AFTER THE FIRE: FIRE CAUSE INVESTIGATIONS AND CODE IMPLICATIONS

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Justin Prasad, AScT, BOABC Level 2 Qualified

Note that this is a redacted slide deck with some photos removed from public distribution

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Intro

Arjun Who?

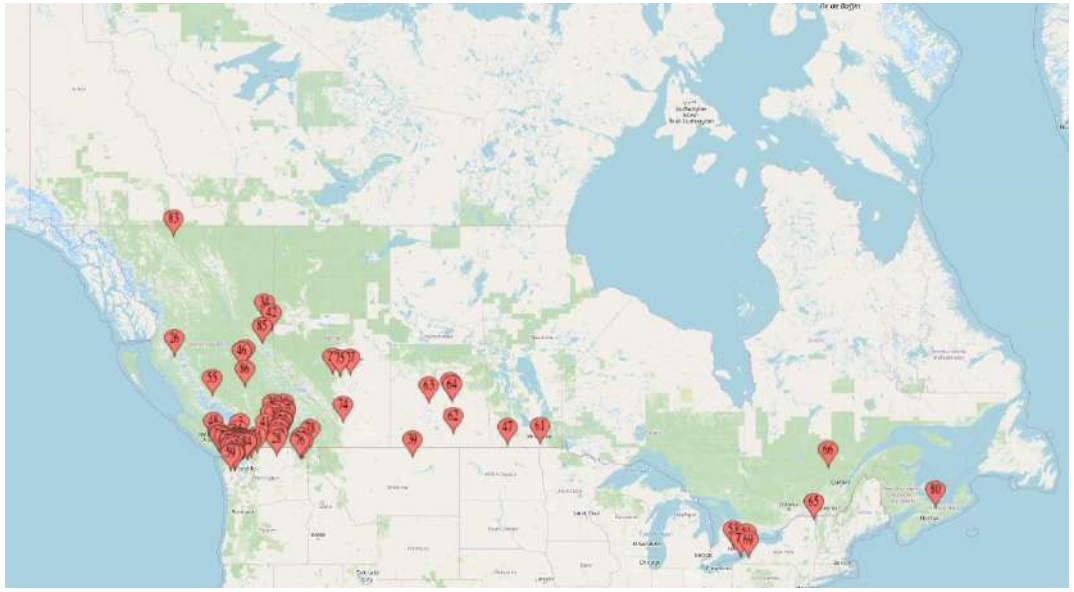
Justin What?

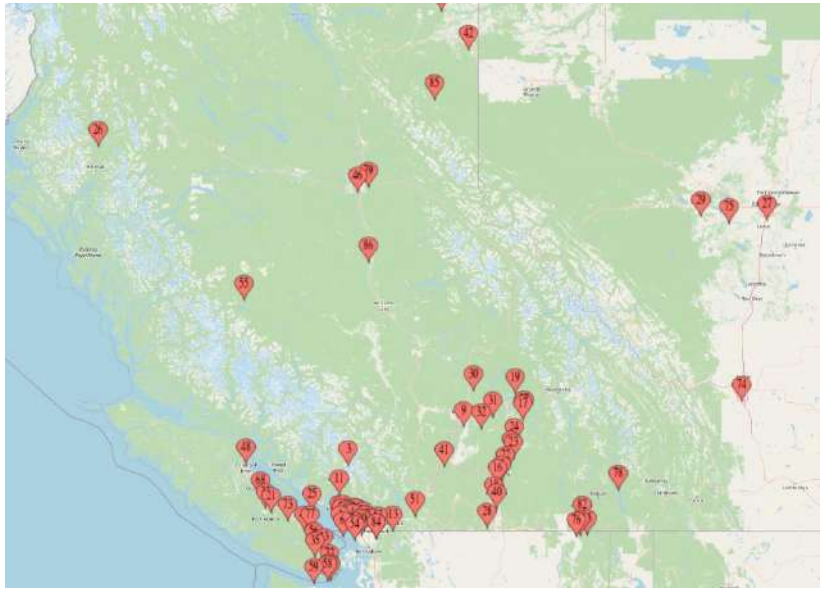
Introductions

Arjun Sethi, P. Eng., CFEI

Arjun is a Forensic Engineer based out of Vancouver, BC, and a Director of the BC Chapter of the International Association of Arson Investigators.

He focuses on fire and explosion investigations and fire protection system failures. He also conducts Integrated Systems Testing for CAN/ULC-S1001, but thinks he could do well as a close-up magician.





Introductions

Justin Prasad, AScT

Justin is an Applied Science Technologist and Level 2 Qualified Building Official working as a Project Consultant at Jensen Hughes.

He focuses on Building Code Consulting and CAN/ULC-S1001 Integrated Systems Testing.

In his spare time, he enjoys playing piano covers of anime music and driving off-road with his Jeep!

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Presentation Topics

Purpose: To give building officials a broader understanding of fire investigations and fire causes, and real life implications of codes when it comes to protection of life and property.

+ Intro to Fire Investigation
+ Fire Cause Case Studies
+ Where does code come in?
  - (close eyes now to avoid spoiler) Code Works!
  - Not always followed…
  - Some cases where code is followed, but still…
  - So what's the deal with Integrated Testing?
+ Takeaways –what it means for Building Officials

How we get involved - Example

Sherlock vs the Real World

Them

Us

Accepted Approach to Investigations

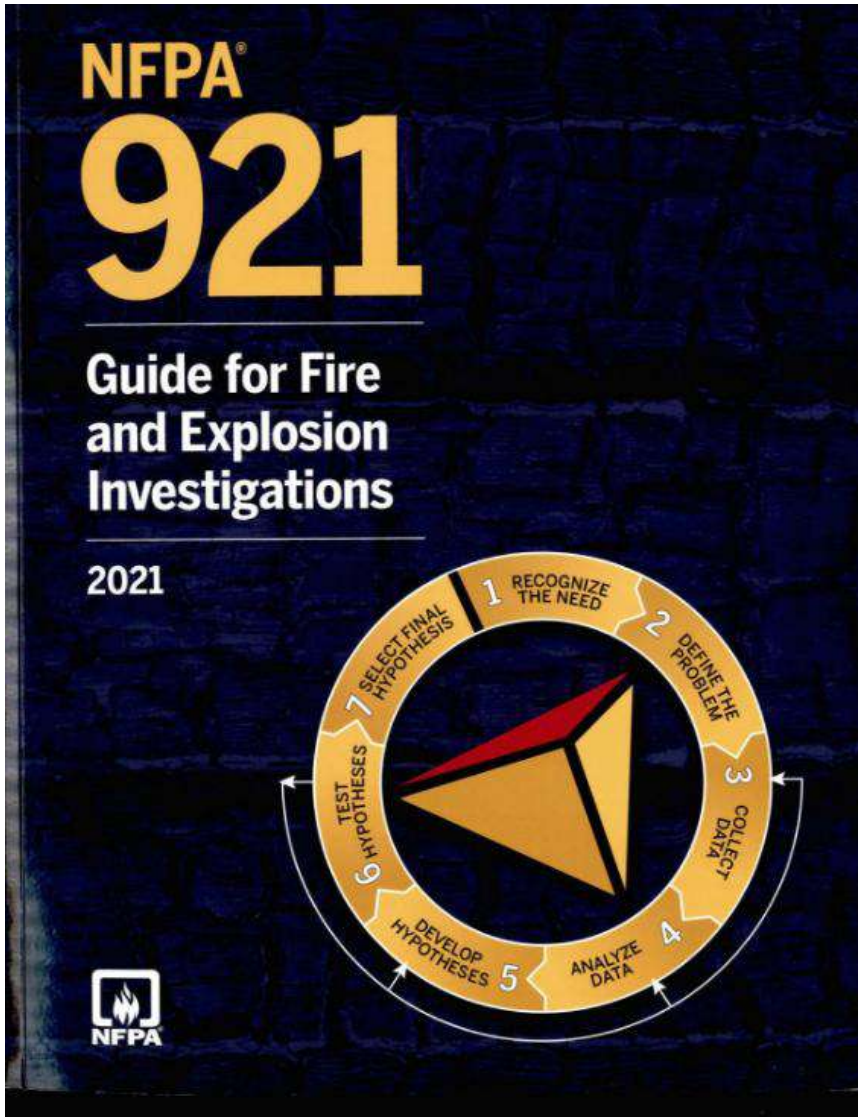
- First Edition of NFPA 921 released in 1992
- Sequence: Area of Origin then Cause Analysis
- **Scientific Method**: A Systematic Process that must be proven with data or reliable inferences

Confirmation bias - natural tendency to confirm rather than to deny a current hypothesis

Expectation bias – reaching a premature conclusion without considering all the data

Predictable-world bias - derived from the inability to acknowledge that coincidences are merely coincidences

Availability bias - causes the investigator to depend primarily upon information that is readily available to him/her.



Test Burns

Test Burns

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Fire Causes

Statistics

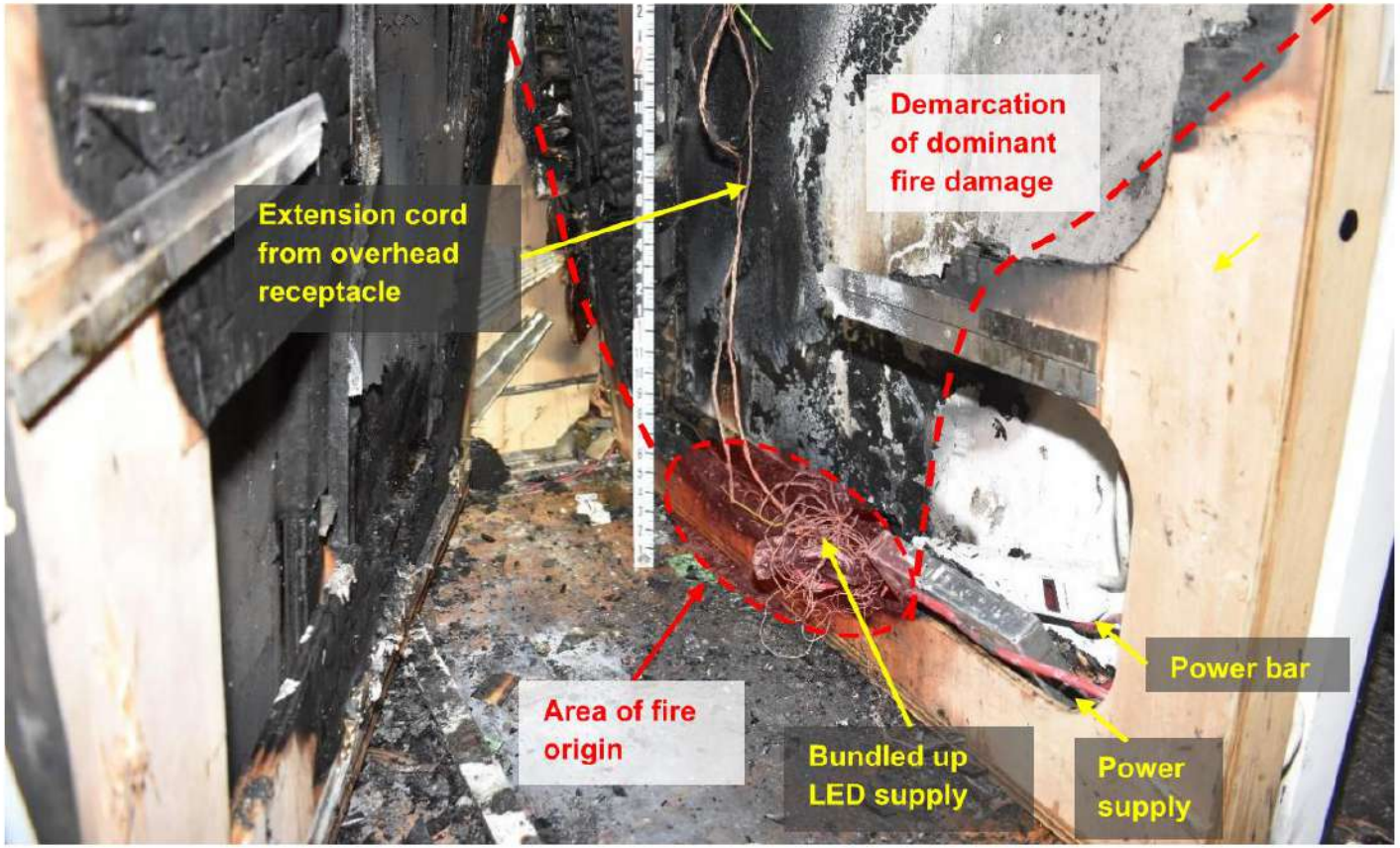
Case Studies

NFPA Home Fire Cause Statistics

NFPA: Leading cause of fires - cooking!

Leading cause of fire deaths - smoking

Example of an Investigation



Fire Cause is an electrical failure. Case closed, correct?

Electrical energy is an ignition source and perhaps a classification, whereas the cause involves low gauge cables bundled together, inconsistent with recommended practice and manufacturer instructions

Case Study – Planters!

- Potting Soil – NOT DIRT. Peat moss and wood chips.
- Very common – cigarettes in planters smouldering and causing fire hours after disposal.

Figure 3: Area of origin, facing south.

Figure 4: Concentrated charring to the inside of the planter box.

Figure 5: Cigarette butts found in the planting soil.

Case Study - Planters

co-operators | Newsroom

News Releases

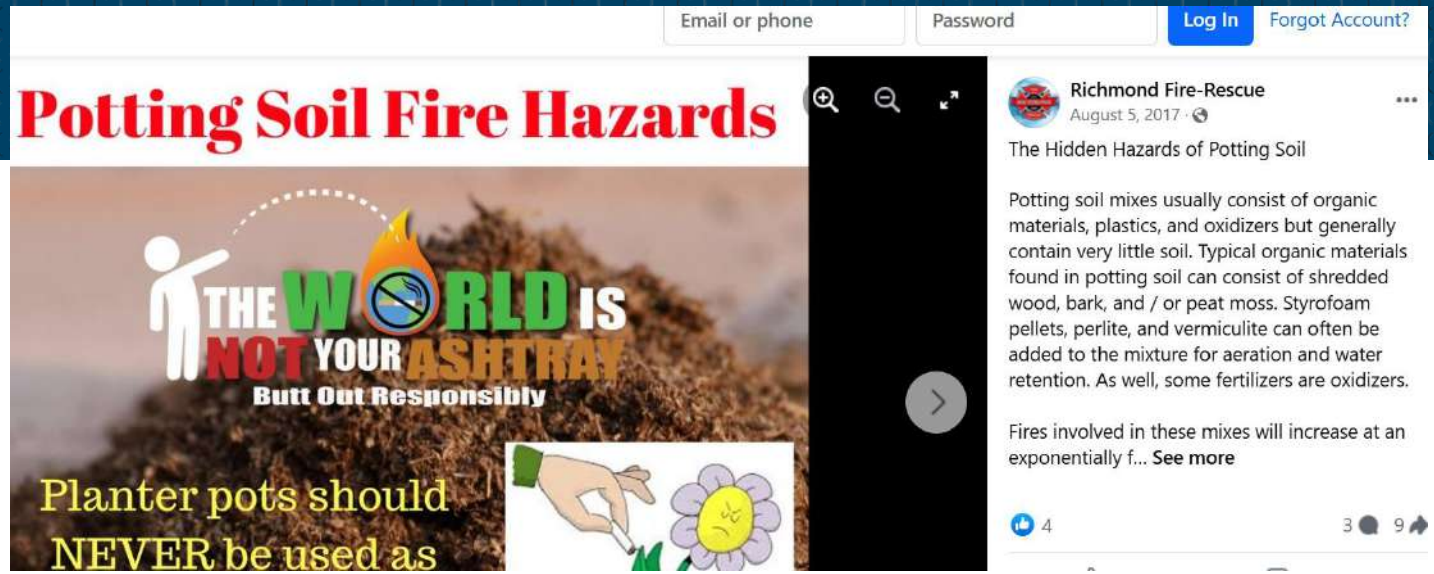
Potting soil emerging as a fire hazard

Canada NewsWire
Canada
Jul 21, 2010
8:00am

GUELPH, ON, July 21 /CNW/ - In March, a massive fire destroyed a Calgary condominium complex, leaving at least 250 occupants homeless. The combustive culprit was a cigarette in a planter outside the complex. Recently there has been a spike in fires sparked by smoking materials in potting soil. The Co-operators is urging Canadians to be aware of the danger associated with disposing cigarettes in potted plants.

There has recently been a noticeable increase of incidents of fires caused by dry peat moss in potting soil. Problems are also related to fertilizers in the soil, which can act as oxidizers that accelerate fires. Many potting soils on the market today contain less dirt and more organic substances that are flammable, such as shredded wood, bark, peat moss, Styrofoam, and vermiculite.

"People should remember to be prudent when disposing their cigarettes," said Glen Oxford, claims manager for The Co-operators. "You might think you are safely extinguishing it in dirt and not realize the soil is actually flammable. The reality is that homes have burned to the ground because of careless cigarette disposal."



Soil ignites alert from Vernon Fire Department

Did you know that the potting soil in your flower pot could catch fire?

Staff Writer
Jun 3, 2012 12:00 PM

Smouldering Combustion - Physical Experiments

Testing smouldering combustion of cigarettes in planters

Legacy JH presented the research at 2015 Fire & Materials conference

Transition to flaming combustion between 77 mins and 400 mins (~ 1 to 6 hrs)

Li-Ion Battery Failures

- Overall fire hazards
- Hazard =/ fire cause mechanism
- Industry moving towards safety certifications

Case Study: Long-Term Low Temperature Ignition of Wood

Pier Park

Case Study – Incendiary Fire

Case Study – Combine Harvester

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Fire Protection Engineering

So How Does Code Come In?

Where does Fire Protection come in?

- Code works!
- Smoke Alarms
- Sprinklers
- …And everything else

Fire Protection - Firewall

It works!

Fire Protection – Firewall (2)

Fire Protection – Spatial Separation

Fire Protection: Fire Separation

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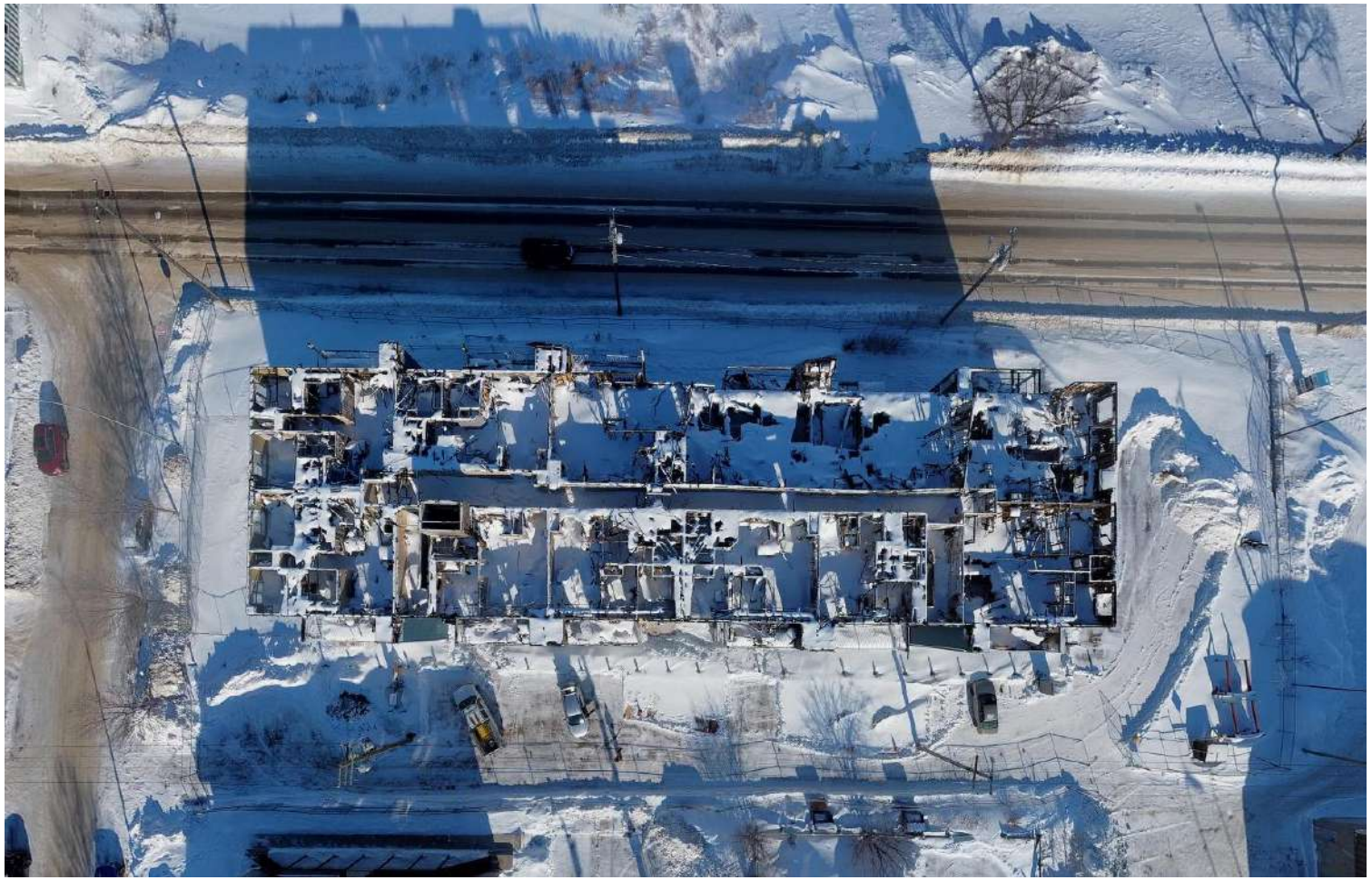
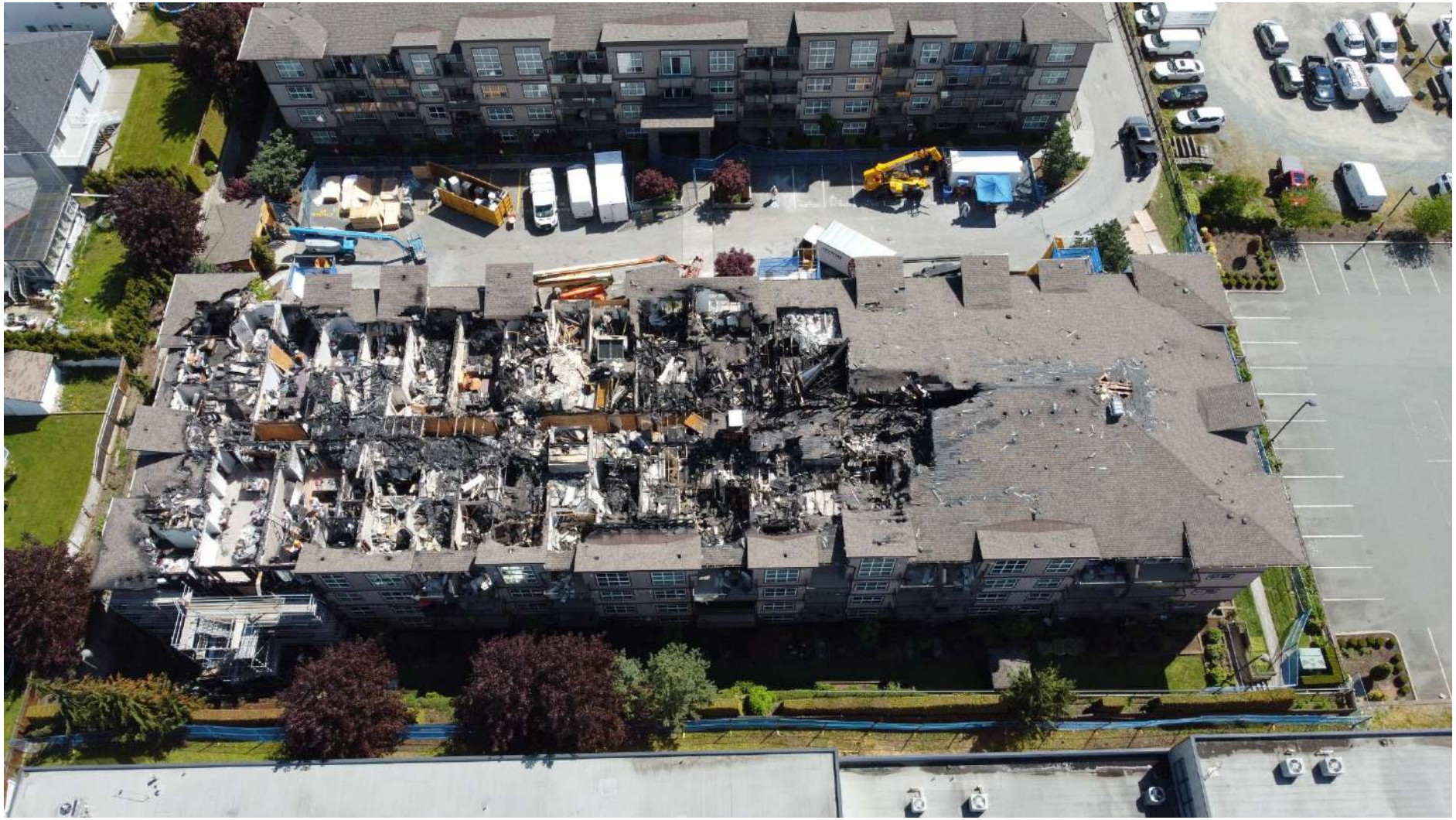
Codes and Caveats

Even When Codes are Followed…

4-Storey, Combustible Siding, No balcony sprinklers



Another One



Code Change/ Early Adoption - 2017

SURREY NOW-LEADER

News More Contests Shop Flyers E-Editions Classifieds Auto Jobs Obituar

Balcony sprinklers to be required for four-storey wood-frame buildings

Announcement comes after Dec. 11 Langley fire that left more than 100 people homeless in Langley City

Dan Ferguson
Mar 15, 2017 4:00 PM

The provincial government has announced fire sprinklers will be required on the balconies of all new four-storey wood-frame residential buildings effective July 20.

The update to the BC Building Code comes after the Dec. 11 Paddington Station fire that destroyed the top floor of an upscale multi-unit complex in Langley City, which the fire department blamed on a balcony fire and lack of sprinklers. More than 100 people were left homeless.

"If this building (Paddington) had sprinklers on the balconies and in the attic, this fire likely would not have spread into the attic space," a report by fire chief Rory Thompson said.

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When Code isn't Followed

Fire Protection System Failure Investigations

Part 9 of Building Code

Figure 5: Dominant fire damage surrounding corner of column with wood stove flue.

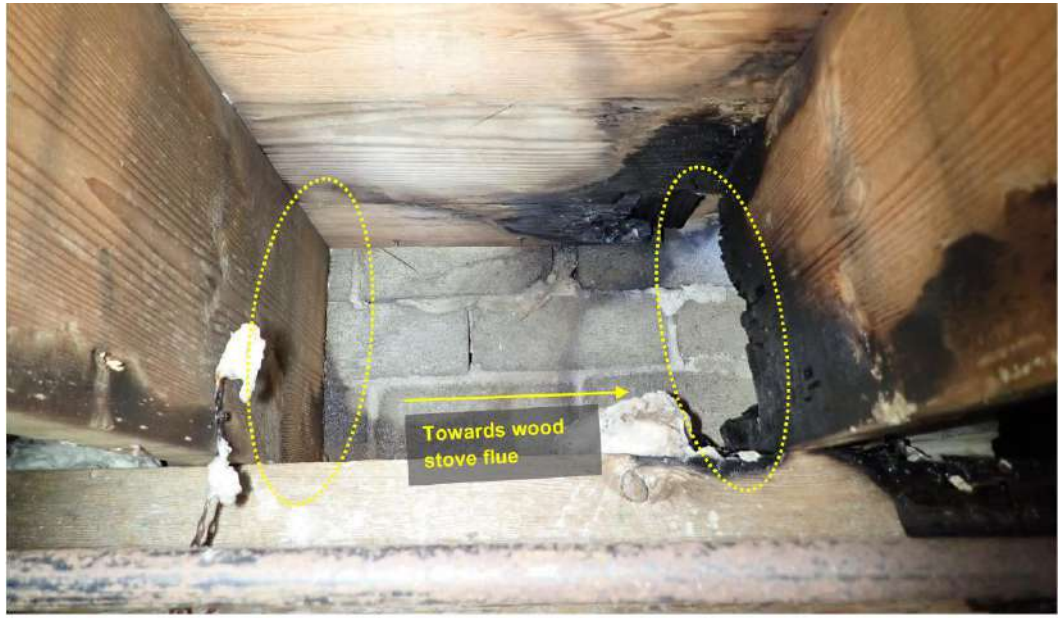


Figure 8: Charring to wood against corner of column with wood stove flue. Framing is immediately against the column.

*Section 9.21 of the BC Building Code, dating back to 1990…**The main floor wood framing was in contact with the chimney while the code requires a 50 mm clearance. The spacing between the flue lining and the chimney was also insufficient.** Long-term, low temperature ignition of wood.*

Sprinkler Failures – Dry System Example

Figure 11: Photo of original installation annotated to show low points and broken piece of pipe elbow.

Sprinkler Failure – Wet Systems Example

Figure 5: Loose-fill insulation without batts in some areas (including near the entrance, which had a lower roof), which buried the pipe in insulation such that it is insulated from the heated space below. Wind from the ventilated soffits can enter the attic space.

A.8.16.4.1.1 Water-filled piping can be run in spaces above heated room, such as attics, even if the space above the room is not heated itself. Insulation can be located above the pipe to trap the heat from below and prevent the pipe from freezing. It is important not to bury the piping in the insulation because if too much insulation ends up between the pipe and the heated space, the insulation will prevent the heat from getting to the pipe. This method of protecting the pipe is acceptable to this standard.

New Construction – Safe?

- Course of Construction Fires
  - Whole different topic

- Building Systems Infallible? Maybe…
  - Inspections
  - Common Sense….

Major Renovation Project

Failure of active and passive fire protection – fire alarm disabled for construct
and firewall did not work

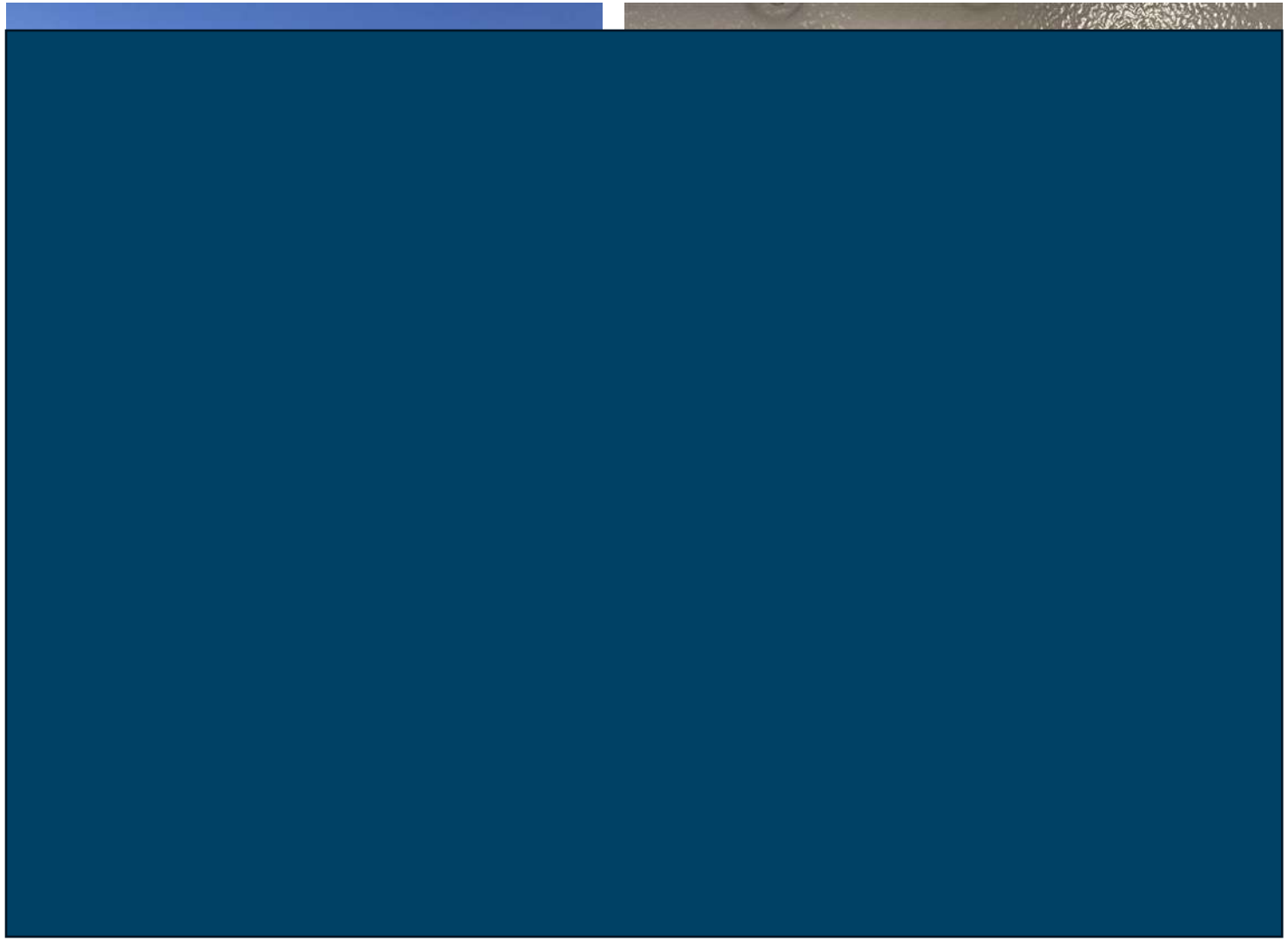
S1001 Integrated Testing Example – Fan testing

Table 4-5: Test Protocol for Integration Between Corridor Pressurization System & Fire Alarm System

Condition	*Off-Normal / Fire Mode Test Procedure*	
Remain active on Fire Alarm (with 30 min EM power)	1a) 2a) 3a) 4a)	Review status of fan (continuously running). Cause an Alarm condition in Building 1 Evacuation Zone. Confirm air movement maintained in corridor vents. With normal power supply terminated, confirm fan continues to run when supplied by EM power.
Shut Down on Duct-Type Smoke Detector	1b) 2b) 3b)	Confirm fan is running. Introduce smoke to activate the duct-type smoke detector. Confirm shut down of fan.
Manual Control at Building 1 panel	1c) 2c) 3c)	Confirm fan status. Control fan from annunciator panel controls. Confirm manual controls override other instructions.
Fire+Smoke Damper Activation	1d) 2d) 3d)	Confirm fan is running. Introduce smoke to activate the detector associated with the FSD for the floor Confirm damper closes and there is no air movement, but dampers at other floors are open.
	5) 6)	Confirm correct fire alarm annunciation. Return fan to normal operation.

Fully verified system…

Integrated Systems Testing



First test – saw that MUA smoke detector had burned

Isn’t the System ‘Verified’?

Verification – ‘electrically tested only’ at relay

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Staying Safe

This is scary, Arjun, Justin...

So what do I do..?

Fire Safety at Home

- Hope for the best, but prepare for the worst.
- Some uninsured businesses…and a frightening number of renters without insurance.

Fire Safety at Home

Home Fire Safety for Individuals

- **Make sure you have working smoke alarms.** Check the alarms once a month, and consider installing a battery-operated smoke alarm in every bedroom if you don't have one already. **NEVER disable a smoke alarm.**

  NFPA reports that roughly **3 out of 5 fire deaths happen in homes without smoke alarms or where the smoke alarm failed to operate.**

- Keep a **fire extinguisher** in an accessible location, and know how to use it.
- Make a **fire safety plan** for your home, and ensure children and other vulnerable members know what to do and where to exit in case of a fire.
- Use extreme caution around live flames such as **candles**. Do not leave candles unattended, and keep them away from pets and children who might knock them over.
- Do not store items on **cooktops**. In case a range is accidentally turned on, it can cause a fire.
- **Never dispose cigarettes in planters or garbage bins**. Potting soil consists of of peat moss and other organic material which can smoulder undetected for hours before starting to flame. The same is true for paper and other material in garbage which may come in contact with cigarette butts. Dispose cigarette butts in containers filled with water.
- Do not leave charging batteries unattended. Do not use damaged batteries. Although this applies to all batteries, this can be particularly relevant to power tools and e-mobility devices such as e-bikes and e-scooters.
- Be mindful of **self-heating reactions** while painting/staining. Rags and other items contaminated with materials susceptible to self-heating (e.g. - stains with linseed oil) can build up enough heat from exothermic reactions and catch on fire if left crumpled up or in garbage cans. Such fires can be caused hours after the staining work is done and rags left. Read the instructions from the manufacturer on disposing such items, which can include disposing them in sealed cans filled with water.

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Conclusion

So, guys, what's your point?

The Point of it All…

- ‘May you live in *Interesting Times*’…First Line of Defense.
- It is important to know what you protect against.
  - Example: Installation over façade: ‘no sources of ignition’?
  - Test the system yourself! People don’t live in drawings…

Questions?

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Extra Slides - Terry Pratchett City Watch Series

Samuel Vimes had a jaundiced view of Clues. He instinctively distrusted them. They got in the way.

And he distrusted the kind of person who'd take one look at another man and say in a lordly voice to his companion, "Ah, my dear sir, I can tell you nothing except that he is a left-handed stonemason who has spent some years in the merchant navy and has recently fallen on hard times," and then unroll a lot of supercilious commentary about calluses and stance and the state of a man's boots, when exactly the same comments could apply to a man who was wearing his old clothes because he'd been doing a spot of home bricklaying for a new barbecue pit, and had been tattooed once when he was drunk and seventeen and in fact got seasick on a wet pavement. What arrogance! What an insult to the rich and chaotic variety of the human experience!

It wasn't by eliminating the impossible that you got at the truth, however improbable; it was by the much harder process of eliminating the possibilities. You worked away, patiently asking questions and looking hard at things.

