Reading Smoke – the Sequel

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

"Sequel"?

- "Reading Smoke" is far from absolute – therefore there is room for interpretation
- Many have "added" fingerprints to the curriculum – helping the information become more street friendly

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Noted thanks to…..

- John Tanaka, Captain, Everett, WA
- Peter McBride, Ottawa Duty Safety Officer
- Dave Ross, Chief of Safety for Toronto
- Billy Goldfeder, Chief of Global F/F Safety!
- NIST: the National Institute of Science and Technology
- Bobby Halton, Ted Nee, Mike West, Brian Kazmierzak, Ed Hadfield, and Gerald Tracy (and many more)
- You – and your emails, videos, and pictures!

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

PowerPoint NOTE

This PowerPoint can serve as a good teaching tool – but is best presented with video examples. Those are NOT included here – you must find your own examples. www.youtube.com has many examples: search under "flashover" or "house fires."

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

The Sequel Plan

- Give you something to help at your next structure fire
- Review the basic process
- Update/refocus some key points
- Offer some "short cuts"

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

The Basic Process

Reading Smoke can help you answer 3 questions:

1. Where, specifically, is the fire?
2. How big or intense is the fire?
3. How fast is it changing? (rate and severity of fire spread)

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Basic Process – the Science

3 concepts help you read smoke:

1. Smoke is FUEL
2. The fuels have changed – more continuity and explosiveness than previously taught
3. The smoke has trigger points

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Smoke is Fuel - Particulates

- 70% of smoke is particulate
- Soot (Black)
- Ash (White)
- Fibers/dust/pulp

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Smoke is Fuel - Aerosols

- Water
- Hydrocarbons (black oil droplets)
- Some oils have self-ignition temps as low as 460°F

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Consider this…

The following gases create "*ladder fuels*" within smoke (remember, there are particulates and aerosols also).

Gas	Self-Ignition Temperature	Flammable Range
Acrolein	450°F	3-31%
Benzene	928°F	1-8%
Hydrogen Cyanide	1000°F	5-40%
Carbon Monoxide	1123°F	12-74%

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Remember…

- Your gear TTP masks heat initially – you can't feel 450°F for minutes – yet the smoke you are crawling in is ignitable!
- The thicker the smoke – the more continuity of fuel between you and the fire.

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Concept #2 – Fuels have changed!

- More synthetics
- Lower density/mass
- High surface-to-mass
- This adds up to *MORE* smoke

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Concept 3: Triggers for Smoke Ignition

Right Temperature & Right Mixture

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Temperature Triggers

Flashpoint = smoke explosions

Firepoint = rapid fire spread

Ignition Temperature = flashover and backdraft

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Mixture Triggers

Courtesy of www.firefighterclosecalls.com

Other Prerequisites to Reading Smoke

You must be able to determine…

- The Rate of Change – getting better or worse in seconds or minutes.
- Is the “box” absorbing heat? Laminar vs. TURBULENT flow

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

The "Reading Smoke" Process

Process Rules:

1. Nothing is absolute
2. Compare ventilation openings *(restricted or unrestricted, smoke or no smoke)*
3. *Watch the smoke –not the flames!*

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

The "Reading Smoke" Process

Don't Forget:

- Turbulent vs. Laminar
- Measure Rate of Change
- Smoke is FUEL!

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

The 3-Steps for "Reading Smoke"

1. Inventory & compare smoke attributes: *volume, velocity, density, and color*
2. Factor in influences that change the meaning of VVDC
3. Answer the questions: Fire location? Size of fire? What will it do next? *(better or worse/seconds or minutes)*

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

STEP 1: Inventory and compare the key attributes

- **Volume**
- **Velocity (Pressure)**
- **Density**
- **Color**

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

VOLUME

- Gives an impression
- Establishes relativity to the “box”
- Remember: a small volume of smoke from a very large box is significant
- Volume is a source of pressure (velocity)

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

VELOCITY (Pressure)

- How fast is the smoke leaving?
- Turbulent or Laminar?
- Is laminar smoke heat or volume pushed?
- Compare velocity from like-sized openings to find fire location

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Density

- Most Important Factor
- Tells you the future
- Continuity of Fuel
- Likelihood of an Event
- “Degree” of the Event

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Color

- Tells Stage of Heating
- Should compliment velocity to find location of fire
- “Brown” Smoke is usually unfinished wood being heated
- Remember, smoke color can be *filtered* over distance or through resistance

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STEP 2: Factor in Influences

- Container *(defines the significance of VVDC)*
- Weather

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STEP 3: Answer the Questions

- Where's the fire?
- How big or Intense is the fire?
- How fast is it changing? *(Getting better or worse – in seconds or minutes?)*

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Update/Refocus

- Velocity trumps color
- *ANY* thick, fast moving smoke is ignitable
- Zero visibility makes you a slave to your environment

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Update/Refocus

- Turbulent smoke is ready to flash – and indicates that floor temperatures are past human life thresholds (zero rescue profile!)
- Manage it – but reduce your risk-taking!

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Update/Refocus

Opinion: Ventilation has never been more important and needs to be our #1 tactical priority *(make the building behave!*)*

**Tom Brennan – we'll never forget you!*

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Short Cuts (not absolute)

- Black/Thick/Fast = heat and explosive
- Black/Thin/Fast = flame near
- White w/Speed = hot – but fire is distant
- Uniform speed/color (steady flow & light color)from many places = deep seated fire
- Brown = unfinished wood being heated
- Turbulent = Flashover

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Practice Time!

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com

Don't Just Be Safe – *Make it Safe!*

THANK YOU!

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com