

ET Summit 2024

Presented by



Hardening Structures against Wildfire

High Density Housing Burn Test



Ron Kliewer
Sr. Building Scientist
Kliewer and Associates





Burn Test Study Research Goals

1. Understand why entire neighborhoods far from wildlands are destroyed in wildfires.
2. Understand why some structures are consumed and nearby structures survive a wildfire event.
3. Identify building materials which are both Fire Resistant and Energy Efficient.
4. Burn a standard structure adjacent to a hardened structure, documenting the process and results.
5. Zero Flame Spread (ZFS) Energy Models
6. Parcel Assessment for Wildfire Hardening (PAWH)

Wildland Urban- Interface (WUI) Definition

“The geographical area where human development, including structures and other infrastructure, meets or intermixes with undeveloped wildlands.”



- The CAL FIRE Fire & Resource Assessment Program (FRAP) classifies land into Fire Hazard Severity Zones (FHSZ)
<https://osfm.fire.ca.gov/divisions/community-wildfire-preparedness-and-mitigation/wildfire-preparedness/fire-hazard-severity-zones/>



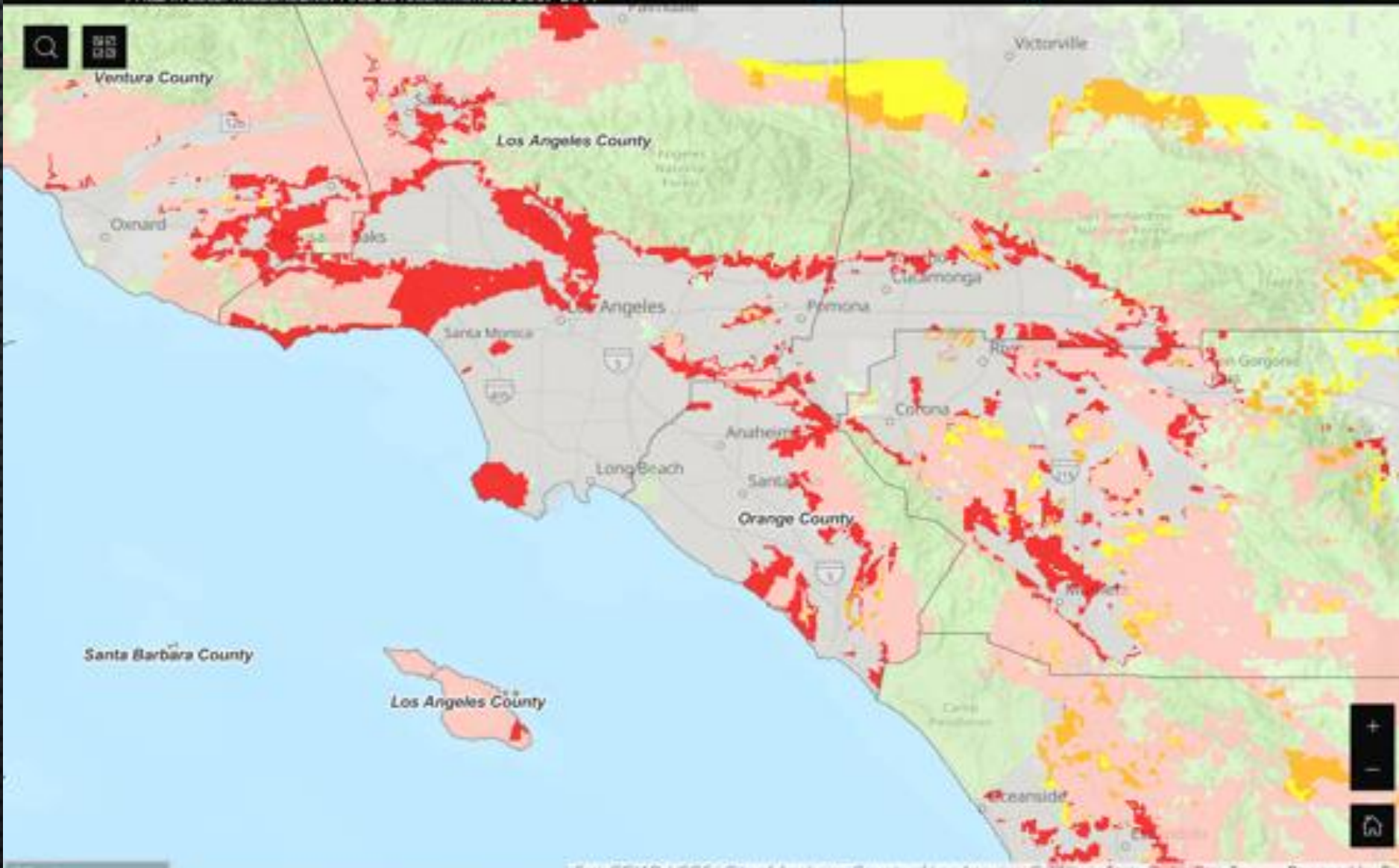
Fire Hazard Severity Zone Viewer

FHSZ in State Responsibility Area effective April 1, 2024

FHSZ in reclassified LRA, adopted as SRA 2007

FHSZ in Local Responsibility Area as recommended 2007-2011

<https://osfm.fire.ca.gov/divisions/community-wildfire-preparedness-and-mitigation/wildfire-preparedness/fire-hazard-severity-zones/#explorefhsz>



About this Map

This map displays adopted Fire Hazard Severity Zones (FHSZ) in the State Responsibility Area (SRA), effective April 1st 2024. It also displays recommended FHSZ in the Local Responsibility Area (LRA) from 2007-2011.

Due to regulatory processes, there are lands that are no longer classified as SRA and have become classified as LRA yet had a FHSZ designation from the 2007 SRA FHSZ map adoption. These areas are shown on the map with hatched symbology.

To verify your Fire Hazard Severity Zone in LRA, please

Legend

Map Layers

Fire Hazard Severity Zones

FHSZ in SRA - Effective April 1, 2024

- Very High
- High
- Moderate

FHSZ in LRA - Reclassified from SRA

- Very High
- High
- Moderate

California Building Code Chapter 7A Home Hardening for New Construction

- 701A.2 Purpose **'RESILIENCY'**
 - "The purpose of this chapter is to establish minimum standards for the protection of life & property by increasing the ability of a building located in any fire hazard severity zone within state responsibility areas or any wildland-urban interface (WUI) fire area to resist the intrusion of flames or burning embers projected by a vegetation fire & contributes to a systematic reduction in conflagration losses."

Embers

- Ember exposures to the residence and parcel can originate from adjacent and/or distant parcels and are beyond the control of the property owner
- **Embers can travel over a mile ahead of the fire front**

Oct 17, 2017

SSD 8 ft to 11 ft



1 ac

Imagery: Google, Landsat/Copernicus. Overlays by NIST.

June 25, 2019

SSD 8 ft to 11 ft



1 ac

Imagery: Google, Landsat/Copernicus. Overlays by NIST.

There are 7 WUI Types by Structure Separation Distance (SSD)

(TYPE 2 HIGH DENSITY SHOWN)

NIST Technical Note 2205

WUI Type 2 High Density Interface - Interior

- >0.25 miles from wildlands interface/perimeter
- Fuel load = Residential structures/multiple parcels
- SSD = 8ft-11ft
- Parcel size = <math><1/6^{\text{th}}</math> acre
- Housing density = 8/acre



Figure 1. The neighborhood of Coffey Park in Santa Rosa, CA is an example of WUI Type 2 (High Density Interface – Interior). For SI: 1 ft = 0.305 m, 1 ac = 0.4 ha.

A significant increase in structure ignition prevention is achieved by hardening structures against the complete range of expected exposures:

Ember Intrusion/ Radiant Heat and Direct Flame

- Remove Fuels
- Reduce Fuels
- Relocate Fuels



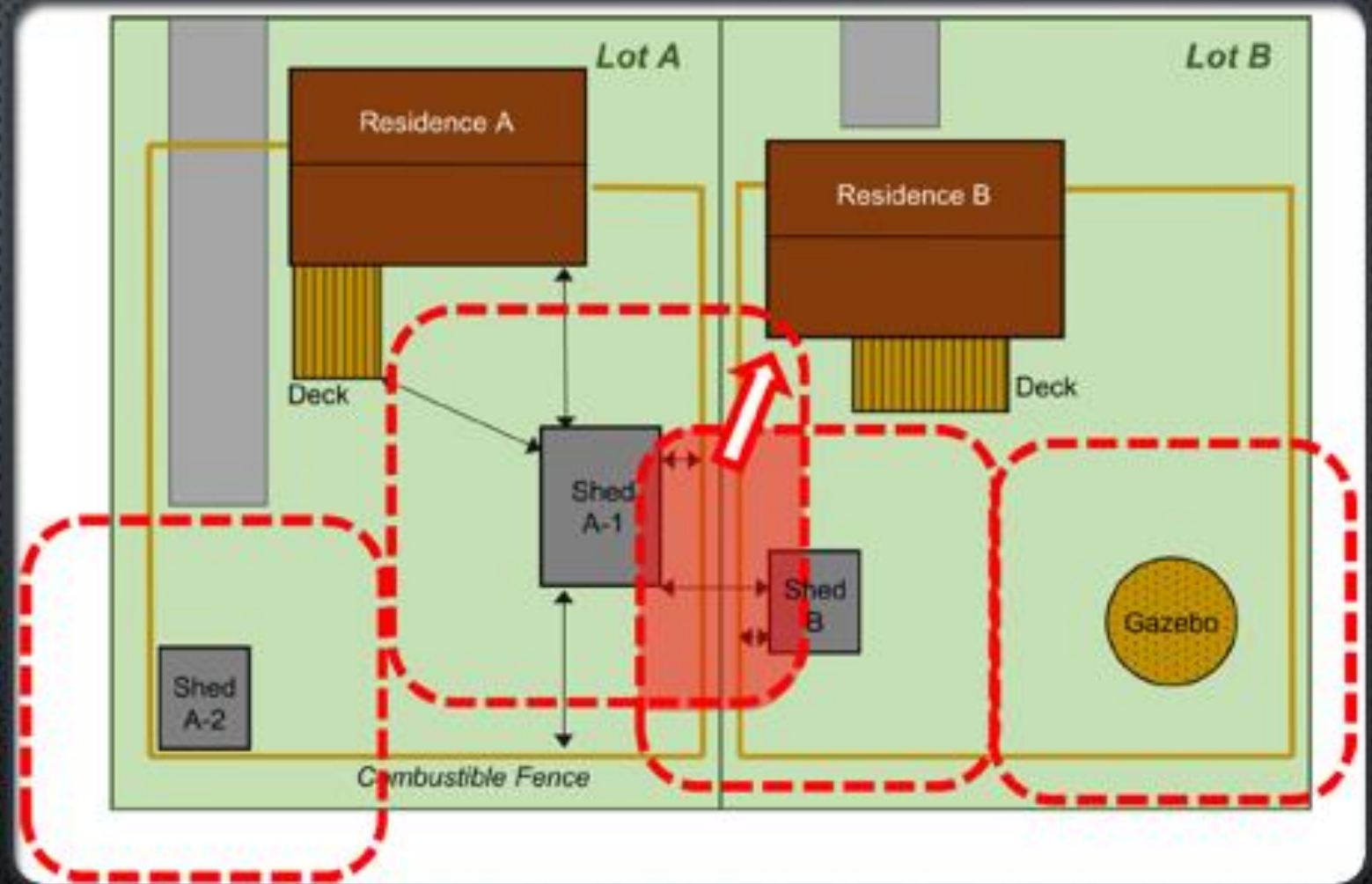
- Fire Resistant Design
- Community Design
- Ignition/Fire Spread Resistant Materials
- Active Systems

WUI Hazard Mitigation Methodology (HMM)

Spatial Relationships Between Fuels on Two Adjacent Parcels are often overlooked

The issues of fuel agglomeration and increased exposure is extremely important in Moderate and High-Density Communities

Indirect exposures occur when a source ignites a secondary fuel, impacting an adjacent structure with radiant heat



Existing Codes are typically parcel centric



**Burn Test performed at San Bernardino Regional
Emergency Training Center**



Goal

- To test ignition resistant & non-combustible building materials as an assembly to stand alone & survive the full duration of a fully involved residential fire in a high-density setting (**up to one hour**).
- **A fully involved residential fire, on average, burns at 1,600 degrees Fahrenheit for a duration of 1 hour.**



Burn Structure -

- Conventionally framed 2"x6"x16" o/c.
- Open eave.
- Vented attic.
- Wood siding.
- Insulation & drywall installed.
- No defensible space.
- Combustibles in the 0'-5' zone around the structure.

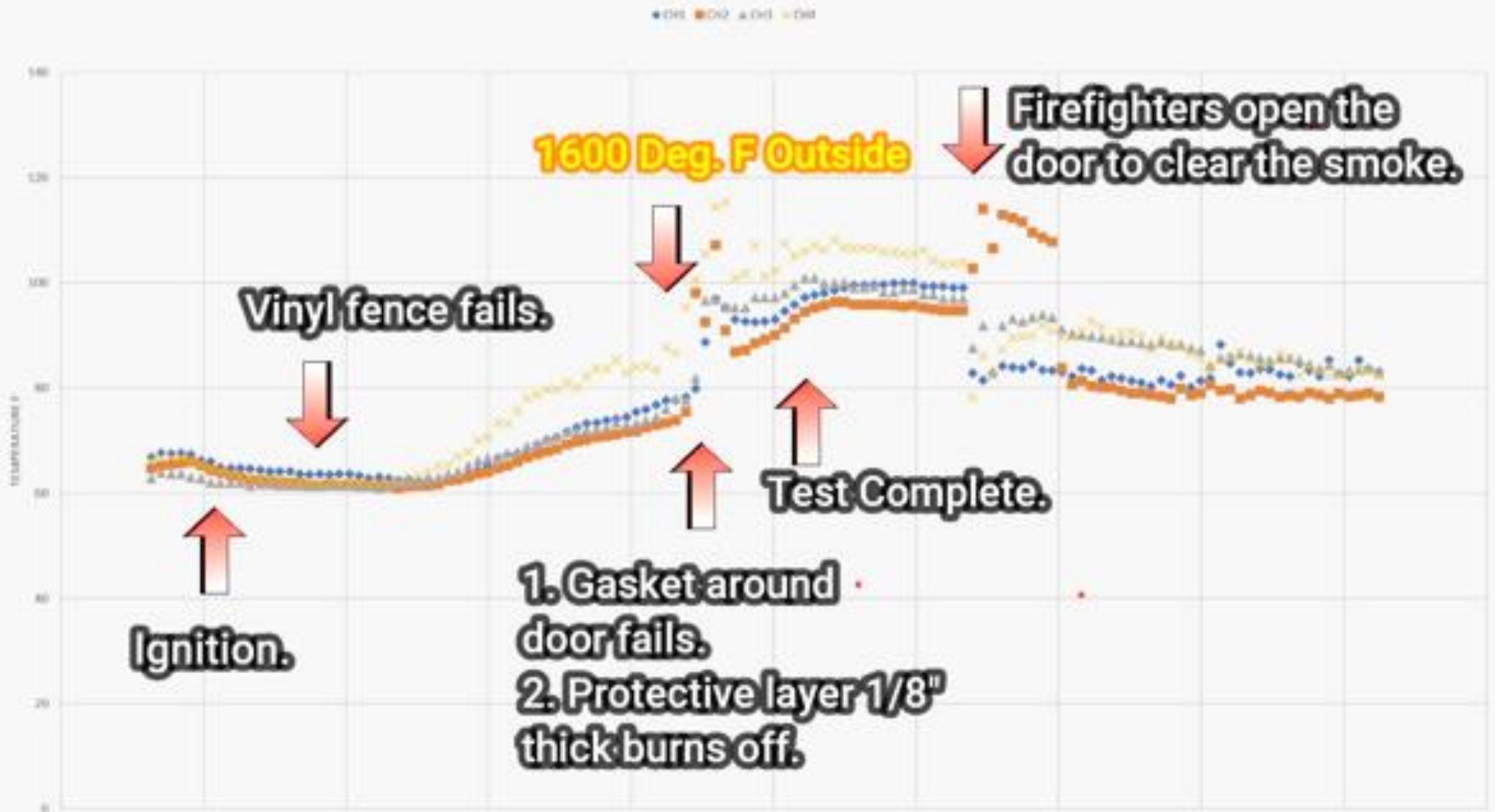


Hardened Structure

- Advanced framing 2" x 6" x 24" O.C. (Less fuel)
- Enclosed eaves
- Sealed attic
- Ignition resistant, non-combustible exterior
- Insulation & drywall installed
- 60-minute Fire Rated window
- 60-minute Fire Rated door
- 5-foot Defensible space (No Flammables)
- SSD 10 feet from neighboring structure

BURN TEST VIDEO







11:18 am



Our design survived the anticipated exposure.

- Advanced framing 2" x 6" x 24" o/c (Less fuel) ✓
- Closed eaves ✓
- Sealed, insulated attic ✓
- Ignition resistant and non-combustible siding. ✓
- 6" Walls Insulated & drywalled ✓
- 60-minute fire rated window ✓
- 60-minute fire rated door ✓
- Fire-proof Insulating Stucco (applied to all exterior surfaces) ✓
- Defensible space (no combustibles within 5') ✓
- SSD 10' from neighboring building. ✓

Second Test



**Wall surface and soffit under eave
reached 1500 F in 15-20 minutes**



No damage to
tar paper under
U-Stucco



Window Lessons Learned

- FR GLAZING PRESENTS A CHALLENGE TO T-24 COMPLIANCE IN NEW CONSTRUCTION. DUE TO NFRC RATINGS MISSING, MORE MEASURES ARE NEEDED TO PASS T-24.
- CONSIDER JUST ONE OR TWO SIDES OF A BUILDING TO APPLY FR RATED WINDOWS TO KEEP COSTS DOWN.
- FR WINDOWS TYPICALLY ARE NOT MANUFACTURED FOR LARGE WINDOW AREAS.
- VINYL WINDOW FRAMES MELT



Hardening Actions Provide:

1. **Additional time for residents to escape**
2. **More time for first responders to arrive**
3. **Increases the probability of the structure surviving.**
4. **Helps create more defensible space, allowing first responders more time to conduct rescue & firefighting operations.**

Kliewer & Assoc.' Building Science Team



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RON@KABUILDINGSCIENCE.COM

CHAD@KABUILDINGSCIENCE.COM

CHRIS@KABUILDINGSCIENCE.COM

DOROTHY@KABUILDINGSCIENCE.COM

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For more information, contact Charles Kim at charles.kim@sce.com

The 5-minute project time-lapse video can be found at:
[Kliwer and Associates performs Burn Test for SCE – YouTube](#)