Wildfire and Near-Building Issues

presented at the

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Objectives

- Review wildfire threat to built environment
  - Review ember ignition scenarios
- Evaluate Zone 1 implications
  - “transition” area
  - Structure-to-home

0-5 ft Zone – Several Names over the Years

- Zone A (U of Nevada)
- Noncombustible (U of Nevada, Living with Fire Program)
- Low-Combustible (U of Nevada, Living with Fire Program)
- Near-Home, Near-Building (?)
- Immediate (NFPA Firewise)
- Zone 0 (Marin County), growing out of Zone 1 terminology
- Ember-resistant (California legislation)
- Home Ignition Zone (IBHS, re-defined to near-home 0-5 ft)

… different names, same intended objective

Zone "A" consists of the area from immediately adjacent to the house to a distance of approximately five feet. The primary purpose of this zone is to have the least flammable type of landscaping adjacent to the house to prevent ignition from firebrands and direct exposure from flames. Considerations for Zone A are:

- Remove native shrubs and trees, unless they are deciduous or low growing.
- Remove pine needles and redistribute to bare areas elsewhere.
- Plant low growing, high moisture content vegetation such as lawn, flowers, and groundcovers. Remove plant material once it has cured. Use supplemental irrigation to keep plants green in this zone.

Smith, E. and G. Adams. 1991. Incline Village / Crystal Bay Defensible Space Handbook. University of Nevada Reno, SP-91-06. 57 pp.

Three exposures

Importance of Wind-blown Embers

- Barrow, 1944 Beaumaris Fire
- Blanchi and Leonard, 2003 ACT Bushfire
- Maranghides et al., 2007 Witch and Guejito Fire
- Colorado Springs FD, 2012 Waldo Canyon Fire
- Cohen, 2016 Roaring Lion Fire

Importance of Wind-blown Embers

“Direct” and “Indirect” Ignition Scenarios

Newspaper reports from 1929 fire in Mill Valley, CA acknowledging the importance of embers

"Houses burned while trees around them didn't …"

"During its mad career, the fire leaped three of the wide fire trails that had been cut along the mountain side to prevent the very thing that happened that night."

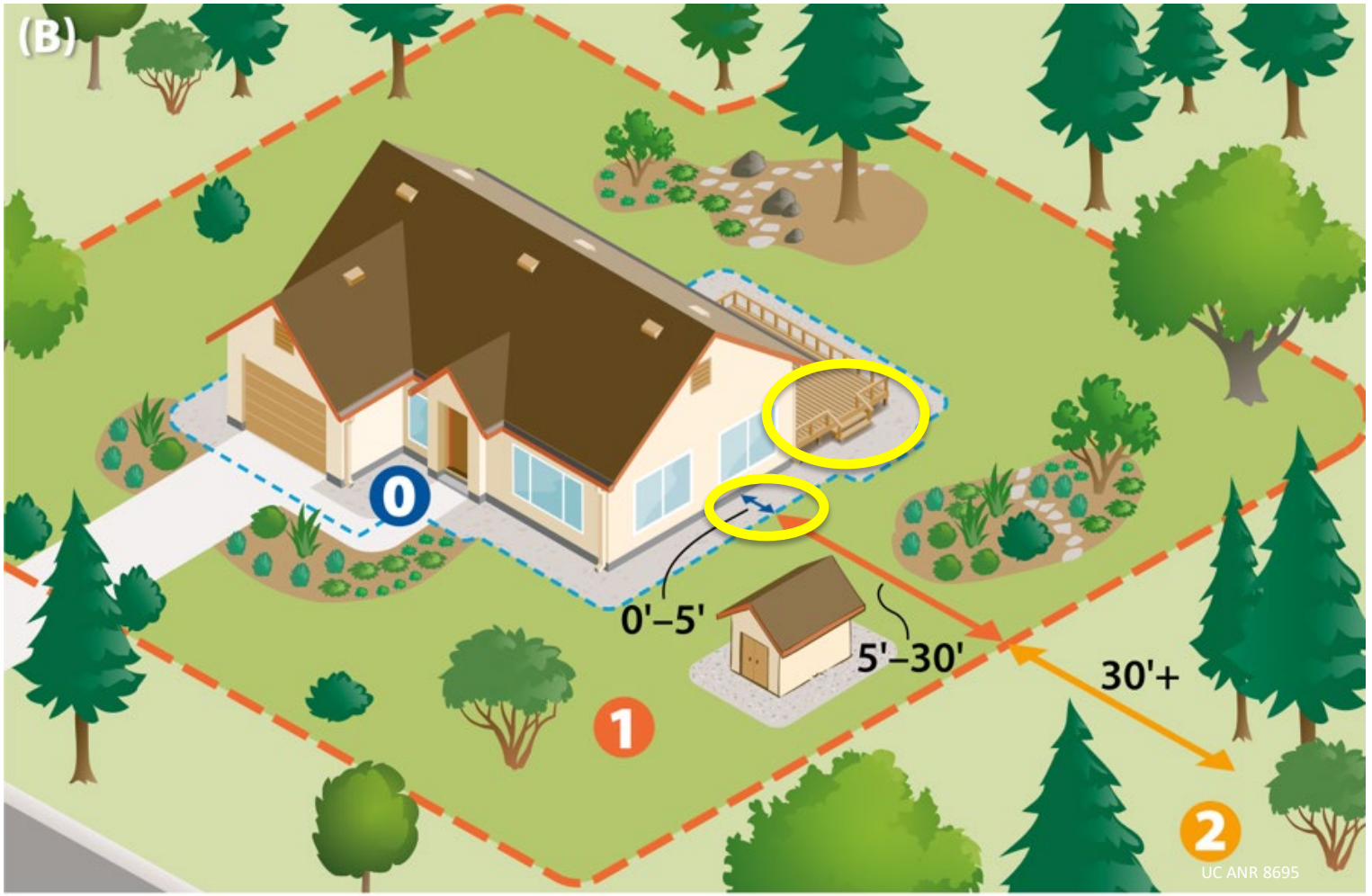
"New fires are starting in a score of places …"

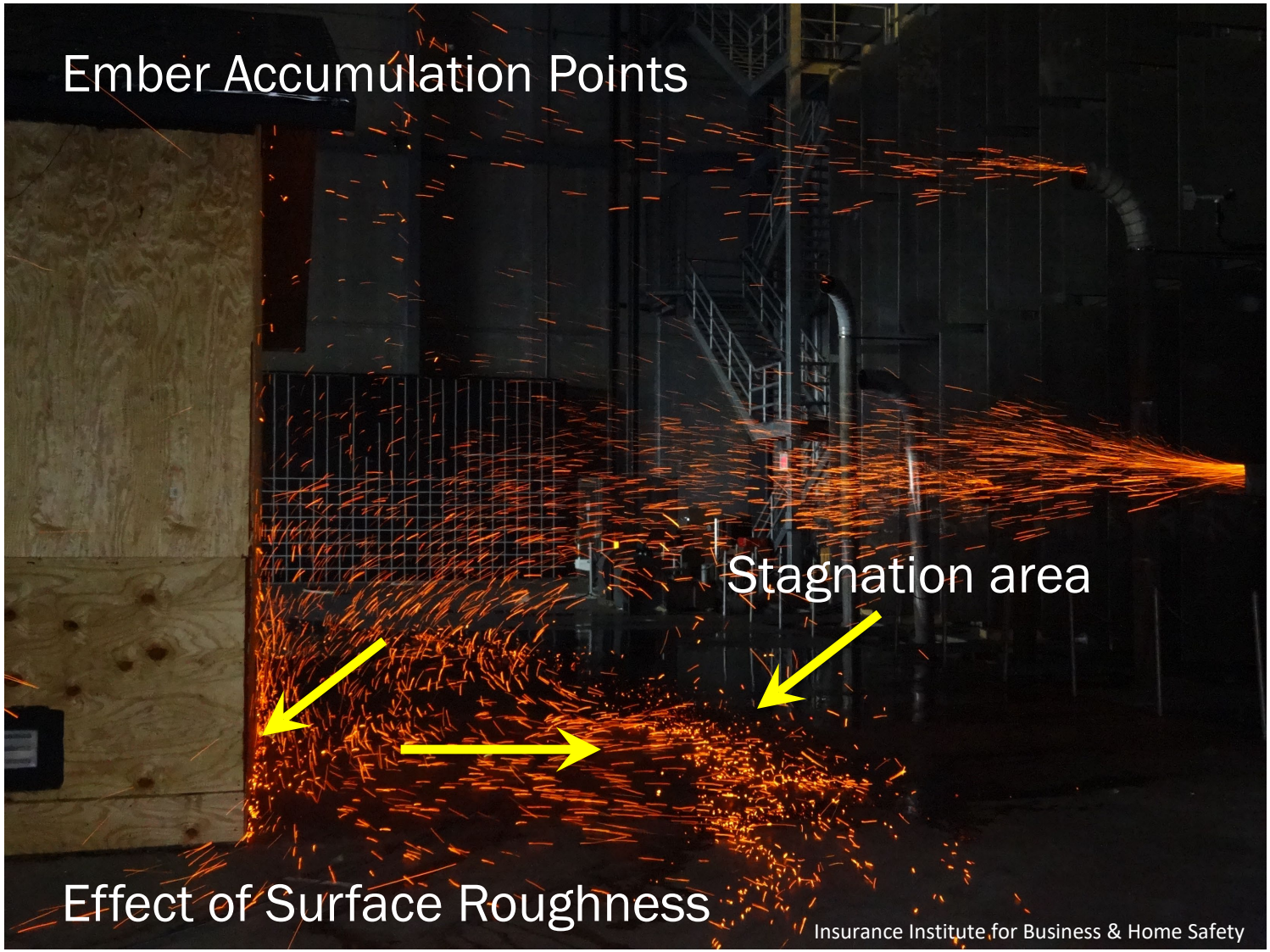
Materials Versus Details – Ember Exposure

"… the resistance to (wild)fire is determined more by the details of construction than by the materials used in the walls."

—G.J. Barrow, after the 1944 Beaumaris Fire in Australia

Focus on Zone 0 – combustible materials will be restricted





Quarles et al. 2023, Factors influencing ember accumulation… IJWF 32(3):380-387

Two adjustments

Source

Target

- Remove Fuels
- Reduce Fuels
- Relocate Fuels

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

Maranghides, et al. 2022. NIST TN 2205.

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Marshall Fire, 2021

Wrong tree for the place

Rock mulch, but tall shrub, not pruned, vulnerable to embers.

Stephen Quarles

"Similarly, vegetation overhanging the structure was also strongly correlated with structure loss in Australia (Leonard, et al. 2009)"

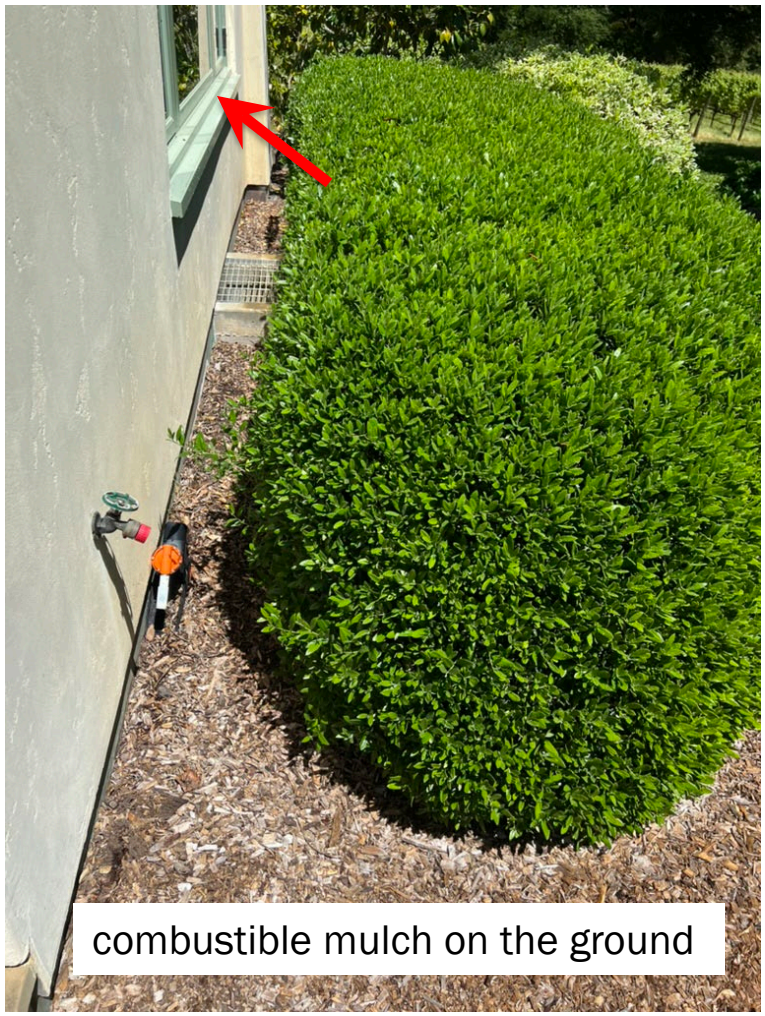
"...this study shows a clear role for defensible space up to 30 m (100 ft)."

"Results suggest the best action a homeowner can take are to reduce percentage cover up to 40% immediately adjacent to the structure and to ensure vegetation does not overhang or touch the structure."

Syphard et al. 2014. IJWF 23, 1165-1175

Leonard et al., Post-fire, Victoria bushfires

Healthy vegetation being vulnerable…



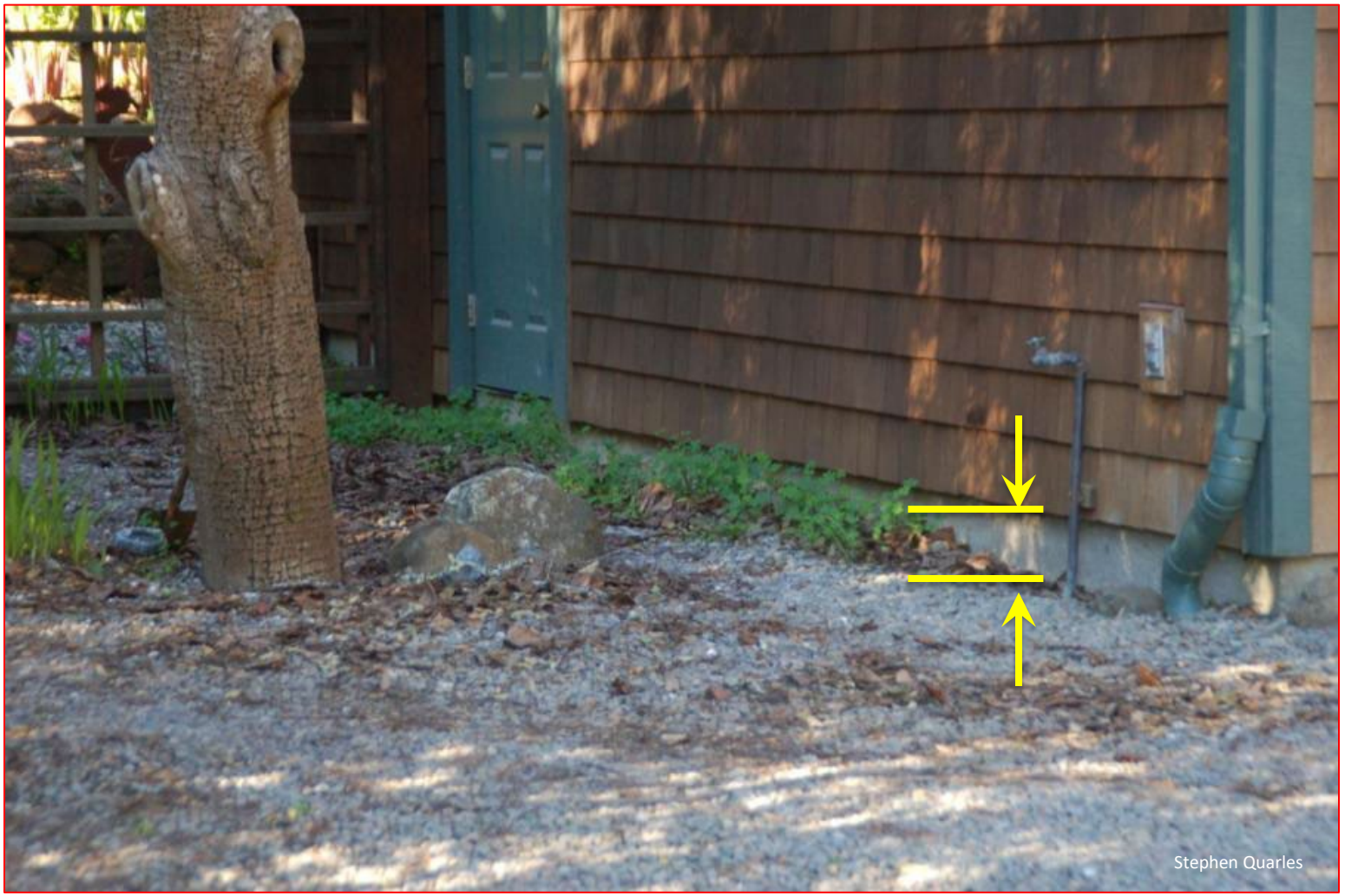
- Some vegetation, but low growing, non-woody
- Likely over-hanging tree, but ignition potential of siding minimal.
- Leaf litter from tree.

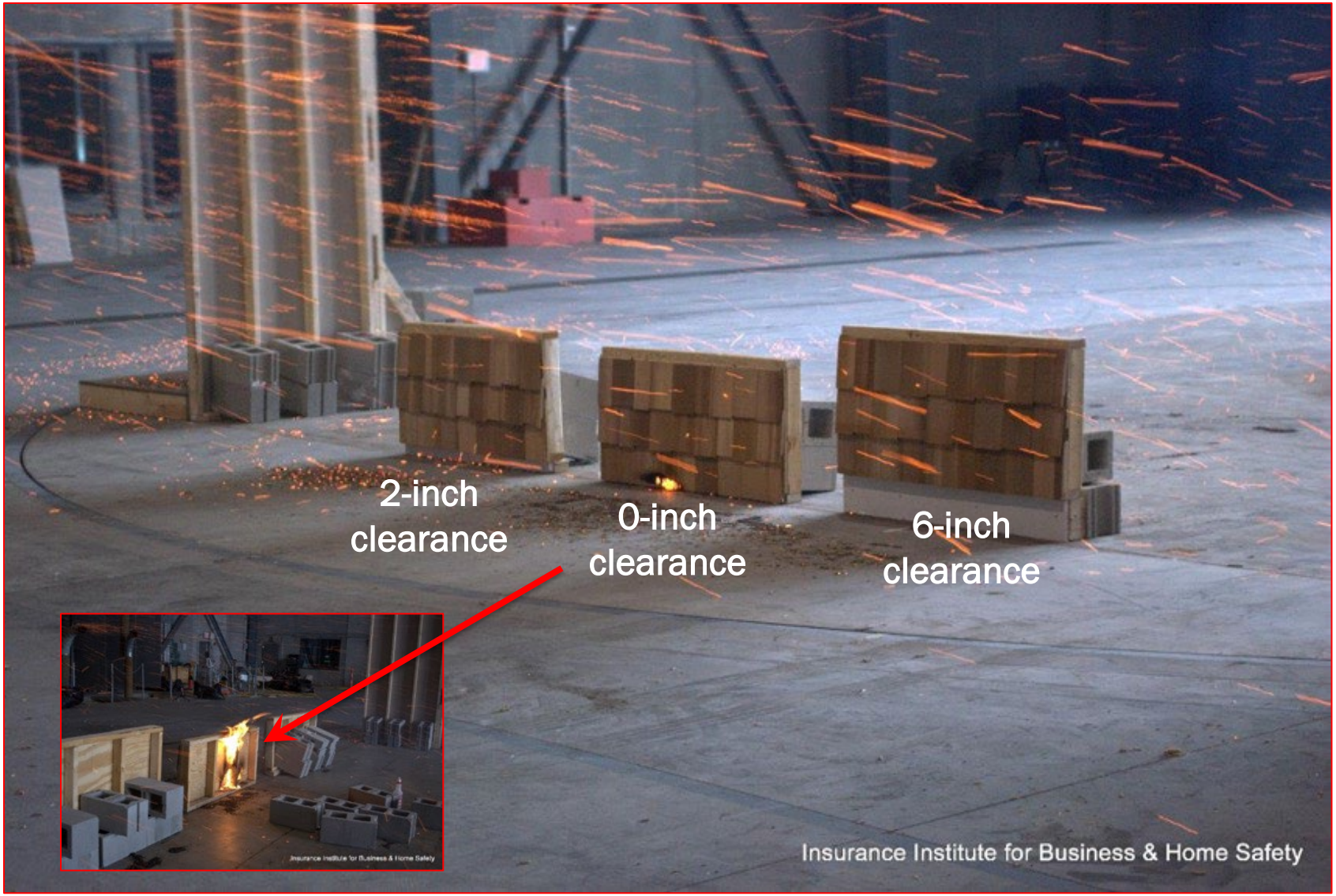
"Vegetation reduction is most effective immediately adjacent to structures [88, 92-94], as it can eliminate the most immediate sources of combustible material. Vegetation overhanging the structure[91] and ornamental plants[95] have been strongly associated with structure loss. Vegetative clearance more than 30 m away, however, seems to provide no significant additional benefit in the shrubland environment of southern California."

Moritz, et al. 2014, Nature

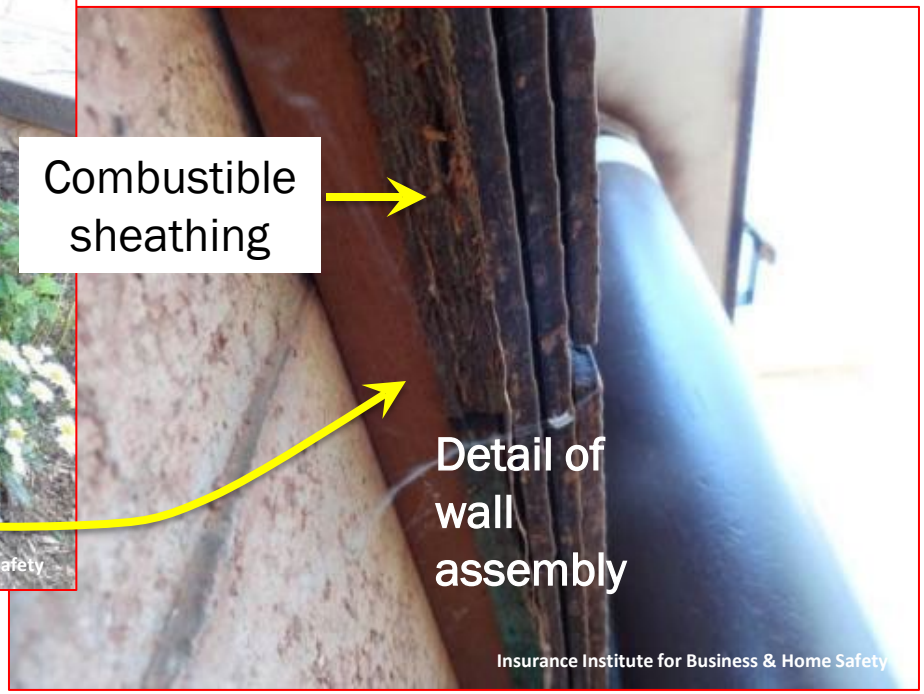
[88] Blanchi and Leonard, 2008
[91] Leonard et al. 2009
[92] Foote et al. 1991
[93] Gibbons, et al. 2012
[94] Syphard, et al. 2014
[95] Franklin. 1996

Vertical Zone 0 to complement horizontal Zone 0

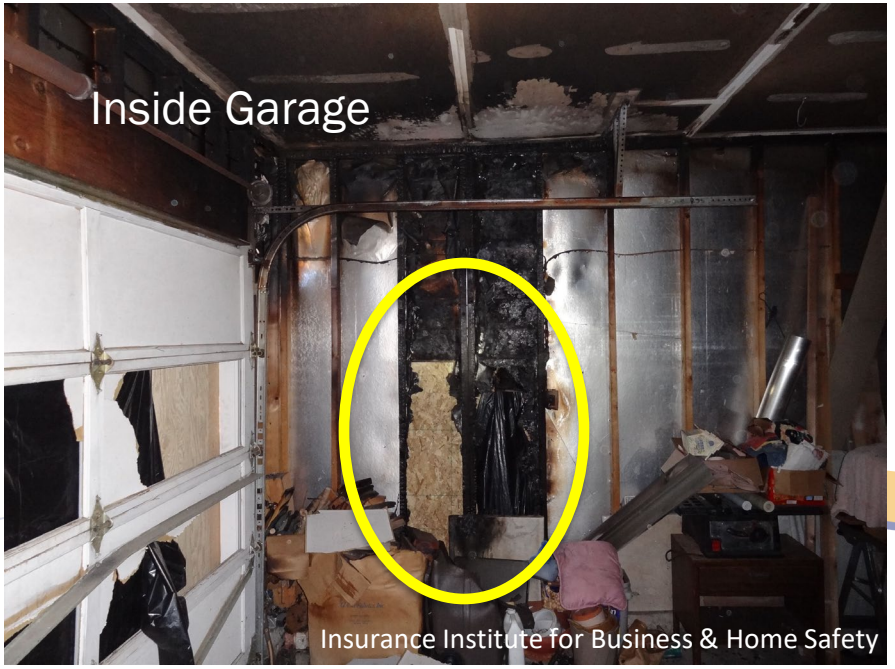



2-inch clearance
0-inch clearance
6-inch clearance
Insurance Institute for Business & Home Safety

Exterior Wall Assembly



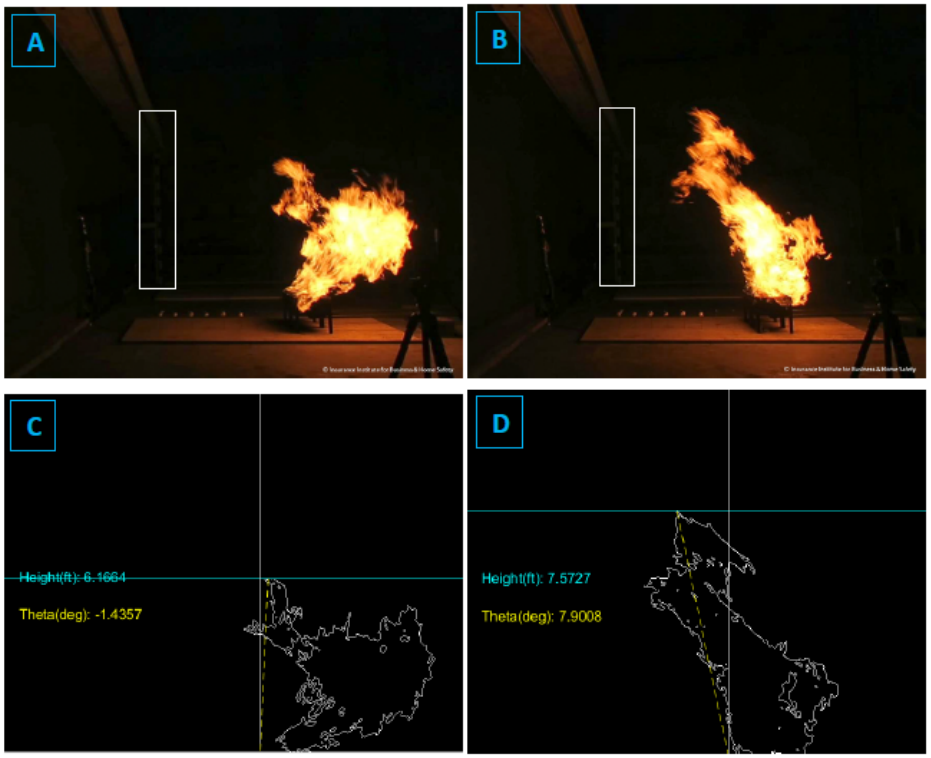
2012 Waldo Canyon Fire
Defensive action – first responder

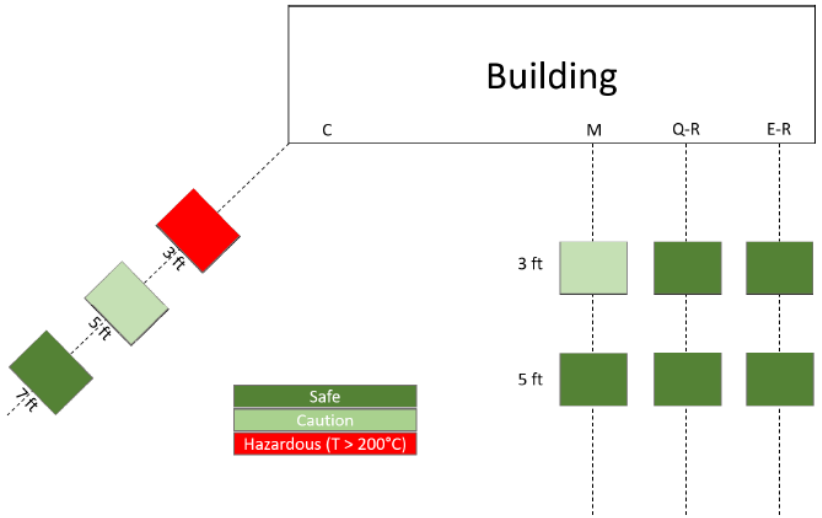


Waldo Canyon Fire
2012, Colorado Springs

Retaining Wall – Burn to Home – Chimney Tops 2

Noncombustible Zone – Adequacy of 5-feet

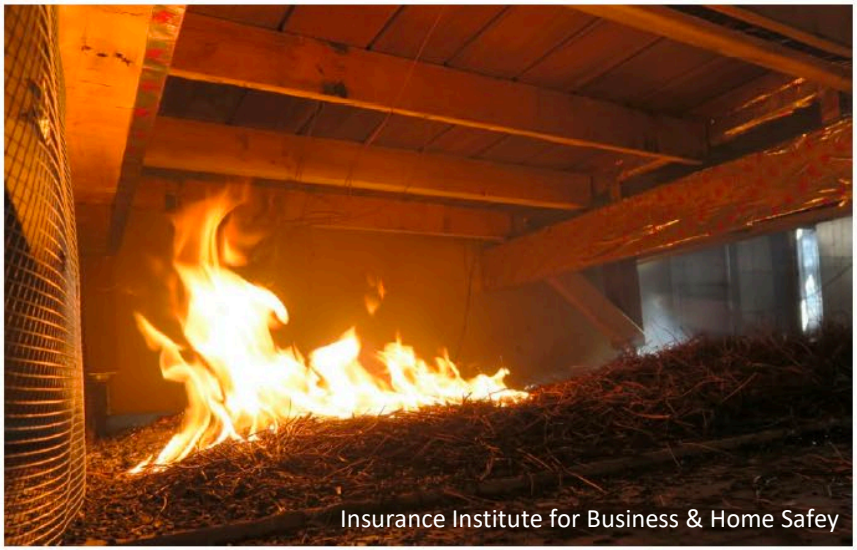




Hedayati, F., C. Stansell, D. Gorham, SL. Quarles. 2018. Near-Building Noncombustible Zone. IBHS, Richburg, SC. 18 pp.

2007 Southern CA Fire (Lake Arrowhead area - Grass Valley Fire)

Potential for under-deck flaming exposure



Hedayati, et al. 2022. Evaluating Deck Fire Performance. *Fire*. 5:107.

Under-deck versus top of deck

Fuels beyond 5-ft

Wind-driven bush fire in Balch Spring, TX

Sheds/accessory structures

Fences


NIST Technical Note 2228


https://www.youtube.com/watch?v=DlWKTNDud0g

Vehicles


NIST Technical Note 2292


https://fsri.org/research-update/experiments-enabling-analysis-electric-vehicle-fire-behavior-are-completed

Adjacent buildings


Lahaina Fire Comprehensive Timeline Report https://doi.org/10.54206/102376/VQKQ5427, Figure 4.3.1.46


https://doi.org/10.1002/fam.3278

Exposure severity ∝ building resistance

Thank you for your attention!

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2007 Fire
Malibu

Home Survival: A Coupled Approach

- Vegetation and other combustibles on the property: Selection, Location and Maintenance
- Home: Construction materials and design features

Seismic and Wildfire

- Earthquake
  - Hayward (1868)
  - San Francisco (1906)
  - Long Beach (1933)

  ✓ Field Act

- Wildfires
  - Wheeler Fire (1947)
  - Refugio (1955)
  - Malibu/Zuma (1958)
  - Bel Air (1961)
  - Weldon (1964)

  ✓ PRC 4291 (1965)

Tubbs Fire – Coffey Park

http://calfire-forestry.maps.arcgis.com/apps/PublicInformation

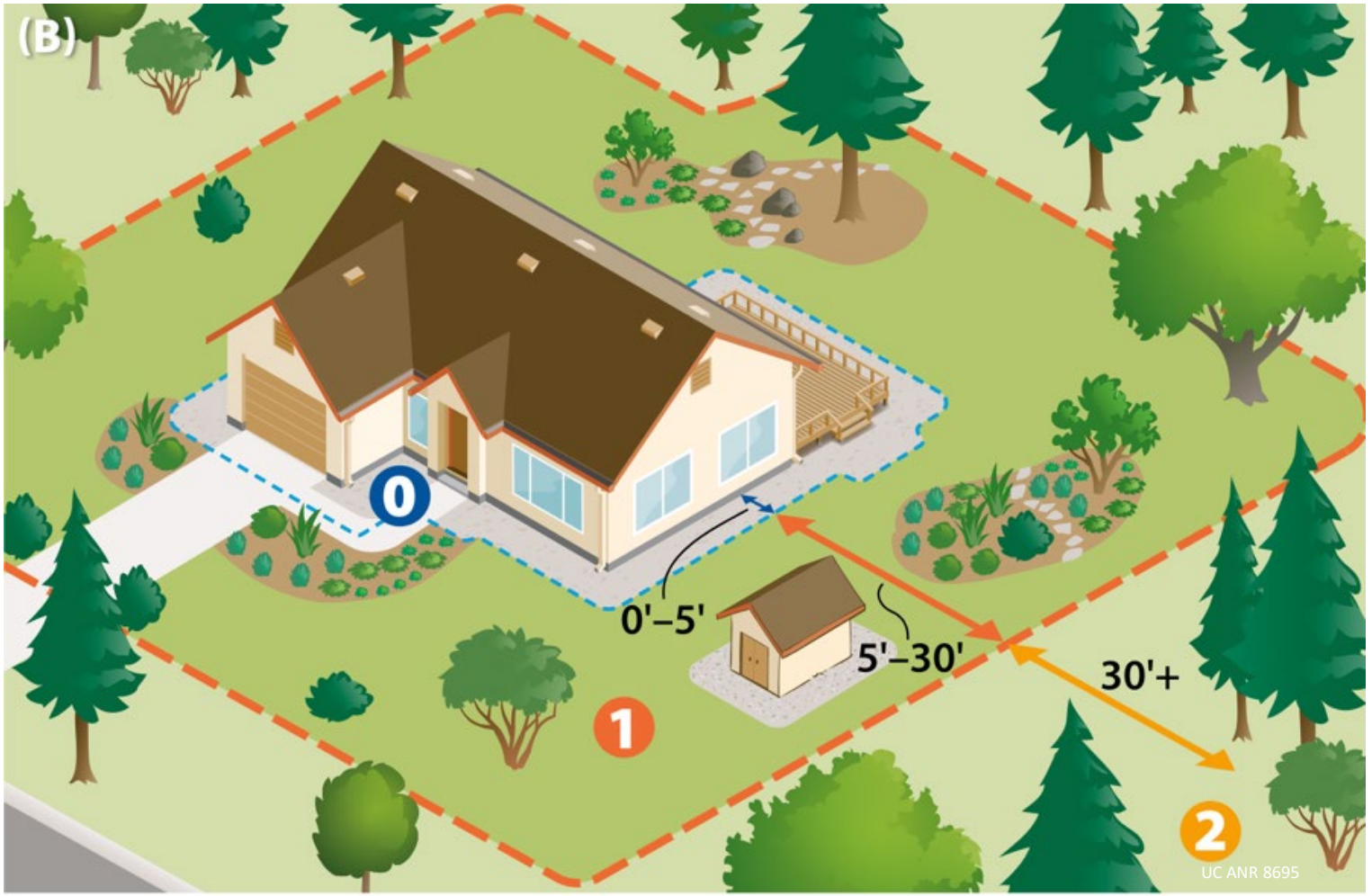
1982 – California enacts PRC 4201 – 4204. State Responsibility Areas (SRA) classified into Fire Hazard Severity Zones.

1992 – Following Oakland-Berkeley Hills fire, passage of Bates Bill (AB 337). Local Responsibility Areas (LRA) assessed based on accumulated fuels, topography, fire weather, building density.

2006 – Defensible Space increased from 30 to 100 feet.

Near-Building Focus

Defensible Space on the Property



Zone 0 - 0-5 ft & under the footprint of any attached deck

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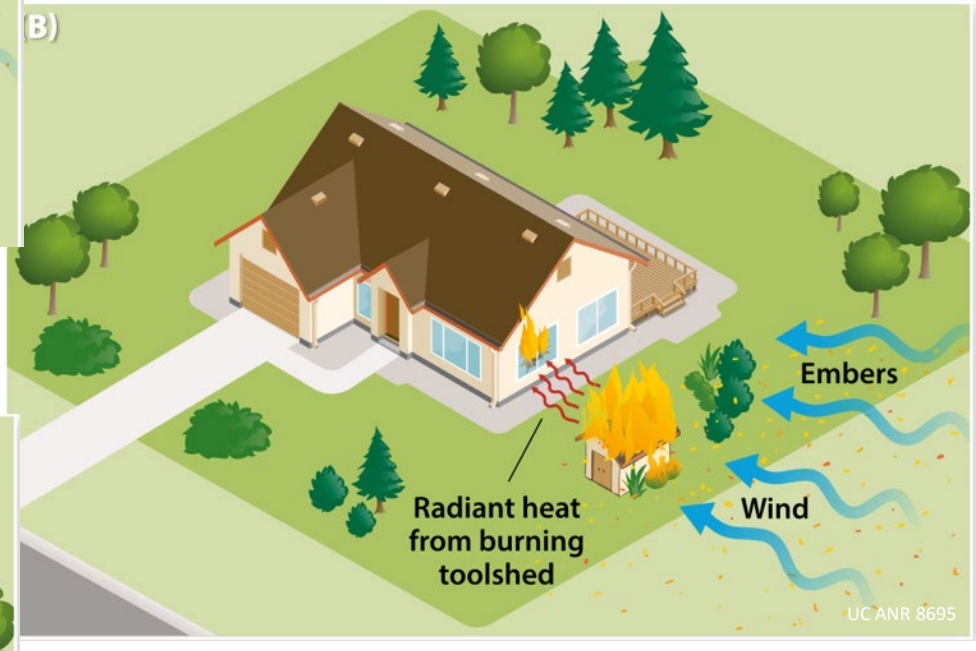
Three Exposures



2007 Fire
Malibu

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- Accumulation of wind-blown vegetative debris

Northwest Crown Fire Modelling Experiment. USFS photo.

Radiant Heat Exposure