparison to the 2010 to 2023 period of the CA Reference Dataset need be shown. Describe, in detail, the process for calculating table values for the Stochastic Wildfire Set.

B. If the modeling organization chooses to segment the Reference CA Historical Wildfire Dataset in a different way, for example by removing fires below a threshold in size, that comparison can be shown as the "Base Wildfire Set" or as a separate table. Describe and justify this alternative segmentation.

C. Provide a scatter plot of the pyrome-total annual average area burned and standard deviation in the stochastic wildfire set versus the Reference California Historical Wildfire Dataset (2010-2023) and (if relevant) versus the Base Wildfire Set. Include line of best-fit, r-squared, and a one-to-one line on the figures as well as marker labels indicating the pyrome number. Include vertical error bars to represent the standard deviation (or variance) of the stochastic set for each pyrome; if the error bars disrupt interpretability of the figure, instead include a shaded confidence band around the line of best-fit to convey uncertainty.

D. Pyrome boundaries for California (19 pyromes in total) should be derived from: Short, Karen C.; Grenfell, Isaac C.; Riley, Karin L.; Vogler, Kevin C. 2020. Pyromes of the conterminous United States. Fort Collins, CO: Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2020-0020

E. The statewide annual area burned (in acres) was calculated using the fire perimeter features from the Reference CA Historical Wildfire Dataset and the ogrinfo GDAL command line tool. Only the area falling within California was counted towards the area burned. The statewide annual area burned was then classified into low, moderate, high, and very high fire severity years using a Jenks Natural Breaks clustering algorithm. The same severity class is retained for the pyrome-level analyses. In order to compare to the Stochastic Wildfire Set, classify any years using the following bin limits:

Fire severity year classification	**Area Burned**

Low	< 480,000 acres
Moderate	480,000 – 1,000,000 acres
High	1,000,000.001 – 2,000,000 acres
Very High	>2,000,000 acres

Length of Stochastic Wildfire Set (years) = _____

Table H-1A

	Reference CA Wildfire Dataset (1970-2023)						**Stochastic Wildfire Set**					
	Acres Burned per Year		**Number of Fires per Year**		**Years in fire severity category**		**Acres Burned per Year**		**Number of Fires per Year**		**Years in fire severity category**	
Fire Year Severity	**Avg**	**Std dev**	**Avg**	**Std dev**	**Number**	**Percent**	**Avg**	**Std dev**	**Avg**	**Std dev**	**Number**	**Percent**
Low												
Moderate												
High												
Very High												
Total												
	Reference CA Wildfire Dataset (2010-2023)						**Stochastic Wildfire Set**					
	Acres Burned per Year		**Number of Fires per Year**		**Years in fire severity category**		**Acres Burned per Year**		**Number of Fires per Year**		**Years in fire severity category**	
Fire Year Severity	**Avg**	**Std dev**	**Avg**	**Std dev**	**Number**	**Percent**	**Avg**	**Std dev**	**Avg**	**Std dev**	**Number**	**Percent**
Low												
Moderate												
High												
Very High												
Total												
	Base Wildfire Set (_____)						**Stochastic Wildfire Set**					
	Acres Burned per Year		**Number of Fires per Year**		**Years in fire severity category**		**Acres Burned per Year**		**Number of Fires per Year**		**Years in fire severity category**	
Fire Year Severity	**Avg**	**Std dev**	**Avg**	**Std dev**	**Number**	**Percent**	**Avg**	**Std dev**	**Avg**	**Std dev**	**Number**	**Percent**
Low												

Moderate												
High												
Very High												
Total												

Table H-1B

Pyrome [#]												
	Reference CA Historical Wildfire Dataset (1970-2023)				**Reference CA Historical Wildfire Dataset (2010-2023)**				**Stochastic Wildfire Set**			
	Acres Burned per Year		**Number of Fires per Year**		**Acres Burned per Year**		**Number of Fires per Year**		**Acres Burned per Year**		**Number of Fires per Year**	
Fire Year Severity	**Avg**	**Std dev**	**Avg**	**Std dev**	**Avg**	**Std dev**	**Avg**	**Std dev**	**Avg**	**Std dev**	**Avg**	**Std dev**
Low												
Moderate												
High												
Very High												
Total												

Pyrome [#]								
	Base Wildfire Dataset (_____)				**Stochastic Wildfire Set**			
	Acres Burned per Year		**Number of Fires per Year**		**Acres Burned per Year**		**Number of Fires per Year**	
Fire Year Severity	**Avg**	**Std dev**	**Avg**	**Std dev**	**Avg**	**Std dev**	**Avg**	**Std dev**
Low								
Moderate								

High								
Very High								
Total								

F. Describe wildfire hazard model variations from the historical frequencies and average area burned.

G. Describe how the historical and modeled wildfire hazard model fire perimeters are established and to the extent validated, in relation to diverse historical wildfires.

Notes on Form H-1, Annual Occurrence Frequency & Burned Area:

1. Each historical and modeled wildfire, regardless of reported or modeled damage, is listed in each pyrome where it spreads, but counted only once in the Statewide (aggregate) in Table H-1A. Wildfires recorded for neighboring states which spread into California should be included and need not have reported damage in California. Areas burned are calculated only including the area burned within California or within a given pyrome.

2. Form H-1, Annual Occurrence Frequency & Burned Area; and Form S-1, Probability and Frequency by Area Burned of California Wildfires per Year, are based on the period consistent with Wildfire Hazard Guideline H-1, Base Wildfire Set. It is intended that the wildfires set underlying Forms H-1 and S-1 will be the same.

Form H-2: Maps of Burn Probability

Purpose: This form illustrates the ability of the wildfire hazard model to simulate regional variations in burn probability.

A. Provide color-coded contour plots with 5-levels on a map with appropriate localized boundaries of the burn probability for the Stochastic Wildfire Set. Burn probability is defined as the number of times a cell fell within a fire perimeter divided by the number of years in the record. Compare to the burn probability of the Reference CA Wildfire Dataset separately for the 1970 to 2023 period and for the 2010 to 2023 period, which has been gridded for this purpose to 30m resolution on a CA Teale Albers (EPSG: 3310) projection. Include boundaries for California pyromes. The reference data should be kept at 30m resolution if possible. If not, it may be re-gridded to a resolution consistent with the modeler's validation process, provided that it is no coarser than 270m. Any methods for re-gridding should be explained. A Jenks Natural Breaks method should be used to determine the contour level bounds, which can be different for the stochastic set from the reference set.

B. Provide a color-coded contour plot with 5-levles on a map with appropriate localized boundaries of the burn probability for the Stochastic Wildfire Set. Overlay upon this contour map hatching for burned areas from the Reference CA Wildfire Dataset (1970-2023). Include the Jaccard's Index value of the Reference and Stochastic set non-zero burn probability area (the ratio of overlap between predicted and actual burned areas to their union). Also report the Hit Rate (the proportion of actual burned area that was correctly predicted), and the False Alarm Ratio (the proportion of predicted burned area that did not actually burn). These scores are not absolute indicators of model performance but are intended to provide an overall understanding of model behavior.

Form S-1: Fire Size Distributions

Purpose: This form illustrates the differences among the Reference California Historical Wildfire Dataset, the Base Wildfire Set, and modeled wildfire size distributions in California.

A. Provide Frequency-Magnitude diagrams incorporating fires in the Stochastic Wildfire Set in red and fires from the Reference CA Historical Wildfire Dataset from the period 2010 through 2023 and separately for the full historical period in blue. Specifically, these figures should be histograms with fire counts on the y-axis and bins of area burned on the x-axis. These should appear as scatter plots with the marker appearing at the mid-point of each burned area-bin. The bin-width should be set to 10000 acres and the x-axis and the y-axis should both be log-scaled. The left axis should correspond to the Reference CA Historical Wildfire Dataset and the right axis should correspond to the Stochastic Wildfire Set. Provide separate figures for fires statewide and for fires within each pyrome. For the statewide figures, the entire area of fires crossing state lines is considered in the fire size. For the pyrome-level figures, fires that cross pyrome boundaries can be attributed to all pyromes in which they burn and the entire area of fires crossing pyrome boundaries is considered in the fire size.

B. Provide Frequency-Magnitude diagrams of the largest fire in each year in the Stochastic Wildfire Set in red and the largest fire in each year from the Reference CA Historical Wildfire Dataset from the period 2010 through 2023 and separately for the full historical period in blue. Specifically, these figures should be binned scatterplots with fire counts on the y-axis and bins of area burned on the x-axis. These should appear as scatter plots with the marker appearing at the mid-point of each burned area-bin. The bin-width should be set to 10000 acres and the x-axis and the y-axis should both be log-scaled. The left axis should correspond to the Reference CA Historical Wildfire Dataset and the right axis should correspond to the Stochastic Wildfire Set. Alternatively, the modeler may choose to normalize the axis and describe the normalization. Provide separate figures for fires statewide and for fires within each pyrome. For the pyrome-level figures, fires that cross pyrome boundaries can be attributed to all pyromes in which they burn. In addition to the largest fire per year, conduct the same analysis for the top 10% of the largest fires to capture a broader picture of extreme fire behavior.

C. Provide Quantile–Quantile (Q–Q) plots comparing fire sizes in the Stochastic Wildfire Set against the Reference CA Historical Wildfire Dataset (2010–2023). The x-axis should represent quantiles of fire size from the Reference dataset (log scale, in acres) and the y-axis should represent corresponding quantiles from the Stochastic set (log scale, in acres). Include a one-to-one line for reference. These figures should be prepared both statewide and at the pyrome level. If a Q-Q plot from above cannot be generated, provide Cumulative Distribution Function (CDF) plots comparing fire sizes in the Stochastic Wildfire Set and the Reference CA Historical Wildfire Dataset (2010–2023). The x-axis should represent fire size (log scale, in acres), and the y-axis should represent the probability that a fire is at least this large (log scale). Display the Reference dataset as a blue line and the Stochastic set as a red line. Separate figures should be produced for statewide fires and for fires within each pyrome. These figures should provide a smooth view of the likelihood of exceeding a given fire size and help highlight differences between the datasets in the tail of the distribution.

D. In addition to the figures described above, alternate versions of the figures described in parts A, B and C may be provided with bin limits selected by the modeler. Justification for alternative bin limits must be provided.

Form S-2: Stochastic Wildfire Parameters

Purpose: This form identifies the dependencies or form of parameters used to generate wildfire stochastic events and provides their justification.

A. Provide the input parameters used for each stochastic wildfire parameter in the wildfire module (event generation and hazard) and the data sources for those input parameters.

B. Provide a summary of the justification for each parameter.

- If the parameter (variable) is an input to the wildfire hazard model or derived from its outputs, identify the variable and elaborate on the method of population for estimating the distribution. For example, the fire intensity or flame length may change by perturbing the acceleration or the spot ignition probability in the wildfire hazard model; provide information for both.

Table S-2

Stochastic Wildfire Parameter (Function or Variable)	**Input parameters or form**	**Data Sources**	**Justification for Parameter Estimates and Form**
EXAMPLE Ignition probability	EXAMPLE Historical all-cause ignition probability	EXAMPLE Official Record of Historical Ignitions 2023 issue;	EXAMPLE Historical ignition probabilities form a reasonable basis for projected probabilities but do not represent all locations and conditions where fires may ignite (Researcher et al., 2023).
	Distance to road, distance to population	Tiger/Line Shapefile US Roads 2023;	A majority of wildfires are caused by humans and therefore occur more frequently near roads and population centers (Researcher et al. 2020, Researcher 2010).
	fire weather variable X	2020 US Census; MERRA-2 reanalysis;	Ignitions only occur under conditions where weather variable X is lower than 0.1units (Researcher et al. 2009).
	Utility wildfire mitigation variable Y	Data created by model vendor from discussions with utilities	Utility wildfire mitigation variable Y has also been shown to be important for ignitions (Researcher 2001), but there is limited publicly available data on this (Article 2023) so the model vendor has created its own data through consultation with experts at utility Z.

Form S-3: Validation Comparisons

Purpose: This form demonstrates the ability of the wildfire catastrophe model to replicate major historical wildfires and compare output to historical wildfire losses.

A. Provide a sufficient body of comparisons (at least four validation cases) of actual residential property wildfire-related loss to modeled wildfire loss such that the validation set represents the diversity of observed wildfire event types and losses in California to the extent data are available. Exposure data and historical loss information will be provided. Report these comparisons by policy coverage, zip-code, or other level of similar detail in addition to total wildfire losses. In addition to providing the total loss, provide the losses that occurred in areas covered by the wildland fire spread methods used in the model and separately the losses that occurred in areas covered by the urban fire spread methods used in the model, if such distinction exists. Include wildfire loss as a percentage of total exposure. Use and provide a definition of the wildfire catastrophe model relevant commercial property classifications.

- Total exposure represents the total amount of insured values (all coverages combined) in the area affected by the wildfire. This would include exposures for policies that did not have a wildfire loss. If this is not available, use exposures for only those policies that had a wildfire loss. Specify which one was used. Coverage D limits should be assumed to be 20% of coverage A (replacement cost).
- Comparisons should include wildfire losses from:

    - Southern California: 2018 Woolsey Fire
    - Sierra Nevada Mountains: 2021 Caldor Fire
    - Northern California: 2018 Carr Fire
    - Coastal California: 2020 CZU Complex Fire

B. Provide maps of modeled damage ratios for each fire at 1.2km resolution and compare with equivalent maps of CalFire Damage Inspection (DINS) data and the fire perimeter from the Reference CA Historical Wildfire Dataset. Grid cell assignments for each location will be provided. For the DINS comparison, use Table A to assign an insured loss amount for each structure. "Observed" (DINS) damage ratio for each grid cell should be calculated as the sum of the damage assignment percent times the building TIV for all buildings in the grid cell divided by the total TIV within the grid cell.

Table A

DINS Categorization	Damage Assignment
No Damage (0%)	0% insured loss
Affected (1-9%)	9% insured loss
Minor (10-25%)	25% insured loss
Major (26-50%)	50% insured loss
Destroyed (>50%)	100% insured loss

C. Describe the overall approach to replicating these fires. Describe the fuel conditions, weather inputs, and any assumptions about conditions or exposures that were made to recreate these fires. Describe any assumptions including the treatment of fire suppression.

Table A.1

2018 Woolsey Fire : Personal Residential Exposure:_____		
Fire Spread Method	**Modeled Wildfire Loss**	**Modeled Wildfire Loss/ Exposure**
Urban		
Wildland		
Total		
2018 Woolsey Fire : Commercial Habitational		
Urban		
Wildland		
Total		

Table A.2

2018 Woolsey Fire : Personal Residential Exposure: _____				
Coverage	**Insurer's Aggregate Actual Wildfire Loss**	**Modeled Wildfire Loss**	**Difference**	**Modeled Wildfire Loss/Exposure**
A	*			
B	N/A		N/A	
C	*			
D	N/A		N/A	
2018 Woolsey Fire : Commercial Habitational				
All	N/A		N/A	

* Calculated from sum of Homeowners, Dwelling (Owner-Occupied), Dwelling (Tenant-Occupied), Mobile Home, and Condominium-Owners losses from fire and smoke from the Personal Property Experience data call.

Table A.3

2018 Carr Fire : Personal Residential Exposure:_____		
Fire Spread Method	**Modeled Wildfire Loss**	**Modeled Wildfire Loss/ Exposure**
Urban		
Wildland		
Total		
2018 Carr Fire : Commercial Habitational		
Urban		
Wildland		
Total		

Table A.4

2018 Carr Fire : Personal Residential Exposure: _____				
Coverage	**Insurer's Aggregate Actual Wildfire Loss**	**Modeled Wildfire Loss**	**Difference**	**Modeled Wildfire Loss/Exposure**
A	*			
B	N/A		N/A	
C	*			
D	N/A		N/A	
2018 Carr Fire : Commercial Habitational				
All	N/A		N/A	

* Calculated from sum of Homeowners, Dwelling (Owner-Occupied), Dwelling (Tenant-Occupied), Mobile Home, and Condominium-Owners losses from fire and smoke from the Personal Property Eexperience data call.

Table A.5

2020 CZU Complex Fire : Personal Residential Exposure:_____		
Fire Spread Method	**Modeled Wildfire Loss**	**Modeled Wildfire Loss/ Exposure**
Urban		
Wildland		
Total		
2020 CZU Complex Fire : Commercial Habitational		
Urban		
Wildland		
Total		

Table A.6

2020 CZU Complex Fire : Personal Residential Exposure: _____				
Coverage	**Insurer's Aggregate Actual Wildfire Loss**	**Modeled Wildfire Loss**	**Difference**	**Modeled Wildfire Loss/Exposure**
A	*			
B	N/A		N/A	
C	*			
D	N/A		N/A	
2020 CZU Complex Fire : Commercial Habitational				
All	N/A		N/A	

* Calculated from sum of Homeowners, Dwelling (Owner-Occupied), Dwelling (Tenant-Occupied), Mobile Home, and Condominium-Owners losses from fire and smoke from the Personal Property Experience data call.

Table A.7

2021 Caldor Fire : Personal Residential Exposure:_____		
Fire Spread Method	**Modeled Wildfire Loss**	**Modeled Wildfire Loss/ Exposure**
Urban		
Wildland		
Total		
2021 Caldor Fire : Commercial Habitational		
Urban		
Wildland		
Total		

Table A.8

2021 Caldor Fire : Personal Residential Exposure: _____				
Coverage	**Insurer's Aggregate Actual Wildfire Loss**	**Modeled Wildfire Loss**	**Difference**	**Modeled Wildfire Loss/Exposure**
A	*			
B	N/A		N/A	
C	*			
D	N/A		N/A	
2021 Caldor Fire : Commercial Habitational				
All	N/A		N/A	

* Calculated from sum of Homeowners, Dwelling (Owner-Occupied), Dwelling (Tentant-Occupied), Mobile Home, and Condominium-Owners losses from fire and smoke from the Personal Property Experience data call.

Form V-1: Vulnerability Sensitivity

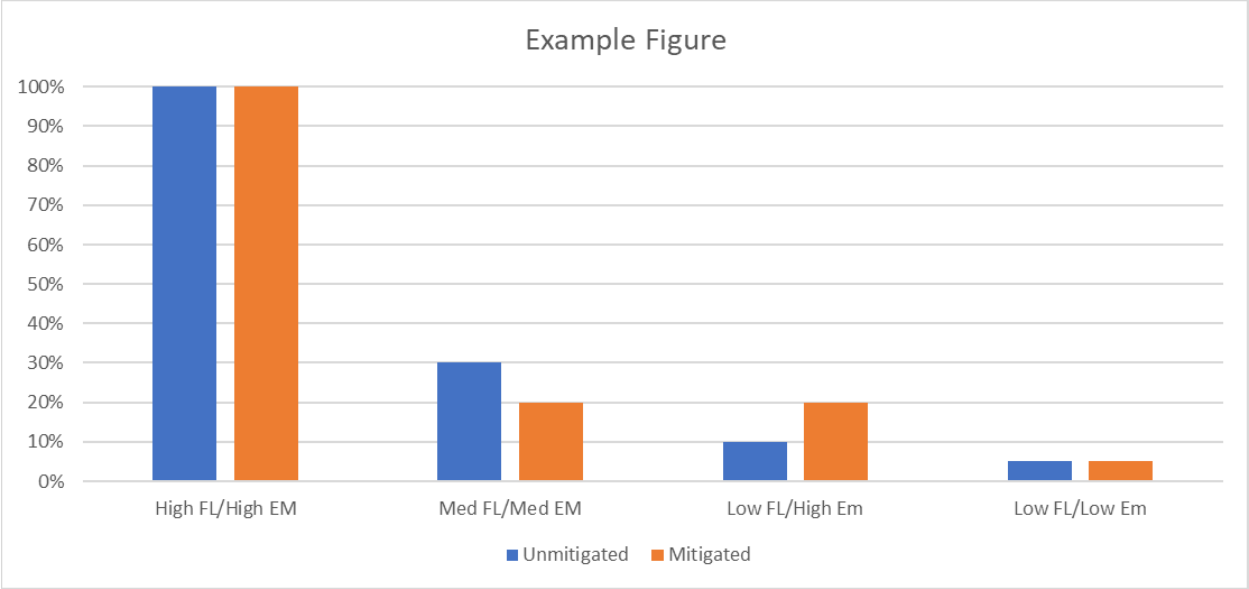
Purpose: This form is developed to isolate the vulnerability from the hazard components of the model in order to test the response of structures exposure to selected WUI fire intensities and evaluate changes in the destruction to different building types including mitigation added to structures.

A. In order to test the sensitivity of vulnerability to differences in building type and parcel-level mitigation in the wildfire catastrophe model independent of the hazard component, use the provided flame length and ember deposition data. A 100-member ensemble of flame lengths and ember deposition from the 2017 Thomas Fire in Ventura County, California was modeled using ELMFIRE (https://elmfire.io/) at 30 m resolution to reproduce fire progression and generate fire intensity, flame length, and ember deposition across the landscape. An urban fire spread model was implemented to generate some exposure data within urban areas. 100 structure locations were then randomly placed within the domain at a single minimum separation distance from one another.

B. Each ensemble run provides a raster of maximum flame length and total ember deposition. In order to evaluate the response of structures to different fire exposures, all 100 ensemble rasters were probed for the maximum, mean, and minimum (non-zero) pixel-level flame length (m) values and ember load (number of embers deposited per pixel) at each structure location. These stratifications allow for quantification of mitigation effectiveness under different fire exposures using the same spatial extent. It is also to be noted that while flame length (meters) has wide acceptance and use in the fire community as a representative value, ember load is more subjective and dependent on the modeling platform. Embers were generated and deposited using standard parameters and assumptions in ELMFIRE (https://elmfire.io/user_guide/spotting.html#spotting) where the number of embers is dependent on fire intensity (with a critical spotting fireline intensity is set to 1000 kW/m). Because the number of embers deposited is often low but widespread, averaged values are typically low and, due to averaging ensembles, often not whole numbers for the mean value.

C. In addition to varying exposure, five of the structure categories from Form A-1 will be applied for each flame length/ember deposition class.

D. Produce the following bar graphs in addition to the table:
   a. Personal residential mean damage ratio (MDR) for mitigated (Type 2) versus unmitigated (Type 1) structures at each flame length and ember load.
   b. Commercial habitational mean damage ratio (MDR) for mitigated (Type 4) versus unmitigated (Type 3) structures at each flame length and ember load.
   c. Mobile home (Type 5) mean damage ratio (MDR) for each flame length and ember load.



E. Document any assumptions in the completion of this form. If the modeler is unable to directly input any of the provided datasets, provide the reason and document how the exercise was implemented to produce equivalent output. Provide the intensity and (if relevant) ember metrics or scaling applied that were used for each location.

Table A

Structure Type (#)	**Structure Description**	**Flame Length**	**Ember Load**	**MDR**
1	Personal Residential Unmitigated	High	High	
1	Personal Residential Unmitigated	Medium	Medium	
1	Personal Residential Unmitigated	Low	Low	
1	Personal Residential Unmitigated	Low	High	
2	Personal Residential Mitigated	High	High	
2	Personal Residential Mitigated	Medium	Medium	
2	Personal Residential Mitigated	Low	Low	
2	Personal Residential Mitigated	Low	High	
3	Commercial Habitational Unmitigated	High	High	
3	Commercial Habitational Unmitigated	Medium	Medium	
3	Commercial Habitational Unmitigated	Low	Low	
3	Commercial Habitational Unmitigated	Low	High	
4	Commercial Habitational Mitigated	High	High	
4	Commercial Habitational Mitigated	Medium	Medium	
4	Commercial Habitational Mitigated	Low	Low	
4	Commercial Habitational Mitigated	High	Low	
5	Mobile Home	High	High	
5	Mobile Home	Medium	Medium	

5	Mobile Home	Low	Low	
5	Mobile Home	Low	High	

Form A-1: Owners' Zero Deductible Personal and Commercial Residential Property Wildfire Loss Costs Geographic Variation

Purpose: This form and the associated maps illustrate the range and variation of zero deductible wildfire loss costs across California using the statewide notional exposure dataset for owners of the reference habitational structures and examples of location-level variation.

A. Provide postal code aggregated maps color-coded (with a minimum of seven value ranges) average zero deductible residential property wildfire loss costs per $1000 of (all coverage) exposure, and csv files displaying highest, lowest, and average zero deductible residential property wildfire loss costs for each zip code per $1,000 of (all coverage) exposure according to the following parameters

1. Reference personal residential unmitigated structure; combined peril; with demand surge (PUCD)
2. Reference personal residential unmitigated structure; combined peril; without demand surge (PUC)
3. Reference personal residential unmitigated structure; smoke only; with demand surge (PUSD)
4. Reference personal residential mitigated structure; combined peril; with demand surge (PMCD)
5. Reference personal residential mitigated structure; smoke only; with demand surge (PMSD)
6. Reference commercial habitational unmitigated structure; combined peril; with demand surge (CUCD)
7. Reference commercial habitational unmitigated structure; smoke only; with demand surge (CUSD)
8. Reference commercial habitational mitigated structure; combined peril; with demand surge (CMCD)
9. Reference commercial habitational mitigated structure; smoke only; with demand surge (CMSD)
10. Reference manufactured home structure; combined peril; with demand surge (MCD)
11. Reference manufactured home structure; smoke only; with demand surge (MSD)
12. Reference condo unit; combined peril; with demand surge (CondoCD)
13. Reference condo unit; smoke only; with demand surge (CondoSD)

B. "Combined peril" here refers to fire and smoke. Assume insurance to value ratios of 100%. Provide the information on how each reference structure is coded in the model (eg. Construction Code, defensible space classification).

C. For the residential and commercial habitational structures, provide a comparison (percentage difference map) between the unmitigated and mitigated reference structures using combined peril and with demand surge. Provide csv files with the difference for each zip code.
1. *100*(PUCD – PMCD)/PUCD*
2. *100*(CUCD – CMCD)/CUCD*

D. Provide results for the unmitigated residential reference structure combined peril with demand surge at location level for the specified building clusters, which can be identified by the "GRID_ID" column in the spatial metadata file. Overlay building clusters, as circle markers colored by loss cost with black marker outlines, with color maps of either: A) Modeled fuels or B) LANDFIRE v2023 Scott & Burgan 40 fuel models. This is intended to show the sensitivity of loss costs to varying fuel types.

E. Provide a histogram of the distribution of loss costs for unmitigated residential structures statewide from the statewide notional exposure dataset as combined peril with demand surge/post-loss amplification.

F. If additional assumptions are necessary to complete this form, including related to appurtenant structures, provide the rationale for the assumptions as well as a detailed description of how they are included and implemented.

G. Include the Average Annual Statewide Wildfire Losses and standard deviation of the average annual statewide wildfire losses as combined peril with demand surge/post-loss amplification

Pyrome	**GRID_ID**	**Description**	**Dominant Fuel Types**	**Notes**
Pyrome 32	E-15	Timber	TL5;TU2;TL8; NB1;TU5	
Pyrome 30	W-33	Agricultural	NB3;GS2	
Pyrome 26	AQ-34	Timber & Built up Lakeside	TU; NB1;TL8 Lakeside	Compare with AR-36
Pyrome 26	AR-36	Timber & not built up Lakeside;	TU Lakeside; Roadbreak	Compare with AQ-34
Pyrome 33	AB-60	Grass	GR2; GS3	
Pyrome 27	BD-61	Timber/Grass/Shrub near lake	TU;GS1;GR3; NextToFireDept	
Pyrome 36	CN-81	Mojave Desert Grass	GR2;GS2;	
Pyrome 41	CL-102	Sonoran Desert Bare Ground	NB9;	
Pyrome 34	BS-98	San Clemente urban but near high FHSZ hazard	NB1; near GS2;GS3;GR2	Compare with BR-99 and BT-99
Pyrome 34	BR-99	San Clemente farther from high FHSZ hazard; coastal	NB1	Compare with BS-98 and BT-99
Pyrome 34	BT-99	Grass/Shrub ; Inland of San Clemente	GS2;GR2	Compare with BS-98 and BR-99

Reference Unmitigated Residential Structure	Reference Mitigated Residential Structure
Single Family Dwelling One story 2000 sq ft Class D roof Wood siding Wood framed exterior walls Single paned glass windows Wooden deck adjacent (75 sq. feet) Opened eaves Vents not covered with 1/8in mesh Mulch within 0 and 5ft from structure Medium fuel load between 5 and 30 ft of structure Constructed in 1995	Single Family Dwelling One story 2000 sq ft Asphalt shingles (Class A) roof Fire resistant vinyl siding Wood framed exterior walls Double paned glass windows Vents covered with 1/8 in mesh No deck or surrounding flammable material within 0 and 5 ft from structure (Defensible space) Low fuel between 5 and 30 ft of structure (Defensible space) Constructed in 2010 (compliant with CBC Chp. 7A)
Reference Unmitigated Commercial Habitational Structure	**Reference Mitigated Commercial Habitational Structure**
10 units No fire-resistant shutters Single paned glass windows Constructed in 1980 Wooden deck for each unit including ground floor (20 sq ft ea.) Mulch within 0 and 5ft of structure Medium fuel load between 5 and 30 ft of structure	10 units Fire resistant exterior walls Double paned glass windows Class A fire resistant roof No deck or surrounding flammable material within 0 and 5 ft of structure (Defensible space) Low fuel between 5 and 30 ft from structure (Defensible space) 2010 Construction (compliant with CBC Chp. 7A)
Reference Unmitigated Manufactured Home Structure	**Reference Condo Unit**
Single unit Manufactured in 1980	Single unit Constructed in 2010

Notional Wildfire Policy Specifications: Policy Type & Coverage Assumptions

Residential Owners	Coverage A = Building	Replacement Cost: $600,000 Replacement Cost included subject to Coverage A Limit
	Coverage B = Appurtenant Structure	Replacement Cost included subject to Coverage B Limit Coverage B limit = 10% of Coverage A
	Coverage C = Contents	Replacement Cost included subject to Coverage C limit Coverage C limit = 75% of Coverage A
	Coverage D = Time Element	Coverage D limit = 20% of Coverage A
	Wildfire loss costs per $1,000 should be related to the sum of all coverages	
Manufactured Home Owners	Coverage A = Building	Replacement Cost: $120,000 Replacement Cost included subject to Coverage A Limit
	Coverage B = Appurtenant Structure	Replacement Cost included subject to Coverage B Limit Coverage B limit = 10% of Coverage A
	Coverage C = Contents	Replacement Cost included subject to Coverage C limit Coverage C limit = 75% of Coverage A
	Coverage D = Time Element	Coverage D limit = 20% of Coverage A
	Wildfire loss costs per $1,000 should be related to the sum of all coverages	
Condo unit Owners	Coverage A = Building	Replacement Cost: $300,000 Replacement Cost included subject to Coverage A Limit
	Coverage B = Appurtenant Structure	Replacement Cost included subject to Coverage B Limit Coverage B limit = 10% of Coverage A
	Coverage C = Contents	Replacement Cost included subject to Coverage C limit Coverage C limit = 75% of Coverage A
	Coverage D = Time Element	Coverage D limit = 20% of Coverage A

	Wildfire loss costs per $1,000 should be related to the sum of all coverages	
Habitational Commercial	Coverage A = Building (“bare-walls” master insurance policy)	Replacement Cost: $3,500,000 Replacement Cost included subject to Coverage A Limit
	Coverage B = Appurtenant Structure	Replacement Cost included subject to Coverage B Limit Coverage B limit = 10% of Coverage A
	Coverage C = Contents	Replacement Cost included subject to Coverage C limit Coverage C limit = 75% of Coverage A
	Coverage D = Time Element	Coverage D limit = provide any assumptions on how coverage D is treated for habitational commercial structures
	Wildfire loss costs per $1,000 should be related to the sum of all coverages	

Average Annual Zero Deductible Statewide Personal and Commercial Residential Property Loss Costs

	Reference Mitigated Personal Residential Structure		Reference unmitigated personal residential structure		Reference Mitigated Commercial Structure		Reference Unmitigated Commercial Structure	
	AAL	**StDev**	**AAL**	**StDev**	**AAL**	**StDev**	**AAL**	**StDev**
Current Wildfire Catastrophe Model Submission (Date: _____)								
Previously Reviewed Wildfire Catastrophe Model Version* (Date: _____)	N/A (as of 2024)		N/A (as of 2024)		N/A (as of 2024)		N/A (as of 2024)	
Percent Change Current Submission/ Previously Reviewed* (Date:_____)	N/A (as of 2024)		N/A (as of 2024)		N/A (as of 2024)		N/A (as of 2024)	

Form A-2: Logical Relationships to Wildfire Risk

Purpose: This form provides an illustration of the wildfire loss cost relationships among deductible, construction, year built (building code), number of stories, roof type, defensible space, window fire-resistance, ember resistant vents and Firewise USA or other comparable community hazard mitigation designations issued by recognized state, local, or other wildfire safety organizations.

A. Perform a stepwise sensitivity test using the scenarios included in Table A for personal residential structures and for commercial habitational structures separately. In addition, test the unknown relative to the base value. Any insurance policy characteristics not specified here should be taken from the coverages for reference residential and reference commercial habitational coverages from Form A-1.

B. Each row in the table below represents a different scenario that modifies one feature at a time relative to a defined base case, while holding all other features of the base case contained in all the other rows constant. The test must be run independently for Residential and for Commercial Habitational occupancies. The base case assumes a 1970-built, wood-frame, one-story structure with a Class U untreated wood shake roof, no defensible space, no community-level mitigation designation, no fire-resistant windows, no ember resistant vents and a 0% of coverage A deductible. For each scenario, replace the relevant feature in the base case sequentially with the value or values indicated in the row, run the loss model, and record the output. The scenarios labeled "Base to Unknown" test model behavior when feature values are unspecified by the user. This test format is designed to isolate the influence of each feature and compare effects across both occupancies.

C. Perform each test using the 19 specified locations in Table A which includes one location for each pyrome. Starting with the Base Value indicated in Table B and for each subsequent variable for each scenario, provide the maximum, minimum, and mean value across all locations as well as the overall direction of change. If a location experiences no wildfire loss in the event catalogue, indicate which location this is in the Notes section and exclude such locations from the calculations in the "Change from Prior (%)" section of the table. Use the notes section to explain any unexpected trends.

D. Wildfire catastrophe models are to treat points as coordinates that would result from a geocoding process. Wildfire catastrophe models should treat points by simulating wildfire loss at exact location or by using the nearest modeled parcel/street/cell in the wildfire model. Report results for each of the centroid points individually, unless specified.

E. If additional assumptions are necessary to complete this form, provide the rationale for the assumptions as well as a detailed description of how they are included and implemented.

Table A

id	Fuel_Type	Pyrome	Population	Longitude	Latitude
1	Shrub-Desert	35	Low	Provided During Review	Provided During Review
2	Grass	36	Low		
3	Grass	41	Medium		
4	Grass-Shrub	34	Medium		
5	Grass	27	High		
6	Grass	78	High		
7	Grass-Shrub	77	Low		
8	Grass	30	Low		
9	Grass	33	Medium		
10	Timber-Shrub	26	Low		
11	Grass	29	High		
12	Grass	31	Low		
13	Mixed-Conifer	32	Medium		
14	Mixed-Conifer	17	Low		
15	Mixed-Conifer	18	Low		
16	Mixed-Conifer	6	Low		
17	Grass	19	Low		
18	Grass	28	Low		
19	Shrub	37	High		

Table B

Personal

Feature	Base Value	Stepwise Values (Tested Sequentially)	
		Known Values	Unknown Value Test
year_built	1970	1998 → 2009 → 2020	Yes
construction	Wood Frame	Masonry → Concrete	Yes
stories	1	3 → 6	Yes
roof_type	Class U Untreated Wood Shake	Class C → Class B → Class A	Yes
def_space_0_5	No	Yes	Yes
def_space_5_30	No	Yes	Yes
Community mitigation designation	No	Yes	Yes
deductible	0%	0.5% → 2%	Yes
fire_resistant_windows	No	Yes	Yes
Ember_resistant_vents	No	Yes	Yes

Commercial Habitational

Feature	Base Value	Stepwise Values (Tested Sequentially)	
		Known Values	Unknown Value Test
year_built	1970	1998 → 2009 → 2020	Yes
construction	Masonry	Masonry → Concrete	Yes
stories	1	3 → 6	Yes
roof_type	Class U Untreated Wood Shake	Class C → Class B → Class A	Yes
def_space_0_5	No	Yes	Yes
def_space_5_30	No	Yes	Yes
Community mitigation designation	No	Yes	Yes
deductible	0%	0.5% → 2%	Yes
fire_resistant_windows	No	Yes	Yes
Ember_resistant_vents	No	Yes	Yes

Table B.1 - Year Built

Scenario Description	From Value	To Value	Occupancy	Change from Prior (%)			Trend (# locations)		
				min	mean	max	Increase	Decrease	No Change
Residential: year_built 1970 → 1998	1970	1998	Residential						
Residential: year_built 1998 → 2009	1998	2009	Residential						
Residential: year_built 2009 → 2020	2009	2020	Residential						
Residential: year_built Base → Unknown	1970	Unknown	Residential						
Commercial Habitational: year_built 1970 → 1998	1970	1998	Commercial Habitational						
Commercial Habitational: year_built 1998 → 2009	1998	2009	Commercial Habitational						
Commercial Habitational: year_built 2009 → 2020	2009	2020	Commercial Habitational						
Commercial Habitational: year_built Base → Unknown	1970	Unknown	Commercial Habitational						

Table B.1 Notes:

Table B.2 - Construction

Scenario Description	From Value	To Value	Occupancy	Change from Prior (%)			Trend (# locations)		
				min	mean	max	Increase	Decrease	No Change
Residential: construction Wood Frame → Masonry	Wood Frame	Masonry	Residential						
Residential: construction Masonry → Concrete	Masonry	Concrete	Residential						
Residential: construction Base → Unknown	Wood Frame	Unknown	Residential						
Commercial Habitational: construction Masonry → Concrete	Masonry	Concrete	Commercial Habitational						
Commercial Habitational: construction Base → Unknown	Wood Frame	Unknown	Commercial Habitational						

Table B.2 Notes:

Table B.3 - Stories

Scenario Description	From Value	To Value	Occupancy	Change from Prior (%)			Trend (# locations)		
				min	mean	max	Increase	Decrease	No Change
Residential: stories 1 → 3	1	3	Residential						
Residential: stories 3 → 6	3	6	Residential						
Residential: stories Base → Unknown	1	Unknown	Residential						
Commercial Habitational: stories 1 → 3	1	3	Commercial Habitational						
Commercial Habitational: stories 3 → 6	3	6	Commercial Habitational						
Commercial Habitational: stories Base → Unknown	1	Unknown	Commercial Habitational						

Table B.3 Notes:

Table B.4- Roof Type

Scenario Description	From Value	To Value	Occupancy	Change from Prior (%)			Trend (# locations)		
				min	mean	max	Increase	Decrease	No Change
Residential: roof_type Class U Untreated Wood Shake → Class C Plywood	Class U Untreated Wood Shake	Class C Plywood	Residential						
Residential: roof_type Class C Plywood → Class B Treated Wood Shake	Class C Plywood	Class B Treated Wood Shake	Residential						
Residential: roof_type Class B Treated Wood Shake → Class A Asphalt Shingle	Class B Treated Wood Shake	Class A Asphalt Shingle	Residential						
Residential: roof_type Base → Unknown	Class U Untreated Wood Shake	Unknown	Residential						
Commercial Habitational: roof_type Class U Untreated Wood Shake → Class C Plywood	Class U Untreated Wood Shake	Class C Plywood	Commercial Habitational						
Commercial Habitational: roof_type Class C Plywood → Class B Treated Wood Shake	Class C Plywood	Class B Treated Wood Shake	Commercial Habitational						
Commercial Habitational: roof_type Class B Treated Wood Shake → Class A Asphalt Shingle	Class B Treated Wood Shake	Class A Asphalt Shingle	Commercial Habitational						
Commercial Habitational: roof_type Base → Unknown	Class U Untreated Wood Shake	Unknown	Commercial Habitational						

Table B.4 Notes:

Table B.5 - Def Space 0-5ft

Scenario Description	From Value	To Value	Occupancy	Change from Prior (%)			Trend (# locations)		
				min	mean	max	Increase	Decrease	No Change
Residential: def_space_0_5 No → Yes	No	Yes	Residential						
Residential: def_space_0_5 Base → Unknown	No	Unknown	Residential						
Commercial Habitational: def_space_0_5 No → Yes	No	Yes	Commercial Habitational						
Commercial Habitational: def_space_0_5 Base → Unknown	No	Unknown	Commercial Habitational						

Table B.5 Notes:

Table B.6 - Def Space 5-30

Scenario Description	From Value	To Value	Occupancy	Change from Prior (%)			Trend (# locations)		
				min	mean	max	Increase	Decrease	No Change
Residential: def_space_5_30 No → Yes	No	Yes	Residential						
Residential: def_space_5_30 Base → Unknown	No	Unknown	Residential						
Commercial Habitational: def_space_5_30 No → Yes	No	Yes	Commercial Habitational						
Commercial Habitational: def_space_5_30 Base → Unknown	No	Unknown	Commercial Habitational						

Table B.6 Notes:

Table B.7 – Community mitigation designation

Scenario Description	From Value	To Value	Occupancy	Change from Prior (%)			Trend (# locations)		
				min	mean	max	Increase	Decrease	No Change
Residential: Community mitigation No → Yes	No	Yes	Residential						
Residential: Community mitigation Base → Unknown	No	Unknown	Residential						
Commercial Habitational: Community mitigation No → Yes	No	Yes	Commercial Habitational						
Commercial Habitational: Community mitigation Base → Unknown	No	Unknown	Commercial Habitational						

Table B.7 Notes:

Table B.8 - Deductible

Scenario Description	From Value	To Value	Occupancy	Change from Prior (%)			Trend (# locations)		
				min	mean	max	Increase	Decrease	No Change
Residential: deductible 0 → 0.005	0%	0.5%	Residential						
Residential: deductible 0.005 → 0.02	0.5%	2%	Residential						
Residential: deductible Base → Unknown	0%	Unknown	Residential						
Commercial Habitational: deductible 0 → 0.005	0%	0.5%	Commercial Habitational						
Commercial Habitational: deductible 0.005 → 0.02	0.5%	2%	Commercial Habitational						
Commercial Habitational: deductible Base → Unknown	0%	Unknown	Commercial Habitational						

Table B.8 Notes:

Table B.9- Fire Resistant Windows

Scenario Description	From Value	To Value	Occupancy	Change from Prior (%)			Trend (# locations)		
				min	mean	max	Increase	Decrease	No Change
Residential: fire_resistant_windows No → Yes	No	Yes	Residential						
Residential: fire_resistant_windows Base → Unknown	No	Unknown	Residential						
Commercial Habitational: fire_resistant_windows No → Yes	No	Yes	Commercial Habitational						
Commercial Habitational: fire_resistant_windows Base → Unknown	No	Unknown	Commercial Habitational						

Table B.9 Notes:

Table B.10- Ember resistant vents

Scenario Description	From Value	To Value	Occupancy	Change from Prior (%)			Trend (# locations)		
				min	mean	max	Increase	Decrease	No Change
Residential: ember_resistant_vents No → Yes	No	Yes	Residential						
Residential: ember_resistant_vents Base → Unknown	No	Unknown	Residential						
Commercial Habitational: ember_resistant_vents No → Yes	No	Yes	Commercial Habitational						
Commercial Habitational: ember_resistant_vents Base → Unknown	No	Unknown	Commercial Habitational						

Table B.10 Notes:

Form A-3: Annual Wildfire Exceedance Probability Curve & Probable Maximum Loss for California

Purpose: This form provides an illustration of the distribution of annual aggregate wildfire losses using a statewide notional dataset. The form also illustrates that appropriate calculations were used to produce annual occurrence and aggregate wildfire probable maximum losses and associated confidence intervals at various return periods using the statewide notional exposure dataset.

A. Provide a detailed explanation of how the annual aggregate wildfire losses and return periods are calculated, including the total number of years simulated.

B. Complete Parts A.1-A.4, B.1-B.4, and C.1-C.4 showing the personal and commercial residential property wildfire annual aggregate exceedance probability curves and annual aggregate and occurrence probable maximum loss for California for each portfolio as described below.

- Part A.1, B.1, and C.1 should be completed using the Reference Older Unmitigated Residential Structure portfolio from the statewide personal and commercial residential property zero deductible notional exposure dataset. Provide results separately for: Combined peril with demand surge (A.1.1; B.1.1; C.1.1); smoke-only with demand surge (A.1.2; B.1.2; C.1.2); Combined peril without demand surge (A.1.3; B.1.3; C.1.3).

- Part A.2, B.2, and C.2 should be completed using the Reference Newer Mitigated Residential Structure portfolio from the statewide personal and commercial residential property zero deductible notional exposure dataset. Provide results for combined peril with demand surge.

- Part A.3, B.3, and C.3 should be completed using the Reference Unmitigated Commercial Habitational Structure portfolio from the statewide personal and commercial residential property zero deductible notional exposure dataset. Provide results for combined peril with demand surge.

- Part A.4, B.4, and C.4 should be completed using the Reference Mitigated Commercial Habitational Structure portfolio from the statewide personal and commercial residential property zero deductible notional exposure dataset. Provide results for combined peril with demand surge.

- In the column, Return Period (Years), provide the return period associated with the average wildfire loss within the ranges indicated on a cumulative basis. For example,

if the average wildfire loss is $4,700 million for the range $4,501-$5,000 million, provide the return period associated with a wildfire loss that is $4,700 million or greater.

- For each wildfire loss range in millions ($1,001-$1,500, $1,501-$2,000, $2,001-$2,500) the average wildfire loss within that range should be identified and then the return period associated with that wildfire loss calculated. The return period is then the reciprocal of the probability of the wildfire loss equaling or exceeding this average wildfire loss size.

- The probability of equaling or exceeding the average of each range should be smaller as the ranges increase (and the average wildfire losses within the ranges increase). Therefore, the return period associated with each range and average wildfire loss within that range should be larger as the ranges increase. Return periods should be based on cumulative probabilities.

- A return period for an average wildfire loss of $4,700 million within the $4,501-$5,000 million range should be lower than the return period for an average wildfire loss of $5,455 million associated with a $5,001-$6,000 million range.

- "Total Wildfire Loss" is the sum of losses for all years with an annual loss falling within a given range.

- "Number of Simulated Years with Total Wildfire Loss in Range" is the total number of simulated years that had annual wildfire loss falling within a given range.

- "Total Number of Loss-Causing Wildfire Events Across All Years in Row" is the total number of loss-causing wildfire events that occurred in all years that had a total wildfire loss falling within a given range.

C. Provide figures of loss exceedance curves A) for personal residential structures plotting the unmitigated with demand surge, unmitigated without demand surge, and mitigated scenarios on a single figure and B) for commercial habitational structures plotting the unmitigated with demand surge, unmitigated without demand surge, and mitigated scenarios on a single figure.

D. Provide the expected wildfire loss, standard deviation of loss, lower bound (10%) of confidence interval, and upper bound (90%) of confidence interval for each of the Return Periods given in Parts B.1-B.4, Annual Aggregate, and Parts C.1-C.4, Annual Occurrence. Describe how the uncertainty in wildfire vulnerability functions has been propagated to the uncertainty in portfolio loss and how it relates to the provided confidence intervals.

E. If additional assumptions are necessary to complete this form, provide the rationale for the assumptions as well as a detailed description of how they are included and implemented.

Part A.1.1 – Reference Older Unmitigated Residential Structure Wildfire Annual Aggregate Exceedance Probability Curve for California, Combined Peril with Demand Surge

WILDFIRE LOSS RANGE (MILLIONS)			(1) TOTAL WILDFIRE LOSS	(2) NUMBER OF SIMULATED YEARS WITH TOTAL WILDFIRE LOSS IN RANGE	(3) = (1) / (2) AVERAGE ANNUAL WILDFIRE LOSSES	(4) TOTAL NUMBER OF LOSS-CAUSING WILDFIRE EVENTS ACROSS ALL YEARS IN ROW	(5) = (4) / (2) AVERAGE NUMBER OF LOSS-CAUSING WILDFIRE EVENTS PER YEAR	(6) = (3) / (5) = (1) / (4) AVERAGE WILDFIRE EVENT LOSS FOR LOSS-CAUSING WILDFIRE EVENTS (MILLIONS)	(7) EXCEEDANCE PROBABILITY	(8) = 1 / (7) RETURN PERIOD (YEARS)
$0	to	$0								
$ >0	to	$ 500								
$ 501	to	$ 1,000								
$ 1,001	to	$ 1,500								
$ 1,501	to	$ 2,000								
$ 2,001	to	$ 2,500								
$ 2,501	to	$ 3,000								
$ 3,001	to	$ 3,500								
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$ 65,001	to	$ 70,000								
$ 70,001	to	$ 75,000								
$ 75,001	to	$ 80,000								
$ 80,001	to	$ 90,000								
$ 90,001	to	$ 100,000								
$ 100,001	to	$ Maximum								
Total										

*Zero deductible statewide Wildfire loss using the referenced zero deductible exposure data.

Part A.1.2 – Reference Older Unmitigated Residential Structure Wildfire Annual Aggregate Exceedance Probability Curve for California, Smoke-Only with Demand Surge

WILDFIRE LOSS RANGE (MILLIONS)			(1) TOTAL WILDFIRE LOSS	(2) NUMBER OF SIMULATED YEARS WITH TOTAL WILDFIRE LOSS IN RANGE	(3) = (1) / (2) AVERAGE ANNUAL WILDFIRE LOSSES	(4) TOTAL NUMBER OF LOSS-CAUSING WILDFIRE EVENTS ACROSS ALL YEARS IN ROW	(5) = (4) / (2) AVERAGE NUMBER OF LOSS- CAUSING WILDFIRE EVENTS PER YEAR	(6) = (3) / (5) = (1) / (4) AVERAGE WILDFIRE EVENT LOSS FOR LOSS-CAUSING WILDFIRE EVENTS (MILLIONS)	(7) EXCEEDANCE PROBABILITY	(8) = 1 / (7) RETURN PERIOD (YEARS)
$0	to	$0								
$ >0	to	$ 50								
$ 51	to	$ 100								
$ 101	to	$ 150								
$ 151	to	$ 200								
$ 201	to	$ 250								
$ 251	to	$ 300								
$ 301	to	$ 350								
$ 351	to	$ 400								
$ 401	to	$ 450								
$ 451	to	$ 500								
$ 501	to	$ 600								
$ 601	to	$ 700								
$ 701	to	$ 800								
$ 801	to	$ 900								
$ 901	to	$ 1,000								
$ 1,001	to	$ 1,100								
$ 1,101	to	$ 1,200								
$ 1,201	to	$ 1,300								
$ 1,301	to	$ 1,400								
$ 1,401	to	$ 1,500								
$ 1,501	to	$ 1,600								
$ 1,601	to	$ 1,700								
$ 1,701	to	$ 1,800								
$ 1,801	to	$ 1,900								
$ 1,901	to	$ 2,000								
$ 2,001	to	$ 2,100								
$ 2,101	to	$ 2,200								
$ 2,201	to	$ 2,300								
$ 2,301	to	$ 2,400								

$ 2,401	to	$ 2,500								
$ 2,501	to	$ 2,600								
$ 2,601	to	$ 2,700								
$ 2,701	to	$ 2,800								
$ 2,801	to	$ 2,900								
$ 2,901	to	$ 3,000								
$ 3,001	to	$ 3,500								
$ 3,501	to	$ 4,000								
$ 4,001	to	$ 4,500								
$ 4,501	to	$ 5,000								
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$ 16,001	to	$ 17,000								
$ 17,001	to	$ 18,000								
$ 18,001	to	$ 19,000								
$ 19,001	to	$ 20,000								
$ 20,001	to	Maximum								
Total										

*Zero deductible statewide Wildfire loss using the referenced zero deductible exposure data.

Part A.1.3 – Reference Older Unmitigated Residential Structure Wildfire Annual Aggregate Exceedance Probability Curve for California, Combined Peril without Demand Surge

WILDFIRE LOSS RANGE (MILLIONS)			(1) TOTAL WILDFIRE LOSS	(2) NUMBER OF SIMULATED YEARS WITH TOTAL WILDFIRE LOSS IN RANGE	(3) = (1) / (2) AVERAGE ANNUAL WILDFIRE LOSSES	(4) TOTAL NUMBER OF LOSS-CAUSING WILDFIRE EVENTS ACROSS ALL YEARS IN ROW	(5) = (4) / (2) AVERAGE NUMBER OF LOSS-CAUSING WILDFIRE EVENTS PER YEAR	(6) = (3) / (5) = (1) / (4) AVERAGE WILDFIRE EVENT LOSS FOR LOSS-CAUSING WILDFIRE EVENTS (MILLIONS)	(7) EXCEEDANCE PROBABILITY	(8) = 1 / (7) RETURN PERIOD (YEARS)
$0	to	$0								
$ >0	to	$ 500								
$ 501	to	$ 1,000								
$ 1,001	to	$ 1,500								
$ 1,501	to	$ 2,000								
$ 2,001	to	$ 2,500								
$ 2,501	to	$ 3,000								
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$ 65,001	to	$ 70,000								
$ 70,001	to	$ 75,000								
$ 75,001	to	$ 80,000								
$ 80,001	to	$ 90,000								
$ 90,001	to	$ 100,000								
$ 100,001	to	$ Maximum								
Total										

*Zero deductible statewide Wildfire loss using the referenced zero deductible exposure data.

Part A.2.1 – Reference Newer Mitigated Residential Structure Wildfire Annual Aggregate Exceedance Probability Curve for California, Combined Peril with Demand Surge

WILDFIRE LOSS RANGE (MILLIONS)			(1) TOTAL WILDFIRE LOSS	(2) NUMBER OF SIMULATED YEARS WITH TOTAL WILDFIRE LOSS IN RANGE	(3) = (1) / (2) AVERAGE ANNUAL WILDFIRE LOSSES	(4) TOTAL NUMBER OF LOSS-CAUSING WILDFIRE EVENTS ACROSS ALL YEARS IN ROW	(5) = (4) / (2) AVERAGE NUMBER OF LOSS-CAUSING WILDFIRE EVENTS PER YEAR	(6) = (3) / (5) = (1) / (4) AVERAGE WILDFIRE EVENT LOSS FOR LOSS-CAUSING WILDFIRE EVENTS (MILLIONS)	(7) EXCEEDANCE PROBABILITY	(8) = 1 / (7) RETURN PERIOD (YEARS)
$0	to	$0								
$ >0	to	$ 500								
$ 501	to	$ 1,000								
$ 1,001	to	$ 1,500								
$ 1,501	to	$ 2,000								
$ 2,001	to	$ 2,500								
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$ 70,001	to	$ 75,000								
$ 75,001	to	$ 80,000								
$ 80,001	to	$ 90,000								
$ 90,001	to	$ 100,000								
$ 100,001	to	$ Maximum								
Total										

*Zero deductible statewide Wildfire loss using the referenced zero deductible exposure data.

Part A.3.1 – Reference Unmitigated Commercial Habitational Structure Wildfire Annual Aggregate Exceedance Probability Curve for California, Combined Peril with Demand Surge

WILDFIRE LOSS RANGE (MILLIONS)			(1) TOTAL WILDFIRE LOSS	(2) NUMBER OF SIMULATED YEARS WITH TOTAL WILDFIRE LOSS IN RANGE	(3) = (1) / (2) AVERAGE ANNUAL WILDFIRE LOSSES	(4) TOTAL NUMBER OF LOSS-CAUSING WILDFIRE EVENTS ACROSS ALL YEARS IN ROW	(5) = (4) / (2) AVERAGE NUMBER OF LOSS-CAUSING WILDFIRE EVENTS PER YEAR	(6) = (3) / (5) = (1) / (4) AVERAGE WILDFIRE EVENT LOSS FOR LOSS-CAUSING WILDFIRE EVENTS (MILLIONS)	(7) EXCEEDANCE PROBABILITY	(8) = 1 / (7) RETURN PERIOD (YEARS)
$0	to	$0								
$ >0	to	$ 500								
$ 501	to	$ 1,000								
$ 1,001	to	$ 1,500								
$ 1,501	to	$ 2,000								
$ 2,001	to	$ 2,500								
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$ 70,001	to	$ 75,000								
$ 75,001	to	$ 80,000								
$ 80,001	to	$ 90,000								
$ 90,001	to	$ 100,000								
$ 100,001	to	$ Maximum								
Total										

*Zero deductible statewide Wildfire loss using the referenced zero deductible exposure data.

Part A.4.1 – Reference Mitigated Commercial Habitational Structure Wildfire Annual Aggregate Exceedance Probability Curve for California, Combined Peril with Demand Surge

WILDFIRE LOSS RANGE (MILLIONS)			(1) TOTAL WILDFIRE LOSS	(2) NUMBER OF SIMULATED YEARS WITH TOTAL WILDFIRE LOSS IN RANGE	(3) = (1) / (2) AVERAGE ANNUAL WILDFIRE LOSSES	(4) TOTAL NUMBER OF LOSS-CAUSING WILDFIRE EVENTS ACROSS ALL YEARS IN ROW	(5) = (4) / (2) AVERAGE NUMBER OF LOSS-CAUSING WILDFIRE EVENTS PER YEAR	(6) = (3) / (5) = (1) / (4) AVERAGE WILDFIRE EVENT LOSS FOR LOSS-CAUSING WILDFIRE EVENTS (MILLIONS)	(7) EXCEEDANCE PROBABILITY	(8) = 1 / (7) RETURN PERIOD (YEARS)
$0	to	$0								
$ >0	to	$ 500								
$ 501	to	$ 1,000								
$ 1,001	to	$ 1,500								
$ 1,501	to	$ 2,000								
$ 2,001	to	$ 2,500								
$ 2,501	to	$ 3,000								
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$ 15,001	to	$ 16,000								
$ 16,001	to	$ 17,000								
$ 17,001	to	$ 18,000								
$ 18,001	to	$ 19,000								
$ 19,001	to	$ 20,000								

$ 20,001	to	$ 21,000								
$ 21,001	to	$ 22,000								
$ 22,001	to	$ 23,000								
$ 23,001	to	$ 24,000								
$ 24,001	to	$ 25,000								
$ 25,001	to	$ 26,000								
$ 26,001	to	$ 27,000								
$ 27,001	to	$ 28,000								
$ 28,001	to	$ 29,000								
$ 29,001	to	$ 30,000								
$ 30,001	to	$ 35,000								
$ 35,001	to	$ 40,000								
$ 40,001	to	$ 45,000								
$ 45,001	to	$ 50,000								
$ 50,001	to	$ 55,000								
$ 55,001	to	$ 60,000								
$ 60,001	to	$ 65,000								
$ 65,001	to	$ 70,000								
$ 70,001	to	$ 75,000								
$ 75,001	to	$ 80,000								
$ 80,001	to	$ 90,000								
$ 90,001	to	$ 100,000								
$ 100,001	to	$ Maximum								
Total										

*Zero deductible statewide Wildfire loss using the referenced zero deductible exposure data.

Part B.1.1 – Reference Older Unmitigated Residential Structure Wildfire Annual Aggregate Probable Maximum Loss for California, Combined Peril with Demand Surge

Return Period (Years)	Expected Wildfire Loss for Return Period Value at Risk (VAR)	Tail Value at Risk (TVaR)	Lower Bound (10%) of Confidence Interval for Return Period Loss	Upper Bound (90%) of Confidence Interval for Return Period Loss
Top Event				
5,000				
1,000				
500				
250				
200				
100				
50				
20				
10				
5				

Part B.1.2 – Reference Older Unmitigated Residential Structure Wildfire Annual Aggregate Probable Maximum Loss for California, Smoke-Only with Demand Surge

Return Period (Years)	Expected Wildfire Loss for Return Period Value at Risk (VAR)	Tail Value at Risk (TVaR)	Lower Bound (10%) of Confidence Interval for Return Period Loss	Upper Bound (90%) of Confidence Interval for Return Period Loss
Top Event				
5,000				
1,000				
500				
250				
200				
100				
50				
20				
10				
5				

Part B.1.3 – Reference Older Unmitigated Residential Structure Wildfire Annual Aggregate Probable Maximum Loss for California, Combined Peril without Demand Surge

Return Period (Years)	Expected Wildfire Loss for Return Period Value at Risk (VAR)	Tail Value at Risk (TVaR)	Lower Bound (10%) of Confidence Interval for Return Period Loss	Upper Bound (90%) of Confidence Interval for Return Period Loss

Top Event				
5,000				
1,000				
500				
250				
200				
100				
50				
20				
10				
5				

Part B.2.1 – Reference Newer Mitigated Residential Structure Wildfire Annual Aggregate Probable Maximum Loss for California, Combined Peril with Demand Surge

Return Period (Years)	Expected Wildfire Loss for Return Period Value at Risk (VAR)	Tail Value at Risk (TVaR)	Lower Bound (10%) of Confidence Interval for Return Period Loss	Upper Bound (90%) of Confidence Interval for Return Period Loss
Top Event				
5,000				
1,000				
500				
250				
200				
100				
50				
20				
10				

5				

Part B.3.1 – Reference Unmitigated Commercial Habitational Structure Wildfire Annual Aggregate Probable Maximum Loss for California, Combined Peril with Demand Surge

Return Period (Years)	Expected Wildfire Loss for Return Period Value at Risk (VAR)	Tail Value at Risk (TVaR)	Lower Bound (10%) of Confidence Interval for Return Period Loss	Upper Bound (90%) of Confidence Interval for Return Period Loss
Top Event				
5,000				
1,000				
500				
250				
200				
100				
50				
20				
10				
5				

Part B.4.1 – Reference Mitigated Commercial Habitational Structure Wildfire Annual Aggregate Probable Maximum Loss for California, Combined Peril with Demand Surge

Return Period (Years)	Expected Wildfire Loss for Return Period Value at Risk (VAR)	Tail Value at Risk (TVaR)	Lower Bound (10%) of Confidence Interval for Return Period Loss	Upper Bound (90%) of Confidence Interval for Return Period Loss
Top Event				
5,000				
1,000				
500				
250				
200				
100				
50				
20				
10				
5				

Part C.1.1 – Reference Older Unmitigated Residential Structure Wildfire Annual Occurrence Probable Maximum Loss for California, Combined Peril with Demand Surge

Return Period (Years)	Expected Wildfire Loss for Return Period Value at Risk (VAR)	Tail Value at Risk (TVaR)	Lower Bound (10%) of Confidence Interval for Return Period Loss	Upper Bound (90%) of Confidence Interval for Return Period Loss
Top Event				
5,000				
1,000				
500				
250				
200				
100				
50				
20				
10				
5				

Part C.1.2 – Reference Older Unmitigated Residential Structure Wildfire Annual Occurrence Probable Maximum Loss for California, Smoke-Only with Demand Surge

Return Period (Years)	Expected Wildfire Loss for Return Period Value at Risk (VAR)	Tail Value at Risk (TVaR)	Lower Bound (10%) of Confidence Interval for Return Period Loss	Upper Bound (90%) of Confidence Interval for Return Period Loss
Top Event				
5,000				
1,000				
500				
250				
200				
100				
50				
20				
10				
5				

Part C.1.3 – Reference Older Unmitigated Residential Structure Wildfire Annual Occurrence Probable Maximum Loss for California, Combined Peril without Demand Surge

Return Period (Years)	Expected Wildfire Loss for Return Period Value at Risk (VAR)	Tail Value at Risk (TVaR)	Lower Bound (10%) of Confidence Interval for Return	Upper Bound (90%) of Confidence Interval for Return Period Loss

			Period Loss	
Top Event				
5,000				
1,000				
500				
250				
200				
100				
50				
20				
10				
5				

Part C.2.1 – Reference Newer Mitigated Residential Structure Wildfire Annual Occurrence Probable Maximum Loss for California, Combined Peril with Demand Surge

Return Period (Years)	Expected Wildfire Loss for Return Period Value at Risk (VAR)	Tail Value at Risk (TVaR)	Lower Bound (10%) of Confidence Interval for Return Period Loss	Upper Bound (90%) of Confidence Interval for Return Period Loss
Top Event				
5,000				
1,000				
500				
250				
200				

100				
50				
20				
10				
5				

Part C.3.1 – Reference Unmitigated Commercial Habitational Structure Wildfire Annual Occurrence Probable Maximum Loss for California, Combined Peril with Demand Surge

Return Period (Years)	Expected Wildfire Loss for Return Period Value at Risk (VAR)	Tail Value at Risk (TVaR)	Lower Bound (10%) of Confidence Interval for Return Period Loss	Upper Bound (90%) of Confidence Interval for Return Period Loss
Top Event				
5,000				
1,000				
500				
250				
200				
100				
50				
20				
10				
5				

Part C.4.1 – Reference Mitigated Commercial Habitational Structure Wildfire Annual Occurrence Probable Maximum Loss for California, Combined Peril with Demand Surge

Return Period (Years)	Expected Wildfire Loss for Return Period Value at Risk (VAR)	Tail Value at Risk (TVaR)	Lower Bound (10%) of Confidence Interval for Return Period Loss	Upper Bound (90%) of Confidence Interval for Return Period Loss
Top Event				
5,000				
1,000				
500				
250				
200				
100				
50				
20				
10				
5				