

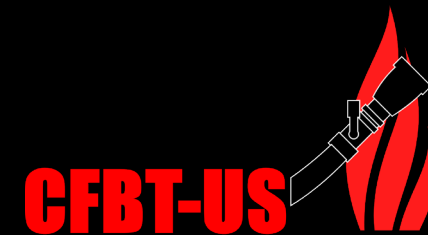


2026 Washington State Firefighters Association

Annual Fire School & Conference – Wenatchee, Washington

TED Talk

Extreme Fire Behavior



Chief Ed Hartin, MS, EFO, FI FireE, CFO



Chief Francis J. Hartin
1917-2008

Learning the Craft Since 1974 1954





23 April 1974



28 February 2025



Backdraft



Definitions



Signs

1. ☐ A ☒ B ☐ C ☐ D
2. ☐ A ☐ B ☐ C ☒ D
3. ☒ A ☐ B ☐ C ☐ D
4. ☐ A ☐ B ☒ C ☐ D
5. ☐ A ☐ B ☐ C ☒ D
6. ☐ A ☒ B ☐ C ☐ D
7. ☐ A ☒ B ☐ C ☐ D
8. ☐ A ☐ B ☒ C ☐ D
9. ☒ A ☐ B ☐ C ☐ D
10. ☐ A ☐ B ☐ C ☒ D



0:00:00





Serious Injury Incident

1327 SE 182nd Avenue
Gresham, OR
May 30, 2024, at 21:04



What is extreme fire behavior?



There is no such thing as “extreme” fire behavior. It’s all normal.

Dr Stefan Svensson

In wildland fires, “Extreme ‘implies a level of fire behavior characteristics that ordinarily precludes methods of direct control action...”

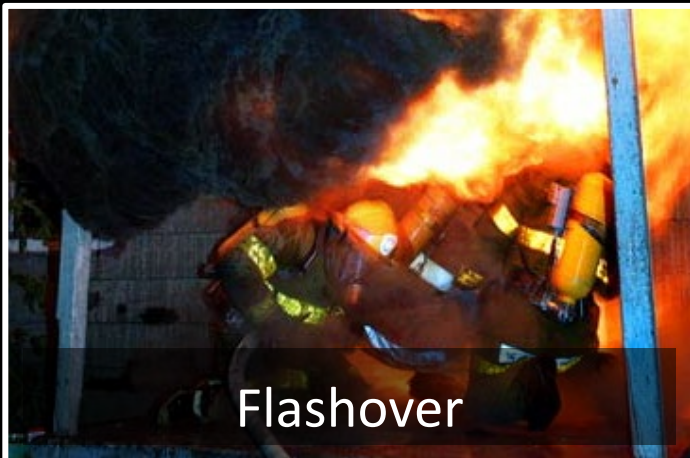
This term is also relevant in a structural context in relation to flashover, flash fire, backdraft, smoke explosion, and wind driven fires



Expectation, Expectancy & Anticipation



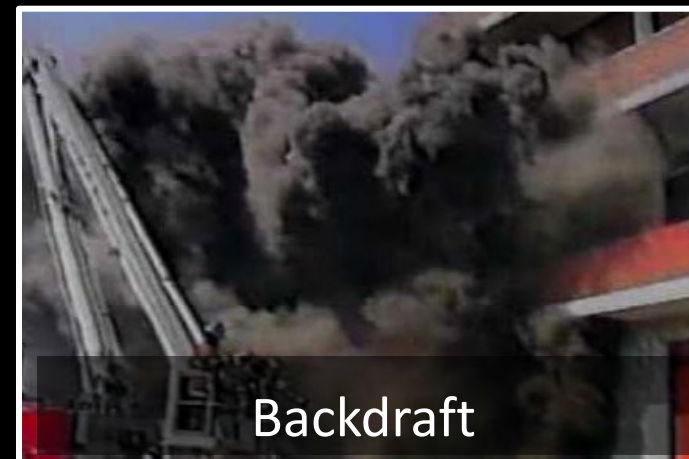
- A belief about what is likely to occur.
- What is likely to happen next, what should be happening, cues to look for.
- What's going to happen next, and what am I going to do about it?



Flashover



Flash Fire



Backdraft



Wind Driven Fires



Low Intake/High Exhaust



Smoke Explosion

Flashover

Doors/Windows Open(ed)
(Vent Limited Fire)

Turbulent Smoke

Pyrolysis of Uninvolved Fuel

Increasing Smoke Velocity

No Water on the Fire

Rollover

Isolated Flames Overhead

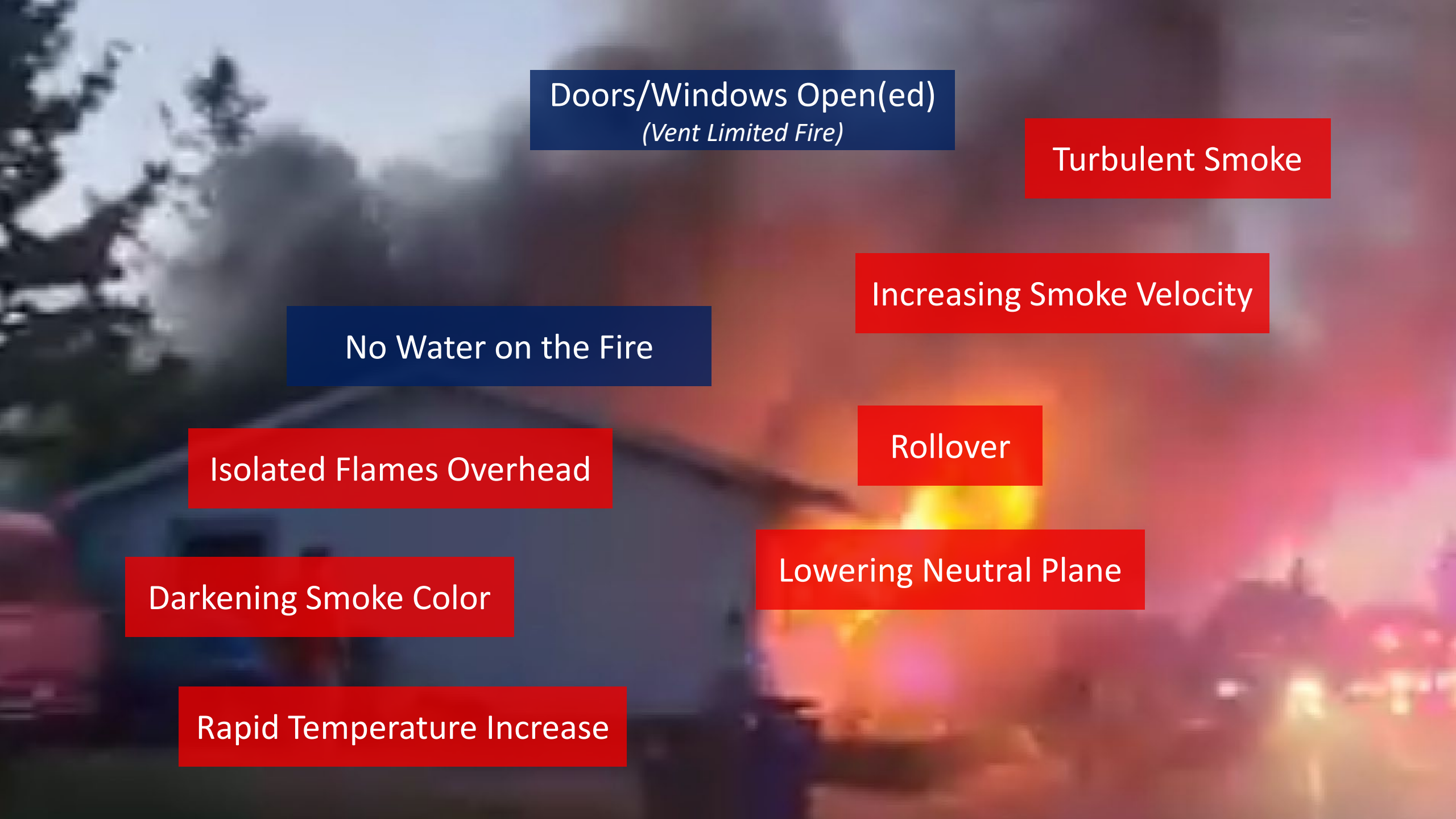
Lowering Neutral Plane

Darkening Smoke Color

Increased Ventilation
(Vent Limited Fire)

Rapid Temperature Increase





Doors/Windows Open(ed)
(Vent Limited Fire)

Turbulent Smoke

Increasing Smoke Velocity

No Water on the Fire

Rollover

Isolated Flames Overhead

Lowering Neutral Plane

Darkening Smoke Color

Rapid Temperature Increase

Wind Driven Fires

Upwind Inlet

Wind Speed > 10 mph

Turbulent, Well Mixed Flames
Floor to Ceiling

Pulsing Flow
Upwind Side

High Velocity Flames/Smoke
Downwind Side

Downwind Exhaust

Unidirectional Flow



Low Intake/High Exhaust

Low Inlet

Bi-Directional Flow

High Velocity Flames/Smoke
In the Flow Path

High Exhaust

Unidirectional Flow



Flash Fire (Fire Gas Ignition)

Smoke Layer

Unconfined



Overpressure Events (Backdraft)

Increased Ventilation
Backdraft

Significantly Vent Limited Compartment
Attic/Void Space

Large Surface Area Smoldering Fuel
Attic/Void Space

Thick Smoke
Texture

Blue Ghosting Flames
In the Smoke Layer

Smoke Color Varies
Unreliable Indicator

Black

Yellow

White

Pulsing Air/Smoke Flow



Overpressure Events (Smoke Explosion)

Significantly Vent Limited Compartment
Attic/Void Space

Large Surface Area Smoldering Fuel
Attic/Void Space

Blue Ghosting Flames
In the Smoke Layer

No Change in Ventilation
(Smoke Explosion)

Smoke Color Varies
Unreliable Indicator

Black

Yellow

White

Pulsing Air/Smoke Flow

Smoke Remote from the Fire



What can you do?



- Go beyond definitions and lists to build understanding of fire dynamics.
- Focus on patterns of cues that indicate potential for extreme fire behavior.
- Train tactics to prevent occurrence of these phenomena.



Questions?

Ed Hartin

Command Competence, CFBT-US LLC

ed.hartin@cfbt-us.com

+01 (503) 793-1296 (Cell/WhatsApp)

<https://commandcompetence.com>



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