MW1 C STATION TRAINING AND INCIDENT CASE STUDIES

FILE NO. 2023 / 31.

4th ALARM CIRCULAR QUAY HIGH-RISE BUILDING UNDER DEMOLITION FIRE.

"Learning from Excellence…

To Protect the Irreplaceable."

Incident Summary:

Fire broke on the side of scaffold mesh on a high-rise building undergoing demolition at Circular Quay, on the northern edge of the Sydney financial district. Within a short time following ignition, fire was rapidly spreading upwards and across the mesh, producing intense flames and large volumes of thick black smoke across the city. As firefighters responded to the scene, site management were reporting workers trapped on the upper levels of the building, scaffolding collapsing and the possible involvement of gas cylinders within the fire area. The fire broke out within business hours and nearby surrounding high-rise office tower blocks were full of staff. Before FRNSW crews arrived on scene they were already facing enormous challenges.

The first challenge for firefighters was containment of the spreading fire through the combustible scaffold mesh that completely wrapped around the entire building on all levels. As containment operations were getting underway, fire spread into the building basement where numerous banks of pressurised gas cylinders were stored (that had only been delivered that morning, placing gas volumes at peak levels). Fire intensity began to increase and a short time later the first of multiple gas cylinder explosions began to occur. Some of the exploding cylinders became dangerous airborne flaming projectiles, spreading fire across the site. Flaming debris was falling from the upper levels of the mesh, igniting fresh fires at ground level. Intense heat from the fire was beginning to impact the steel support structure of the site tower crane, presenting a collapse risk. Numerous other hazards existed on the site that were not immediately obvious. The fireground was unstable, expanding, and dynamic. It was also extremely hazardous.

Firefighters employed a systematic and coordinated firefighting plan, involving aerial operations on three sides of the building and firefighting from hose-line crews at ground level. Firefighters displayed courage, skill and determination as they directed cooling streams into the burning basement where banks of pressurised gas cylinders were being impacted by extreme fire conditions, resulting in multiple explosions occurring. Firefighters achieved fire containment, fire control and eventual total extinguishment. Vulnerable structures and equipment at the site were protected.

Fires involving buildings under demolition are specialised fire scenarios, requiring specialised tactics and strategies; these fires are very different to “ordinary” building fires, due to a range of complexities and unique conditions associated with buildings undergoing demolition (discussed in this paper). Tragically, firefighters have been killed fighting fires in buildings undergoing demolition because of the unexpected and unique situations that exist on these buildings. The Circular Quay fire represented some of the many unique and complex challenges, hazardous conditions and operational difficulties that can occur at fires involving buildings under demolition. Significantly, the fire also demonstrated the textbook manner in which firefighting operations were conducted, consisting of skilful, professional and determined firefighting, underpinned by sound fireground command and strong incident leadership.

Cover Picture: The scene that confronted first arriving firefighters as flames ascend the Alpha side scaffold mesh.

Note: The author recommends that this paper is read in conjunction with SR / 01 - A. SPECIAL EDITION – Part 1 FIRES IN HIGHRISE BUILDINGS UNDER CONSTRUCTION

Key Learning Points:

1. Fires involving External Scaffolding Perimeter Mesh

2. Fires Involving Buildings Under Demolition.

3. Water Supplies.

4. Aerial Operations.

5. Pressurised Gas Cylinders involved in Fire.

6. Electricity at Construction/Demolition Sites

7. Steel Support Structures Exposed to Fire.

8. Incident Command Structure.

9. Changing Firefighting Strategy.

Incident Type: Incident Type: High-Rise Office Building Fire (under demolition).

Learning/Subject References:

High-Rise Building Fires, Incident Command Structure, Water Supply, Fireground Communications, Installed Fire Protection, Fires in Concrete Buildings under Demolition.

Station Training Program References:

STP Drill 1 - Flammable Liquids and Gases
STP Drill 2 - Special Fires (Bulk Storage, Dust, Cladding, Plastics, Metal, and Rubber Fires)
STP Drill 4 - Psychological Preparedness
STP Drill 5 - Physical Preparedness
STP Drill 6 - Personal Safety and Risk Management
STP Drill 7 - Pumps/Pumping Operations
STP Drill 8 - Operational Entry and Use of Hoses and Branches
STP Drill 9 - Hose Handling, Branches and Portable Ladders
STP Drill 13 - Fire Behaviour
STP Drill 15 - Salvage and Overhaul
STP Drill 16 - Incident Management
STP Drill 17 - Incident Communications
STP Drill 18 - Fire Detection and Suppression Systems
STP Drill 19 - High Rise
STP Drill 22 - Hazardous Atmospheres – Self Contained Breathing Apparatus
STP Drill 26 - HAZMAT Theory and Practical
STP Drill 32 - Electricity and Fire Involving Electrical Hazards
STP Drill 33 - Methods of Construction and Structural Collapse

Abbreviations/Acronyms Used in this Report:

BA – Breathing Apparatus.
BLEVE – Boiling Liquid Expanding Vapour Explosion.
CAN - Conditions Actions Needs report.
FireComs – FRNSW Fire Communications.
FIRU – Fire Investigation and Research Unit.
FRNSW – Fire and Rescue NSW.
IC – Incident Commander.
MFO – Main Fire Occupancy.
SAR – Search and Rescue.
SCBA – Self Contained Breathing Apparatus.
SFF – Senior Firefighter.
TIC – Thermal Imaging Camera.

Relevant Definitions Used in this Report:

Fire brigade booster assembly: Terminology used within AS 2419.1 to describe the booster fitting and installed equipment used by firefighters to increase pressure and flow within the installed fire main.

Time, Date and Place of Call:

0843 hours on Tuesday 13th February 2018, 13 Pitt Street, Sydney.

FRNSW Response:

Pumpers 3 (The Rocks), 4 (Darlinghurst), 38 (Pyrmont), 11 (Woollahra) and 53 (Neutral Bay), Runner 1 (City of Sydney), CAFS Pumper 18 (Glebe), Hazmat Pumpers 13 (Alexandria) and 51 (Forestville), Rescue Pumpers 36 (Crows Nest) and 15 (Burwood), Ladder Platforms 1, 4 and 36, Heavy Rescue 1, Heavy Hazmat 13, Logistics Support Vehicles 1 and 21 (Kogarah), Mobile Command Centre Bravo and Bulk Water Transfer 1.

Duty Commanders ME1 (City), ME2 (North) and ME3 (Inner West), Zone Commander ME2 (North), Staff Officer Field Operations, Deputy Commissioner Field Operations, Operational Media Coordinator, Tactical Operations Research Analyst and Fire Investigation and Research Unit.

Additional Agencies/Services in Attendance:

NSW Police, NSW Ambulance, Electricity Authority, Sydney Trains, Sydney Buses, Transport Management Centre and building site management staff.

Fireground Description:

The fire building, a former Sydney landmark known as "*Goldfields House*", was a vacant high-rise commercial office building undergoing demolition. The fire building had been reduced in height from 28 levels to six levels. The building was 55 m x 20 m, formed of a steel frame consisting of cellular steel floors topped with poured concrete. The building was formed with pre-cast concrete panels supported at floor level, spanning between steel columns. In its original form the building contained 4,000 tonnes of structural steel. Construction of the building was completed in 1966. In 2016 demolition work commenced to remove the entire building.

Perimeter containment screens formed of high-density polyurethane and fiberglass reinforced banding, secured to the building external metal scaffolding surrounded the building on all sides from ground level to the highest level of the building during the demolition. The purpose of these screens was to provide a safety anti-fall barrier for workers in the building. The screens also prevented the accidental release of any materials from the site during the demolition process. At the time of the fire, the perimeter containment screens extended from ground level to level six. As the building was progressively demolished and the height of the building came down, the attached scaffolding and containment screens were removed. Excess containment screens were stored beneath the building.

Access to the upper levels of the building was via two sets of scaffold stairs, located on the building exterior at the eastern and western ends of the building.

LPG and “D” size oxygen cylinders were stored on pallets in the building basement. These gas cylinders were used for steel cutting associated with the demolition process. LPG cylinders were also used for the powering of forklifts. On the morning of the fire, three pallets containing 27 LPG cylinders (nine cylinders per pallet) were delivered to the site and located in the basement. Approximately 1,000 litres of diesel fuel within 50 x 20 litre containers were located across the site for the powering of construction equipment. A 60 m high tower crane was located on the southern side of the building, within .5 m from the scaffolding and mesh.

An open area of the building located at the building base (loosely referred to as the building basement) contained stored LPG and oxygen cylinders, construction timbers, quantities of stored fuel and excess containment mesh.

The “open” nature of the building (unsecured/open lift shafts and interior stairwells) presented a number of potential avenues for uncontained vertical fire travel through the building. Similarly, there was no separation on any levels within the building, promoting uncontained lateral fire spread. The building contained two internal stairwells, however these were filled with debris and were impassable. Building lift shafts were filled with debris.

The building site external perimeter was surrounded by timber hoarding approximately eight metres high.

Fireground Installed Firefighting Systems:

At the time of the fire, the previously installed standpipe/hydrant system, automatic fire sprinkler system and automatic fire alarm detection systems had been disconnected and removed. Although there were some hoses located at the site, these were for dust suppression and unsuitable for firefighting purposes. A number of handheld portable fire extinguishers were located at various locations across the site.

Weather at Time of Call:

South/South Westerly winds at 11 km/h, temperature 24.2°C, relative humidity 73%, cloud 6/8 and mean sea level pressure 1012.0 hPa recorded at Bureau of Meteorology Sydney Observatory automatic weather station (approximately 0.5km from the fire building).

Situation Prior to FRNSW Arriving on Scene:

Approximately 25 workers were on site, engaged in building demolition works. Approximately 13 workers were located on level six of the building. At this time, workers were cutting through steel reinforcing bars along the eastern side of the building on level 6 using LPG and oxygen cutting equipment. As a result of this work, sparks ignited a section of the perimeter containment screen (formed of high-density polyurethane and fiberglass reinforced banding).

Shortly after ignition, a section of the burning screen began to melt, falling to the ground where it ignited piles of stored screen that had been previously removed from the upper levels. This fire rapidly spread upwards, igniting the screen near ground level. Fire involving the perimeter screen quickly began to burn upwards and outwards along the east (Alpha) side of the building. The 13 workers located on level 6 began to evacuate via the external scaffold stairs, as the fire increased in size.

Fire Behaviour Considerations

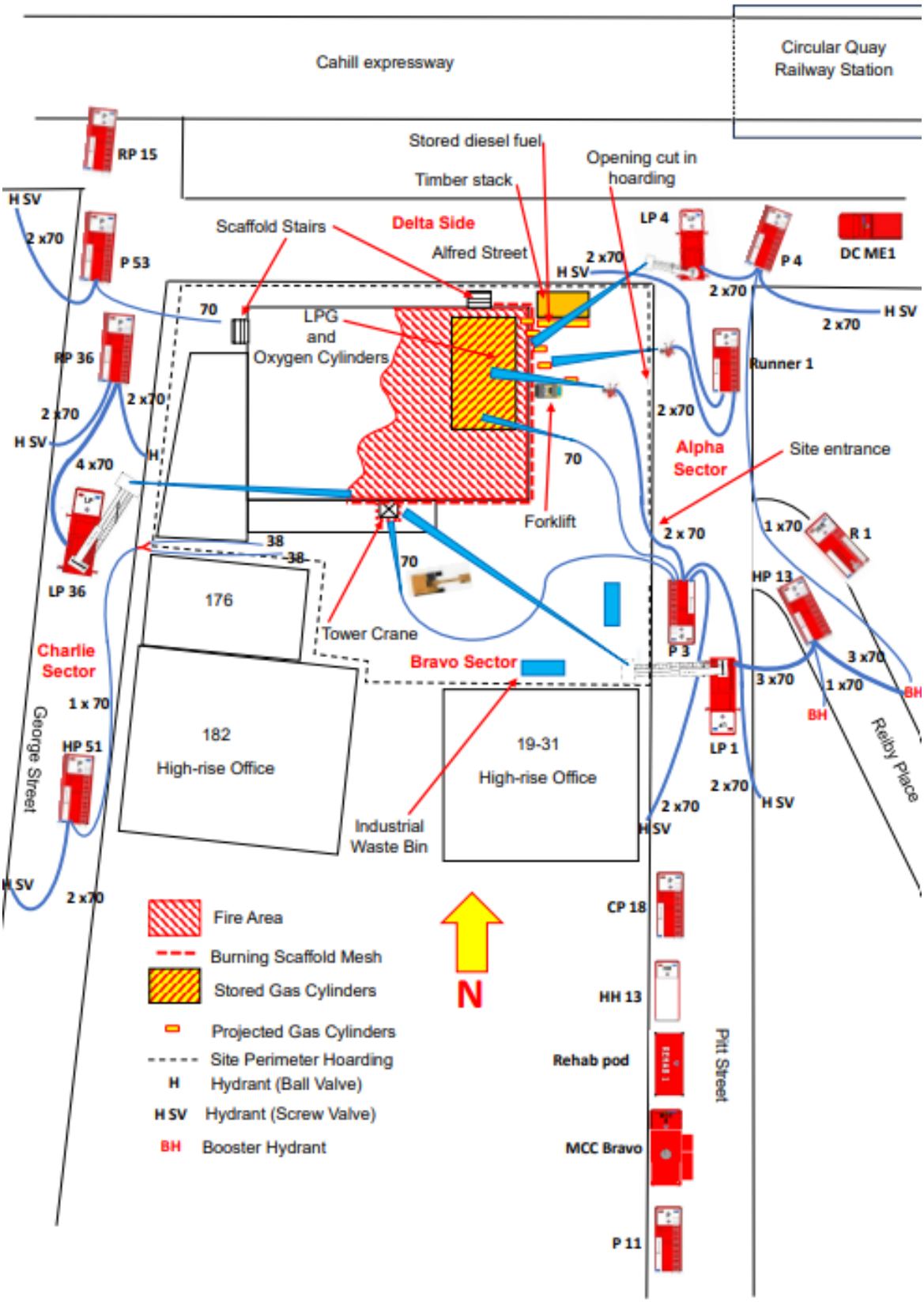
The following fire behaviour considerations are of note:

1. The burning product (trade name *Dynamesh*) is formed of high-density polyurethane and fibreglass reinforced banding. This material is used for "*scaffold containment*", preventing the release of dust and debris from the site and protecting workers from falling from the scaffolding.

2. Polyurethane is a highly flammable material that burns and melts. The fuel arrangement (almost vertical) and high surface area to volume ratio ensure vigorous and intense combustion. Fire travelled rapidly upwards and outwards through the scaffolding containment screen. Fire at the base of the screen was pre-heating material above, resulting in release of highly flammable pyrolysis gases, increasing fire intensity. Intense flaming activity produced high heat release rates (radiant heat) and large volumes of thick, black, acrid and oil-based smoke.

3. Burning/flaming material was separating from the screen and falling to the ground.

4. Scaffolding and protective screening was placed around the 28-level building prior to demolition commencing. Commencing at the top, the building was progressively demolished. As the height of the building was reduced, scaffolding was removed and perimeter containment mesh was stored in rolls within the basement. As well as fire involving the screen attached to the scaffolding, the fire was now burning amongst rolls of stored containment screen located in the basement. This fuel load was significant, producing significant levels of fire intensity (heat release rates, rate of spread, flame height and smoke production).



Fireground Drawing

Drawing not to Scale

Initial Call and Response:

At 0843 hours on Tuesday 13th February 2018, Sydney Fire Communications Centre received the first of numerous '000' calls reporting a building fire at 13 Pitt Street, Sydney. Pumpers 3 and 4 were initially assigned to the call. While the initial '000' call was being taken, Fire Communications received additional '000' calls and at 0844 hours the response was increased to a structure fire 2nd Alarm, additionally consisting of Ladder Platforms 1 and 4, Pumper 38, Runner 1, Hazmat Pumper 13 and Duty Commander City of Sydney Inspector Graham Jarrett.

Response Increased to 3rd Alarm:

Shortly after receiving the initial '000' call, Fire Communications continued to receive numerous additional '000' calls reporting the fire. One of these callers was from a member of staff at the site where the fire was located. The caller stated the **fire was located on level six of the building site, construction workers were still trapped in the building and scaffolding was beginning to collapse.**

As a result of receiving the above information at 0847 hours Sydney Fire Communications Centre staff increased the response to a Structure Fire 3rd Alarm, consisting of additional appliances Pumper 53, Rescue Pumper 36, Hazmat Pumper 51, Rescue 1. Heavy Hazmat 13, Logistics Support vehicle 1 and Duty Commander North.

Firefighters aboard the initial assignment of appliances responding to the fire were able to observe large volumes of black smoke visible from the reported fire. As Pumper 3 approached the fire scene, firefighters could see high flames between the city office buildings. At 0850 hours, Pumper 3 Officer in Charge Station Officer Chris Benjamin sent a **RED** message reporting large volumes of smoke en-route and confirming response of the 3rd Alarm.

First crews Arrive on Scene:

Pumper 3 was the first appliance to arrive on scene. As the appliance came to a stop, S.O. Benjamin made the following initial observations:

"The mesh attached to the scaffolding on the side of the building was heavily involved in fire and burning fiercely. We were unable to see the fire clearly at its base nor the base of the building at ground level because of timber hoarding surrounding the building. The fire was burning intensely. My initial firefighting strategy was to try and contain the fire to where it was burning."

At 0850 hours S.O. Benjamin sent the following arrival message:

"FIRECOMS PUMPER 3 BLUE, CODE 3 FROM 13 PITT STREET, SYDNEY. IT APPEARS THE OUTSIDE SHEETING OF SCAFFOLDING IS ALIGHT. GETTING PUMP TO WORK, COMMENCING FIRE ATTACK, CONFIRM 3rd ALARM, OVER."

Runner 1, under the command of S.O. Craig Burchmore arrived on scene a short time after Pumper 3. S.O. Burchmore made the following initial observations of the fire scene:

"En-route we could see large volumes of thick black smoke coming from the area of the reported fire. Upon arrival we could see a large amount of the perimeter mesh attached to the scaffolding alight. The mesh was burning from the ground to the top of the building. The fire was extending around from the Alpha side to the Bravo side of the building. Our initial plan was to set the aerial appliances up to try and stop the fire from spreading."

Upon arrival S.O. Benjamin was met by the site foreman who reported all workers had evacuated from the building and all were safely accounted for. The site manager also reported a large number of forklift LPG cylinders and oxygen cylinders were stored in close proximity to the fire. After receiving confirmations all persons were accounted for, S.O. Benjamin sent the following update at 0852 hours:

"FIRECOMS PUMPER 3 BLUE, FURTHER UPDATE, ON SITE MANAGER REPORTS ALL PERSONS HAVE EVACUATED AND ARE SAFE. COMMENCING FIRE ATTACK, 2 X 38 GETTING TO WORK. S.O. 3 IS I.C. THE INCIDENT WILL BE KNOWN AS PITT STREET COMMAND, OVER."

The fire was spreading rapidly (vertically and horizontally) through the scaffolding containment mesh. Scaffold containment mesh on the Alpha side of the building (from top to bottom) was fully involved in fire and was beginning to spread horizontally along mesh attached to the Bravo side of the building. This fire was travelling towards the steel tower of the tower crane located on the Bravo side of the building. Flaming pieces of mesh were falling from the screen to the ground below. The basement was heavily involved in fire.

Initial Firefighting Operations:

Pumper 3 and Hazmat Pumper 13 firefighters wearing SCBA began to direct two 38 mm streams onto the flanks of the burning screen from the Alpha/Bravo corner in an attempt to stop the fire spreading along the Bravo side of the building towards the tower crane. Fire was travelling rapidly, burning intensely and the handline attack was having limited success. Firefighters were located outside of the building collapse zones approximately 12-15 metres from the building corner. Flaming debris from the burning screen was also falling to the ground.

Tower Crane Under Threat:

The tower (also known as a mast) supporting the tower crane was formed of unprotected structural steel, consisting of triangulated lattice structure 2.2 m square. The vertical tower was located less than one metre from the Bravo side of the building. Fire was spreading through the mesh towards the tower crane. The unprotected steel of the tower crane mast was extremely vulnerable to the impact of heat and was supporting the entire crane structure weighing approximately 50 tonnes. Site engineers expressed serious concern that the impact of heat from the fire could cause the tower to lose strength, resulting in total collapse of the crane. The only way to stop this from by happening would be to cool the steel that formed the crane tower and stop the spread of fire from reaching the crane.

Structural Performance Considerations

The following structural performance issues were of note:

1. Scientific testing of burning polyurethane foam by National Institute of Standards and Technology (NIST) fire testing has identified Heat Release Rates of 1070 kW to 1110 kW produced by burning polyurethane foam. Flame temperatures reaching up to 820 degrees Celsius are measured for polyurethane foam. A peak heat flux density (heat rate per unit area) of 760 kW/m2 is calculated for this material.

2. This material alone has a flame temperature of 820 degrees Celsius.

2. Structural steel begins to lose tensile strength at around 300°C. At this temperature, the steel will begin to soften. Significant loss of strength rapidly occurs after 400°C. At about 550°C, steel will lose half its load bearing capacity. At about 1,000°C, steel will only have about 10% or less of its load bearing capacity. As mentioned in paragraph 1 above, the flame temperature for polyurethane foam is 820°C, therefore fire behaviour had a direct impact on structural performance.

Aerial Appliances Prepare for Operations:

Shortly after the arrival of Pumpers 1, 4 and Runner 1, Ladder Platforms 1 and 4 arrived on scene. The fire was expanding rapidly and the handline attack was having limited effect. The I.C.'s intention was to position the aerial appliances on the fire flanks on the Pitt Street side of the building (the Alpha Side) and establish fire cut-offs with elevated aerial master streams to try and cut off the spread of the fire. The aerial appliances were positioned on the building's corners. Ladder Platform 1 was positioned on the Alpha/Bravo corner and Ladder Platform 4 was positioned on the Alpha/Delta corner.

Firefighters from Pumper 4 and Runner 1 assisted to establish water supplies for the aerial appliances. An initial problem for firefighters was the lack of available hydrants to secure water supplies from to supply the aerial appliances. Firefighters located a number of supply hydrants connected to fire brigade booster assemblies within nearby high-rise office buildings. Collector lines were laid from these hydrants to pumpers supplying water to the aerial appliances. Pumper 4 supplied lines to Ladder Platform 4. Hazmat Pumper 13 supplied water to Ladder Platform 1. The objectives of the aerial attack were as follows:

1. Contain the spread of the fire.
2. Reduce fire intensity.
3. Protect the tower crane.

Fire Conditions Continue to Intensify:

The fire spread into the basement of the building, containing stored rolls of polyurethane containment mesh and was burning fiercely. Fire intensity was worsened due to the involvement of volatile materials including ruptured containers of diesel fuel. Heat within the basement area was intense. Construction timbers located on scaffolding were involved in fire. Fire burning within scaffolding mesh on the Bravo side of the building was continuing to spread towards the tower crane.

Rescue Pumper 15 firefighters, under the command of S.O. Jim Stephen and Pumper 38 firefighters under the command of S.O. Scott Hayward, were attacking the fire from the Alpha Side of the Main Fire Occupancy with 38 mm attack lines. These lines were increased to 70 mm attack lines. S.O. Hayward was appointed Safety Officer.

Aerial Attack Commences:

Once water supplies were established, the aerial appliances were placed in operation. Ladder Platform 1 was located on the Alpha/Bravo corner and commenced directing the elevated aerial master stream onto the threatened tower crane mast. The large deluge aerial stream began to cool the unprotected steel of the crane mast.

Ladder Platform 4 was attacking the fire from the Alpha/Delta corner. Fire was rapidly ascending the building perimeter mesh on the Alpha side and beginning to spread sideways towards the Delta side of the building (facing Circular Quay). As the fire ascended the scaffold mesh, fire spread to timber scaffold decking which then caught alight. Firefighter Jarrod Oriel, located in the aerial working cage, was directing the aerial stream onto the burning mesh, extinguishing the burning mesh and timber decking as the fire ascended the side of the building.

Multiple Explosions:

The fire was burning intensely within the basement, where numerous pressurised gas cylinders were stored. As fire intensity increased, a number of gas cylinder explosions occurred (this is discussed in much greater detail within the section below "*Fire Behaviour Considerations*"). These explosions caused the cylinders to be violently propelled through the air. The basement was open sided facing Pitt Street (Alpha side). Although most of the exploding cylinders were contained within the basement, a number were propelled through basement opening, beyond the building. The explosions were so powerful they produced pressure waves that could be felt at the fireground. Intense venting flame jets were released from other cylinders. As the explosions started to occur, firefighters operating 38 mm lines attacking the fire near the Alpha/Bravo corner used a large steel industrial bin as shielding.

Firefighters were unable to see what was causing the explosions, which were occurring out of sight within the building basement. It was a now a priority for Pumper 4 Station Officer Craig Hare to liaise with site management to identify what was stored in the basement. The site manager informed firefighters the basement contained LPG and oxygen gas cylinders. He also advised that on the morning of the fire, three pallets containing 27 LPG cylinders (nine cylinders per pallet) had just been delivered to the site and were located in the basement. Numerous 20 litre containers of diesel fuel had also been recently delivered and were located in the basement.

The aerial appliances had only just commenced operations when the explosions began to occur. Ladder Platform 4 Firefighter Jarrod Oriel was located in the aerial working cage, attacking fire burning on the side of the building in the scaffold mesh near the Alpha/Delta corner. Firefighter Oriel describes what he saw shortly after the explosions commenced:

"Shortly after commencing operations a number of explosions occurred. I observed a number of cylinders become airborne. There were at least 5 or 6 major explosions. Most of the cylinders were contained within the basement, however at least two of the cylinders were projected beyond the building."

The Ladder Platform 4 aerial monitor was fitted with a stack tip nozzle, giving the aerial stream greater reach. The aerial stream was being projected at 1200 kPa. The basement was heavily involved in fire and fire activity in the area in front of the basement was intense. Ladder Platform 4 cage operator Firefighter Oriel directed the aerial stream onto an area of heavy fire activity in front of the basement to reduce fire intensity.

Fire Behaviour Considerations

The following fire behaviour considerations are of note:

1. The basement was formed from concrete, retaining heat and providing limited ventilation. Heat levels within the basement were rising at a fast rate.

2. Numerous pressurised gas cylinders were stored in the basement. As heat levels rose, pressure within the cylinders increased, causing the cylinder pressure relief valves to operate, resulting in flammable LPG (Liquified Petroleum Gas, specifically propane) to be released into the fire area, greatly increasing fire intensity. The flame temperature of propane in air is **1,980 °C**.

3. In addition to venting LPG cylinders, oxygen cylinders stored in the basement were also venting. The flame temperature of venting propane increases to **2,820 °C** when propane mixes with oxygen.

4. Heat within the basement rose to very high levels, causing pressure within the gas cylinders to rise at a rate faster than the cylinder pressure relief valves could release expanding gas. As cylinder pressures continued to rise, an over pressure and failure of the cylinder casings occurred, resulting in the cylinders rupturing and a BLEVE (Boiling Liquid Expanding Vapour Explosion) occurring. BLEVE events are characterised by the sudden release and explosive ignition of cylinder contents. It is often accompanied by the transformation of the cylinder into a projectile, in reaction to the sudden and explosive release of burning flammable product.

5. The BLEVE situation was worsened due to the abundant presence of oxygen from the venting oxygen cylinders within the basement. Ordinarily the release of LPG would be extremely rich until sufficient oxygenated air mixed to bring the gas within the flammable range. However with the presence of saturated oxygen in the area of gas release, ignition was faster and more intense.

At the time the explosion began to occur, Hazmat Pumper 13 firefighters were directing a 38 mm attack line onto the basement, attempting to reduce fire intensity. This line was increased to a 70 mm attack line to achieve greater cooling onto the fire area and reduction in fire intensity. S.O. Gategood advised firefighters began to encounter exploding LPG cylinders and numerous fuel containers burning fiercely. Exploding gas cylinders were being violently projected into the area between the site perimeter and the open basement, necessitating the withdrawal of firefighters to a position of safety on Pitt Street, shielded by the site perimeter hoarding.

At 0858 hours the I.C. sent the following message:

“FIRECOMS PUMPER 3 PITT STREET COMMAND, BLUE. WE HAVE MULTIPLE EXPLOSIONS OCCURRING INVOLVING STORED LPG CYLINDERS. AN EXCLUSION ZONE IS IN PLACE. LADDER PLATFORMS ARE GETTING TO WORK IN SECTORS CHARLIE AND DELTA. NUMEROUS FIREFIGHTERS IN B.A. ARE AT WORK ATTACKING THE FIRE, OVER.”

Transfer of Command:

Duty Commander City Inspector Graham Jarrett arrived at the fireground and following a hand-over briefing, command was transferred to Duty Commander City.

Response Increased to 4th Alarm:

Due to the expanding fire conditions, at 0912 hours the IC increased the response to a structure fire 4th Alarm. The fireground Command Structure was as follows:

Incident Commander: Duty Commander ME1 (City) Inspector Graham Jarrett
Operations Officer: Pumper 3 S.O. Chris Benjamin then Duty Commander ME2
Safety Officer: Pumper 38 S.O. Scott Hayward.
Sector Alpha Commander: Pumper 18 S.O. Scott Henderson.
Sector Bravo Commander: Hazmat Pumper 13 S.O. Richard Gategood.
Sector Charlie Commander: Rescue Pumper 13 S.O. James Murphie.

Defensive Firefighting Operations:

The priority of the I.C. was to try and flow as much water into the basement as possible, to reduce the fire intensity, lower the temperature within the basement and stop the gas cylinders from venting. Timber hoarding separated Pitt Street at the site perimeter from the fire building. The crew of Runner 1 used a chainsaw to cut a square opening (30 cm x 30 cm) through the 25 mm thick timber hoarding, enabling firefighters to safely direct attack streams onto the fire. From the street Hazmat Pumper 13 firefighters directed a 70 mm attack stream through the hoarding opening into the involved basement. The hoarding was providing shielding from exploding gas cylinders while firefighters attacked the fire. The 70 mm line provided an attack stream of greater projection and had a much greater cooling ability than the 38 mm lines previously in operation, increasing the ability of reducing fire intensity (The ability of one 70 mm attack stream to reduce fire intensity is equivalent to between five and seven 38 mm attack streams, depending on fire intensity. As fire heat release rates increase, the relative effectiveness of a 70 mm attack stream increases).

As the fire continued to spread towards the base of the tower crane on the Bravo side of the building, firefighters placed a second 70 mm attack line in operation, attacking the spreading fire and cooling the steel of the threatened crane tower.

At 0927 hours the I.C. sent the following CAN report:

“FIRECOMS DUTY COMMANDER CITY, PITT STREET COMMAND, BLUE. GAS CYLINDERS IN ALPHA SECTOR ARE VENTING AND ARE IN AN ENCLOSED AREA. A NUMBER OF CYLINDERS HAVE BREACHED THE BUILDING PERIMETER. CREWS ARE ATTEMPTING TO GET WATER ONTO THEM. EXCLUSION ZONES ARE IN PLACE, OVER.”

Charlie Sector Operations:

Ladder Platform 4 cage operator Firefighter Oriel extended the aerial cage to roof level to investigate for fire spread when he observed smoke coming from the rear of the tower crane on the Charlie side of the building. This information was reported to the I.C. and Rescue Pumpers 15 and 36, Hazmat Pumper 51 and Ladder Platform 36 were deployed to the Charlie Side of the building to make investigations. The fire was spreading along the Bravo Side of the building from Alpha to Charlie, threatening a number of Bravo exposures including 176 George Street, a three-level entertainment venue (formerly known as “Jacksons on George”). As the fire progressed closer towards the Charlie side of the Main Fire Occupancy, windows within Exposure Bravo 1 started to come under threat. Rescue Pumper 36 firefighters advanced a 70 mm line into a laneway between the Main Fire Occupancy and Exposure Bravo and directed a protection stream onto Exposure Bravo 1. Ladder Platform 36 was positioned on George Street on the Bravo/Charlie corner and directed an aerial stream onto the burning perimeter mesh, stopping the fire from progressing towards the Charlie Side of the building.

It was reported that homeless persons lived in the laneway between the Main Fire Occupancy and Exposure Bravo 1. Rescue Pumper 36 and Hazmat Pumper 51 firefighters carried out searches of the laneway to ensure there were no homeless persons who might have become incapacitated because of the fire.

Defensive Firefighting Operations Continue:

The fire was now surrounded on all sides. The I.C.’s objective was to reduce the level of fire intensity to enable final extinguishment to commence. Ladder Platforms 1 and 4 attacked the fire from the Alpha side. The aerials were extremely effective, extinguishing fire burning on the sides of the building within scaffold meshing. Following extinguishment of the scaffold mesh fire, Ladder Platform 1 was directing an aerial deluge onto the crane tower, cooling the steel that formed the tower.

The crew of CAFS Pumper 18, under the command of S.O. Scott Henderson, were attacking the fire from the site entrance way with a 70 mm handline. This line was switched to a ground monitor and the monitor stream directed onto the fire. Rescue 1 firefighters used the lashing kit to secure the ground monitor. Pumper 53 firefighters, under the command of S.O. Luke Chalmers, were directing a 70 mm attack line through the opening that had been cut in the timber hoarding onto the basement fire.

Operations Continue to Protect Crane:

The lower section of the crane tower was located within a three-level section of building structure, shielding the crane from the aerial stream of Ladder Platform 1. The scaffold mesh at this location was located inside the structure, adjacent to the crane and was alight. Rescue Pumper 15 firefighters under the command of S.O. Jim Stephen advanced a 70 mm attack line from Pumper 3 to the Bravo side of the building, where they directed an attack stream onto the fire burning at the base of the tower. Firefighters used two large excavators as shielding when they attacked the fire. Firefighters used thermal imaging cameras to measure the temperature of the steel that formed the crane tower, identifying that cooling was successfully lowering the temperature of the steel. This attack successfully extinguished the fire burning near the crane tower, greatly reducing the threat of collapse.

Offensive Firefighting Operations:

The main area of concern was now fire burning in the basement where gas cylinders were stored. While explosions continued to occur, firefighters were directing two 70 mm hand line streams, a ground monitor stream and an aerial stream (Ladder Platform 4) into the basement. These combined streams slowly lowered the temperature within the basement sufficiently to reduce fire intensity to a level that no further explosions occurred. Areas of fire continued to burn within the basement beyond the reach of defensive attack streams. The I.C. made the decision to recommence offensive firefighting operations to complete extinguishment.

The dangers associated with the stored gas cylinders continued to be a significant threat to firefighters. CAFS Pumper 18 and CO2 38 firefighters repositioned the ground monitor that had been located on Pitt Street into the yard between the basement and the hoarding and directed the monitor stream onto stored oxygen and LPG cylinders and the LPG powered forklift, cooling the heat impacted cylinders. The monitor stream was also extinguishing pockets of fire within the basement. Pumper 53 firefighters wearing SCBA advanced a 70 mm line to the opening of the basement, where they were are able to direct a 70 mm attack stream into the fire area, extinguish burning timber stacks and rolls of stored polyurethane mesh. Firefighters were using concrete barricades to provide protection from any continuing explosions from within the basement. Firefighters entered the basement with a 38 mm line to complete extinguishment of burning materials within the basement. During cooling operations, firefighters used thermal imaging cameras to measure the temperatures of external gas cylinder casings.

From Charlie Sector, the Ladder Platform 36 aerial crew observed smoke coming from the stairwell exits of the Main Fire Occupancy. The aerial appliance was shut down and Rescue Pumper 36 and Hazmat Pumper 51 firefighters entered the building via the scaffolding stairs, advancing a 38 mm line to investigate for fire spread. These investigations did not identify fire within the stairwells or on the Charlie side of the building.

Operations to Continue Cooling Gas Cylinders:

Firefighters had extinguished the basement fire and all fire involving the scaffold perimeter mesh. Investigations found no further areas of fire spread at the site. Firefighters continued cooling streams onto the stored gas cylinders due to the intense levels of heat the cylinders had been exposed, to minimise the possibility of any further cylinder explosions. At 1005 hours the I.C. sent the following strategic CAN report:

"FIRECOMS DUTY COMMANDER CITY, PITT STREET COMMAND, BLUE. WE HAVE A LARGE BUILDING OF 9 LEVELS UNDERGOING DEMOLITION. FIRE IS CURRENTLY IN THE CONTAINED PHASE. WE STILL HAVE ACTIVE FIRE IN SECTORS ALPHA BRAVO AND CHARLIE. WE HAVE 3 LADDER PLATFORMS AT COMPLETING FINAL EXTINGUISMENT. WE ARE CURRENTLY REOPENING ROADS AND TRAINS. THERE IS A LARGE BANK OF GAS CYLINDER BEING COOLED IN THE BUILDING BASEMENT. SOME HAVE VENTED. WE HAVE HAD A FIRE IMPACTING A CRANE WHICH HAS BEEN EXTINGUISHED AND THE CRANE IS STABLE. NO FURTHER RESOURCES REQUIRED AT THIS TIME, OVER."

Electricity Isolation:

Electrity Authority staff attended the site and identified power to the site was supplied by an on-site substation connected directly to an 800 kV link that would require specialist operators to disconnect. Qualified electricity operators attended the site and located a switchboard near the perimeter hoarding where power to the site was able to be disconnected and isolated. Electricity operators were accompanied by firefighters into the basement where they checked the main electricity distribution board for the building, confirming power was dead.

Hazmat Operations:

The crew of Heavy Hazmat 13 set up firefighter rehabilitation and provided air cylinders for SCBA crews. Water approximately 150 mm deep had accumulated in the building basement. Hazmat firefighters carried out testing of the accumulated water for pH levels, which were neutral. All firefighting was contained to the site within the three-level basement and no water run-off occurred.

Structural Integrity:

Following establishment of fire control, the I.C. undertook measures to ensure the structural integrity of the building scaffolding and tower crane were intact. Structural engineers accompanied by firefighters conducted a walkaround of the site and undertook a survey of fire impacted areas. Engineers were satisfied the integrity of the scaffolding and tower crane were not compromised.

At 1142 hours the I.C. sent the following Strategic CAN report:

“FIRECOMS DUTY COMMANDER CITY, PITT STREET COMMAND, BLUE. A FIRE AS PREVIOUSLY STATED. FIRE HAS NOW BEEN CONTAINED. SALVAGE AND OVERHAUL BEING CARRIED OUT. ENGINEERS ON SCENE CHECKING FOR STRUCTURAL INTEGRITY OF THE CRANE, BUILDING AND SCAFFOLDING. CREWS HAVE BEEN REHABED. SCALING CREWS BACK. INVESTIGATIONS BEING CARRIED OUT. FIRU ENROUTE. 15 WORKERS TREATED BY AMBULANCE FOR SMOKE INHALATION ON SCENE. NO PERSONS TRANSPORTED TO HOSPITAL. ALL EVACUEES FROM SURROUNDING BUILDINGS HAVE BEEN ALLOWED TO RETURN, OVER.”

Final Overhaul Operations:

Firefighters conducted a post fire inspection of all floors of the building, to ensure all areas of fire had been extinguished and no hidden hot spots or pockets of fire remained that could re-ignite. During these investigations, firefighters identified that 20 of the cylinders stored on site had vented.

FRNSW Operations Concluded:

At the conclusion to salvage and overhaul operations, the I.C. sent the following **STOP** message at 1548 hours:

“FIRECOMS DUTY COMMANDER CITY, PITT STREET COMMAND, GREEN, STOP. FIRE INVOLVING A 9 LEVEL BUILDING WHICH IS UNDER DEMOLITION. FIRE EXTINGUISHED USING 3 X LADDER PLATFORMS, 2 X GROUND MONITORS, 4 X 70M AND 4 X 38 MM HOSE. BUILDING POWER ISOLATED AND CONFIRMED BY ENERGY AUSTRALIA. NUMEROUS LPG AND OXYGEN CYLINDERS VENTILATED. ALL REMAINING CYLINDERS CHECKED FOR HEAT AND THE TEMPERATURES ARE ALL CLEAR. ENGINEERS HAVE INVESTIGATED THE TOWER CRANE AND SCAFFOLDING FOR INTEGRITY AND GIVEN ALL CLEAR. 15 WORKERS TREATED ON SCENE BY AMBULANCE FOR SMOKE INHALATION AND RELEASED. FIRU HAVE COMPLETED INVESTIGATIONS AND HAVE DEPARTED SCENE. ALL FRNSW DUTIES HAVE COMPLETED AND ALL RESOURCES HAVE NOW BEEN RELEASED. SITE NOW HANDED BACK TO DELTA CONSTRUCTIONS.”

The final FRNSW resources departed the scene a short time later.

Incident Outcomes

The following incident outcomes were achieved:

1. Containment of fire burning in the scaffold mesh was established.

2. Fire intensity within the basement was reduced and fire control was established.

3. Temperaures in proximity to stored gas cylinders was reduced, resulting in cessation of pressurised gas cylinder BLEVEs.

4. Tower crane steel was cooled and integrity of tower crane protected.

5. Surrounding exposures were protected.

6. Fire was extinguished.

7. Contaminated water was contained to the site.

8. Persons in immediate proximity to the incident were evacuated and remained safe.

9. Following fire containment being established, most persons were able to return to workplaces with minimal disturbance to surrounding businesses, industry, services and local community.

Operational Safety Considerations

Some of the Operational Safety Considerations identified at this incident include the following:

1. One of the hazards associated with the scaffolding fire was falling flaming debris. Firefighters operated outside of debris fall zones.

2. The involvement of pressurised gas cylinders exposed to fire was problematic for firefighters for a number of reasons:

a. When the cylinders were heated pressurised jets of flame vented from the cylinder pressure relief valve at high temperature.

b. When temperatures beyond the capacity of pressure relief valves to operate adequately, the cylinder casing rupture due to “over-pressure”, resulting in a BLEVE (Boiling Liquid Expanding Vapour Explosion) occurring. These events caused the sudden release of the liquid contents of the cylinder that rapidly expanded and mixed with air, producing an explosion. The cylinders or parts of the cylinder were projected extremely violently due to this explosion. Heat caused by the explosion was extreme.

c. The lighter cylinder casings of some LPG cylinders exposed to flame impact burnt through, allowing gas to escape and rapidly burn.

Firefighters protected themselves from the above gas cylinder events by shielding and distance. Some of the shielding used by firefighters included the timber hoarding, heavy machinery and large steel industrial bins. Firefighters withdrew from the immediate area of the cylinders, creating a distance barrier. The gas cylinders were cooled with master streams, lowering pressure within the cylinders and reducing the chance of further explosions occurring. These measures were extremely effective.

3. Typical of many buildings undergoing demolition, all installed firefighting systems, in particular sprinklers and the internal fire main/standpipe system, had been disconnected and were unusable. Similarly, the “ordinary” access paths through the building, such as internal stairs, were blocked by debris and impassable.

4. The tower crane structure and building scaffolding were both formed of steel and vulnerable to weakening and failure to the impact of heat caused by the fire. Firefighters established collapse zones around these structures, cooled exposed steel with water and undertook surveys with engineers to ensure the integrity of these structures was not compromised.

5. Electricity isolation is always an important safety factor at most structure fires. The building was surrounded by large areas of steel scaffolding, representing potential conductors if contact was made with live electrical circuits. Electricity authority staff were requested at time of call. Due to complexities associated with supply arrangements, specialist crews were required to attend to enable power to be disconnected. All firefighters treated the site as “live” until power isolation had been confirmed by electricity authority staff.

6. Thermal imaging cameras are valuable tools to measure temperatures of the surfaces of materials that could be threatened by the impact of heat, such as gas cylinders or steel structures. Heat registrations can identify a surface requiring cooling and can also identify the effectiveness of cooling operations. This is particularly important because radiant heat is invisible.

7. Fires involving buildings under demolition present significant issues for firefighters. This was demonstrated no more graphically than on the occasion of the tragic Deutsche Bank building fire at 130 Liberty Street, Manhattan on 18th August 2007, that claimed the lives of two Fire Department of the City of New York (FDNY) firefighters and injured a further 105 firefighters. The author visited the building prior to the fire; in many respects the two buildings were very similar. Some of the issues include:

a. Disconnection of installed firefighting systems, including automatic alarms, automatic fire sprinklers and standpipe systems.

b. Large quantities of combustible materials located throughout the building, particularly construction timbers.

c. “Ordinary” building access paths (doorways, corridors and stairways, etc) blocked, obstructed or impassable.

d. Re-design of the building interior to facilitate demolition works (building plans are out of date and unreliable), resulting in firefighters working in “maze” like conditions often in conditions of poor visibility and heavy smoke.

e. Large openings through walls, floors and ceilings, facilitating rapid internal vertical and horizontal fire spread.

f. Egress passages unprotected from fire impingement.

g. Plentiful air supply due to the “open” format of the building, increasing fire intensity.

Learning Notes

Significant learning notes from this incident include the following:

1. Fires involving scaffold mesh present unusual and unique problems for firefighters. The mesh material at Circular Quay produced intense fire activity, consisting of fierce flames, rapid spread of fire, high heat release rates and production of large volumes of thick, black and acrid smoke. The fuel arrangement of scaffold mesh results in rapid vertical fire spread, and at the same time fire will spread laterally outwards. Fire spread from the burning scaffold mesh was caused by direct fire spread, radiant heat, airborne burning materials and falling burning materials.

2. Aerial appliances were a significant firefighting resource, due to their ability and flexibility to direct well placed elevated aerial master streams onto a wide area of the scaffold mesh, halting vertical and horizontal fire spread. The aerial streams were highly effective controlling fire spread, reducing fire intensity and achieving extinguishment. The large deluge streams from the aerial appliances were highly effective reducing fire intensity in the area of fire impingement onto gas cylinders, increasing firefighter safety due to the ability of the streams to be projected from a greater range. The aerial streams delivered large volumes of cooling water onto the tower crane steel structure, assisting the steel to maintain integrity, preventing structural failure and crane collapse. The aerial appliances were positioned to enable streams to reach the greatest possible area of the building. A secondary effect of fire attack on the scaffold mesh was cooling of the scaffold steel, assisting the scaffolding to maintain integrity. The aerial operations were undertaken in a coordinated manner with the hose line streams.

3. Closely associated with aerial appliance operations is the need to ensure an adequate water supply is established for aerial operations. In most situations this will require obtaining water from a separate source that is already supplying the fireground, to prevent water supplies already in use being over-run. Water supplies at Circular Quay were obtained from several sources, including reticulated street mains (spring valve and ball valve hydrants) and supply hydrants connected to building Fire Brigade Booster Assemblies.

4. Firefighting operations were supported a robust incident command structure that was reflective of fireground operations. All crews were working within designated sectors and reporting to sector commanders. This ensured full accountability of personnel, operations conducted in a coordinated manner, operations being conducted in accordance with incident objectives and significantly improved safety of all personnel at the fireground.

5. On a number of occasions the mode of firefighting operations (offensive/defensive) was changed in accordance with changing incident conditions. These transitions were seamless, rapid and without complication, on account of the incident command structure in place and the cohesive fireground communications plan.

6. It is advantageous for firefighter to be aware of buildings under demolition within their station area, particularly large sites. No two sites are ever the same and fire behaviour will often be changeable and unpredictable. Site familiarisation will assist firefighters to identify in advance any unusual, complex or potentially hazardous conditions they could encounter if they needed to respond to a fire at the site.

Conclusion:

The fire at 13 Pitt Street, Sydney presented firefighters with some unique and unusual challenges. Firefighters encountered unusual fire behaviour on account of the fuel load material and layout (scaffold mesh on the side of the building) that resulted in an intense and fast-moving fire travelling vertically and horizontally along the side of the building. Although the fire involved a building under demolition, it would be wrong to say the fire was simply "*a fire on a demolition site"* and therefore was of little real consequence; a large body of fire burning with high levels of intensity developed rapidly, producing high levels of radiant heat and airborne burning materials, threatening numerous surrounding exposures, including multiple nearby high-rise office buildings. As the fire grew in intensity, there was a significant danger of collapse of the tower crane and scaffolding structure, again placing multiple exposures under threat. An even greater danger was created by heavy fire impact to the stored banks of LPG and oxygen cylinders, causing explosions that resulted in flaming cylinders being projected violently through the air across the fireground, threatening further fires and placing lives in danger. It is important to consider that these events occurred on the northern edge of the Sydney financial district during business hours when the city population was approaching peak level. The fireground was metres from major transport infrastructure including ferry terminals, Sydney underground railway and the Cahill Expressway. The incident was more than simply a fire on a demolition site. One of the most memorable fires in the history of this fire service occurred in 1968 on an Oxford Street, Sydney, inner-city demolition site involving a building known as "*Buckingham's Department Store*".

Firefighters faced many unique challenges commonly associated with buildings under demolition, including disconnection of installed firefighting systems, open travel paths for the passage of fire through the building and the presence of combustible, flammable and hazardous materials on the site, contributing to a worsening of fire conditions. Firefighters fought the fire with skill, determination and professionalism. Firefighting operations were conducted in a coordinated manner, with the use of aerial and ground streams and strategies and tactics were adjusted in accordance with changing incident conditions. Fireground command was textbook in nature. Fires involving buildings under demolition should be treated in accordance with the unique and complex conditions situations present in these buildings that can create a hazardous and unexpected environment for firefighters. The Circular Quay fireground was extremely dynamic, consisting of rapidly spreading fire along the building scaffold mesh, intense fire behaviour within the building basement and extremely dangerous BLEVEs involving stored pressurised gas cylinders. It also involved fire impact to a number of extremely vulnerable high-risk structures that could have ended with catastrophic consequences if not managed correctly. Specific firefighting strategies and tactics were applied for each of the fire situations that developed on this continuously evolving fireground, enabling incident objectives of fire containment, fire control and fire extinguishment to be safely and effectively achieved. This fire is an excellent example of the significant challenges firefighters can face when responding to fires involving buildings under demolition; it is also equally an excellent example of textbook firefighting operations at these types of fires. Congratulations to all FRNSW crews who responded to Circular Quay on your extremely professional firefighting and the very good incident outcomes achieved.

Fire ascending the external scaffold mesh on the Alpha side of the building. Flames spread rapidly in a vertical direction from bottom to top and then began spreading laterally. Photograph on the top left shows fire (**A**) has now progressed to the Bravo side wall. Burning material that has fallen from the mesh has ignited fresh fires at ground level (**B**). These fires spread into the basement where the gas cylinders were stored.

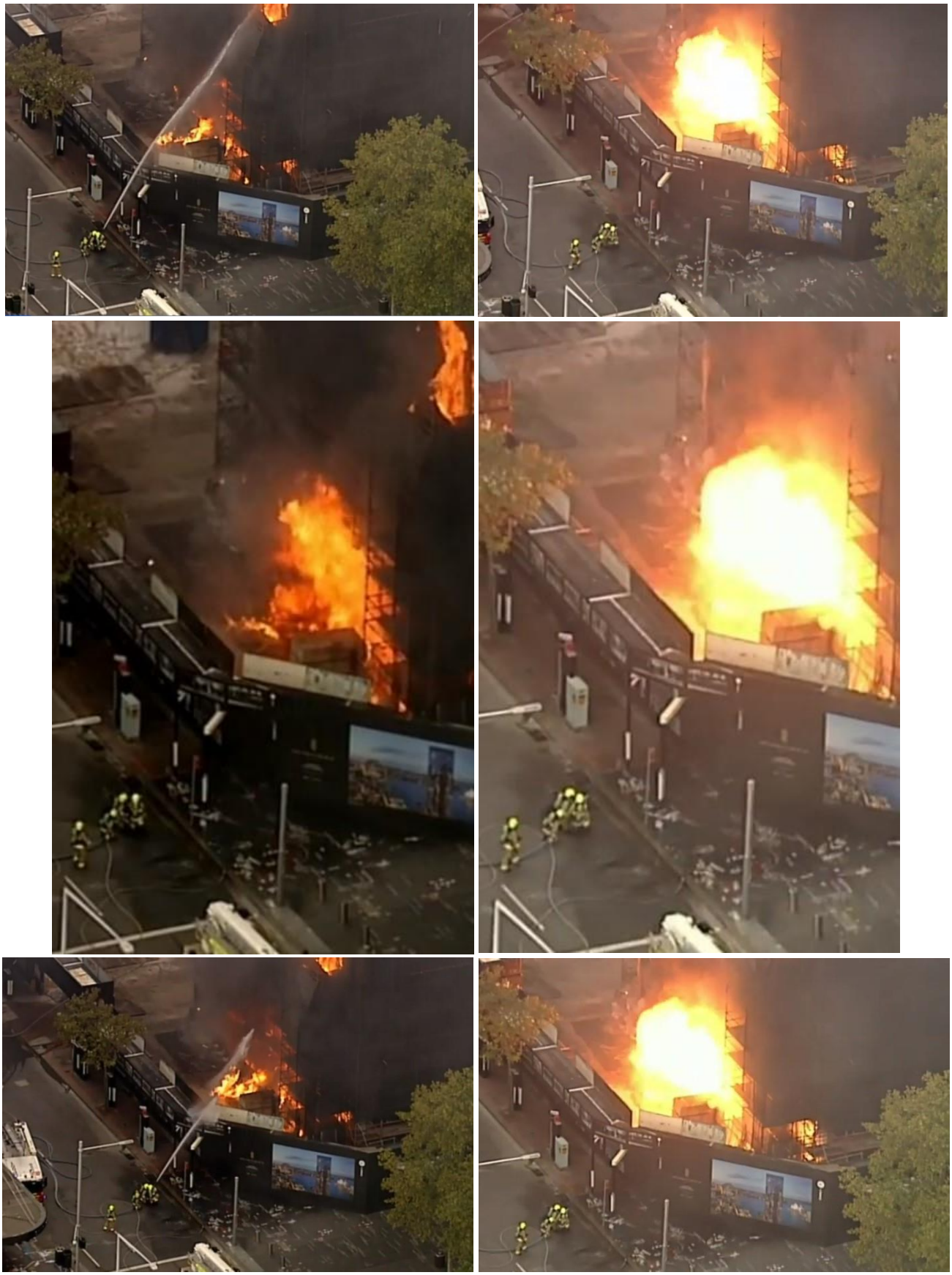
The fire scene shortly at about the time firefighters arrived: **A** The tower crane in the path of the spreading fire. **B** Fire spreading along the Bravo side scaffold mesh from right to left. **C** Fire that has ignited at ground level due to burning mesh falling, **D** Firefighters attacking the basement fire used this steel waste bin as a shield when the gas cylinders were exploding. **E** Fire spreading through the Alpha side scaffold mesh towards the Delta side of the building. **F** Fire that has ignited at ground level due to burning falling mesh. This fire involves stored rolled mesh and is spreading into the basement where gas cylinders are stored.

Ladder Platform 4 attacks fire burning within the Alpha side Scaffold mesh. Burning mesh has fallen and ignited combustible materials on the lower scaffolding **A** resulting in fire spread. The aerial streams achieved numerous incident objectives, including achieving fire containment, reducing fire intensity, extinguishment of spot fires and cooling of steel being impacted by fire (particularly the tower crane structure).

The aerial cage operator of Ladder Platform 4 attacks the fire burning on the Alpha side scaffold mesh, stopping fire from spreading to the Delta side of the building.

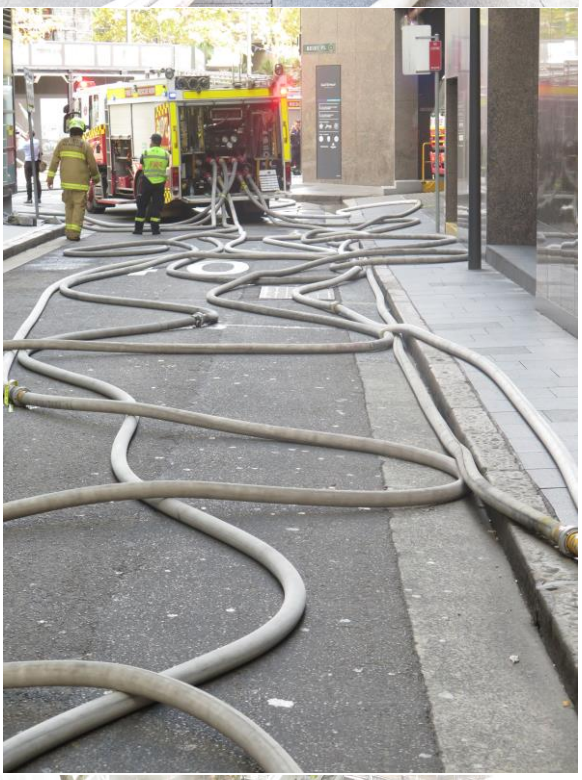


Upper: Pumper 3 and Runner 1 operating in Pitt Street. Middle: Pumper 4 obtains water using a screw valve hydrant and supplies water to Ladder Platform 4. Lower a ground monitor directs a stream into the area where gas cylinders had been exploding, providing cooling.



Gas cylinder explosions (Boiling Liquid Expanding Vapour Explosions/BLEVEs) occurred inside the basement. Several gas cylinders became flaming projectiles, travelling beyond the basement. These fire events are extremely dangerous. Firefighters used shielding and continued to fight the fire.

From the Alpha side of the building firefighters direct a ground monitor cooling deluge into the basement where numerous stored gas cylinders are located, successfully preventing further explosions from occurring.

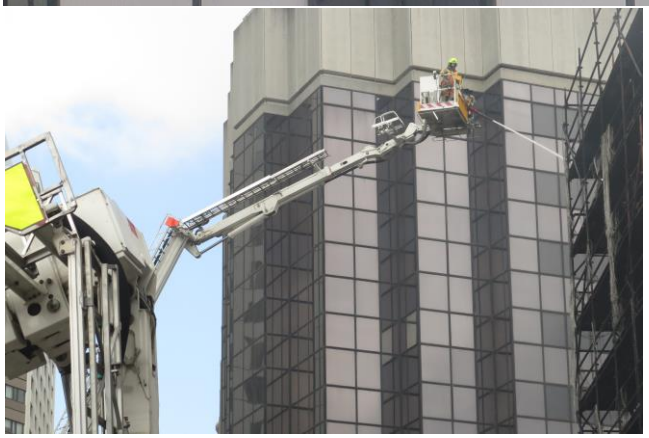


Fireground water supplies were obtained from a number of different sources. Top and middle: Water was obtained from supply hydrants connected to Fire Brigade Booster Assemblies. Lower left: Screw valve hydrant and elbow delivery. Lower right: Standpipe and ball valve.

Charlie Sector Operations: Ladder Platform 36 attacks the fire on the Charlie Side. Pumper 53, Rescue Pumper 36 and Hazmat Pumper 51 attacked the fire on the Bravo/Charlie sides with hand lines.

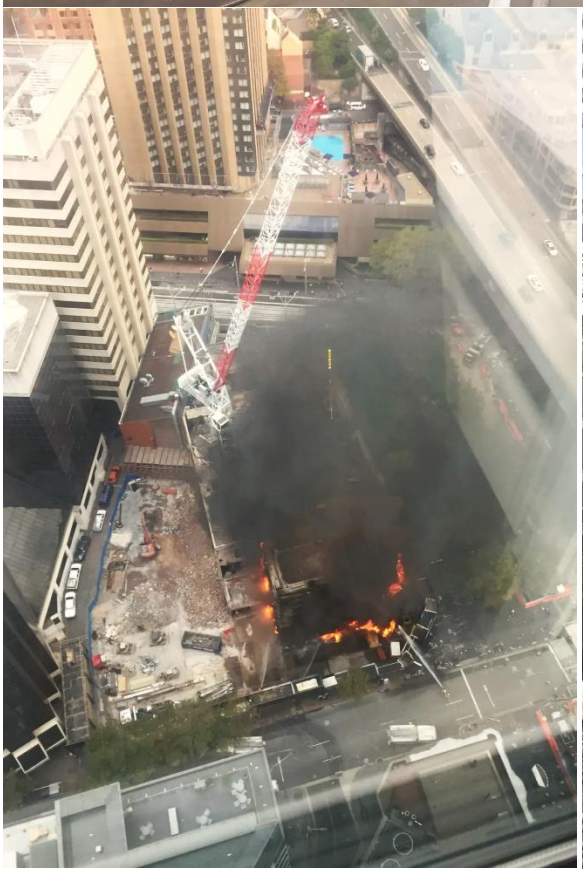
Firefighters encountered a number of LPG cylinder Boiling Liquid Expanding Vapour Explosions (BLEVEs) from severely heat impacted gas cylinders stored in the basement.

Vertical fire is spreading outwards towards the Delta and Charlie sides of the building, from Alpha and Bravo sides. Firefighters are attempting to establish containment. Visible in the lower pictures are flames resulting from LPG cylinder Boiling Liquid Expanding Vapour Explosions (BLEVEs).



Ladder Platform 1 established cutoff of fire burning the perimeter scaffold mesh on the Bravo side. The aerial master stream was also used to cool the steel tower supporting the tower crane.







Top: Firefighters direct a cooling stream onto cylinders stored in the basement. Middle left: Black smoke vents from the burning polyurethane. Fire is spreading towards the tower crane. Middle Right: Ladder Platform directs an aerial stream onto the steel structure supporting the tower crane. Lower: Rescue Pumper 15 firefighters under the command of S.O. Stephen direct water onto an area of fire beyond the reach of the aerial appliance near the base of the tower crane.

Top Left: Pitt Street – Pumper 4 supplies water to Ladder Platform 4. Ladder Platform 1 attacks the fire in the background. Top right: Runner 1 supplying water to a ground monitor in Pitt Street. Middle: First arriving Pumper 3 supplies attack lines to firefighters working in Alpha Sector. Lower left: Smoke billows over Pitt Street. Lower right: Pumper 3 and Runner 1 operate in Pitt Street.

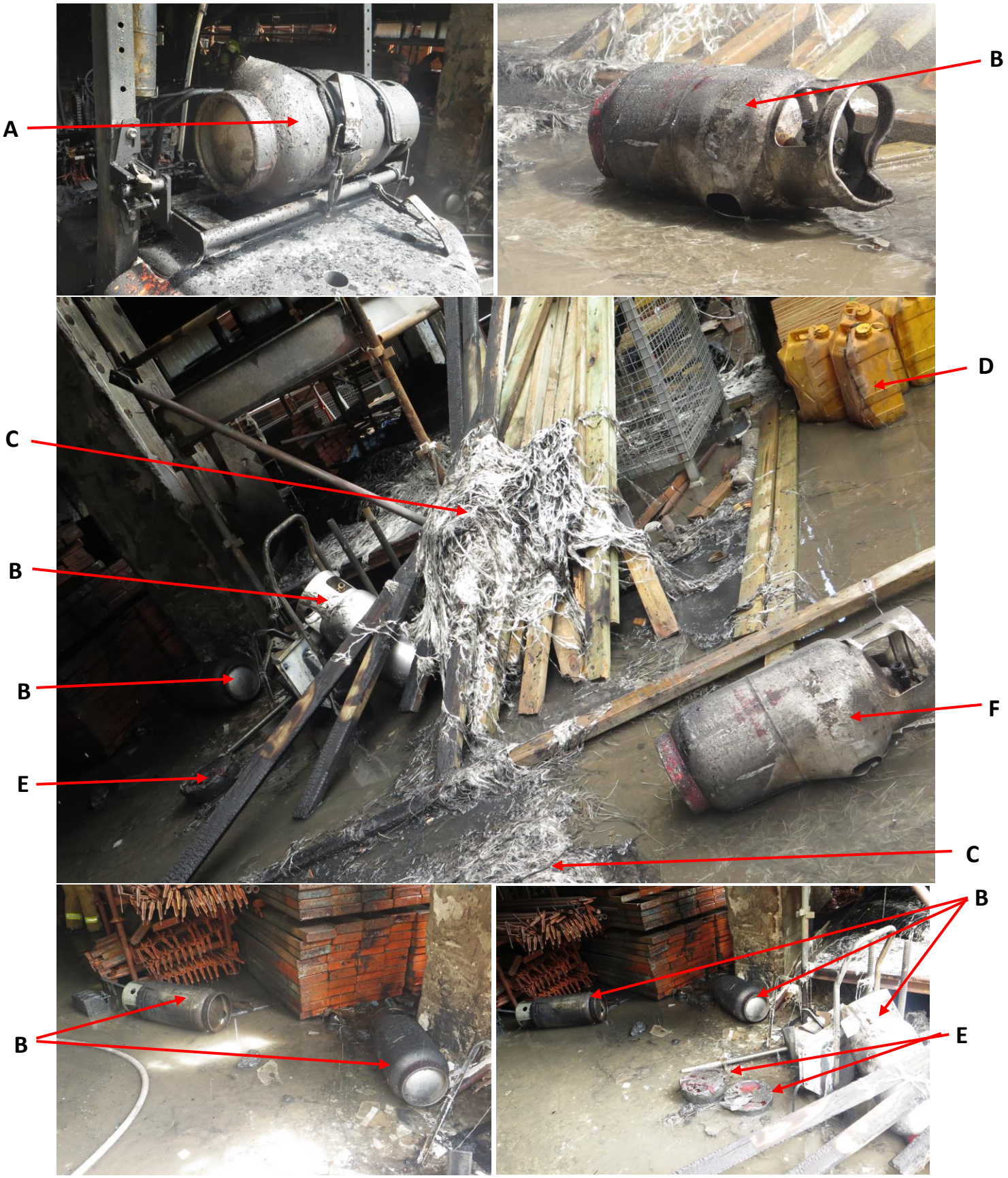
Upper: In Alpha Sector firefighters wearing SCBA establish cooling of the basement using a 70 mm line and ground monitor. Lower: SCBA on deck crews located at the entrance to Alpha Sector.

Firefighters continue to apply cooling streams onto gas cylinders located in the basement. Main B.A. Control is located at the rear of Pumper 3. A Stage I B.A. Control Board is in operation.

Top left: Sector Comamnder confers with fire attack commander. Top right: SCBA crews withdraw. Middle Upper: Pumper 3 supplying water to fire attack crews in Alpha Sector. Lower: Runner 1 supplies water to crews via an opening cut through the hoarding.

Upper: Ladder Platform 1 protected the structural steel that formed tower of the tower crane.
Lower: Scaffold stairs located on the side of the buiding that enabled the workers to escape Indiacted by arrows).

Fire entered the basement where gas cylinders were stored. Top left: LPG cylinders. Top right: Oxygen cylinders. Middle left Oxygen cylinders and projected LPG cylinders. Middle right: Oxygen and LPG cylinders used for cutting. Lower left: Breached LPG cylinders. Lower right: Stored diesel fuel.



A Ruptured LPG cylinder on a forklift **B** Projected LPG cylinders. **C** Fallen high-density Polyurethane mesh creating intense fire activity at the basement entrance. **D** Stored diesel fuel. **E** Remnants of LPG cylinders following BLEVE. **F** Ruptured and projected LPG cylinders.

Fire initially involved scaffold containment mesh, formed of high-density polyurethane and fibreglass reinforced banding. The **burning mesh separated and fell** igniting fresh fires on lower levels and at ground level, adjacent to the basement. Fire intensity of the burning mesh was severe, resulting in fire entry into the basement and explosion of multiple stored gas cylinders within the basement.

Fire initially involved scaffold containment mesh, formed of high-density polyurethane and fibreglass reinforced banding. The **burning mesh separated and fell** igniting fresh fires on lower levels and at ground level, adjacent to the basement. Fire intensity of the burning mesh was severe, resulting in fire entry into the basement and explosion of multiple stored gas cylinders within the basement.

Fire burnt through the scaffold containment mesh on the Alpha and Bravo sides of the building. Ladder Platform 4 firefighters established containment on the Alpha/Delta corner **A.** Ladder Platform 1 cut the fire off on the mid point of the Bravo side. The steel support tower of the tower crane **B** was vulnerable to fire impact and protected by cooling streams from Ladder Platform 1.

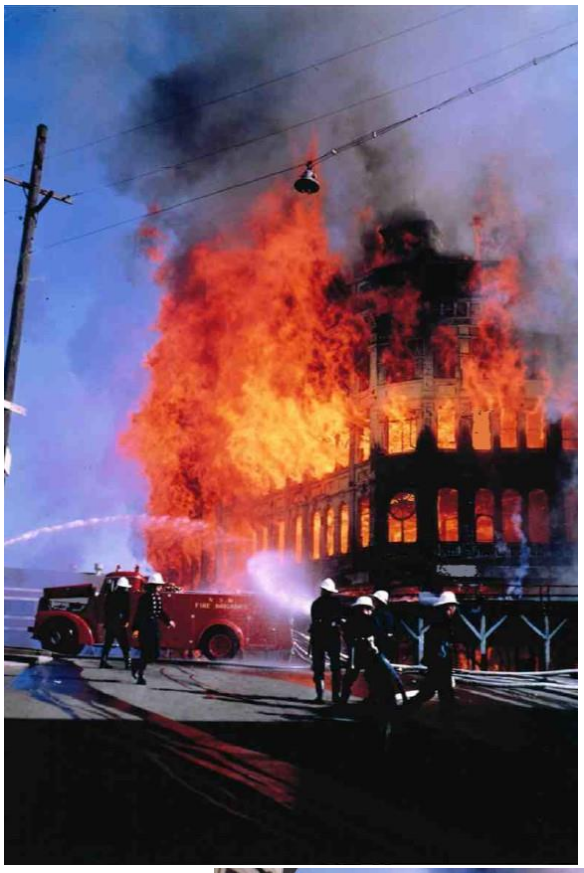
As fire ascended and progressed through the scaffold containment mesh, the material forming the mesh lost strength and failed, allowing large sections of burning high-density polyurethane to separate and fall, igniitng new fires. There were three problems with the scaffold containment mesh; fire ascended the mesh, fire travelled sideways and fire “dropped down” ignited new fires on lower levels.





Top: As always, our colleagues from Ambulance provided fantatsic support. Middle left: Fire ascends vertically through the scaffold mesh. The volumes of black smoke are being produced by rolls of polyurethane mesh burning in the basement, ignited by fire falling. Middle right: "*Gold Fields House*" in happier times prior to demolition commencing. Lower: Appliance staging area.





Notable fires involving buildings under demolition – Top: The Deutsche Bank building fire in New York City on 18th August 2007 killed two firefighters and injured a further 105. Lower: Buckingham's Department Store fire on Oxford Street Sydney, 25th April 1968 was as spectacular as it was dangerous. Fires involving building's under demolition have a dangerous history for firefighters and can never be underestimated.