



# JENSEN HUGHES

Advancing the Science of Safety

## CASE STUDY OF EXISTING BUILDING CLADDING LESSONS LEARNED

**James A. Bychowski, PE, BS FPE, MBA**

Safety Design in Buildings



Kuwait Conference

Wednesday, December 06, 2017, Crowne Plaza Kuwait

# Course Description

JENSEN HUGHES will share methods for determining combustible properties of existing building cladding through minimally invasive testing and for conducting risk analysis on buildings with moderate to highly combustible cladding to determine if cladding replacement is necessary. The presentation will also discuss potential methods for reducing risk of exterior cladding fires in high-rise buildings.



# Presenter

James A. Bychowski, P.E., BS FPE, MBA  
*Senior Vice President, JENSEN HUGHES*

James A. Bychowski, P.E., has over 30 years of fire protection experience. As Senior Vice President – Middle East, Mr. Bychowski has been responsible for JENSEN HUGHES Middle East operations for the past 10 years.

Mr. Bychowski established the first JENSEN HUGHES Middle East office in Dubai in 2006. He is a member of the NFPA MENA Advisory Committee, has served as a principal member on the NFPA 72 technical committee, as alternate to the chairman of NFPA 13 and is a founding board member of the International UAE chapter of the Society of Fire Protection Engineers (SFPE).



# Learning Objectives

1. Primary causes of exterior cladding fires
2. Basic fire test used to evaluate combustibility of exterior cladding
3. Risk assessment based on test results.

The purpose of this presentation is to convey technical knowledge to the conference participants.

The presentation also contains slides with text that summarises the content of the presentation and the main learning objectives.

These may be used to update CPD records for relevant organisations including the Chartered Institute of Building (CIOB).



# BEAUTIFUL BUILDINGS

## ALUMINUM COMPOSITE PANELS (ACP)

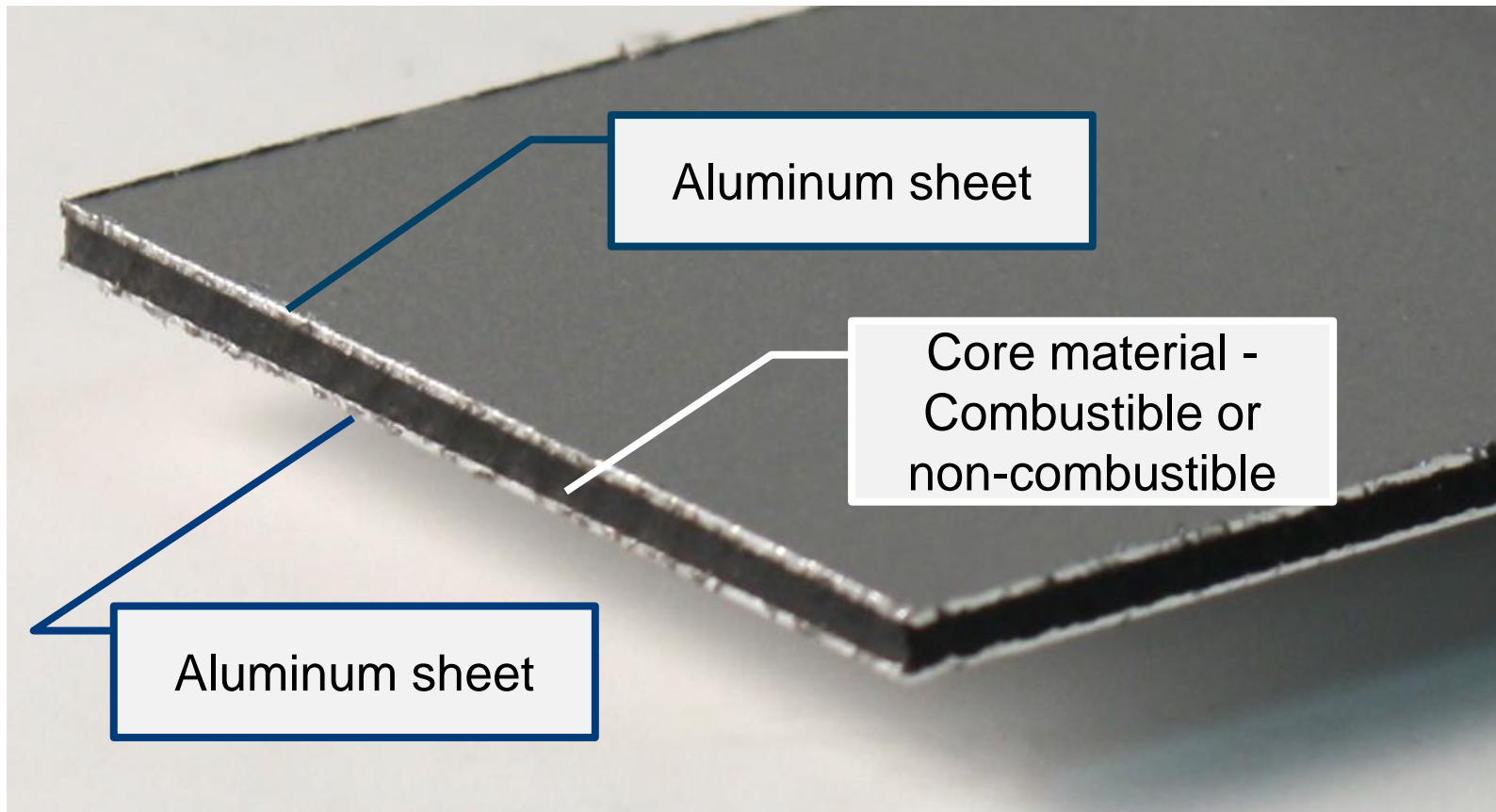
- Durable
- Great insulator
- Easily installed
- Many shapes and profiles
- Unlimited details using ACP



Credit: Flickr-Marco Verch



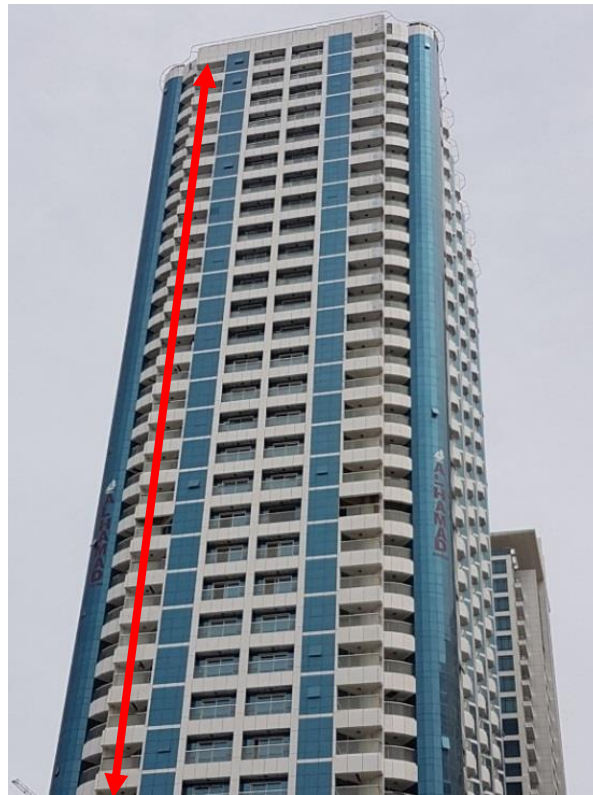
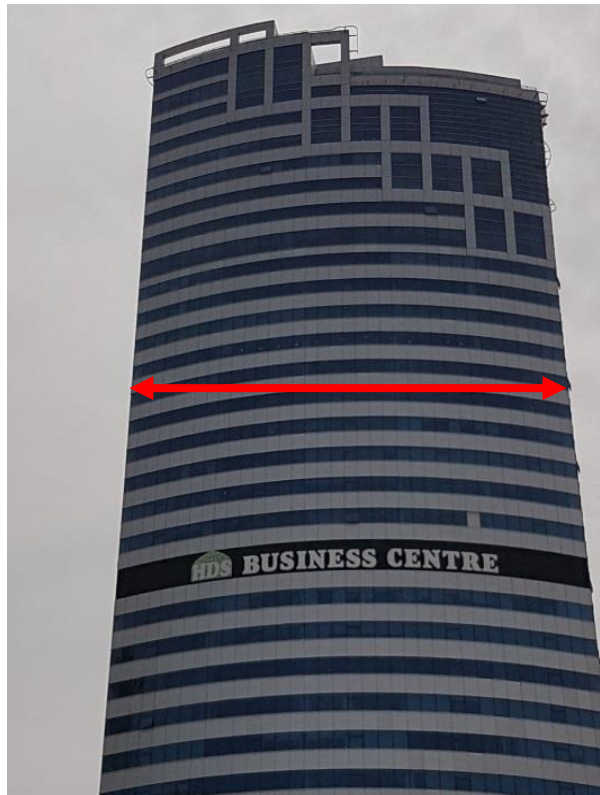
# ACP BASICS



# HIGH-RISE BUILDINGS USING ACP

## EXPANSIVE WALLS AND VERTICAL RUNS

- Continuous stacked fuel source if ACP with combustible core



# EXTERIOR BUILDING FIRES





# HIGH-RISE BUILDING SPECIAL FEATURES

## BALCONIES

- Sheltered combustible boxes
- Fuel loading from furniture
- Sources of ignition
- Human error



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# HIGH-RISE BUILDINGS

## OUT OF REACH

- Fires develop quickly due to array
- Often beyond reach of tallest Civil Defense ladder trucks



# THE PROBLEM

## IS THIS A PROBLEM?



# APPROACH TO IDENTIFY IF I HAVE A PROBLEM

## REVIEW AS-BUILT DOCUMENTS

- Review as-built drawings and data sheets
- Review manufacturer's fire test documents

## NO ACP DOCUMENTATION - TESTING REQUIRED

- Take small samples (1 replaceable panel)
- Small scale test (ASTM E1354-16)
- Determine if combustible or non-combustible

## COMBUSTIBLE?

- Conduct risk analysis to determine exposures



# EXISTING CASE STUDY – 200 Buildings

## REVIEW DOCUMENTATION

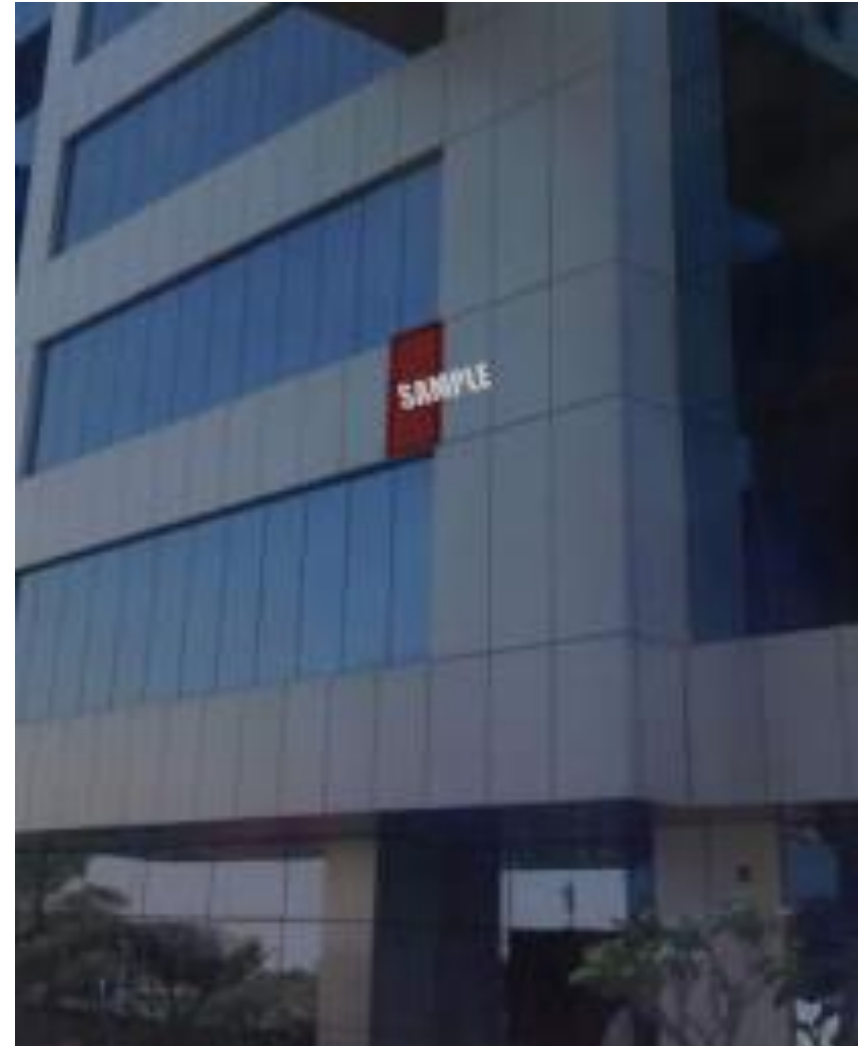
- JENSEN HUGHES reviewed Architect/Engineer's approved as-built drawings and manufacturer's data sheets
- As-built documents must include manufacturer's material fire testing documentation corresponding to installation
- No documentation = TESTING.



# BUILDING INSPECTION

## SITE VISIT

- JENSEN HUGHES surveyed buildings to identify locations of panel samples
- Provided specification for panel removal and replacement for owner's contractor.



# SAMPLE REMOVAL

## OWNER'S CONTRACTOR

- Purchased new matching panel or retrieved from owner's spare stock

## OVERSIGHT OF SAMPLE REMOVAL

- JENSEN HUGHES witnessed panel removal and marked/photographed for chain of evidence.



# TEST METHODOLOGY

## ASTM E1354 – CONE CALORIMETER TEST

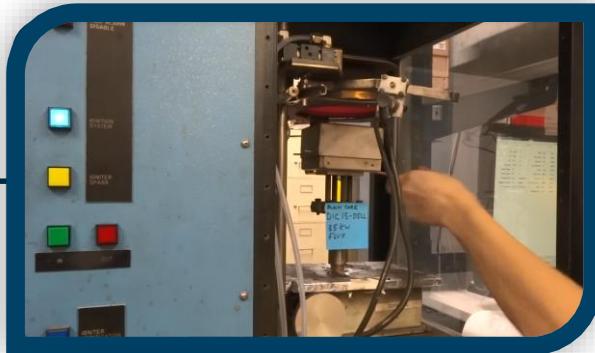
- Sample size = 10cm X 10cm
- Samples were subjected to incident heat flux exposures of 35 kW/m<sup>2</sup> and 50 kW/m<sup>2</sup>
- Duplicate and triplicate tests were run to obtain reliable data





# TESTING

Samples subject to heat flux exposure of 50Kw/m<sup>2</sup>

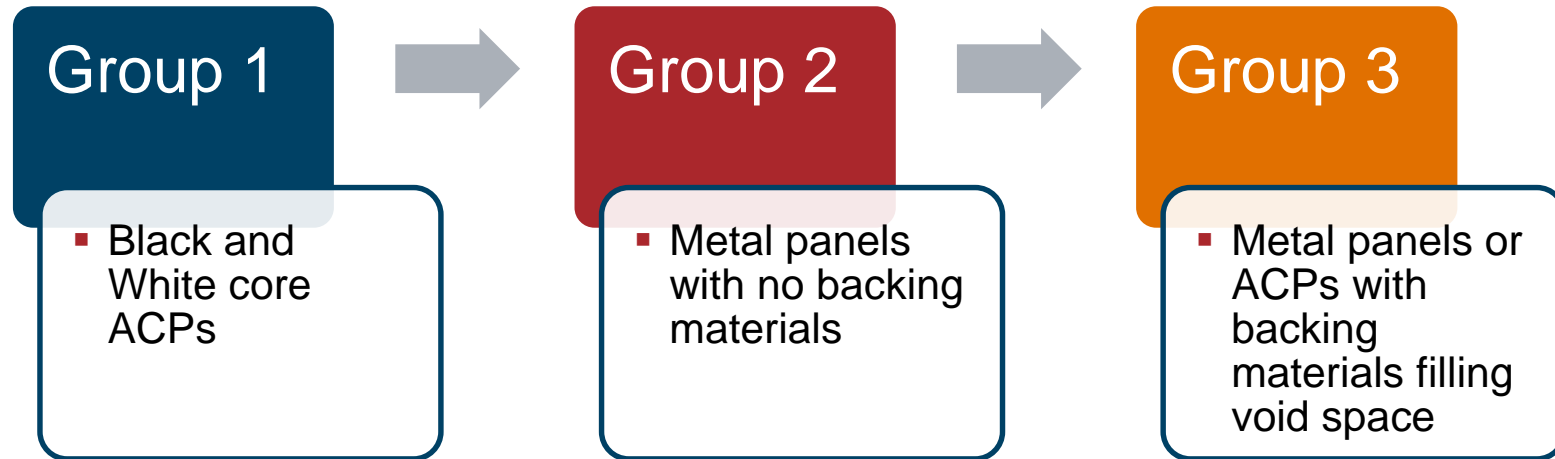


Samples subject to heat flux exposure of 35Kw/m<sup>2</sup>



# TEST GROUPS

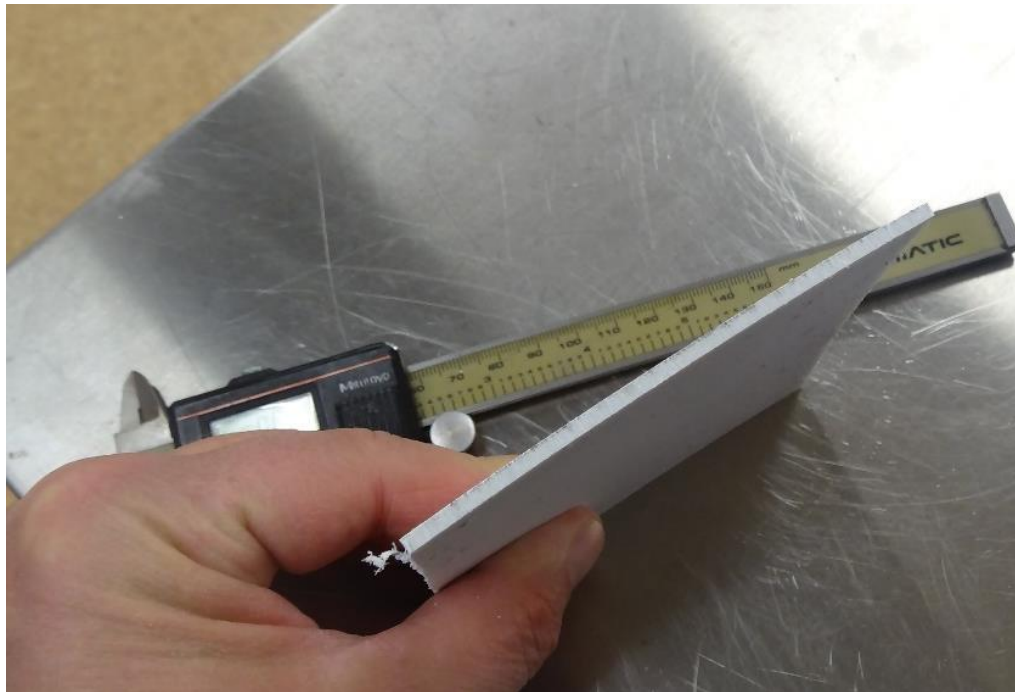
Three basic groups of panels:



# TEST RESULTS

## GROUP 1A - WHITE CORE SAMPLES

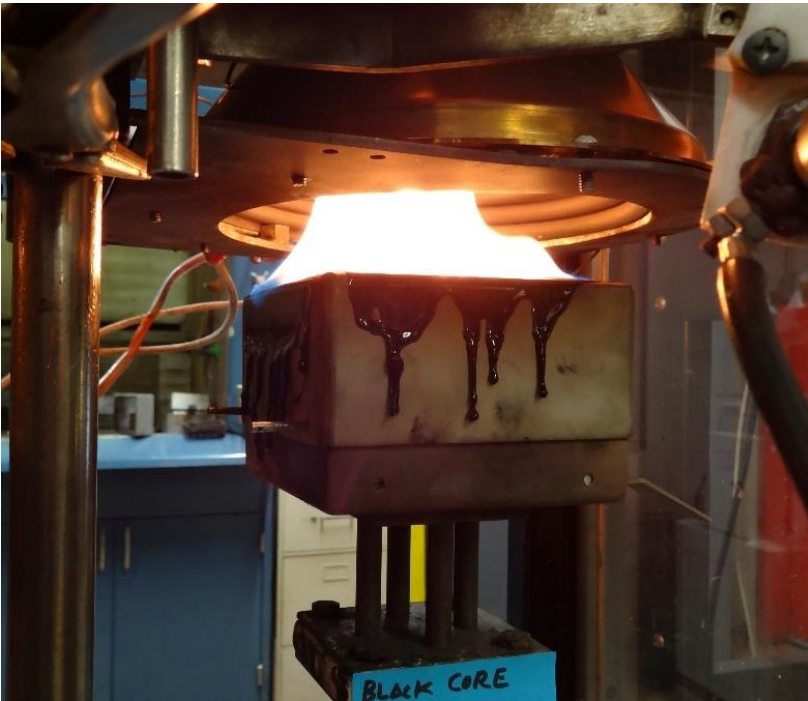
- ACPs with white core material had peak heat release rates of 217 -229 kW/m<sup>2</sup>.



# TEST RESULTS

## GROUP 1B - BLACK CORE SAMPLES

- Black core samples had very high peak heat release rates of 600 to over 1000kW/m<sup>2</sup> with the core material exposed.



# TEST RESULTS – GROUP 2

## GROUP 2 – METAL PANELS WITH NO BACKING MATERIALS

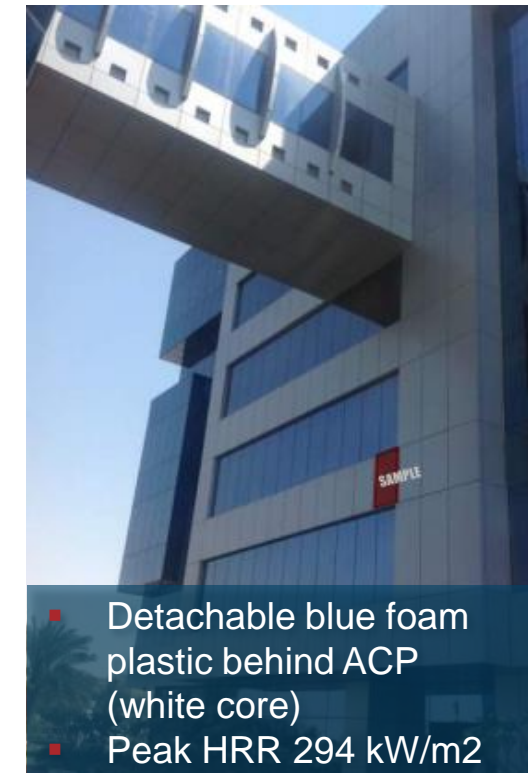
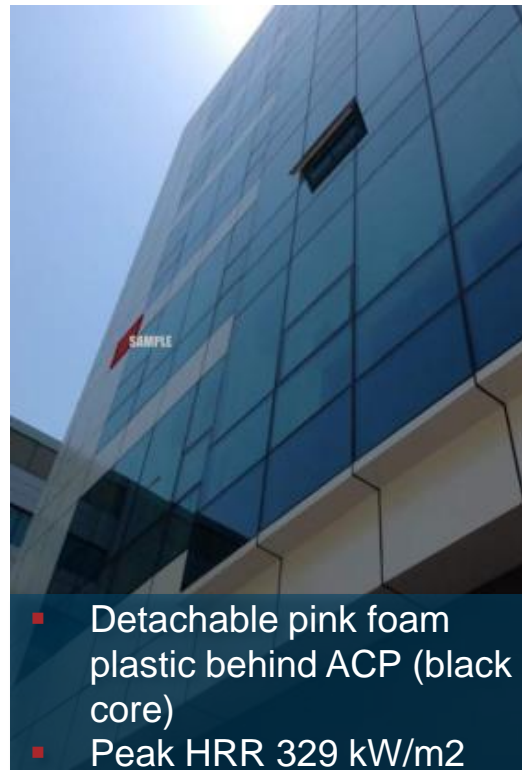
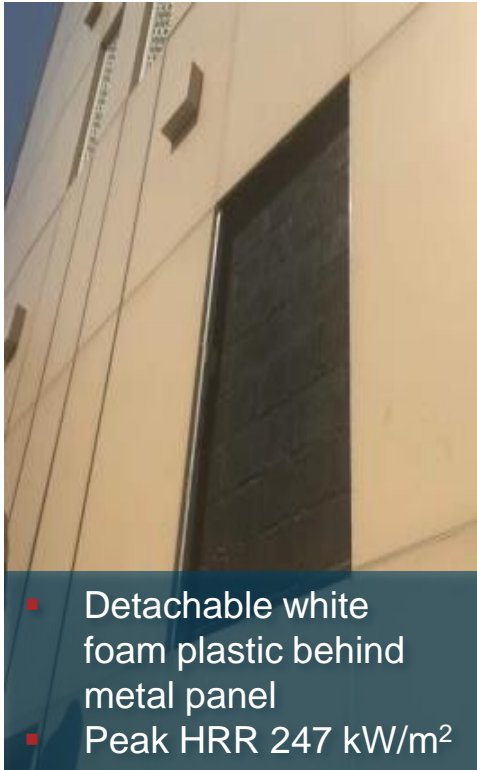
- No cone calorimeter testing was performed
- These panels were solely metal panels rather than sandwich panels with an integral combustible core.



# TEST RESULTS – GROUP 3

## GROUP 3 – METAL PANELS OR ACP WITH DETACHABLE EXTRUDED FOAM PLASTIC BACKING PANELS

- Peak HRR noted for the foam plastic



# CONCLUSIONS / RECOMMENDATIONS

## GROUP 1B – BLACK CORE

- Very high peak heat release rates
- Black core melts readily and FLOWS LIKE LIQUID.
- REPLACE all ACP panels with black core material or conduct DETAILED RISK ANALYSIS.



# CONCLUSIONS / RECOMMENDATIONS

## GROUP 1A and 3

### ADDITIONAL NFPA 285 TESTING OR REPLACEMENT OF BACKING MATERIAL RECOMMENDED FOR:

- GROUP 1A panels with white core with high heat release rates.
- GROUP 3 extruded or expanded foam plastic insulation installed behind a metal or ACP.
- JENSEN HUGHES' experience with large scale NFPA 285 testing shows that this type of construction (ACP panels over extruded or expanded foam plastic) exhibits unacceptable performance and fire spread on exterior walls.





# CONCLUSIONS / RECOMMENDATIONS

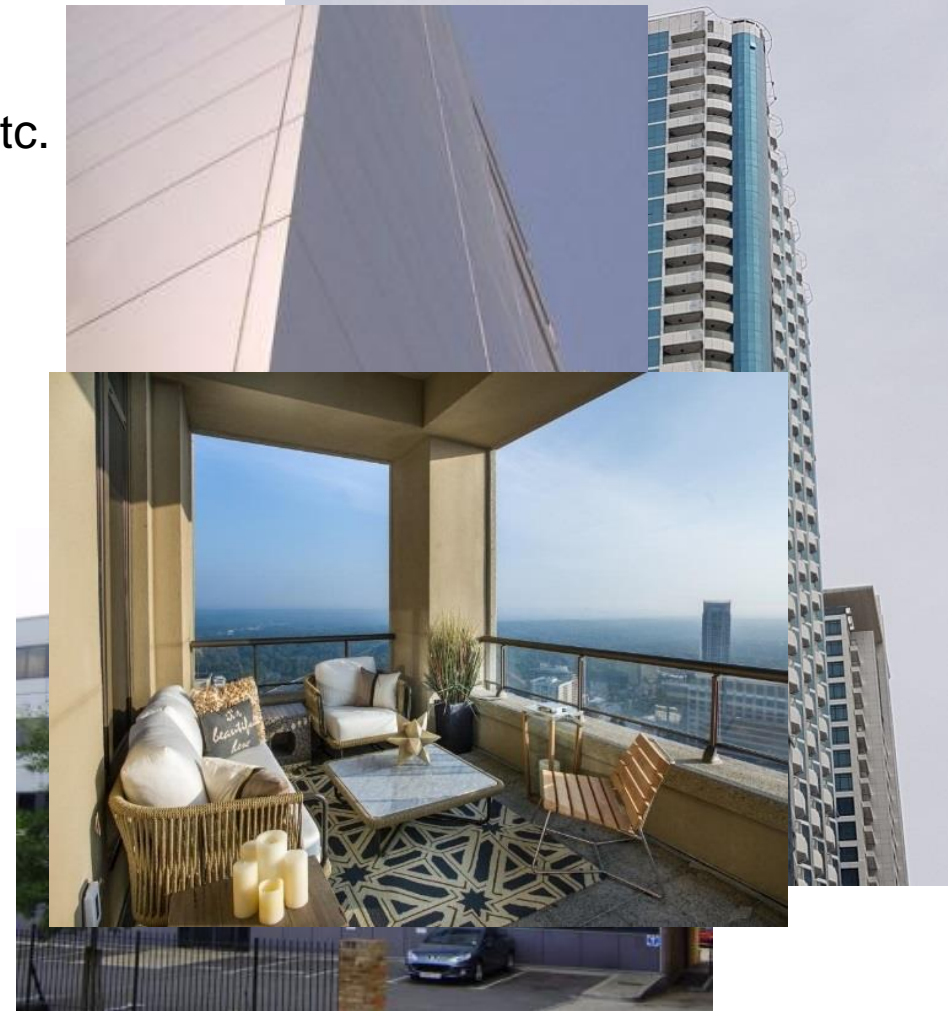
## GROUP 2 – NO ACTION REQUIRED

- GROUP 2 metal panels with no combustible materials installed in the interstitial space behind panels.



# RISK ANALYSIS FOR EXISTING BUILDINGS

- **BUILDING HEIGHT AND OCCUPANCY**
  - Business, Residential, Assembly, Industrial, etc.
- **ACP % COVERAGE AND CONTINUITY**
  - Vertical runs vs separated horizontal strips
- **BALCONIES**
  - Array, construction and use

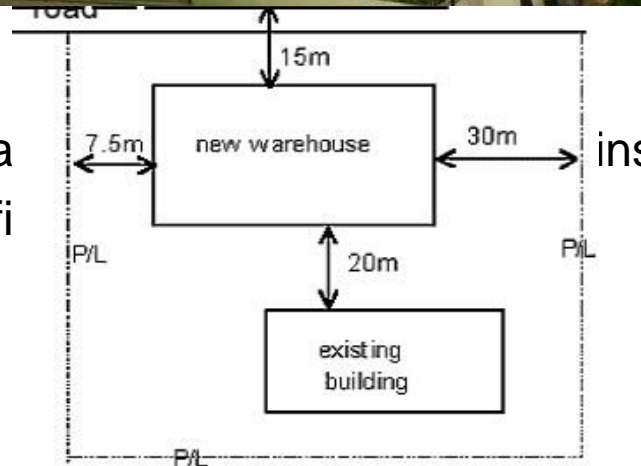


# RISK ANALYSIS FOR EXISTING BUILDINGS

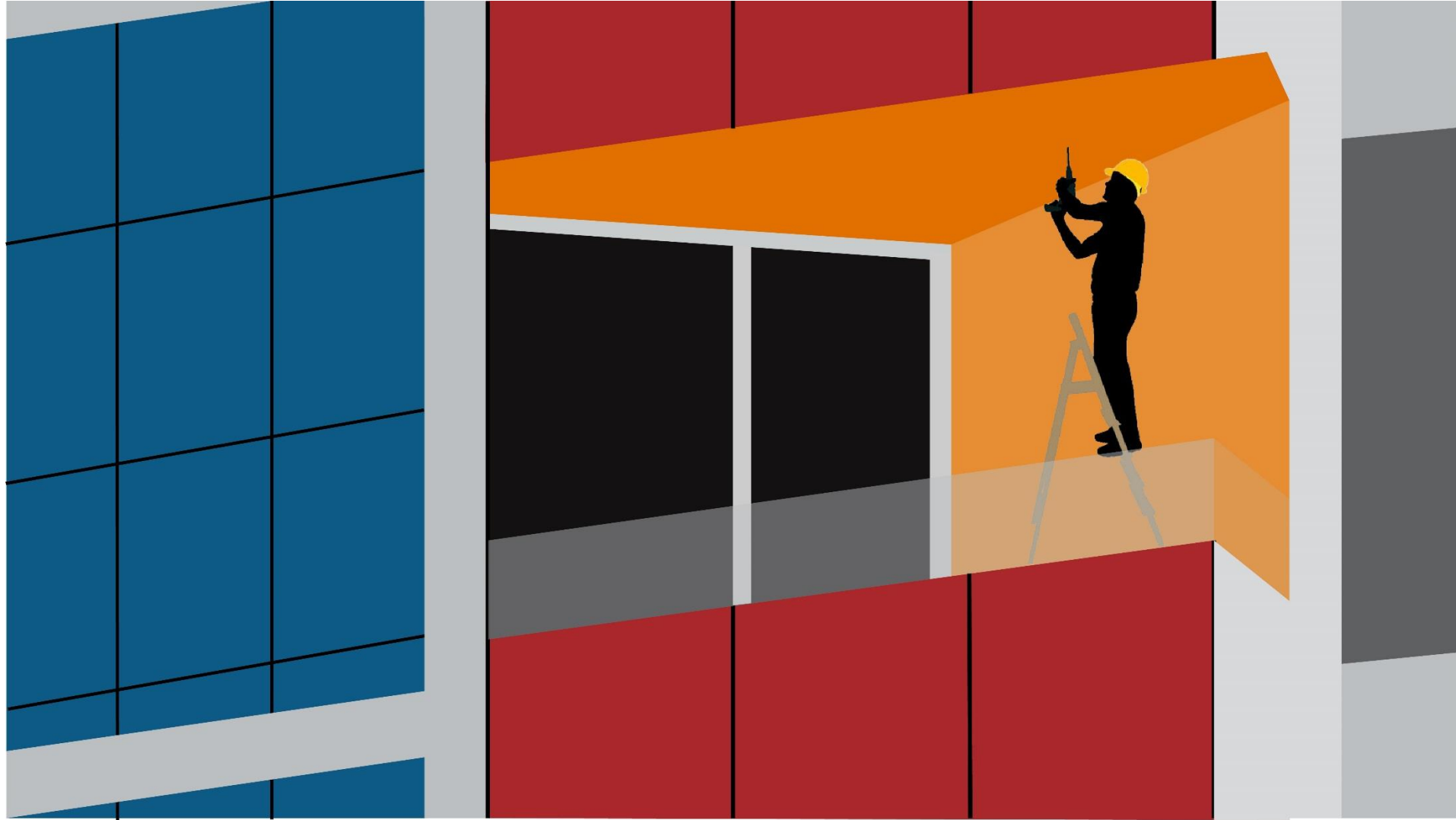
- ADJACENT EXPOSURE
  - Separation distance
- BUILDING ACTIVE
  - Properly designed
  - Exterior hydrants
  - Civil Defense access



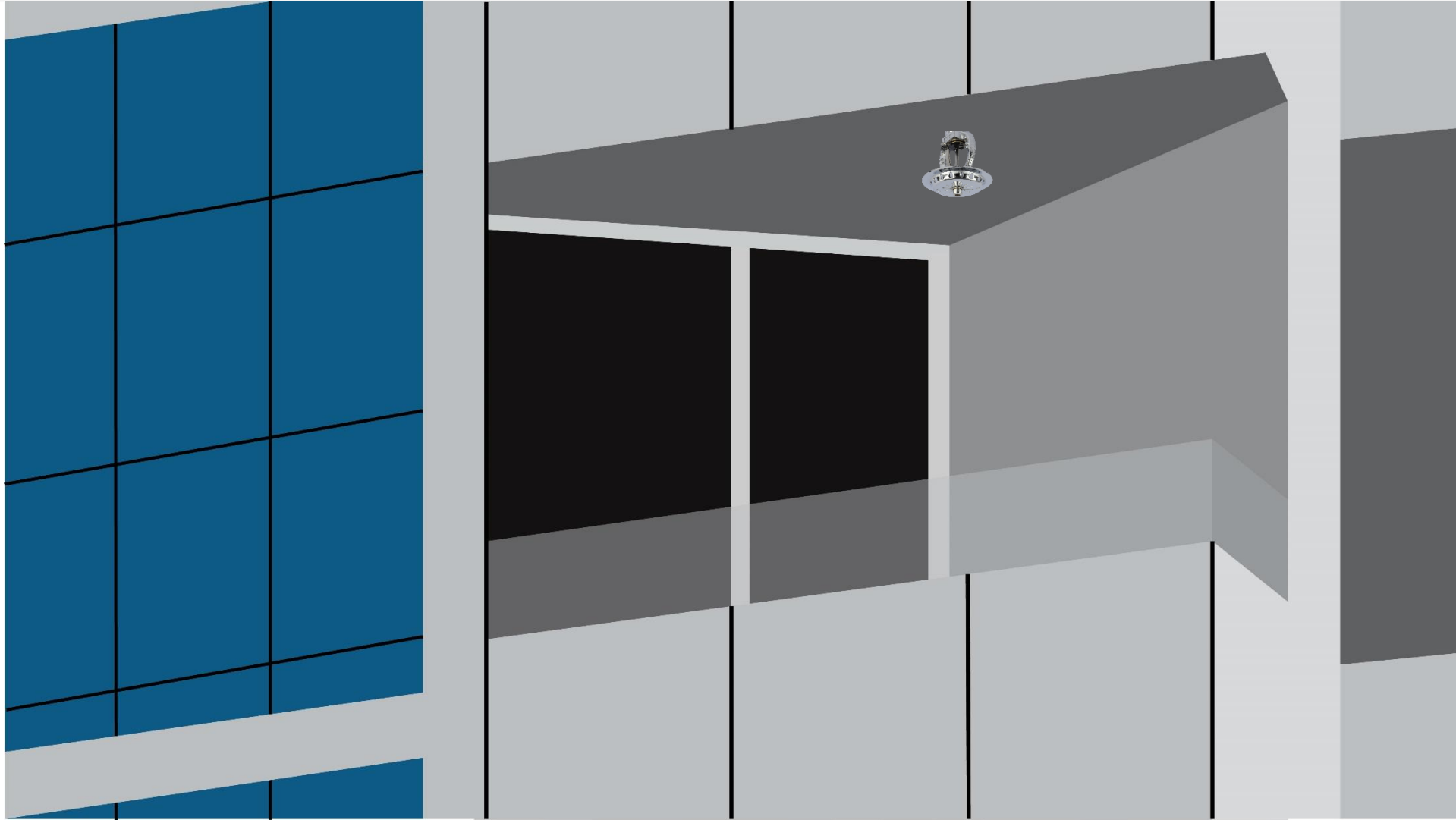
- EXTERIOR FIRE IGNITION
  - Ground floor exterior restaurant
  - High intensity electrical light fixture



# POSSIBLE SOLUTIONS



# POSSIBLE SOLUTIONS



# RECOMMENDED APPROACH – Existing Buildings with ACP

## REVIEW DOCUMENTATION

- ACP fire test documentation available?

## PERFORM BASIC TESTING

- Flammable/Non-flammable

## RISK ANALYSIS

- By qualified fire protection engineer based on results of testing

## REMEDATION PLAN

- Additional testing by qualified laboratory
- Design of upgrades by qualified fire protection engineer and structural team

## REPAIR AND RECOMMISSION

- Shop drawing review by qualified fire protection engineer and structural team
- Small scale sample testing of contractor's submitted cladding product
- Construction oversight by qualified fire protection engineer and structural team



Thank You!



# QUESTIONS?

## Contact

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