



Wildfire Hardened and Energy Efficient Building Assemblies –

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*Funded by Energy Codes and Standards
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Learning Objectives

1. Burn Test Study (K&A Building Science & SCE)
2. Wildfire Hardened Displays - SCE Energy Education Center
3. Parcel Assessment for Wildfire Hardening (PAWH) Form
4. Key Points



Learning Objective #1

Burn Test Study



*San Bernardino Regional Emergency
Training Center
Burn Test
January 30th, 2024*



Residential Fires

- What is the average duration of a residential fire?
- How hot is a residential fire?



Residential Fires

- The average duration = 60 minutes
 - 15 minutes up to 3 hours
- The average temperature = 1,600° F
 - Extreme fuels and winds = 2,000° F

Burn Structure -

- Needs to last 60 minutes
- Produce direct flame & radiant heat exposures of 1,600° F



Conventionally Framed

- 2"x6" lumber 16" O.C. (on center)
- Traditional framing adds more fuel to a structure.



- Open Eave
- Vented Attic
- Wood Siding



Insulated, Drywall and Vinyl Window



The Goal of our Burn Test Study

- To test ignition resistant & non-combustible building materials as an advanced framed assembly, in a high-density setting, to stand alone & survive the full duration of a residential fire.
- Structures facing each other, not side by side.



U-Stucco being installed.

A lot of wood furniture!



- Standard wood door
- No defensible space
- Combustibles in the 0'-5' zone around the structure





Hardened Structure -

- Advanced framing 2" x 6" x 24" O.C. (Less fuel)
- Enclosed eave
- Unvented attic
- Non-combustible siding
- Insulated, drywall and taped
- 60-minute fire rated window
- 60-minute fire rated door
- Defensible space – Zone 0 (0'-5')
- SSD 10' from neighboring parcel

Hardened Structure - Construction

Advanced Framing 24" o/c Single Top Plate
and 2-Stud Corners



Site-Built Trusses



Hardened Structure - Construction

Fiberglass Batts & Mineral Wool



Drywall & Taped for Air Seal



SAFTIFIRST 60 min. Fire Rated Window

Steel Clips



Steel Square Tubing



SAFTIFIRST 60 min. Fire Rated Window

Mineral Wool – Thermal Barrier



Gypsum Filled Aluminum Caps



SAFTIFIRST 60 min. Fire Rated Window

Interior View – Ready for Glazing



Double-Pane Non-Operable



SAFTIFIRST 60 min. Fire Rated Window

Interior View



SPECIFICATION

SECTION 08 88 13: FIRE-RATED GLAZING
SuperLite® II-XL 60 minute and SuperLite® II-XL 60 minute
with Starphire Ultra-Clear® Glass by Vitro

Unvented Attic and Enclosed Eaves



Non-Combustible Exterior Siding & Roofing

Lathing



U-stucco: Single Coat (7/8"-1")



60 min. Fire Rated Door

Steel Door Jamb



Intertek 1-Hour Fire Door



Standard Steel Fence

5' Tall



K&A Fabricated Supports



Standard Vinyl Fence (5' from each structure)

Supports for the Vinyl Fence



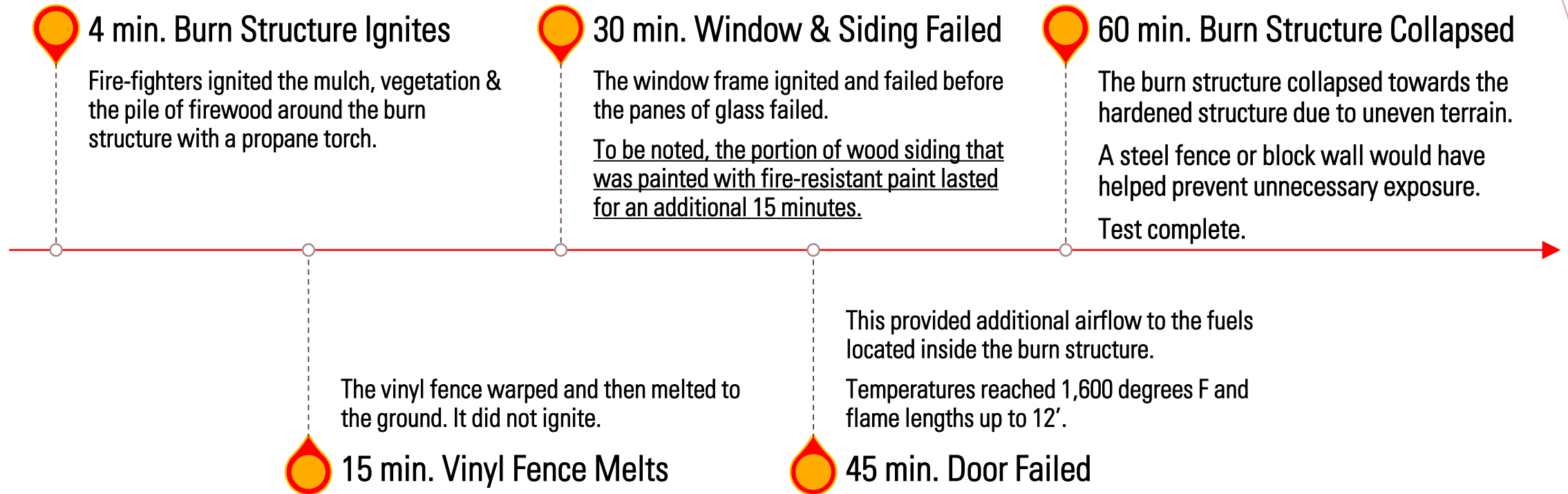
Free Standing Fence



FR-Clear Coating or Paint: Red Taped Sections



Burn Structure Timeline



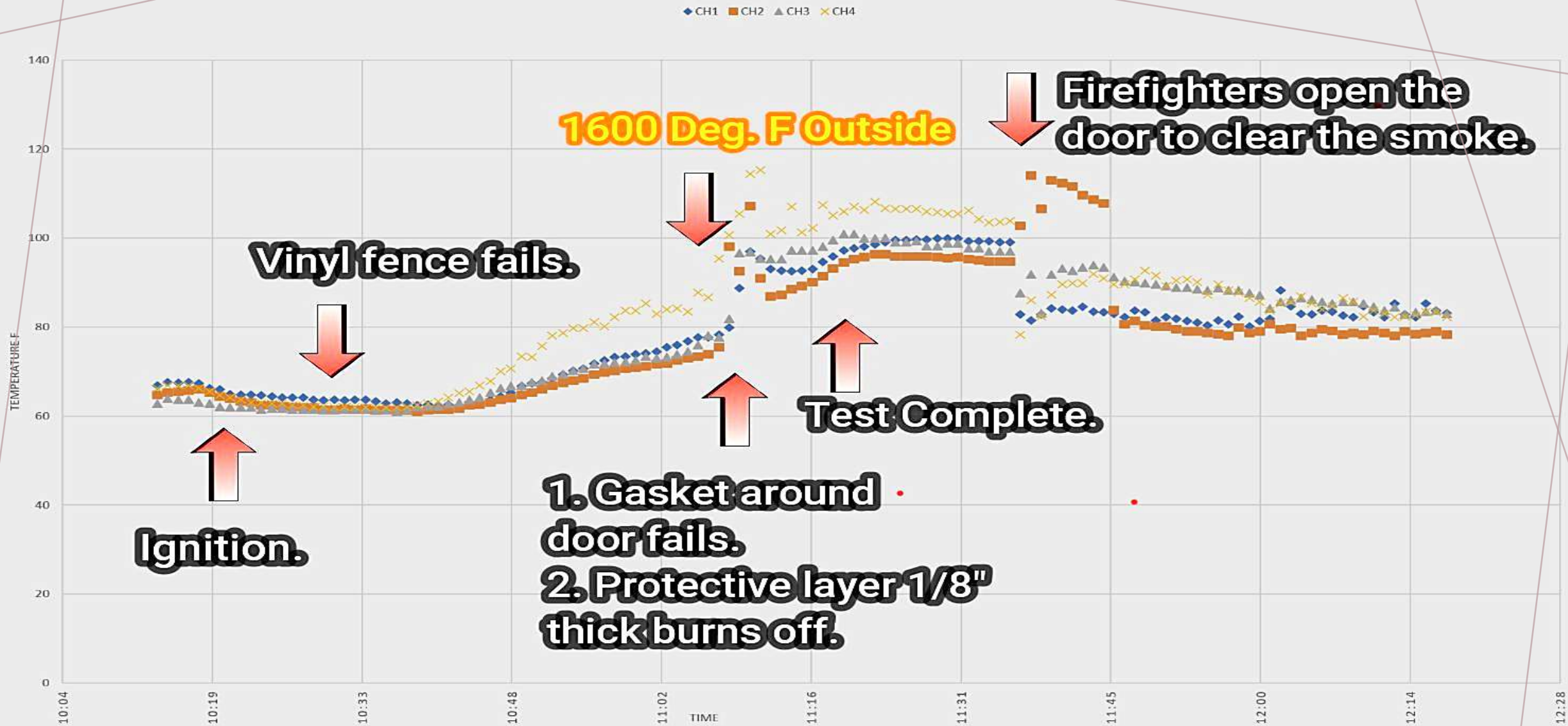
VIDEO



Video:
Kliwer and Associates performs
Burn Test for SCE

https://youtu.be/VJKS_qSk9P4?si=eJ2hNJUi3e8pp1jU

BURN TEST - TEMPS INSIDE FORTIFIED STRUCTURE



Channel Legend:

- ◆ CH1 1 Behind Window
- CH2 2 Behind Middle Door
- ▲ CH3 3 Behind Top Door
- ✕ CH4 4 Ceiling



10:47 am



11:18 am

Vinyl fence melts and does not sustain flame.



FR-Paint & Coating

FR-paint provided 15 minutes of protection.

Neither are approved in California building codes.





We Did Not Anticipate

- The burn structure collapsing towards the hardened structure.
- Building materials may have to withstand impact.
- Steel fence or a concrete block wall.
- Wildfire events may have extremely high winds and debris that may fall onto or against your structures.



Design met the anticipated exposure

- Advanced framing 2" x 6" x 24" O.C. (Less fuel)
- Enclosed eave
- Unvented attic
- Ignition resistant and non-combustible siding
- Insulated, drywall and taped
- 60-minute fire rated window
- 60-minute fire rated door
- Defensible space
- SSD 10' from neighboring parcel



Forensic Study

1/8" Layer on the 60min. FR-Door Contributes to Direct-Flame Exposure to the Closed Eave.



Observations

- Eaves trap heat.
- **Extremely vulnerable to ignition.**
- Relatively easy to enclose with non-combustible materials.



A rectangular metal vent with a grid of slats, installed in a roof deck. The vent is made of stainless steel and has four screws securing it to the roof. The roof deck is made of a light-colored, textured material, possibly concrete or a composite material.

Recommendations

- If attics are vented, use ember and fire-rated vents with 1/16" - 1/8" openings. Options may include:
 - Stainless steel wire (looks like steel wool).
 - Intumescent firestop materials; Expands when heated which closes the screened openings preventing ember and direct flame exposure.
 - Replaceable cartridge design.
 - Metal louvers over the screen mesh prevents the screen mesh being painted over.

2024 International Wildland-Urban Interface Code

- Class 1 & 2 ignition-resistant construction prohibits ventilation in soffits, eave overhangs, between rafters at eaves (504.10.3 and 505.10.3 Vent locations).
- **Critical building code**



60-Minute Fire Rated Door

1/8-inch layer burned off.



Fire Resistant Core



1-Hour Fire Door (UL10C/NFPA 252)

Intertek 1-Hour Fire Door



Aluminum threshold survived
(melts at 1,221 degrees F)



Steel Door Jamb

Timely galvanized steel door frame.



Fiber cement board 0.25" provided a thermal break.



Heat Transfer at the Hinges

Concentrated heat at the door hinges.

Critical Information



Fiber cement & drywall withstood heat transfer.



Wood stud was scorched at steel hinge.



Recommendations

- Ensure the steel door frame is installed over noncombustible materials such as drywall or fiber cement board.
- Use thermal breaks to prevent heat transfer.
- Caulk any gaps with fire rated caulking or intumescent materials in through-hole penetrations.



Door Recommendations

- 60–120-minute fire-rated door.
 - Highest rating possible when fuel or structure exposures are less than 30' (High-density).
- Must include the equivalent rated door jamb & weather stripping.
 - If steel, install ¼" fiber cement board between the steel door jamb and wood framing.





Non-Combustible Siding & Roof: U-Stucco

Second burn test performed by placing wood directly against the single coat u-stucco (R2 per inch)

- Regular stucco R0.20
- Energy Efficiency (EE) gain

Non-Combustible Siding/Roof: U-Stucco

Did heat transfer through?



No damage



Non-Combustible Siding/Roof: U-Stucco

Cracking from installation



No damage to wood sheathing or underlayment



Heat did not transfer through U-Stucco



SAFTIFIRST 60min. Fire Rated Window

Superlite II-XL



Intumescent Interlayer Expands



SAFTIFIRST 60min. Fire Rated Window

Appears the gypsum pack plastic coating heated up enough to stick to the steel tubing



Wood framing undamaged



Conclusion – Hardening and Defensible Space Provides:

- Additional time for residents to escape
- More time for first responders to arrive
- A safer working environment for first responders to defend the structure
- Did not contribute to the spread of embers
- Evidence that structures can be designed to stand-alone against wildfires

Recent 2025 Palisades Fire



Learning Objective 2: Southern California Edison Energy Education Center Wildfire Hardened Module Pullouts



6090 Irwindale Ave, Irwindale, CA 91702
800-336-2822

*SCE Building
Envelope
Classroom –
Wildfire
Hardened Pull-
Out Modules
and How to Meet
T24 Part 7 2025
California
Wildland-
Urban Interface
Code*





Module 3 – Roof Assembly



Module 3 – Wall Assembly





MODULE #6			
ROOF		THICKNESS	R-VALUE
1	Concrete roof tiles (Incl battens & air space)	2"	2.95
2	SOLO-SKIN FR-underlayment	1/8"	5.5
3	72lb Mineral surfaced cap sheet	1/8"	0.34
4	Rockwool mineral wool insulation board	1"	4.2
5	LP Flame-block sheathing	7/16"	0.55
6	Drip edge steel flashing	26 Gauge	
7	Fascia fiber cement siding	1/4"	0.13
8	Ember & fire rated vent	2.13"	
9	Engineered raised-heel truss		
10	Blown-in Cellulose (R3.1/in)	12.25"	38
WALL			
11	2x6 single top plate	1.5"x 5.5"	5.5
12	2x6 studs @24" on center	5.5"	
13	Optimum Window 60min, FR Glazing	1-7/8" Low-E	
14	Air Seal Plumbing and Wiring Penetrations		N/A
15	Rockwool mineral wool batts	5.5"	22
16	Gypsum wall board	1/2"	0.45
17	OSB sheathing	7/16"	0.51
18	Weather Resistant Barrier (WRB) - Tyvek	0.0087"	2
19	Rockwool mineral wool insulation board	1"	4.2
20	Fiber cement vertical siding	1/4"	0.13
21	Fiber cement batten trim	3/4"	N/A
22	Galvanized steel Z bar flashing	26 Gauge	
23	Fiber cement lap siding	1/4"	0.13
24	Galvanized steel 6" flashing	26 Gauge	
25	Ceramic tile N/A		
26	Inside Air Film		0.68
27	15lb felt paper	1/16"	0.06
28	Slab on grade (simulated)		N/A
		FIRE RATING	
		Class A	
		ASTM E108	
		UL Listed Type G3 Capsheet	
		Class A/ASTM E84/UL 723	
		ASTM E84/UL 723	
		Noncombustible	
		ASTM E84/E136/C177	
		Intumescent Vent	
		Class 1	
		Not Rated	
		Class A/ASTM E84/UL 723	
		Class A	
		Class A/ASTM E84/UL 723	
		Noncombustible	
		Noncombustible	
		IWUC - IGNITION RESISTANT CONSTRUCTION CLASS 3 *	
		*Remove the eave vent = Class 1	
ROOF FRAMING FACTOR		6.8%	
ROOF ASSEMBLY U-VALUE		0.020	
WALL FRAMING FACTOR		17%	
WALL ASSEMBLY U-VALUE		0.035	

Module 6 – Roof Assembly



Module 6 – Wall Assembly





Learning Objective #3

Parcel Assessment for Wildfire Hardening (PAWH) form

Best Practices

Parcel Assessment for Wildfire Hardening (PAWH)

1 Parcel Information	
Assessor:	Date: Year Built:
Property Address:	
Property Owners:	
Phone #:	Email:
Fire Hazard Severity Zone:	Housing Density Type:
Ignition-Resistant Construction Class: ☐ 1 ☐ 2 ☐ 3	FireWise Community: ☐ Yes ☐ No

2 Parcel Image
Insert an image showing a birdseye view of the parcel and neighboring parcels.



3 Parcel Images (Take pictures of the residence from each corner of the parcel)	
☐ NW	☐ NE





Parcel Assessment for Wildfire Hardening (PAWH) form

Homeowners

Communities

Architects

Insurance carriers

Local fire departments

Inspectors

Building Officials

Parcel Assessment for Wildfire Hardening (PAWH) form

1) Parcel Information

- 1) Fire Hazard Severity Zone
- 2) Housing Density Type
- 3) Ignition Resistant Class (2024 IWUIC)
- 4) FireWise Community

2) Parcel Image (Birdseye view)

3) Parcel Images

- Take a picture of the residence from each corner of the parcel towards the residence.

Parcel Assessment for Wildfire Hardening (PAWH)	
1 Parcel Information	
Assessor:	Date: Year Built:
Property Address:	
Property Owners:	
Phone #:	Email:
Fire Hazard Severity Zone:	Housing Density Type:
Ignition-Resistant Construction Class: ☐ 1 ☐ 2 ☐ 3	FireWise Community: ☐ Yes ☐ No
2 Parcel Image	
Insert an image showing a birdseye view of the parcel and neighboring parcels.	
	
3 Parcel Images (Take pictures of the residence from each corner of the parcel)	
☐ NW	☐ NE
	

Parcel Assessment for Wildfire Hardening (PAWH)

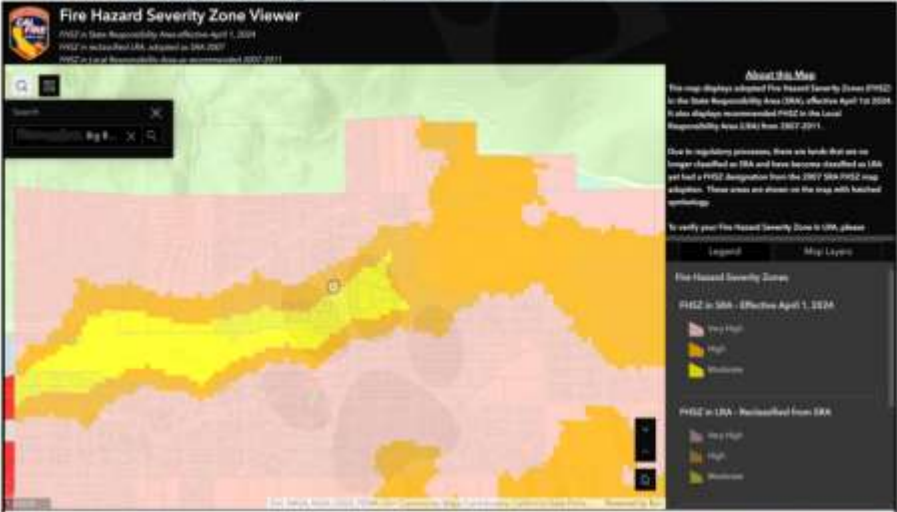
3) Parcel Image (Continued)

4) Fire Hazard Severity Zone Viewer Image

5) Housing Density -

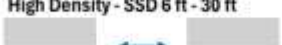
- Based on the Structure Separation Distance (SSD)

☐ SW ☐ SE 

☐ 4 **FHSZ Viewer Image**
<https://experience.arcgis.com/experience/03beab8511814a79a0e4eabf0d3e7247/>


☐ 5 **Housing Density - Select the Structure Separation Distance (SSD)**
☐ 5.1 **Low Density - SSD > 100 ft**

☐ 5.2 **Medium Density - SSD 30 ft - 100 ft**

☐ 5.3 **High Density - SSD 6 ft - 30 ft**


Parcel Assessment for Wildfire Hardening (PAWH)

6) ADU/Shed/Detached Garage –

- Based on the Structure Separation Distance (SSD)

7) Wildland-Urban Interface (WUI)

- Intermix, Perimeter, or Interior

8) Housing Density Type -

- Based on the NIST Technical Note 2205 (March 2022)

6 ADU/Shed/Detached Garage - Structure Separation Distance (SSD)

☐ 6.1 Low Density - SSD > 100 ft What type of structure & how many?

☐ 6.2 Medium Density - SSD 30 ft - 100 ft What type of structure & how many?

☐ 6.3 High Density - SSD 6 ft - 30 ft What type of structure & how many?

7 Wildland-Urban Interface - Intermix, Perimeter, or Interior?

0 - miles $\longleftrightarrow$ 0.25 miles $\longrightarrow$

Wildlands Single Family Residence - Intermix	Community Interface - Perimeter	Community Interface - Interior
7.1 ☐	7.2 ☐	7.3 ☐

8 Housing Density Type (Record in section 1)

Table 2. WUI Types classified by structure separation distance (SSD) and typical parcel size.

Type #	WUI Type Name	SSD (ft)	Typical Parcel Size (ac)	Typical Housing Density (struct/ac)
1	High Density Interface – Perimeter	6 ^a to 30	< 0.5	2 to 8 +
2	High Density Interface – Interior ^b	6 ^a to 30	< 0.5	2 to 8 +
3	Medium Density Interface – Perimeter	30 to 100	0.5 to 1+	< 2
4	Medium Density Interface – Interior ^b	30 to 100	0.5 to 1+	< 2
5	Medium Density Intermix	30 to 100	0.5 to 1+	< 2
6	Low Density Interface	100+	1+	< 1
7	Low Density Intermix	100+	1+	< 1

For SI: 1 ft = 0.305 m, 1 ac = 0.4 ha
^a representative of parcels with a 3 ft setback (common for new construction of sprinklered residences)
^b interior of community defined as > 0.25 mi (400 m) from wildlands

Natl. Inst. Stand. Technol. Tech. Note 2205, page 8, Table 2 (March 2022)

Parcel Assessment for Wildfire Hardening (PAWH) form - Sections

9) Vegetation Management –

- California Fire Code Chapter 49 Section 4906

10) Slope of Vegetation – The Minimum Fuel Separation Distance if the slope of concern is between wildland fuels & structures (*Applies to Intermix and Perimeter*).

- Flat to mild slope $<20^\circ = 100\text{ft}$
- Mild to moderate slope $20^\circ\text{-}40^\circ = 150\text{ft}$
- Moderate to steep slope $>40^\circ = 200\text{ft}$

9	C.F.C. Chapter 49 Section 4906 - Vegetation Management	Mitigate?
☐ 9.1	Is there an existing landscape plan? (If yes, include it at the end of this assessment)	☐ Yes ☐ No
☐ 9.2	Shrubs shall not exceed 6 ft in height. If yes, describe below.	☐ Yes ☐ No
☐ 9.3	Groupings of shrubs are limited to aggregate diameter of 10 ft.	☐ Yes ☐ No
☐ 9.4	Shrub groupings shall be separated from other groupings a minimum of 15 ft.	☐ Yes ☐ No
☐ 9.5	Shrub groupings shall be separated from structures a minimum of 30 ft.	☐ Yes ☐ No
☐ 9.6	Where shrubs are located below or within a tree's drip line, the lowest tree branch shall be a minimum of 3x the height of the understory shrubs or 10 ft, whichever is greater.	☐ Yes ☐ No
☐ 9.7	New trees that are fire resistant shall be planted and maintained so that the tree's drip line at maturity is a minimum of 10 ft from any structure.	☐ Yes ☐ No
☐ 9.8	The horizontal distance between crowns of new trees and crowns of adjacent trees shall not be less than 10 ft.	☐ Yes ☐ No
☐ 9.9	Existing trees shall be trimmed to provide a minimum separation of 10 ft away from chimney and stovepipe outlets.	☐ Yes ☐ No
*Note: New trees not classified as fire-resistant vegetation, such as conifers, palms, pepper trees and eucalyptus species, shall be permitted provided the tree is planted and maintained so that the tree's drip line at maturity is a minimum 30 ft from any structure.		

10 Slope of Vegetation		
Flat to Mild	Mild to Moderate	Moderate to Steep
5-FOOT MINIMUM CLEARANCE 3X 10 FEET Flat to mild slope (<20%)	4X 20 FEET Mild to moderate slope (20%-40%)	6X 30 FEET Moderate to steep slope (>40%)

<https://www.papertown-view.com/cal-fire-communications/cal-fire-ready-set-go-brochure-final-files-v4-print/?pd=MU252417&p=11&v=2%3F>

- ☐ 10.1 Select which slopes are found on this parcel. ☐ <20 deg. ☐ 20 - 40 deg. ☐ >40 deg.
- ☐ 10.2 Select which slopes are found adjacent to this parcel. ☐ <20 deg. ☐ 20 - 40 deg. ☐ >40 deg.
- ☐ 10.3 Minimum Fuel Separation Distance if slope of concern is between wildland fuels & structures:
(Applies to **Perimeter** and **Intermix** settings. See "Housing Density Type" chart in section 8.)
- ☐ Flat to mild slope (<20 degrees) = **100ft**
 - ☐ Mild to moderate slope (20 - 40 degrees) = **150ft**
 - ☐ Moderate to steep slope (>40 degrees) = **200ft**
 - ☐ Does not apply

Parcel Assessment for Wildfire Hardening (PAWH)

11) Defensible Space

- Zone 0: 0 – 5ft from structures
- Zone 1: 5ft – 30ft from structures
- Zone 2: 30ft – 100ft from structures

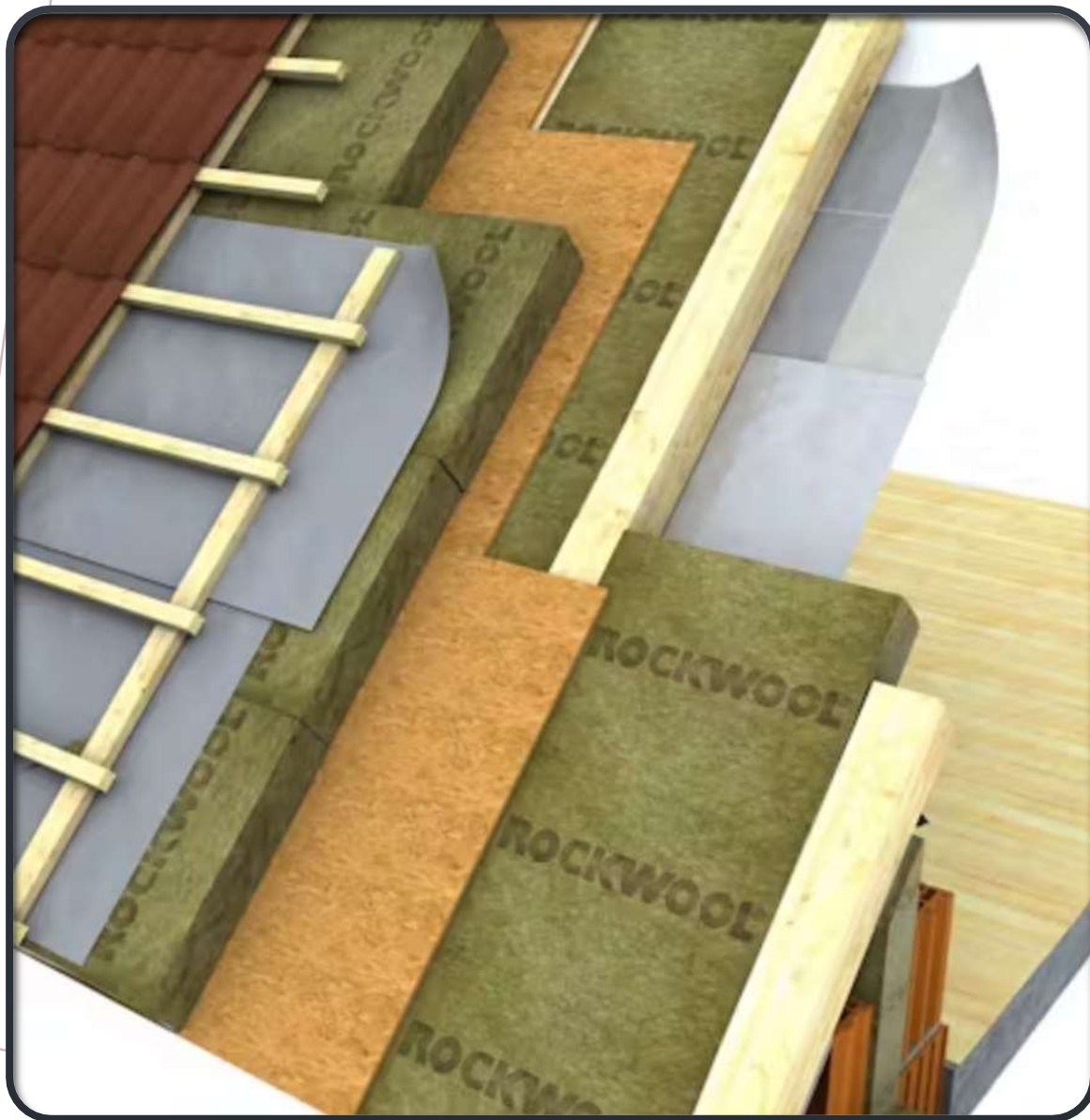
11 Defensible Space	
☐ 11.1 Zone 0: 0 - 5 ft from structures (include supporting images). *No stacked firewood, vegetation, vehicles, wood fences, bbq, smoker, or any other combustible fuels.	
Items assessed:	Mitigation recommendations:
☐ 11.2 Zone 1: 5 ft - 30 ft from structure (include supporting images) 5ft-10ft: Small vegetation, propane tanks up to 125 gallons per C.F.C. Chapter 61 Section 6104.3. 10ft-25ft: Propane tanks between 126 - 500 gallons per C.F.C Chapter 61 Section 6104.3, existing trees trimmed at least 10ft away from chimney and stovepipe outlets, new trees that are fire-resistant, and when the trees drip line at maturity is at least 10ft away. 25ft-30ft: Propane tanks between 501 - 2,000 gallons per C.F.C Chapter 61 Section 6104.3. * Combustible fuels such as firewood, RV's, boats, sheds, gazebos, or shrub groupings, shall be relocated into Zone 2. If the following combustible fuels cannot be relocated in Zone 2, than removal or structure hardening is required. See section 13 for details.	
Items assessed:	Mitigation recommendations:
☐ 11.3 Zone 2: 30 ft - 100 ft from structure if applicable (include supporting images). 30ft-50ft: Firewood, shrub groupings, and new trees not fire resistant; dripline at maturity. 50ft-100ft: ADU's, sheds, structures, RV's, boats, gazebo, propane tanks between 2,001 - 30,000 gallon per C.F.C. Chapter 61 Section 6104.3. * If the above combustible fuels cannot be relocated into Zone 2, removal or structure hardening is required. See section 13 for details.	
Items assessed:	Mitigation recommendations:

Parcel Assessment for Wildfire Hardening (PAWH)

12) Fire & Ember Hardening

- Class 1, 2, or 3 Ignition-Resistant Construction
- State Fire Marshal Building Material Listing link
- Start top down on each structure
 - Roof Assembly
 - Roof Skylights
 - Solar Panels
 - All Vents
- Energy Efficiency (EE)

12 Fire & Ember Hardening (Includes Direct Flame Exposure, Radiant Heat & Convection)	
(Select between Class 1, 2 or 3 Ignition-Resistant Construction based on sections 12.1 - 12.4)	
12.1 Class 1 Ignition-Resistant Construction (IWUIC Chapter 5)	
The primary structure, neighboring structure & auxiliary structure separation distance is < 30ft or for extreme hazards located in FHSZ.	
12.2 Class 2 Ignition-Resistant Construction (IWUIC Chapter 5)	
The primary & auxiliary structure separation distance is between 30ft - 50ft for high hazards located in FHSZ.	
12.3 Class 3 Ignition-Resistant Construction (IWUIC Chapter 5)	
The primary & auxiliary structure separation distance is between 50ft - 100ft for moderate hazards located in FHSZ.	
12.4 Class 1 Ignition-Resistant Construction (IWUIC Chapter 5)	
The primary & auxiliary structure does not meet the Minimum Fuel Separation Distance (MFSD) between untreated wildland fuels & structures, based on topography (Natl. Inst. Stand. Technol. Tech. Note 2205, Table B, Page 62, March 2022)	
☐	Flat to mild slope (<20 degrees) = 100ft
☐	Mild to moderate slope (20 - 40 degrees) = 150ft
☐	Moderate to steep slope (>40 degrees) = 200ft
☐	Does not apply
State Fire Marshal resource: https://calfire.gov/motus.org/BMLSearch/Index	
Fire & Ember Hardening (Start top down)	
EE12.5 Roof Assembly:	
☐	Class 1: Class A rated roof, space at the eave ends shall be firestopped or have one layer of 72lb mineral-surfaced nonperforated cap sheet complying, repair damages, plug openings with non-combustible materials, seal gaps, roof valley flashing 26ga. galvanized and corrosion resistant 36-inches wide the entire length over one layer of 72lb mineral-surfaced nonperforated cap sheet, flashing over fascia and thermal barrier under flashing (optional: install a thermal barrier such as stone wool board and ignition-resistant roof tile batten).
☐	Class 2: Class A rated roof, space at the eave ends shall be firestopped or have one layer of cap sheet complying with ASTM D3909, repair damages, plug openings with non-combustible materials, seal gaps, roof valley flashing 26ga. galvanized and corrosion resistant 36-inches wide the entire length over one layer of 72lb mineral-surfaced nonperforated cap sheet, flashing over fascia and thermal barrier under flashing (optional: install a thermal barrier such as stone wool board and ignition-resistant roof tile batten).
☐	Class 3: Same as Class 2. (Class B roof covering, IWUIC section 506.2, prohibited in CA).
12.6 Roof Skylights:	
☐	Install tempered glass outer pane
☐	Install metal screen if the skylight opens
☐	Metal flashing
☐	No exposed wood.
12.7 Solar Panels:	
☐	Install 1/8 inch corrosion resistant screen mesh to prevent debris accumulation under the solar panels.
12.8 All vents (including makeup air intake):	
☐	Ventilation openings shall be fully covered with vents that have been tested in accordance with ASTM E2886. Ventilation openings shall not exceed 144 square inches each. Vents shall be covered with noncombustible corrosion resistant mesh with openings between 1/16 - 1/8 of an inch.
☐	Class 1: Attic ventilation openings shall not be located in soffits, in eave overhangs, between rafters at eaves or in other overhang areas. Gable-end and dormer vents shall be located not less than 10 feet from lot lines. Underfloor ventilation openings shall be located as close to grade as practical. Consider vents with intumescent material and louvers. Dryer vents shall have a metal flapper with no screen. Seal any gaps with fire-rated exterior caulking.
☐	Class 2: Same as Class 1.



Stone Wool Insulated Board



SOLARSKIN

THERMAL UNDERLAYMENT

TEST DATA

THERMAL PERFORMANCE

R 5.5 ASTM C1363/C1224

PHYSICAL PROPERTIES

Flame Spread	Class A	ASTM E 84-10a
Smoke Developed	Class 1	ASTM E 84-10a
Burning Brand	Class B	ASTM E -108
Meets ASTM D226		

Parcel Assessment for Wildfire Hardening (PAWH)

12) Fire & Ember Hardening (Continued)

- Start top down on each structure
 - Unvented Attics
 - Gutters and Downspouts
 - Eaves and Soffits
 - Exterior Wall Siding
 - Windows
 - Exterior Doors

• Energy Efficiency

☐ Class 3: Attic ventilation may be installed in soffits, in eave overhangs, between rafters at eaves or in other overhang areas.		
☐ EE12.9 Unvented Attics (C.B.C. T24 Section 1202.3):	☐ Consider for SSD <30ft.	☐ Yes ☐ No
☐ 12.10 Gutters and Downspouts: ☐ Yes ☐ No		
For all classes of ignition-resistant construction. ☐ Install metal gutters and downspouts ☐ Metal gutter guards ☐ Metal flashing over fascia ☐ Thermal barrier under flashing ☐ Seal gaps.		
☐ 12.11 Eaves and Soffits: ☐ Yes ☐ No		
☐ Class 1: Protect exposed underside with 1hr fire-rated ignition resistant or noncombustible materials directly over exposed wood. Consider enclosing the eaves with noncombustible materials. Attic ventilation openings shall not be located in soffits, eave overhangs, between rafters at eaves or in other overhang areas (IWUIC section 504.10.3). Seal gaps with exterior fire-rated caulking. Consider unvented attic designs per C.B.C. T24 section 1202.3. ☐ Class 2: Protect exposed underside with 1hr fire-rated ignition resistant or noncombustible materials directly over exposed wood. Exposed rafter tails shall not be permitted unless constructed of heavy timber materials (IWUIC section 505.3). Attic ventilation openings shall not be located in soffits, eave overhangs, between rafters at eaves or in other overhang areas (IWUIC section 505.10.3). Seal gaps with exterior fire-rated caulking. ☐ Class 3: Protect exposed underside with 1hr fire-rated ignition resistant or noncombustible materials directly over exposed wood. Exposed rafter tails shall not be permitted unless constructed of heavy timber materials (IWUIC section 505.3). Attic ventilation openings are permitted at the eave or soffit using fire and ember rated vents complying with ASTM E2886.		
☐ EE12.12 Exterior Wall Siding: ☐ Yes ☐ No		
☐ Class 1: Constructed with non-combustible or 1hr fire-rated materials. Consider a 2hr fire-rated wall assembly when SSD is <30ft. Install 6-inch metal flashing at the ground, decking & roof intersections. Install thermal barrier between metal siding or flashing to wood sheathing. Seal any gaps with fire-rated exterior caulking. ☐ Class 2: Constructed with one of the following methods: ☐ Materials approved for not less than 1hr fire-rated construction. ☐ Approved noncombustible materials. ☐ Heavy timber or log wall construction. ☐ Fire-retardant treated wood labeled for exterior use. ☐ Ignition-resistant materials. Complying with section 503.2 on the exterior side extending from the top of the foundation to the underside of the roof sheathing. Seal any gaps with fire-rated exterior caulking. ☐ Class 3: Same as Class 2.		
☐ EE12.13 Windows: ☐ Yes ☐ No		
☐ Class 1: IWUIC section 504.8 "Exterior windows, window walls and glazed doors, windows within exterior doors, and skylights shall be tempered glass, multilayered glazed panels, glass block or have a fire protection rating of not less than 20 minutes." Consider 1hr+ fire-rated metal framed windows when SSD <30ft or fire-rated operable shutters over existing windows or windows with only a 20 minute fire-rating. Install metal screens on operable windows. Install a thermal barrier between metal framed windows and wood framing. ☐ Class 2: IWUIC section 505.8 "Exterior windows, window walls and glazed doors, windows within exterior doors, and skylights shall be tempered glass, multilayered glazed panels, glass block or have a fire protection rating of not less than 20 minutes." Consider installing fire-rated operable shutters over existing windows or windows with only a 20-minute fire-rating when SSD is between 30ft-50ft. ☐ Class 3: Exterior windows, window walls and glazed doors, windows within exterior doors, and skylights shall be tempered glass, multilayered glazed panels, glass block or have a fire protection rating of not less than 20 minutes.		
☐ EE12.14 Exterior Doors: ☐ Yes ☐ No		
☐ Class 1: Exterior doors shall be approved noncombustible construction or have a fire-rating of not less than 1-hour. Install noncombustible threshold and door jamb. Install fire, ember and smoke rated weather stripping. If the door jamb is metal, install a thermal barrier between the metal and wood framing to prevent each transfer,		

Parcel Assessment for Wildfire Hardening (PAWH)

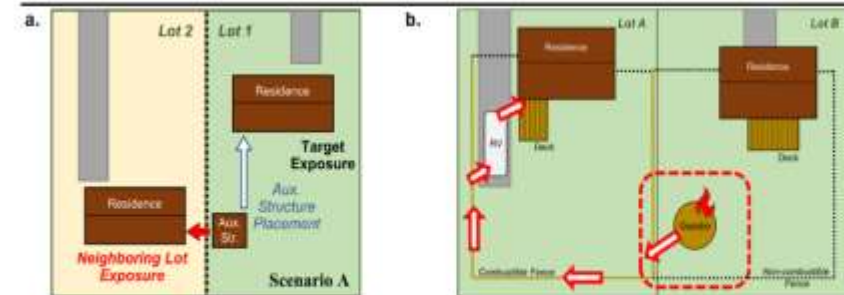
12) Fire & Ember Hardening (Continued)

- Start top down on each structure
 - Exterior Screen Doors
 - Garage Doors
 - Skirting
 - Decks, Stairs and Landings Attached to Residence
 - Deck-to-Wall Intersections
 - Fence-to-Residence
 - Retaining Walls
 - Combustible Furniture
 - Other Penetrations
- Illustrations
 - a. Auxiliary Structure Exposure
 - b. Fire Ladder

especially at the hinges. Seal gaps with fire-rated exterior caulking. ☐ **Class 2:** Exterior doors shall be approved noncombustible construction, solid-core wood not less than 1 3/4 inches thick (45mm), or have a fire-rating of not less than 20 minutes. Windows within doors and glazed doors shall be tempered, multiglazed panels, glass block or have a fire-rating of not less than 20 minutes. Install fire, ember and smoke rated weather stripping. Seal gaps with fire-rated exterior caulking. ☐ **Class 3:** Same as Class 2.

☐ 12.15 Exterior Screen Doors:	☐ Yes	☐ No
☐ Replace wood screen doors with metal screen door with metal mesh screen material.		
☐ 12.16 Garage Doors:	☐ Yes	☐ No
☐ Exterior garage doors shall resist the intrusion of embers from entering by preventing gaps between doors and door openings, at the bottom, sides and tops of doors, from exceeding 1/8 inch (3.2mm). If the garage door is not metal, install 6 inch metal flashing around the bottom of the door inside and out, within 1/8 inch of the ground, and add fire-rated-gasketing around the garage door.		
☐ 12.17 Skirting:	☐ Yes	☐ No
☐ Install non-combustible or 1hr fire-rated skirting on all sides of spaces under all structures on the parcel.		
☐ 12.18 Decks, stairs and landings attached to residence:	☐ Yes	☐ No
For all classes of ignition-resistant construction: ☐ Replace combustible materials with non-combustible or 1hr fire-rated material, and ☐ the area under the deck, stairs or landing must be maintained with no combustible materials. ☐ Install metal flashing between deck boards at joists.		
☐ 12.19 Deck-to-wall intersection:	☐ Yes	☐ No
☐ Replace combustible siding with non-combustible or 1hr fire-rated siding and ☐ install metal flashing with a thermal barrier such as fiber cement board to prevent heat transfer to protect exposed sheathing.		
☐ 12.20 Fence-to-residence:	☐ Yes	☐ No
☐ Replace wood fence with metal/non-combustible option. ☐ Consider installing a block wall when SSD is <30ft.		
☐ 12.21 Retaining Walls:	☐ Yes	☐ No
☐ Replace retaining wall length equal to two times retaining wall height with non-combustible material.		
☐ 12.22 Combustible Furniture:	☐ Yes	☐ No
☐ Replace furniture with non-combustible furniture ☐ move to Zone 1 ☐ place cushions indoors when not in use.		
☐ 12.23 Other Penetrations:	☐ Seal around penetrations with exterior fire-rated caulking	☐ Yes ☐ No

Notes:



a. Auxiliary structure exposure b. fire ladder

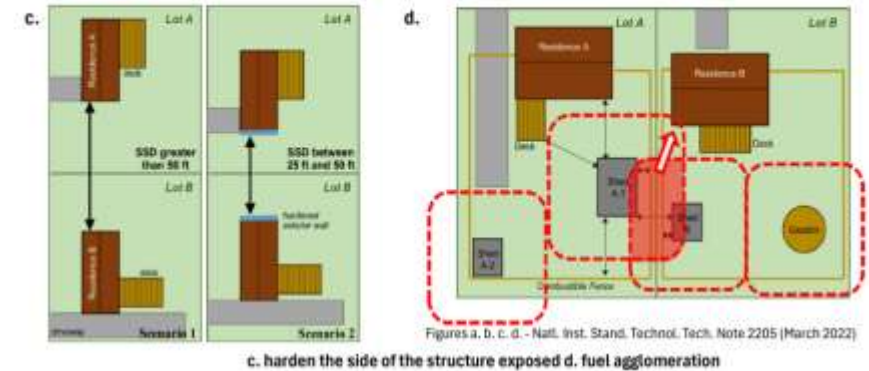
Parcel Assessment for Wildfire Hardening (PAWH)

12) Fire & Ember Hardening (Continued)

- Illustrations
 - c. Harden the side of the structure exposed
 - d. Fuel agglomeration

13) Overview of Recommendations

- Insert an image or draw an illustration with recommendations or requirements



Key Points

- 100% ember hardening compliance is required
 - All homes located in Fire Hazard Severity Zones and the Wildland-Urban Interface
- Successful hardening against direct flame, radiant heat and convection includes:
 - Defensible space
 - Non-combustible materials for high-density settings <30'
 - 1hr minimum ignition-resistant materials >30'
 - Prevent thermal bridging:
 - Metal contacting wood framing
 - Advanced framing (less lumber)
 - Enclosing the eaves as they trap heat (w/non-combustible materials)
 - Sealing gaps

Key Points

- **Energy Efficiency** gains are realized from:
 - Air sealing
 - Proper sealing around fire-rated doors and windows
 - Advanced framing
 - Non-combustible or ignition-resistant thermal barriers added to:
 - Roof decks
 - Exterior sheathing/siding

Key Points

- Vinyl window frames have been observed melting and failing with a residential fire 50ft away.
- Consider:
 - Using 60-120min. fire-rated steel framed windows only on the sides of the structure that are exposed to high fuel loads.
 - Installing fire-rated operable shutters over existing or new vinyl framed windows.



Q&A

Pushing the Building Envelope

Energy Research: Efficiency/ Demand Response

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"Good buildings aren't an accident; they happen by design" -Joe Lstiburek



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