TWO BOILERS
AND A WATER
HEATER

CALIFORNIA BOILER INSPECTORS
ASSOCIATION

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MECHANICAL ENGINEER
• Boiler #1 – Hospital in Rural, Eastern Utah – NEAR MISS
  • 250 hp Cleaver-Brooks boiler
  • Both low-water cutouts failed
  • Boiler “dry-fired” when feedwater pump failed
  • Smoke coming out of boiler room and boiler was shutdown

• Boiler #2 – Hotel in San Francisco Bay Area – Personal Injury
  • Small pool heater boiler, about 400,000 BTU
  • Carbon-dioxide poisoning
  • Exhaust located near open hotel sliding-glass door

• Water heat explosion – Hollywood, CA
  • Commercial electric water heater – 45 kW
  • Empty restaurant – closed by health department
BOTH LOW WATER CUTOUS FAILED – IMMERSION SENSOR ON TOP

+ BRAND NEW MCDONNEL-MILLER FLOAT TYPE
CLOSE-UP OF DAMAGE TO EXTERIOR
DAMAGE TO OPPOSITE SIDE
INTERIOR OF BOILER
FIBERGLASS ROPE GASKET – TURNED TO GLASS!
McDonnel-Miller low water cutout was replaced the day before this incident

Ignoring the instructions, the boiler tech did not test the low water cutout

The next day, the feedwater pump lost its coupling

The McDonnel-Miller low water cutout did not shutdown the burner

The spark-plug type immersion low water cutout also did not shutdown the burner

Luckily someone saw smoke coming out of the boiler room and luckily, the technician shut down the burner before any water entered the boiler
BOILER #2 – HOTEL IN BAY AREA – CARBON MONOXIDE POISONING
BOILER #2 – BOILER EXHAUST RIGHT BELOW SLIDING GLASS DOOR
SMALL RAYPAK BOILER – POOL WATER HEATER
SUBJECT
RAYPAK
PACKAGE
BOILER
EXHAUST FLUE ACROSS EQUIPMENT ROOM
HOOD, FORCED EXHAUST, AND FLUE RECONSTRUCTED ON GRASS
CLOSE UP OF DETERIORATED EXHAUST FLUE
INSTALLED FORCED EXHAUST TO REMOVE EXHAUST FROM LAB
DEMONSTRATING DRAFT
CONCLUSION ON BOILER #2

• The subject boiler was not installed per code. The exhaust was too close to the door above.

• The subject boiler was not maintained. The boiler tube area was so full of rust, dirt, and debris that it interfered with the draft, causing incomplete combustion and the generation of about 50 times the normal production of carbon monoxide.

• There was not sufficient make up air, contributing to further carbon monoxide production.

• The flue was perforated and allowed additional carbon monoxide to flow into hotel room.

• Once the boiler tube area was “vacuumed” – the carbon monoxide produced were within acceptable levels.
WATER HEATER EXPLOSION.
POLICE INITIALLY THOUGHT IT WAS A TERRORIST BOMBING INCIDENT
RESTAURANT WINDOWS BLOWN OUT
WINDOWS BLOWN OUT ON BOTH SIDES
WATER HEATER EXPLOSION – EMPTY RESTAURANT IN HOLLYWOOD
SUBJECT WATER HEATER
HEATING ELEMENTS NEAR BOTTOM OF WATER HEATER
HEATING ELEMENT FRAGMENTS
KITCHEN INTERIOR
SHEET METAL EXTERIOR AND ELECTRICAL PANEL IN OPPOSITE CORNER OF KITCHEN
WATER HEATER WAS INSTALLED UNDER STAIRS
TEMPERATURE & PRESSURE VALVE
(T & P VALVE)
INSULATION ON HOT WATER PIPE WAS MELTED AND ESSENTIALLY COOKED!
WATER HEATER EXPLOSION – STILL UNDER INVESTIGATION

• Arcing found on wire in heating element indicates that the water heater was on and operating at the time of the fire

• The 480-volt, 3-phase 90 amp circuit breaker that fed the water heater was in the tripped position, with soot and smoke coming out of the arc chutes

• Insulation on the hot water pipe was melted, indicating that the water heater was making steam at the time of this incident

• Further testing of the insulation will be required to determine its thermal characteristics

• The T & P valve was replaced. It comes with a Watts T & P valve, but the T & P at the time of this incident was manufactured by Wilkins.

• There were check valves installed on the hot water and cold water piping
ANY QUESTIONS???

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