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
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).

<table>
<thead>
<tr>
<th>Gas</th>
<th>Self-Ignition Temperature</th>
<th>Flammable Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acrolein</td>
<td>450°F</td>
<td>3-31%</td>
</tr>
<tr>
<td>Benzene</td>
<td>928°F</td>
<td>1-8%</td>
</tr>
<tr>
<td>Hydrogen Cyanide</td>
<td>1000°F</td>
<td>5-40%</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>1123°F</td>
<td>12-74%</td>
</tr>
</tbody>
</table>

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

Too Lean . . .

Too Rich . . .

Just Right . . .

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

Courtesy of Battalion Chief Dave Dodson & www.firefighterclosecalls.com
STEP 2: Factor in Influences

- Container (defines the significance of VVDC)
- Weather

Courtesy of www.firefighterclosecalls.com
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
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