JENSEN HUGHES

Advancing the Science of Safety

CASE STUDY OF EXISTING BUILDING CLADDING LESSONS LEARNED

Lucia Ortega

Safety Design in Buildings

Muscat Conference

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Presenter

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Lucia Ortega is a Senior Consultant in JENSEN HUGHES' Dubai office with over 12 years of professional experience in both prescriptive and performance-based fire safety engineering principles. Since graduating with a Bachelor of Science Degree in Industrial Engineering from Polytechnic University of Valencia, and a Post-Graduate Diploma in Business from Engineering College of Copenhagen in 2004, she has been developing fire safety strategies for all aspects of the built environment including transport infrastructure, stations, tunnels, tall buildings and industrial facilities within UK, Spain, Hong Kong, UAE and Qatar.

Ms. Ortega's areas of expertise include life safety and code consultation, building and fire code analysis, code conflict resolution, consultation and negotiation with authorities, egress analysis and evacuation modeling, fire load / flammability analysis, fire sprinkler system design and analysis, mathematical fire and smoke modeling, and risk analysis.

Course Description

JENSEN HUGHES will share with designers and building owners 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.

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.

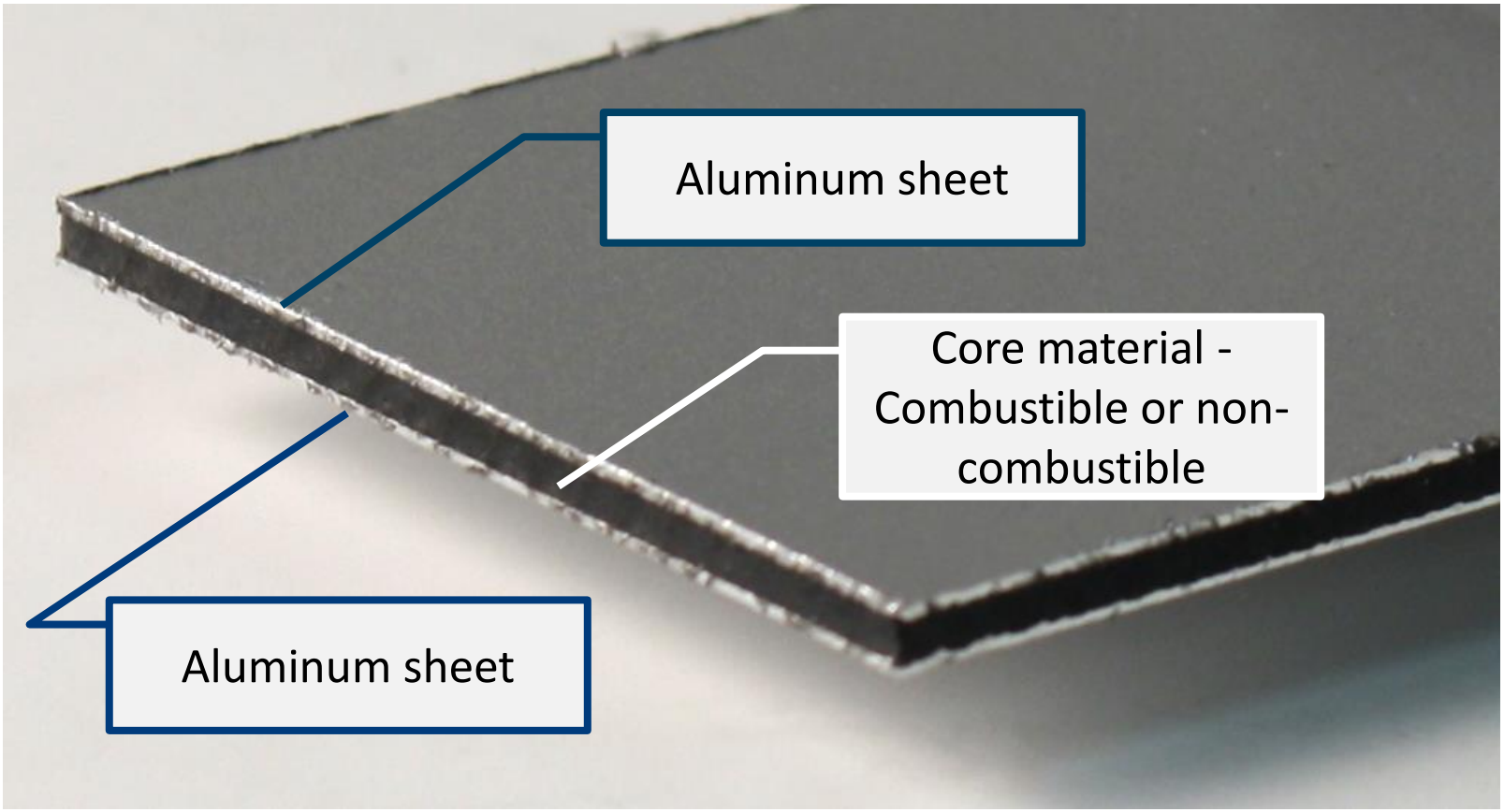
These may be used to update CPD records for relevant organisations including the Chartered Institute of Building (CIOB).

BEAUTIFUL BUILDINGS

ALUMINUM COMPOSITE PANELS (ACP)

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

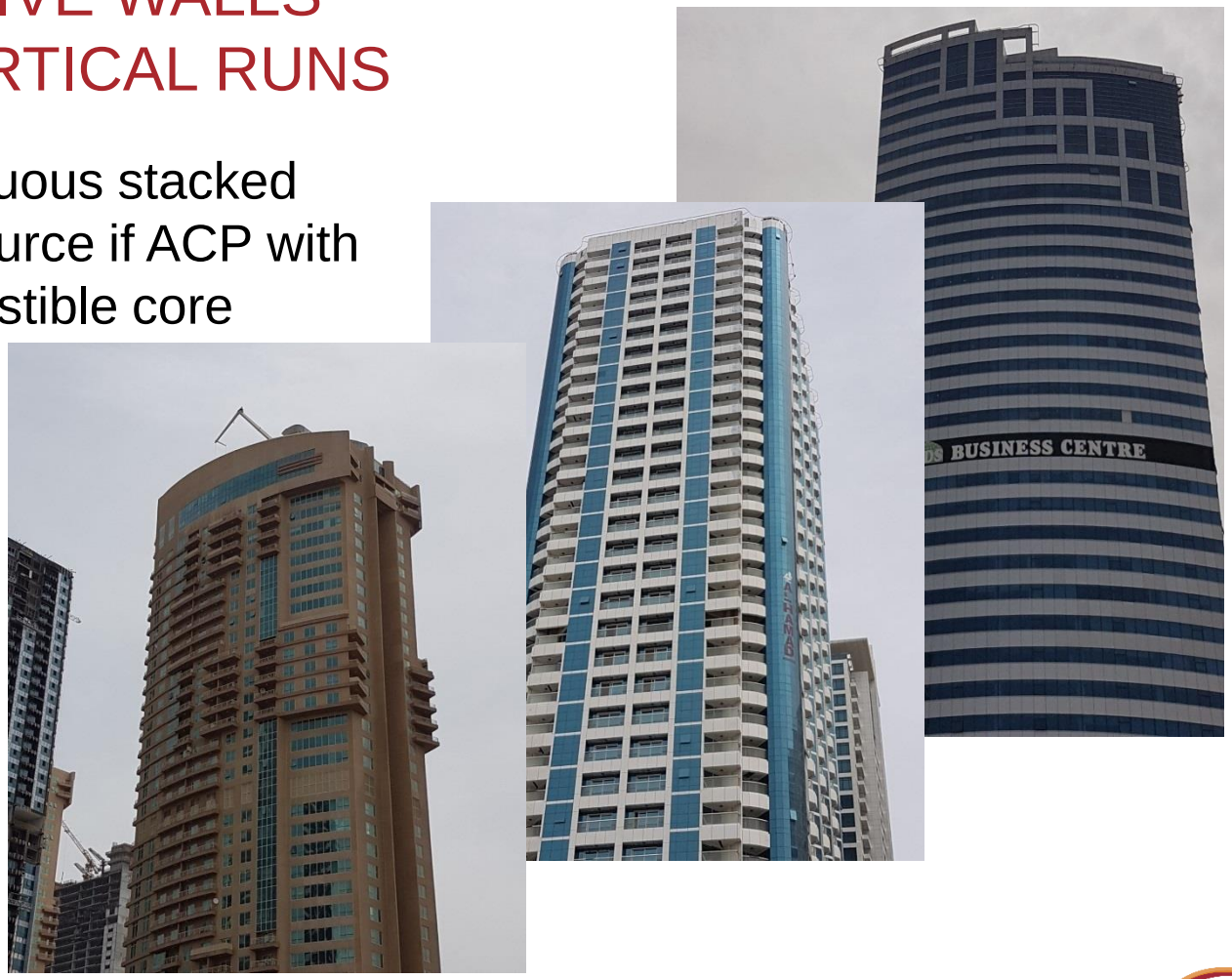
ACP BASICS



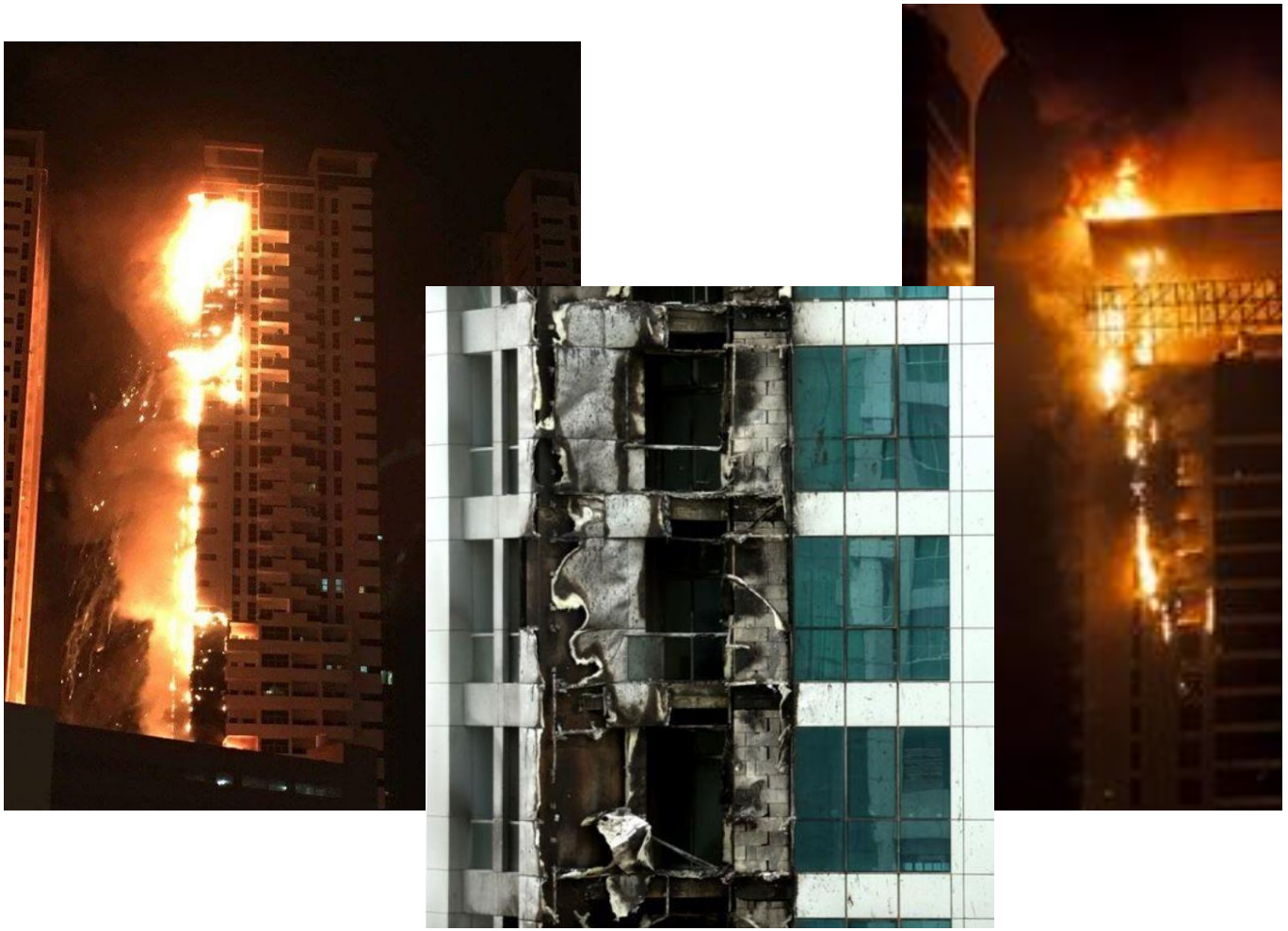
HIGH-RISE BUILDINGS USING ACP

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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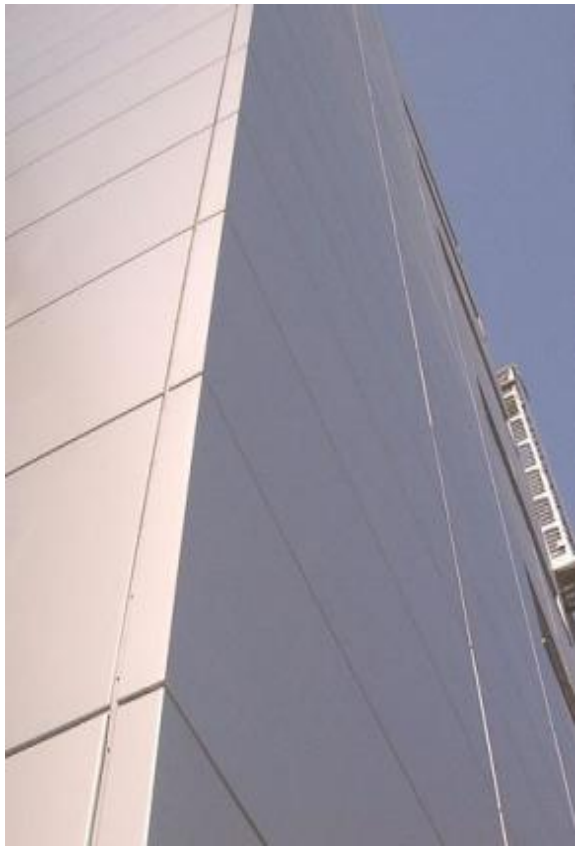
HIGH-RISE BUILDINGS

VERTICAL RUNS

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

THE PROBLEM

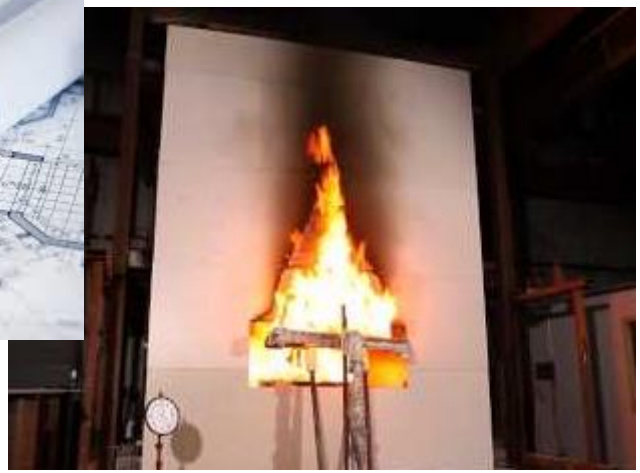


IS THIS A PROBLEM?

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.

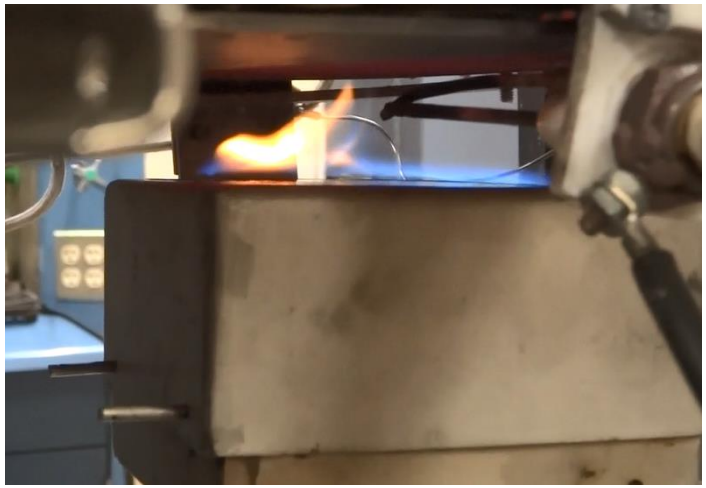
TEST METHODOLOGY

ASTM E1354 – CONE CALORIMETER TEST

- Sample size = 10cm X 10cm
- Samples were subjected to incident heat flux exposures of 35 kW/m2 and 50 kW/m2
- Duplicate and triplicate tests were run to obtain reliable data.

TESTING

Samples subject to heat flux exposure of 35Kw/m^2



Samples subject to heat flux exposure of 50Kw/m^2

TEST GROUPS

Three basic groups of panels

- Group 1 – Black and White core ACPs

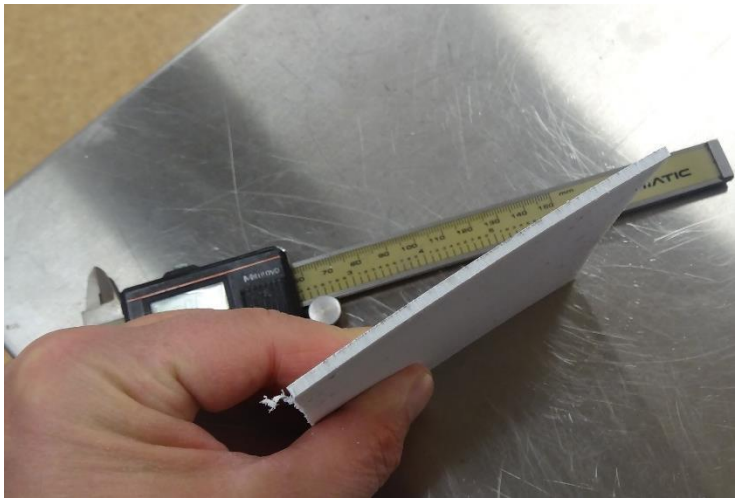
- Group 2 – Metal panels with no backing materials

- Group 3 – Metal panels or ACPs with backing materials filling void space

TEST RESULTS

GROUP 1A - WHITE CORE SAMPLES

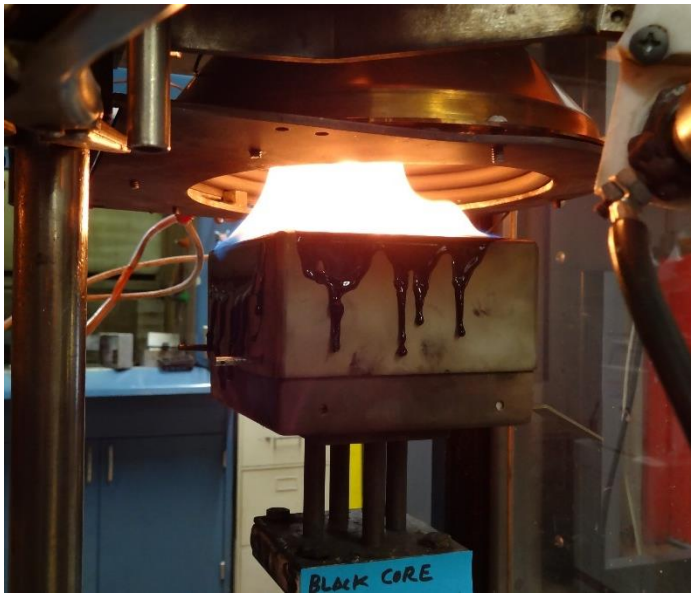
- ACPs with white core material had peak heat release rates of 217 -229 kW/m^2.



TEST RESULTS

GROUP 1B - BLACK CORE SAMPLES

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



TEST RESULTS – GROUP 2

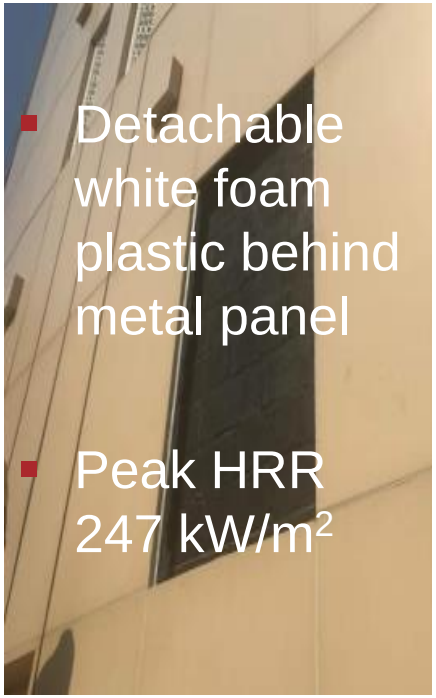
GROUP 2 – METAL PANELS WITH NO BACKING MATERIALS

- 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.

HOW DO I KNOW 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

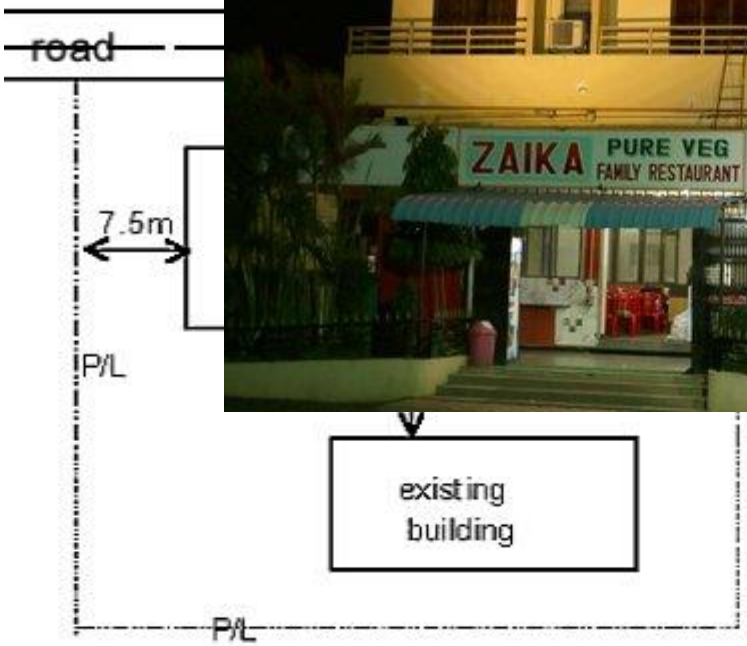
COMBUSTIBLE?

- Conduct risk analysis to determine exposures.

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 EXPOSURES AND FIRE HAZARDS
  - Separa
- 

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  - Ground floor exterior restaurants, car parking and trash bins.

SUMMARY – 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
- REMEDIATION 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?

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