A CHECKLIST FOR STAYING IN BUSINESS - UNDERNEATH FOAMED PLASTICS

Robin McRae
Technical Risk Manager
FOAMED PLASTICS CONTINUE TO PRESENT CHALLENGES TO THE INSURANCE INDUSTRY AND NEW ZEALAND FIRE SERVICE ALIKE!
Big coolstores rated high risk

5:00AM Saturday April 12, 2008
By Wayne Thompson

Large coolstores for supermarket and distribution companies in the industrial areas of Auckland are rated as high risk by firefighters.

"They are up there in our risk matrix ... up with the large warehouses without sprinklers that are being built in South Auckland," said assistant Auckland regional fire commander Larry Cocker.

Like the coolstore that exploded and burned down at Tamahere, on the outskirts of Hamilton last Saturday, thousands of chiller and freezer produce operations have been built with expanded polystyrene panels (EPS).

They are not fitted with sprinkler systems to act as first aid until fire crews arrive and they do not always have town supply water mains to allow crews to extinguish fire and disperse flammable and toxic gases used for refrigerants.
These combustible plastic materials include:

- Polyurethane (PUR)
- Polyisocyanurate (PIR)
- Modified Phenolic foam and
- Expanded and extruded Polystyrene (EPS/XPS).
JUST WHAT IS AN INSULATING PANEL SYSTEM?

• Panels plus interlocking joint detail/ fixings

• Primarily used for temperature controlling qualities

• Also called “composite” or “sandwich” panels

• Typically 1 m wide and possibly up to 30 m long
Insulating panels utilising foamed plastics are bonded together so all three components act compositely under load...

GLUE → CORE → METAL FACINGS
WHILST IN NZ, MOST RIGID EXPANDED POLYURETHANE FOAM WAS SIMPLY SPRAYED DIRECTLY ONTO INTERNAL BUILDING SURFACES...
EIGHT SIGNIFICANT FIRES AND THEIR KEY LESSONS

• **Lion House**, egress (PUR - 1987)
• **Gear Meat**, fire resistant ceiling supports (EPS - 1970)
• **Eleos**, electrical inspection and water supply (EPS – 1999)
• **Earnest Adams**, hot flues (EPS - 2002)
• **Fonterra**, hot work, fire compartmentation, *partial sprinkler protection* (EPS - 2005)
• **Satara**, electrical inspection and fire segregation (EPS - 2008)
• **Balanced Investments**, hot work/ dust explosion, *fire segregation* (PUR - 2008)
Icepak Tamahere (EPS/ Propane - 2008):

- Flammable hydrocarbon refrigerants require special treatment

- AS/NZS 1677:1998 Refrigerating Systems gives related guidance, including signage, isolation/ ventilation controls and fire segregation of electrical hazards:
  - Part 1. Refrigerant classification
  - Part 2. Safety requirements for fixed applications.
THE FIRE BEHAVIOUR OF EPS PANELS

EPS FIRE TEST NO SPRINKLERS – 5.5 MINUTES (SAY JUST >5 MW FIRE).
NO SPRINKLERS - BAD

6 MINUTES – BLACK SMOKE IN BACK CORNER INDICATES EPS INVOLVEMENT.
NO SPRINKLERS - BAD

6 MINUTES - VIEW FROM BACK OF TEST RIG. EPS WELL INVOLVED (SAY >20 MW FIRE).
NO SPRINKLERS - BAD

6.5 MINUTES - CEILING PANELS PARTIALLY DELAMINATED. HIGH FLAMES & BLACK SMOKE SHOW EPS WELL INVOLVED.
7 MINUTES - MAJOR FIRE INVOLVEMENT. NOTE BURNING DROPLETS AND FULL DELAMINATION OF CEILING PANELS.
NO SPRINKLERS - BAD

8 MINUTES - CEILING TOTALLY DESTROYED
(A TYPICAL STRUCTURE FIRE WITH ENCLOSED SIDES AND NORMAL INTERNAL FIRE LOAD, WOULD BE WORSE).
WITH SPRINKLERS - GOOD

2 MINUTES - SPRINKLERS NOT YET ACTIVATED (SAY 3-5 MW FIRE).
WITH SPRINKLERS - GOOD

3 MINUTES INTO FIRE - SPRINKLERS NOT YET ACTIVATED. NO EPS BURNING.
5 MINUTES 15 SECONDS – A SPRINKLER HEAD OPERATES, WHITE SMOKE INDICATES STEAM FROM SPRINKLER WATER DISCHARGE. POLYSTYRENE NOT BURNING.
SURFACE DAMAGE ONLY TO PANELS. POLYSTYRENE DID NOT IGNITE. NO DAMAGE TO CEILING PANELS.
Makes specific design provision where panels are not approved to FM 4880 (US) or LPCB LPS 1181/1208 (UK), as follows:

- Increased discharge densities in the range of 8 – 18 mm/min over an operating area of 186 m² (say > 66% flow rate) and

- Supplementary sprinkler heads to provide addition “Perimeter protection” (i.e. wall wetting) in some cases.
THE FIRE BEHAVIOUR OF SPRAY ON POLYURETHANE

JOHN BISSET/ TIMARU HERALD
BLAZE: FLAMES, REPORTEDLY 20M HIGH, WERE SEEN ROLLING OUT OF ONE OF FOUR EMPTY POTATO STORAGE SHEDS...
IN SUMMARY, WITH OR WITHOUT SPRINKLERS – IT'S ALL BAD

• Ignition results in dense acrid smoke and flames can flash rapidly across the unfaced surface

• This hazard CANNOT be treated with sprinklers

• Retrofit options are use of inert facings or removal. Both are difficult and expensive.
HOWEVER, NOT ALL THINGS ARE AS BAD AS THEY MAY FIRST SEEM...
ENTER THE CHECKLIST FOR STAYING IN BUSINESS!
• Bare exposure of any plastic core prohibited
• Repair of any panel perforation or other damage undertaken immediately
• Service penetrations kept sealed tight
• Wiring penetrations in conduit
• No potential exists for core exposure to temperatures >75°C (flues/ vents/ ducts etc).

• Any new hot flue, vent, duct etc supported by a suitable fire report.

• Grease/ oil/ solid particle carrying flues/ vents/ ducts are inspected regularly and cleaned as necessary without delay.
"...Requirement for adequate separation of hot surfaces, exhausts and gas flues from combustible insulation"

IPENZ PRACTICE NOTE 15

Coldstore Engineering in New Zealand
Foamed plastics do not start fires on their own. The majority of coolstore fires in New Zealand have occurred as a result of electrical faults or hot work...

NZS 4781 (Clause 6.2.4) specifically identified the fire hazard of thermally insulating materials in 1973.
• Detailed annual inspection and maintenance report completed for all electrical wiring, lighting, other fittings and machinery items, with particular attention paid to potential hot spot areas. Any remedial action then completed without delay

• Thermographic imaging used to detect electrical hot spots on annual inspection
JUST WHAT IS A “DETAILED ELECTRICAL INSPECTION”? 

- Use the prescription of AS/NZS 3019:2007 Electrical Installations – Periodic Verification
- Do not rely on thermographic imaging in isolation
- Always utilise a Registered Electrical Inspector (with a current practicing licence), who should also be an approved member of the Electrical Safety Organisation (ESO)
- A certificate of verification must be issued without qualification and should specifically state the interval to the next periodic verification, (annual for the purposes of fire insurance).
• Hot work permit scheme in place and fully operative at all times, PLUS the following supplementary “cold work” controls:
  • No heat producing cutting/ drilling equipment used directly on panels. (Where panels need to be cut, only cold cutting methods such as shearing [hand operated], low speed or cooled/ lubricated drills or hand saws to be used)
  • Total prohibition on use of heated rods or similar to make small holes through core
  • No equipment retro mounted on IP panels unless through bolted and supported properly
  • No post job core exposure (i.e. all penetrations sealed/joint covers etc replaced immediately as job progresses)
  • All job waste and associated combustibles removed immediately as job progresses.
No employee or outside contractor may start any hot work until a permit has been obtained. Valid only for a limited period of time – this permit ensures:

- Operators are aware of **fire exit locations** and these are unobstructed
- All combustibles are removed or protected to make the **area as safe as possible** before work begins
- **Active** fire watch is undertaken while work is in progress
- Work area is checked **afterwards**.
The permit is a printed form/tag setting out all precautions necessary for authorised Hot Work to occur.

Tag should be attached to hot work plant/tool. Where this is impractical (e.g. small hand tools such as self powered angle grinders), the tag should be clearly displayed at the worksite.

Whilst the provisions of NZS 4781 are totally sound, it should be noted the permit shown at Appendix A is too simplistic.
A STANDARD METAL CUTTING SKILL SAW BLADE. THESE SPARK HEAVILY AND SO ARE NOT SATISFACTORY FOR COLD CUTTING EPS PANELS.
A SUITABLE THREE PRONG "BEATER" BLADE FROM BY-RAY PRODUCTS CHRISTCHURCH. MADE TO ORDER.
THIS BEATS THE STEEL SKIN AT HIGH SPEED. SPLIT IS SHALLOW AND SKIN FOLDS IN SLIGHTLY, WITH NO VISIBLE SWARFING OR DANGEROUS SHARP EDGES.
• Smoking completely prohibited in or against building
• Re fuelling forklift trucks/ other vehicles prohibited in or against the building
• Forklift charging area has 3 m clear fire break or is fire insulated 3 m in all directions
• All external fire loads are actively prohibited within 10 m of building (unless building is fully sprinkler protected and approved external wall drenching sprinklers installed)
• Unauthorised access to the external cladding prevented, to reduce the possibility of an arson attack.
CASE STUDY; CONSIDER A FIVE-STRAND STOCK FENCE PERIMETER AND ONGOING VANDALISM OF NIGHT LIGHTING...
WHAT ACTUALLY HAPPENED. ONLY SKILLFULL USE OF A FRONT END LOADER AND THE ABSENCE OF WIND SAVED SEVERAL ADJACENT BUILDINGS HERE
ITS PROBABLY TIME NOW FOR SOME MORE GOOD NEWS...

Panel systems with “better behaved” plastic cores (i.e. fire rated/ insurer approved PIR and Phenolic composites), are now readily available and gaining a foothold in New Zealand...
AND THEY WORK!
• A large scale fire
• 90% EPS, was largely destroyed
• 10% PIR, performed as expected
• Since 2004, the production of non fire resistant EPS insulating panels has almost ceased completely in the UK

• Relative factors included; bad fire history, Sun Valley, Sahib Foods and then 9/11

• Whilst in New Zealand, the production and use of non fire resistant panel has changed little in the last five years (say 80% of the market).
• Approved fire resistant panels are readily available
• Some increasing use in multiple markets; cool stores, food processing, schools, retail, industrial, government and other sectors
• There are multiple New Zealand suppliers:
  – Kingspan (PIR)
  – Bondor Xflam (*Modified Phenolic/ EPS composite*)
  – Polyphen, manufactured by IP&D and Metalcraft (Phenolic/ EPS)
  – CSR Bradcore (Rockwool – mineral fibre).
• Fire resistant panel costs can only come down with volume

• This needs to be looked at in terms of the overall project cost, where typically they add 3-5%

• Smart designs need early engagement with panel suppliers. Many designs continue as per EPS:
  – Thick panels spanning a long way (expensive - say up to + 20%)
  – Not taking into account thermal performance of the panels and over specifying the thickness (also expensive up to + 20%)
  – Lack of supporting structural element (i.e. a frame).
Insurance and construction industries have to recognise:

- The majority of coolstore fires in New Zealand have occurred as a result of electrical faults or hot work
- Flammable hydrocarbon refrigerants require special treatment
- Basic risk control principles of fire compartmentation and plant segregation need to be re-learned
Panel systems with better behaved plastic cores are gaining a foothold in New Zealand. However anticipate price decreases and better availability, only if you are prepared to help lever them.

This will not negate the need for sound risk management practices or reward of such practices.

One size will never fit all.
SO WHAT SHOULD THE MARKET DO?

• Holistic designs:
  – Fire resistant panels
  – Supported by structure
  – Fire compartmentation
  – Sprinklers
  – Risk Management.

• Fonterra’s new cool storage hub facility at Crawford Street, Hamilton – covers all these bases

• WELL DONE FONTERRA!
ACKNOWLEDGEMENTS

• Insurance Council of New Zealand
• ABI
• Standards New Zealand
• FM Global
• Kingspan
• University of Canterbury/ BRANZ/ NZ Fire Service
• IPENZ
• Fonterra

No panel system installers, brokers or insurers were burnt or otherwise harmed during the making of this presentation...