HVAC EQUIPMENT RISK ASSESSMENT

GEM SERVICE
RUDOLPH LIBBE GROUP

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EXECUTIVE SUMMARY

In March 2023, GEM Service visited our customer's Ohio facility to evaluate the primary HVAC equipment. There is a relatively wide variety of equipment, varying in type, age, and condition. Many pieces of equipment are at increased risk of failure based on the condition and age and it is highly recommended a proactive capital plan be established for equipment replacements. That plan is provided at the end of this report.

There are multiple Rooftop Units (RTU's), ranging from approximately 9 to 30 years old. The typical useful life for this equipment type is 15 years. Seven of these units have met or exceeded this typical useful life. Two heat exchangers within the RTU's were found to have failed and subsequently approved for replacement. Two additional heat exchangers were found to be in poor condition, representing a risk of failure during next heating season. There are many original air conditioning compressors within these units, and these represent an increasing risk of failure and expensive repairs. Indications of at least two refrigerant leaks are present, one of which is in a relatively large Carrier unit that requires obsolete and expensive R22 refrigerant. In total, the RTU's contain over 80 pounds of refrigerant. Should it need to be recharged due to leaks or compress burnouts, both increasingly likely with aging equipment, the cost may as high as $8,000. Mitigating this risk is a good reason to proactively replace air conditioning equipment near the end of the typical useful life.

A large portion of the building is ventilated and heated by an Air Rotation Unit (ARU), and this unit is estimated to be 37 years old and in very poor condition. In the past, substantial expense has been incurred modifying and repairing this unit to keep it functional.

There are three air conditioning split systems on site. One system is relatively new and provides cooling for a server room. The second is very old and understood to be abandoned or non-functional. The third system is still functional and, at 10 years old, has useful life remaining.

There is a relatively new chiller and condenser on site for process needs. This equipment appears to be in good condition and expected to have useful life remaining.

The one process cooling tower may be as old as 37 years. This is beyond the typical useful life with obvious deterioration.

Not directly related to the equipment, many deficiencies were observed related to poor installation workmanship, damage, and deterioration over many years.

It is estimated implementing the recommended capital plan herein could avoid nearly **$325,000** repairing obsolete equipment and **$27,000** in energy expense over the next 10 years. This is documented at the end of the report.

SITE FINDINGS

Lennox RTU (GEM #108815)

FINDING: Cracked condensate drain trap.

EFFECT: Condensate may drain improperly and overflow into building. Air can flow through drain, increasing heating and cooling requirements and energy usage.

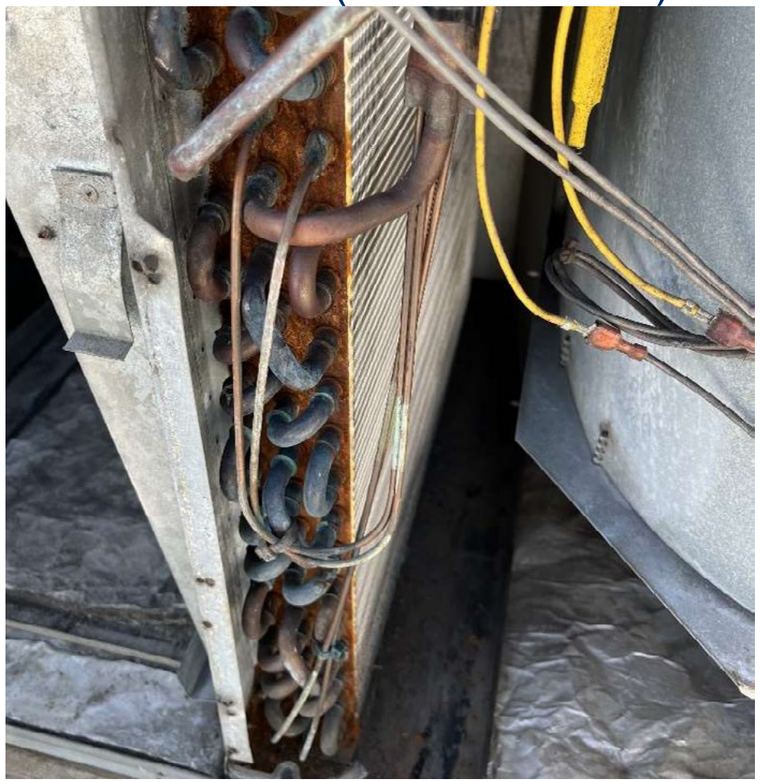
Carrier RTU (GEM #108816)

FINDING: Cracked heat exchanger.

EFFECT: Unit was shut down and heat exchanger subsequently approved for replacement.

SITE FINDINGS

Trane RTU (GEM #108817)



FINDING: Rusting of evaporator tube sheets.

EFFECT: Indication of unit age and condition. Increasing risk of evaporator failure/refrigerant leaks.

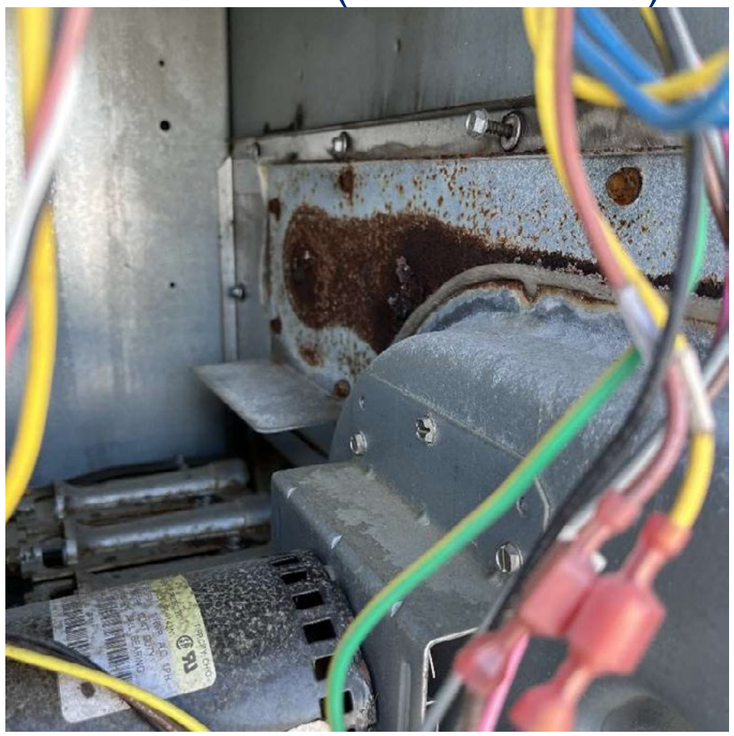
Trane RTU (GEM #108817)

FINDING: Appears to be original 25 year old compressor.

EFFECT: Increasing risk of compressor failure based on age.

SITE FINDINGS

Carrier RTU (GEM #108819)



FINDING: Significant rust of heat exchanger wall.

EFFECT: Heat exchanger likely close to failing based on this observation and other observations in subsequent pictures.

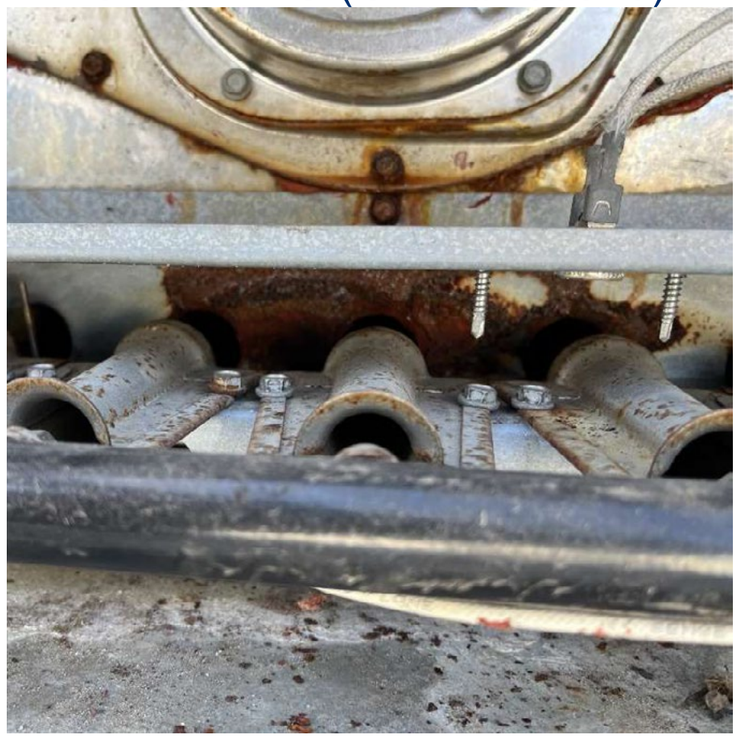
Carrier RTU (GEM #108819)

FINDING: Significant rust of inducer fan.

EFFECT: Heat exchanger likely close to failing based on this observation and other observations in subsequent pictures.

SITE FINDINGS

Lennox RTU (GEM #108826)



FINDING: Significant rust of heat exchanger wall.

EFFECT: Heat exchanger was found to be failed, unit was shut down and heat exchanger subsequently approved for replacement.

Lennox RTU (GEM #108826)

FINDING: Failed heat exchanger with at least two holes in dimpled areas of heat exchanger.

EFFECT: Unit was shut down and heat exchanger subsequently approved for replacement, a significant investment into a 14 year old RTU.

SITE FINDINGS

York RTU (GEM #108827)

FINDING: Old compressor, probably replaced at least once before.

EFFECT: Increasing risk of compressor failure and expensive repairs of old equipment.

York RTU (GEM #108827)

FINDING: Possible refrigerant leak, indicated by oil on refrigerant piping.

EFFECT: Increasing risk of expensive recharging (R22 refrigerant), compressor failure and expensive repairs of old equipment.

SITE FINDINGS

Air Rotation Unit

FINDING: Unit beyond the typical useful life and in very poor condition.

EFFECT: Significant nuisance shutdowns and repair expenses have occurred.

Air Rotation Unit

FINDING: Unit beyond the typical useful life and in very poor condition.

EFFECT: Significant nuisance shutdowns and repair expenses have occurred.

EQUIPMENT ASSESSMENT

EQUIPMENT DESCRIPTION	MANUFACTURER	AGE [1]	TYPICAL LIFE [2]	RISK OF FAILURE [3, 4]
Packaged RTU (GEM #108815)	Lennox	15	15	
Packaged RTU (GEM #108816)	Carrier	9	15	
Packaged RTU (GEM #108817)	American Standard	25	15	
Packaged RTU (GEM #108818)	American Standard	8	15	
Packaged RTU (GEM #108819)	Carrier	9	15	
Packaged RTU (GEM #108821)	Rheem	19	15	
Packaged RTU (GEM #108823)	York	24	15	
Packaged RTU (GEM #108824)	American Standard	11	15	
Packaged RTU (GEM #108825)	Trane	8	15	
Packaged RTU (GEM #108826)	Lennox	14	15	
Packaged RTU (GEM #108827)	York	30	15	
Packaged RTU (GEM #108828)	Carrier	19	15	
Air Rotation Unit (GEM #108833)	Rapid	37	20	
Liebert Split System	Liebert	2	15	
Mini-split System	Sanyo	29	15	
Mini-split System	Quietside	10	15	
Chiller	Thermal Care	5	20	
Condenser	Keeprite	5	20	
Cooling Tower	Marley	37	20	

1. *Estimated age; exact age not obtainable for all equipment.*
2. *Per industry recognized standards such as ASHRAE.*
3. *In consideration of typical useful life and observed condition. Risk of failure indicated from red to green color gradient, with red being highest risk and green the lowest.*
4. *Equipment list is not exhaustive and risk guidance is not a guarantee of current condition or probability of failure.*

10 YEAR CAPITAL PLAN

Equipment Description	Manufacturer	Replacement Time Horizon (Yrs.)	Replacement Value [1]	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Total 10 Yr. Capital Investment [1]
Packaged RTU (GEM #108815)	Lennox	0	$ 18,000	$ 18,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 18,000
Packaged RTU (GEM #108816)	Carrier	6	$ 18,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 18,000	$ -	$ -	$ -	$ 18,000
Packaged RTU (GEM #108817)	American Standard	0	$ 20,000	$ 20,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,000
Packaged RTU (GEM #108818)	American Standard	7	$ 20,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,000	$ -	$ -	$ 20,000
Packaged RTU (GEM #108819)	Carrier	0	$ 18,000	$ 18,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 18,000
Packaged RTU (GEM #108821) [2]	Rheem	0	$ 20,000	$ 20,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,000
Packaged RTU (GEM #108823)	York	0	$ 25,000	$ 25,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 25,000
Packaged RTU (GEM #108824)	American Standard	4	$ 25,000	$ -	$ -	$ -	$ -	$ 25,000	$ -	$ -	$ -	$ -	$ -	$ 25,000
Packaged RTU (GEM #108825)	Trane	7	$ 15,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 15,000	$ -	$ -	$ 15,000
Packaged RTU (GEM #108826)	Lennox	1	$ 25,000	$ -	$ 25,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 25,000
Packaged RTU (GEM #108827)	York	0	$ 16,000	$ 16,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,000
Packaged RTU (GEM #108828)	Carrier	0	$ 75,000	$ 75,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 75,000
Air Rotation Unit (GEM #108833) [3]	Rapid	0	$ 50,000	$ 50,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 50,000
Liebert Split System [4]	Liebert	13	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Mini-split System [2]	Sanyo	0	$ 15,000	$ 15,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 15,000
Mini-split System	Quietside	5	$ 17,500	$ -	$ -	$ -	$ -	$ -	$ 17,500	$ -	$ -	$ -	$ -	$ 17,500
Chiller [4]	Thermal Care	15	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Condenser [4]	Keeprite	15	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cooling Tower	Marley	0	$ 75,000	$ 75,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 75,000
Total			**$ 452,500**	**$ 332,000**	**$ 25,000**	**$ -**	**$ -**	**$ 25,000**	**$ 17,500**	**$ 18,000**	**$ 35,000**	**$ -**	**$ -**	**$ 452,500**

FINANCIAL RISK ASSESSMENT

Summary - **10 Year Totals**		
Avoided Repair Risk [1, 2, 3, 4]	$	324,400
Avoided Energy Expense [1, 4]	$	26,688
Investment [1]	$	(452,500)

1. *Shown in present day dollars; not a guarantee of actual amount.*
2. *Projection to demonstrate the significant financial risk of keeping obsolete equipment in service; impossible to determine actual amount.*
3. *In addition, any risk associated with unscheduled outages, building shut-down, etc. should be carefully considered.*
4. *Value prorated per each piece of equipment, corresponding with replacement date in 10 Year Capital Plan.*