

TWO BOILERS AND A WATER HEATER

CALIFORNIA BOILER INSPECTORS
ASSOCIATION

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MECHANICAL ENGINEER



CONTENTS

- 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





BOILER #1



BOTH LOW
WATER CUTOUTS
FAILED –
IMMERSION
SENSOR ON TOP

+

BRAND NEW
MCDONNELL-
MILLER FLOAT
TYPE



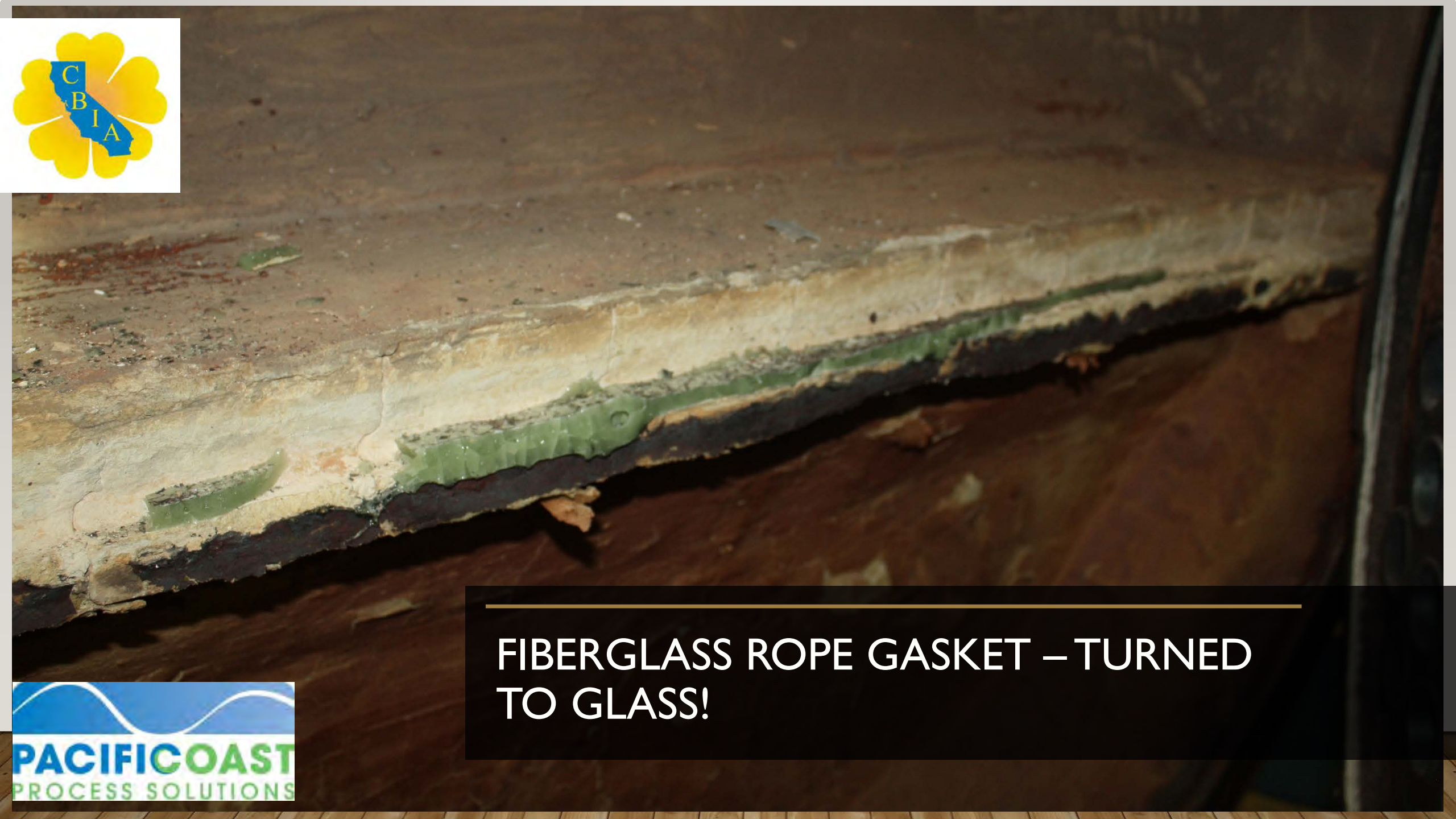
CLOSE-UP OF
DAMAGE TO
EXTERIOR



DAMAGE TO
OPPOSITE
SIDE



INTERIOR OF BOILER



FIBERGLASS ROPE GASKET – TURNED TO GLASS!





FIBERGLASS ROPE GASKET
TURNED TO GLASS

CONCLUSION ON BOILER #1

- McDonnell-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 McDonnell-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

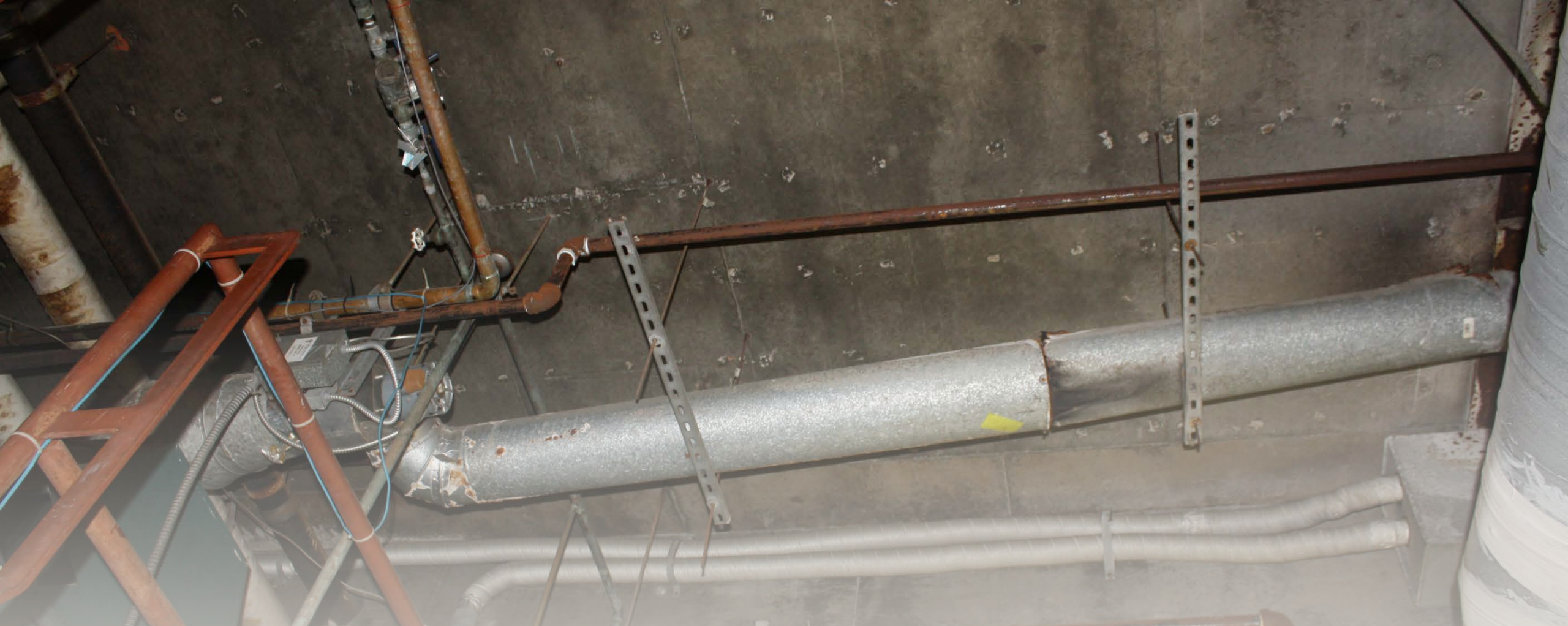


SMALL
RAYPAK
BOILER –
POOL WATER
HEATER



SUBJECT RAYPAK PACKAGE BOILER





EXHAUST FLUE ACROSS EQUIPMENT ROOM



HOOD, FORCED EXHAUST, AND FLUE
RECONSTRUCTED ON GRASS



CLOSE UP OF DETERIORATED EXHAUST
FLUE



TESTING – BERKELEY RESEARCH



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





ONLY ONLY ONLY



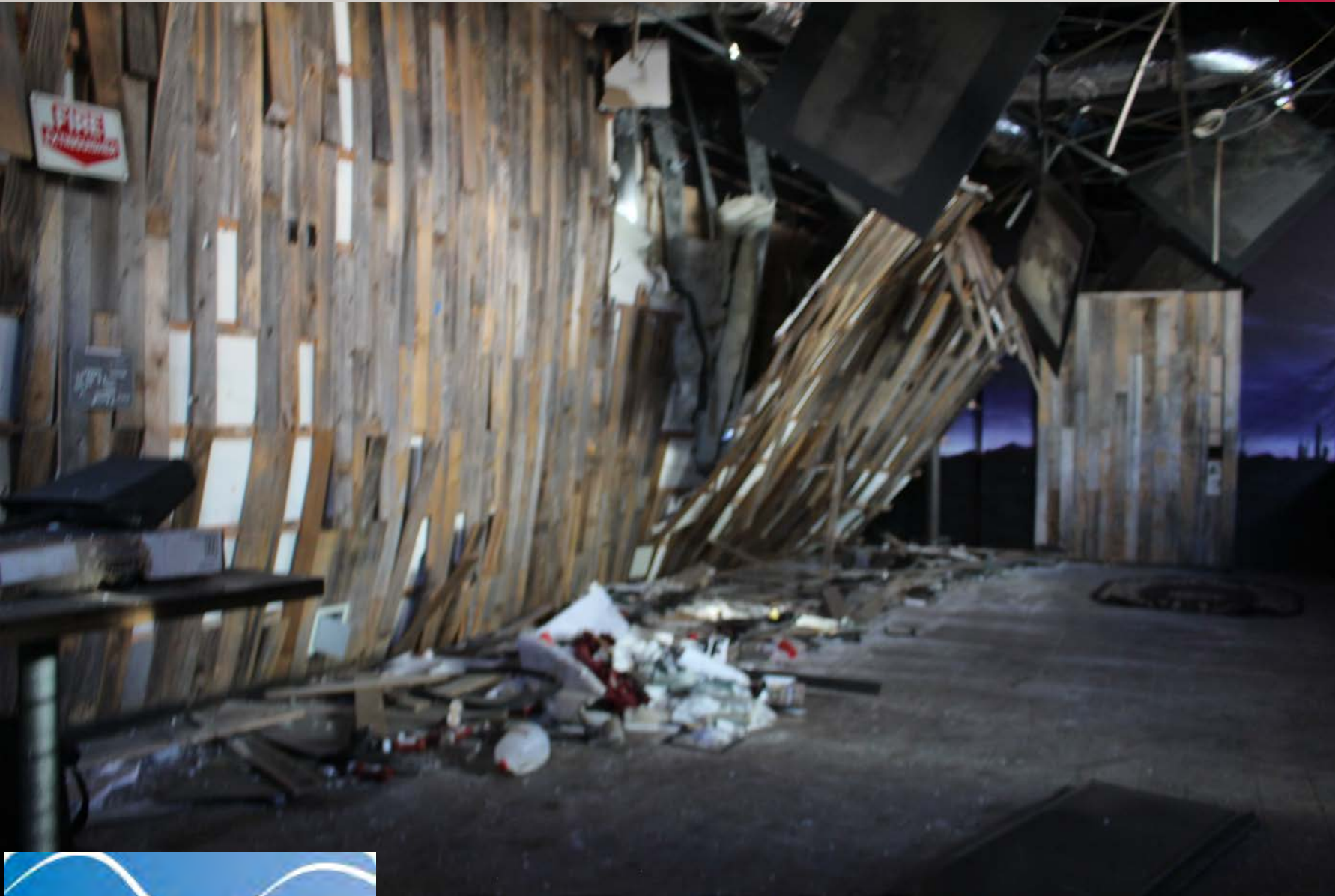
RESTAURANT WINDOWS BLOWN OUT





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



EMERGENCY EVACUATION PLAN











SHEET METAL EXTERIOR AND ELECTRICAL
PANEL IN OPPOSITE CORNER OF KITCHEN



WATER HEATER WAS INSTALLED
UNDER STAIRS







SUBJECT WATER HEATER – TOP VIEW



TEMPERATURE & PRESSURE VALVE
(T & P VALVE)



1 3 5

SIEMENS

Type **NGB**
Tipo

Volts Max:
600Y/347 V~
125/250 V---

Interrupting Ratings
Max. RMS Sym. Amps.
Valores de Interrupción
Amp. RCM Máx Sim.

ON

TRIP

90

OFF

OM076 2011

Volts	kA
240V ~	100
480Y/277V ~	25
600Y/347V ~	14
125/250V ---	14

UL ISSUE NO. AD-7937
LISTED C.B.
3 POLE UNIT
HACR TYPE



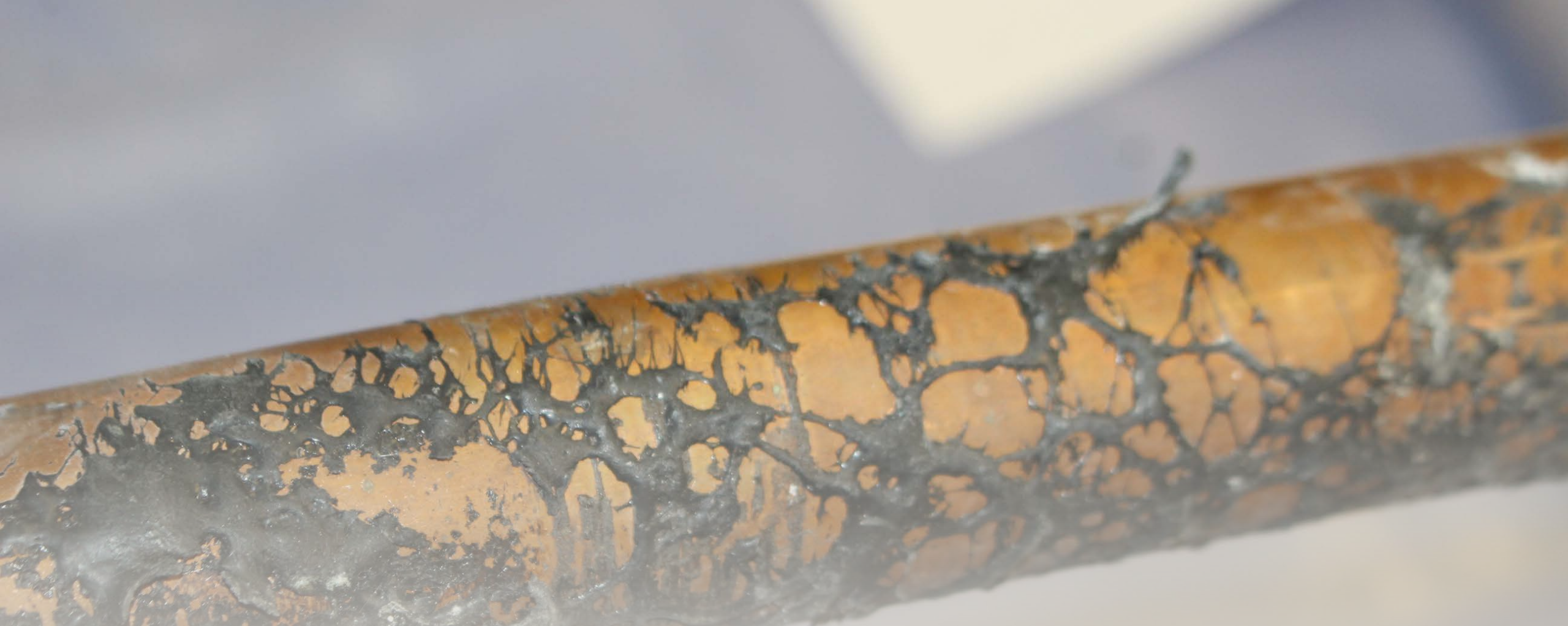
~ = 50/60 Hz 40°C

Use outside poles
for --- or
single phase ~.

NGB3B090

Cu-Al F0 75°C
A/VG mm² (lb-in) (N-m)





**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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