FEFPA 2024 Summer Conference

NSU Chiller Plant
"Sharks on Ice"
Design, Build, Operate and Maintain

Presented By:

Tony Shahnami, Bobby Shahnami, Eugene Vladoiu, Terry Watson, Charlie Ewing, Jonathan Miller

Continuing Education Provider- PE# 41204 CEU Accredited Reference for Earning 1 CEU

SGM ENGINEERING

NSU Florida
NOVA SOUTHEASTERN UNIVERSITY

Hill York
An EMCOR Company

YOUR PRESENTERS

Tony Shahnami

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Nova Southeastern University

Terry Watson

Nova Southeastern University

Johnathan Miller

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Charlie Ewing

Hill York

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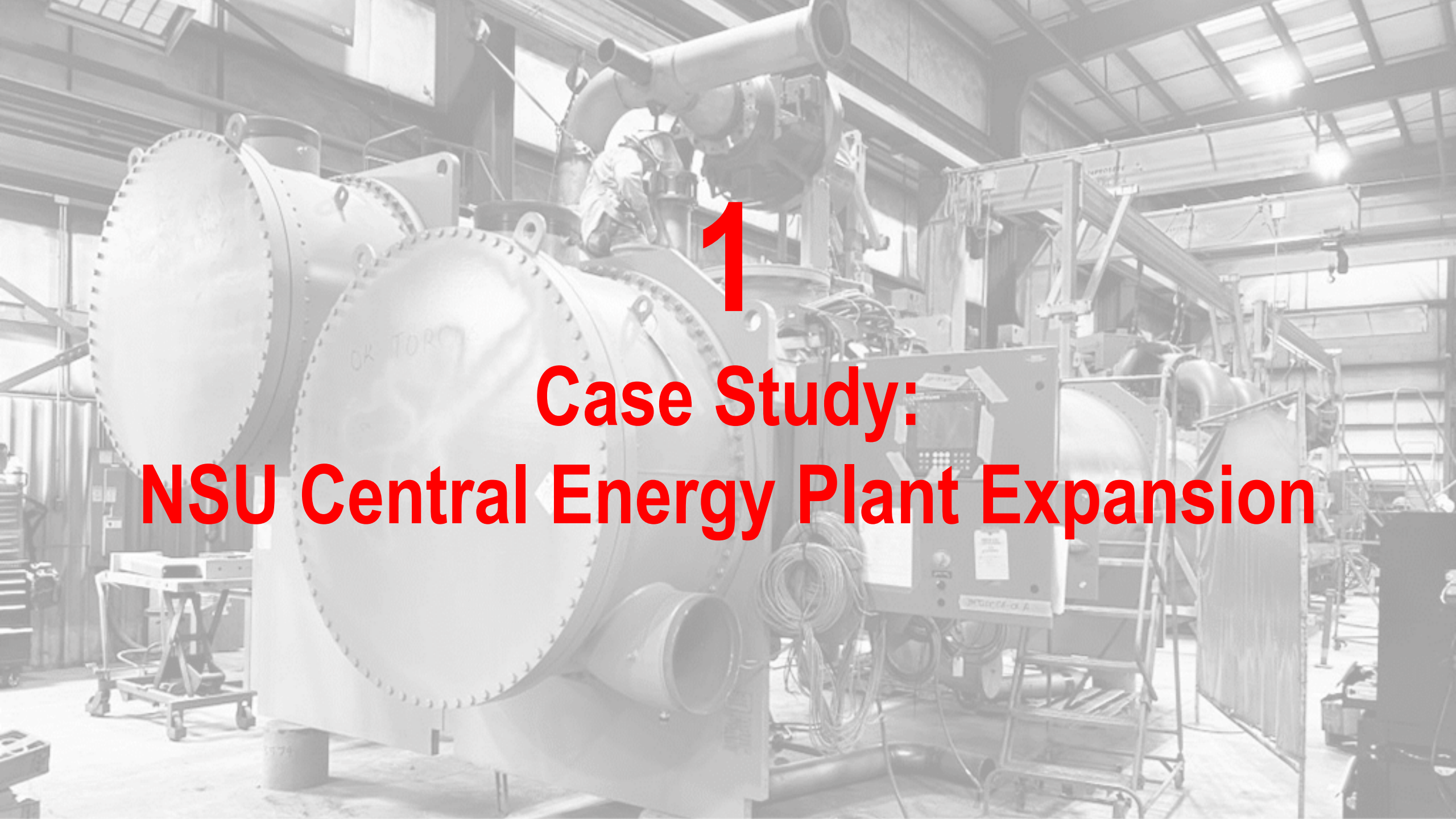


1

Case Study:
NSU Central Energy Plant Expansion

NSU Central Energy Plant Preventative Maintenance

1. Case Study: NSU Central Energy Plant Expansion

Project Summary: Central Energy Chiller Plant Expansion

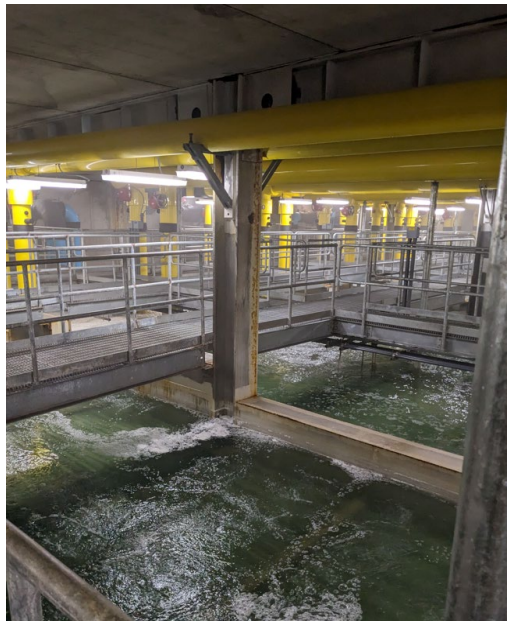
- The new chillers will supply HPD, the future Administrative Services Building, the Terry Building expansion, and the new Athletics building with chilled water cooling
- There are Three (3) existing York Ice Making Chillers with 2,300 Tons Each in Capacity
- Adding Two (2) Additional York Ice Making Chillers (received February 2024)
- Project Completion: December 2025

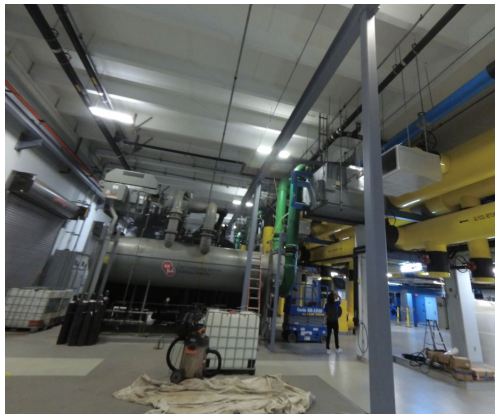
NSU Central Energy Plant Preventative Maintenance

1. Case Study: NSU Central Energy Plant Expansion

Project Summary: Central Energy Chiller Plant Expansion

- 68,000 Ton Hours Ice Storage
- Our chiller plant currently provides 70% of our cooling needs for the buildings on our main campus.
- Following completion of this project, we are looking to approach 90% of the campus supported by the NSU Central Energy Plant.





NSU Central Energy Plant Preventative Maintenance

1. Case Study: NSU Central Energy Plant Expansion

Project Summary: How much equipment are we looking at when the build out is complete?

a. (5) York Ice Making Chillers @ 1800 tons each (2300 nominal) 4160v
b. (74) Miles of Coils in Tank- (4) Tanks Total
c. 17,000 Ton Hours Per Tank
d. 365,000 Gallons Of Water Per Tank
e. (5) Massive Cooling Towers
f. (5) 200hp Glycol Pumps

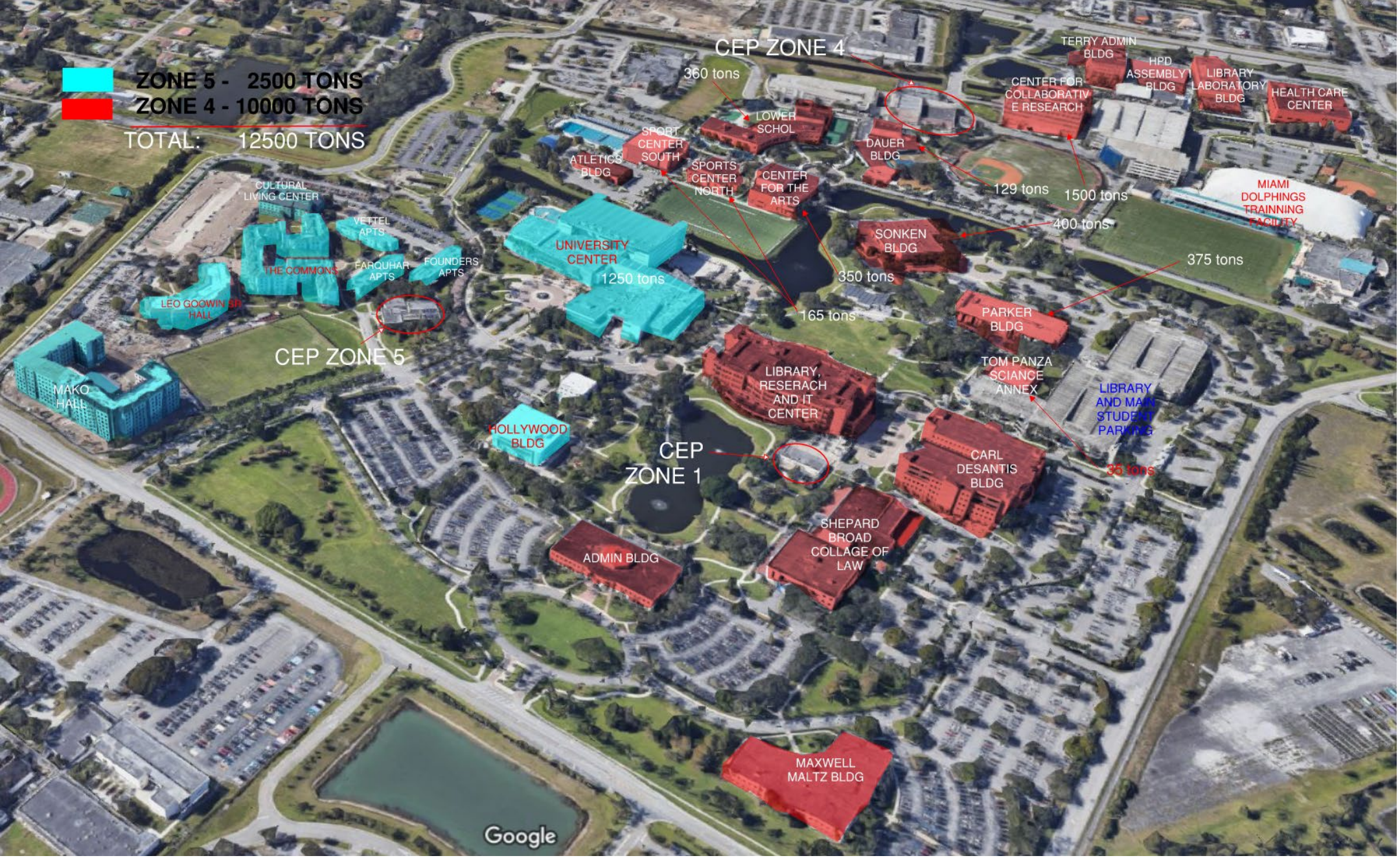
NSU Central Energy Plant Preventative Maintenance

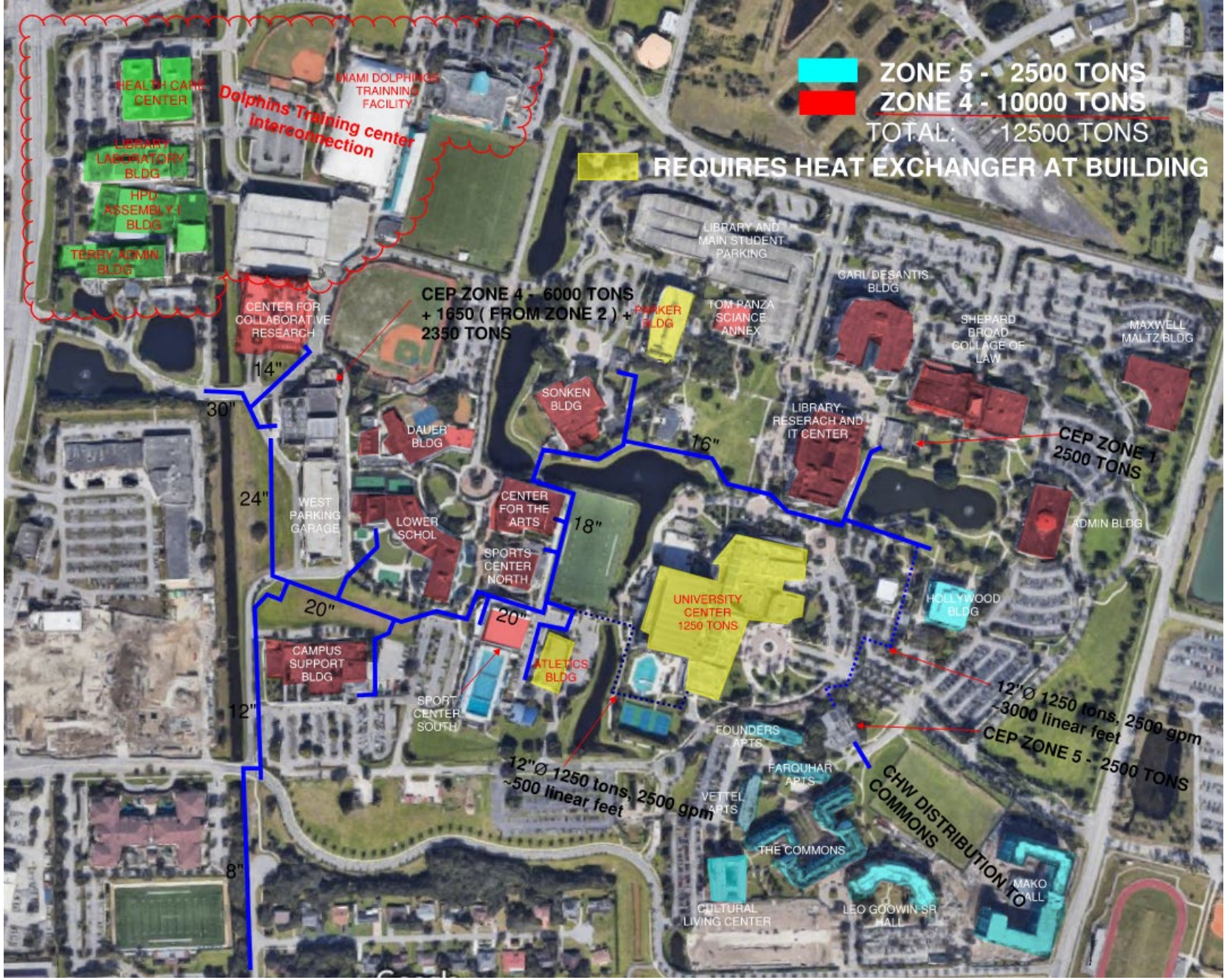
1. Case Study: NSU Central Energy Plant Expansion

Project Summary: How much equipment are we looking at when the build out is complete?

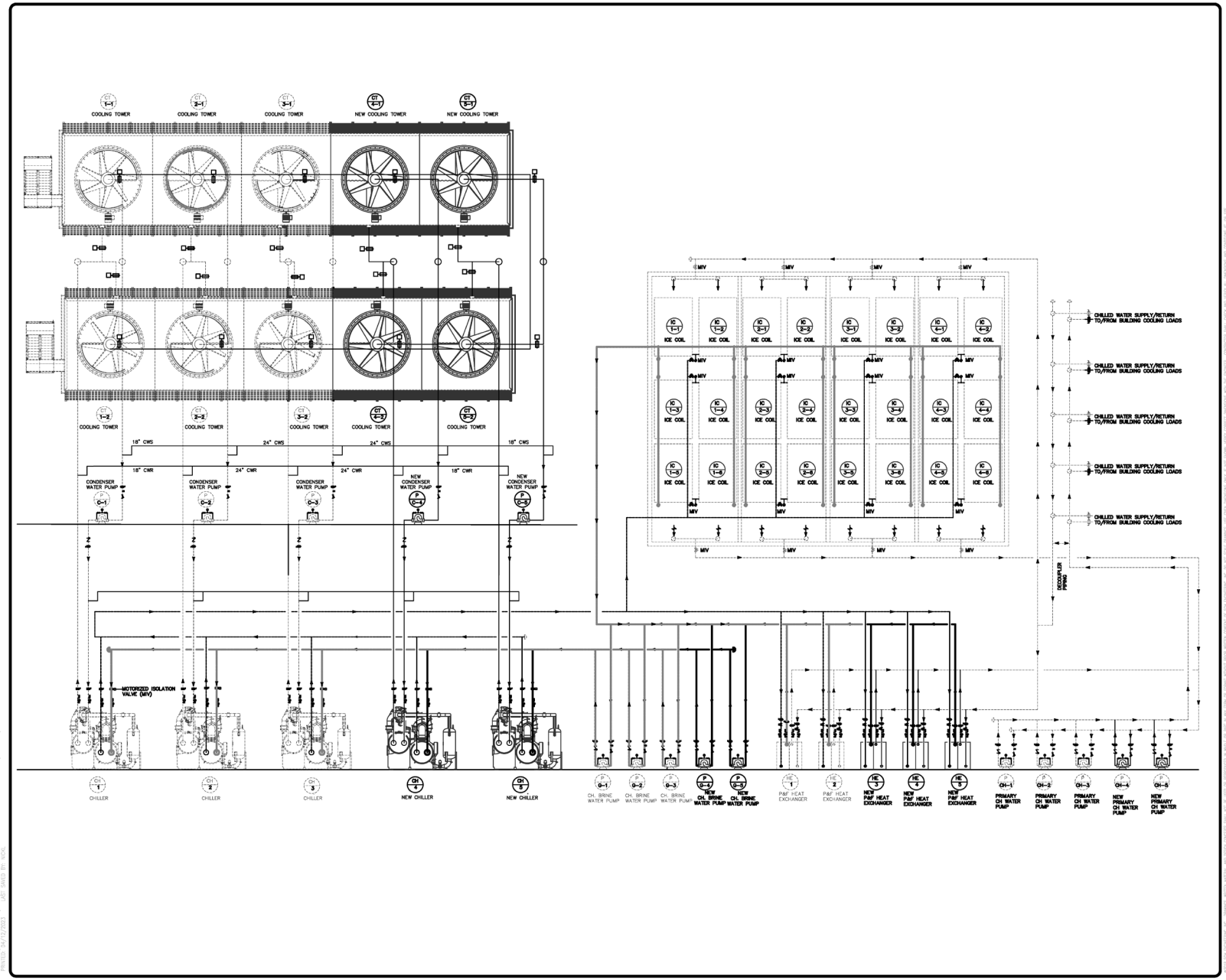
g. (5) 150hp Condenser Water Pumps
h. (5) 100hp Chilled Water Pumps
i. (1) Massive Spirotherm Filter
j. Actuators, Agitators, VFD's, Gearboxes, Motors....
k. Chlorine Dioxide Generator and Feed System.

New Spirotherm Generator


ZONE 5 - 2500 TONS
ZONE 4 - 10000 TONS
TOTAL: 12500 TONS
CEP ZONE 4
360 tons
LOWER SCHOL
SPORT CENTER SOUTH
ATLETICS BLDG
SPORTS CENTER NORTH
CENTER FOR THE ARTS
DAUER BLDG
129 tons
1500 tons
400 tons
SONKEN BLDG
350 tons
165 tons
375 tons
TERRY ADMIN BLDG
HPD ASSEMBLY BLDG
LIBRARY LABORATORY BLDG
HEALTH CARE CENTER
CENTER FOR COLLABORATIVE RESEARCH
MIAMI DOLPHINGS TRAINNING FACILITY
CULTURAL LIVING CENTER
VETTEL APTS
THE COMMONS
FARQUHAR APTS
FOUNDERS APTS
UNIVERSITY CENTER
1250 tons
LEO GOOWIN SR HALL
CEP ZONE 5
MAKO HALL
PARKER BLDG
LIBRARY, RESERACH AND IT CENTER
TOM PANZA SCIANCE ANNEX
LIBRARY AND MAIN STUDENT PARKING
35 tons
HOLLYWOOD BLDG
CEP ZONE 1
CARL DESANTIS BLDG
SHEPARD BROAD COLLAGE OF LAW
ADMIN BLDG
MAXWELL MALTZ BLDG
Google


ZONE 5 - 2500 TONS
ZONE 4 - 10000 TONS
TOTAL: 12500 TONS
REQUIRES HEAT EXCHANGER AT BUILDING
HEALTH CARE CENTER
MIAMI DOLPHINS TRAINNING FACILITY
Dolphins Training center Interconnection
LIBRARY LABORATORY BLDG
HPD ASSEMBLY I BLDG
TERRY ADMIN BLDG
CENTER FOR COLLABORATIVE RESEARCH
CEP ZONE 4 - 6000 TONS + 1650 (FROM ZONE 2) + 2350 TONS
PARKER BLDG
LIBRARY AND MAIN STUDENT PARKING
TOM PANZA SCIANCE ANNEX
CARL DESANTIS BLDG
SHEPARD BROAD COLLAGE OF LAW
MAXWELL MALTZ BLDG
SONKEN BLDG
DAUER BLDG
LIBRARY, RESEARCH AND IT CENTER
CEP ZONE 1 2500 TONS
WEST PARKING GARAGE
LOWER SCHOL
CENTER FOR THE ARTS
SPORTS CENTER NORTH
ADMIN BLDG
UNIVERSITY CENTER 1250 TONS
HOLLYWOOD BLDG
CAMPUS SUPPORT BLDG
ATLETICS BLDG
SPORT CENTER SOUTH
12"Ø 1250 tons, 2500 gpm ~3000 linear feet
CEP ZONE 5 - 2500 TONS
12"Ø 1250 tons, 2500 gpm ~500 linear feet
FOUNDERS APTS
FARQUHAR APTS
VETTEL APTS
CHW DISTRIBUTION TO COMMONS
THE COMMONS
MAKO HALL
CULTURAL LIVING CENTER
LEO GOOWIN SR HALL
14"
30"
24"
20"
20"
18"
16"
12"
8"


GLYCOL RETURN
5 TON



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Client Name:

NSU Florida

NOVA SOUTHEASTERN UNIVERSITY
3380 SW 7TH AVENUE
DAVIE, FLORIDA, 33314

Issue: 100% CD

No.	Date	Description
–	–	–

Project Name:
NSU ZONE 4 CHILLER PLANT EXPANSION

Drawing File Name: 1500-M401-2022437.DWG
Seal:
OMAR SHANNAN LICENSE No. 78419 STATE OF FLORIDA PROFESSIONAL ENGINEER

Project Number:	2022-437
Scale:	AS SHOWN
Design By:	WCN
Drawn By:	WCN
Checked By:	BBC
Engineer of Record:	OMAR SHANNAN
License Number:	FL78419

Sheet Name:
MECHANICAL FLOW DIAGRAM

Sheet Number:
M501

NSU Central Energy Plant Preventative Maintenance

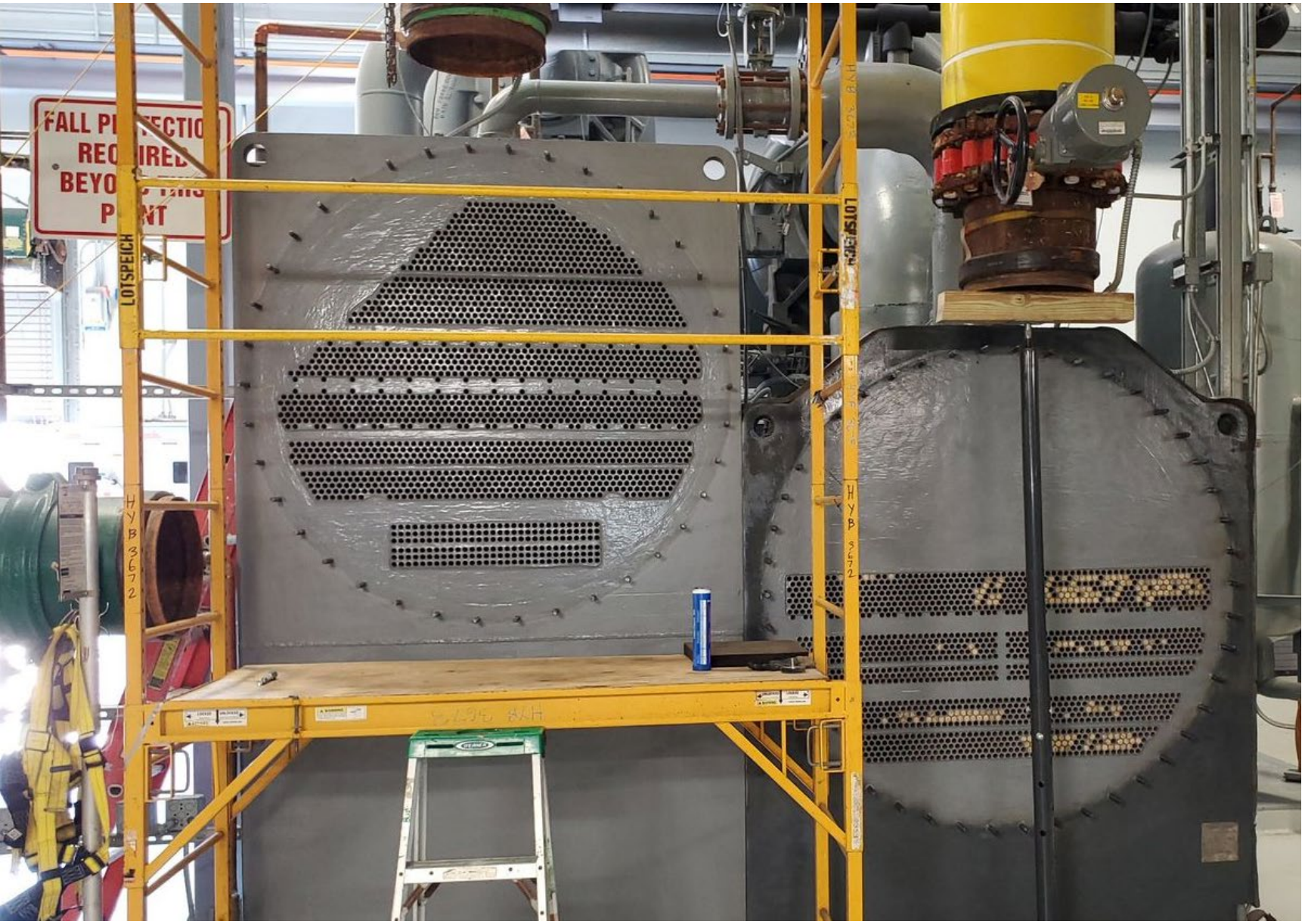
1. Case Study: NSU Central Energy Plant Expansion

Project Goal: To transition the utilization of NSU's make-up water for NSU's Central Energy Plant from domestic to reclaimed water through the local plant.

How It Was Done: Once it was determined that NSU was going to utilize the reclaim water provided by the town of Davie, we had to prepare the system.

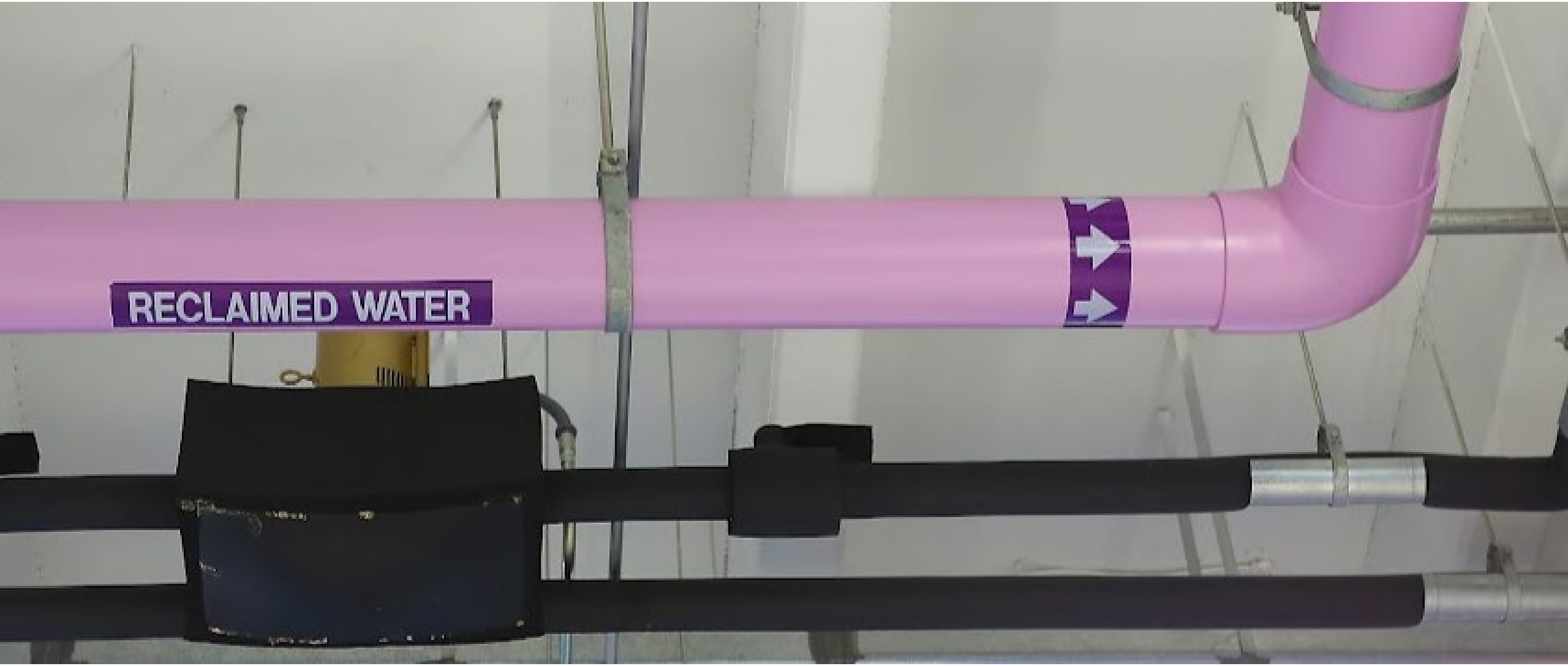
- Although the piping was there to bring it to the chillers, the chillers were not prepped to receive the reclaim water.
- So the first thing we did was during the chiller annuals we pulled both ends off and protected the tube sheets and ends with epoxy/Belzona
- We also performed baseline Eddy current test for both the evaporator and condenser.
- Additionally, we needed to measure the flow & pressure of the incoming reclaim water provided by the town of Davie for two reasons.
  - The first reason to validate the gallons that were going to be provided and billed for
  - The second was to have an indicator if flow/pressure was compromised so we could go back to city water without missing a beat.

Chiller #2 Tube Sheets Following New Epoxy



Chiller #2 End Bell Following New Epoxy

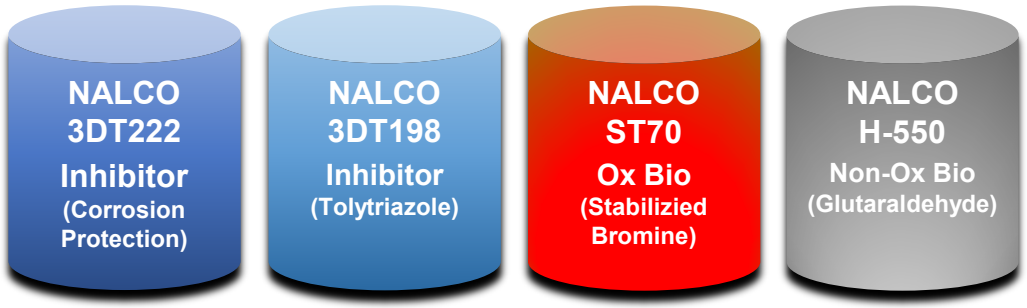
New Reclaim Water Piping in Zone 4 Plant



NSU Central Energy Plant Preventative Maintenance
Water Treatment Program Updates

Previous Water Treatment Program of 3 Condenser Water Systems

- Cooling Tower Make-up Water: CITY WATER
- Make-up Water Tendency: Corrosive
- Water Usage: 22,876,125 gal / year
- Associated Water Costs: $ 17.82 / 1,000 gal
- Total Yearly Water Cost: $ 407,744.05
- Water Treatment Program: Corrosion Protection

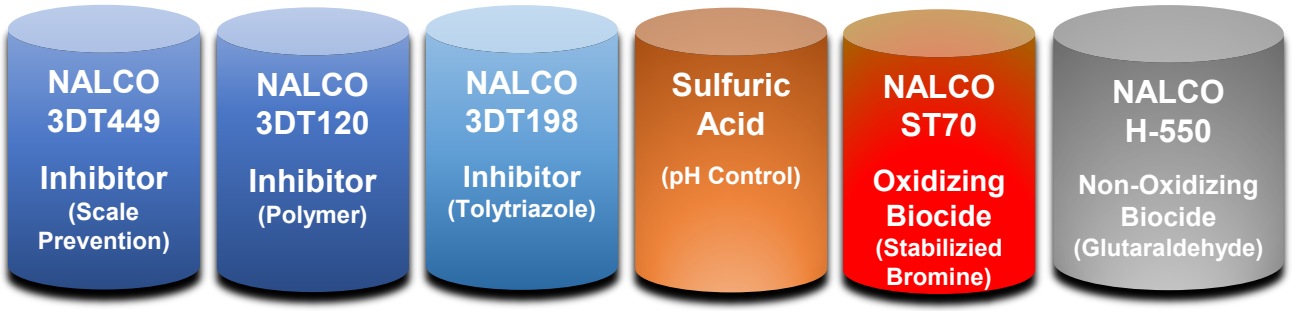


- **Water Treatment Vendor: NALCO Water**
- **Program Cost: $ 18,720.00**
- **Inhibitor Package: NALCO 3DT222 (Corrosion Protection)**
- **Additional Corrosion Inhibitor: 3DT198 (Tolytriazole)**
- **Primary Biocide: NALCO ST70 (Stabilized Bromine)**
- **Secondary Biocide: NALCO H-550 (Glutaraldehyde)**
- **Conductivity: 1,800 – 2,800 pH Range: 8.0 – 9.4**
- **3DT Trasar Range: 100 – 200**
- **Organic-Phosphate: > 3.0 Tolytriazole: > 3.0**
- **Chlorides: < 600 Alkalinity: < 450 Hardness: < 350**
- **Operating Cycles of Concentration: 5.0**

NSU Central Energy Plant Preventative Maintenance
Water Treatment

Current Water Treatment Program of 3 Condenser Water Systems

- Cooling Tower Make-up Water: RECLAIM WATER
- Make-up Water Tendency: Scale-Forming
- Water Usage: 36,601,800 gal / year
- Associated Water Costs: $ 0.29 / 1,000 gal
- Total Yearly Water Cost: $ 10,614.52
- Water Treatment Program: Scale Prevention



- **Water Treatment Vendor: NALCO Water**
- **Program Cost: $ 135,200.00**
- **Inhibitor Package 1: NALCO 3DT449 (Scale Prevention)**
- **Inhibitor Package 2: NALCO 3DT120 (Polymer)**
- **Corrosion Inhibitor: 3DT198 (Tolytriazole)**
- **pH Control: Sulfuric Acid (pH Control)**
- **Primary Biocide: NALCO ST70 (Stabilized Bromine)**
- **Secondary Biocide: NALCO H-550 (Glutaraldehyde)**
- **Conductivity: 1,200 – 1,600 pH Range: 6.8 – 7.4**
- **3DT Trasar Range: 30 – 80**
- **Ortho-Phosphate: < 40 Tolytriazole: > 3.0**
- **Chlorides: < 300 Alkalinity: < 200 Hardness: < 200**
- **Operating Cycles of Concentration: 2.0**

NSU Central Energy Plant Preventative Maintenance
Water Treatment

Cost Breakdown (FY2024)

- Previous Water Cost: $ 407,744.05
- Current Water Cost: $ 10,614.52
- Annual Water Savings: $ 397,129.53

- Previous Water Treatment Costs: $ 18,720.00
- Current Water Treatment Costs: $ 135,200.00
- Annual Water Treatment Increase: $ 116,480.00

	$ 397,129.53	(Annual Water Savings)
-	$ 116,480.00	(Additional Annual Water Treatment Costs)
	$ 280,649.53	(Overall Annual Savings)

NSU Central Energy Plant Preventative Maintenance

1. Case Study: NSU Central Energy Plant Expansion

Return on Investment (ROI): The total overall Return on Investment (ROI) for the transition from domestic water make up to reclaim water is anticipated to materialize 19 months from project start.

			Total Gallons	Tgals	Cost average of Water	$/Tgal 12month average	Annual Cost of Water w/ Water Treatment	$ Savings Reclaim V. Domestic	% Savings Reclaim V. Domestic
	Reclaim						*$135,200.00*		
	May-22		1,917,480	1,917.480	$533.06				
FY 23	July 22 - June 23		30,240,920	30,240.920	$8,406.98	$0.278	$143,606.98	$209,880.01	146.15%
FY 24	July 23- June 24		36,601,800	36,601.800	$10,614.52	$0.290	$145,814.52	$280,649.53	192.47%
	To date		2,515,744	2515.744	$729.57				
			71,275,944	**71,275.944**	**$20,284.12**				
	Domestic Water		Estimated 40% reduction in consumption compared to reclaim				*$18,720.00*		
	May-22			1198.425	$21,226.50				
FY 23	July 22 - June 23			18,900.575	$334,766.98	$17.712	$353,486.98		
FY 24	July 23- June 24			22,876.125	$407,744.05	$17.824	$426,464.05		
	To date			1572.34	$28,025.39				
				44,547.465	**$791,762.93**				

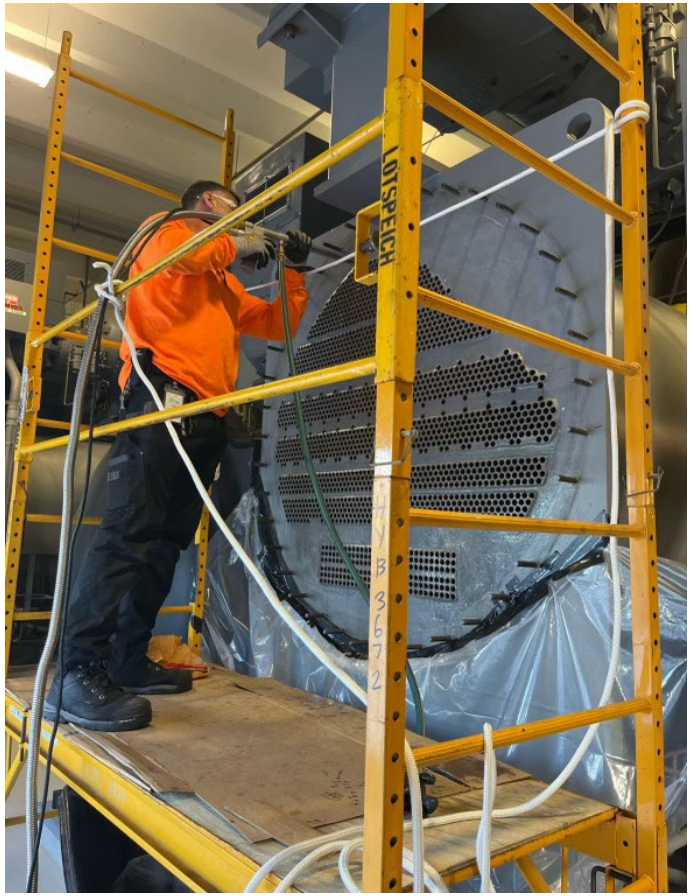
2

What are the goals of the NSU CEP preventative maintenance program?

NSU Central Energy Plant Preventative Maintenance

2. What are the goals of the NSU CEP preventative maintenance program?

- Minimize Unscheduled Downtime
- Keep Equipment Running Efficiently from an Energy Perspective
- Meet or Beat Manufacturers Estimated Life Cycle of The Equipment



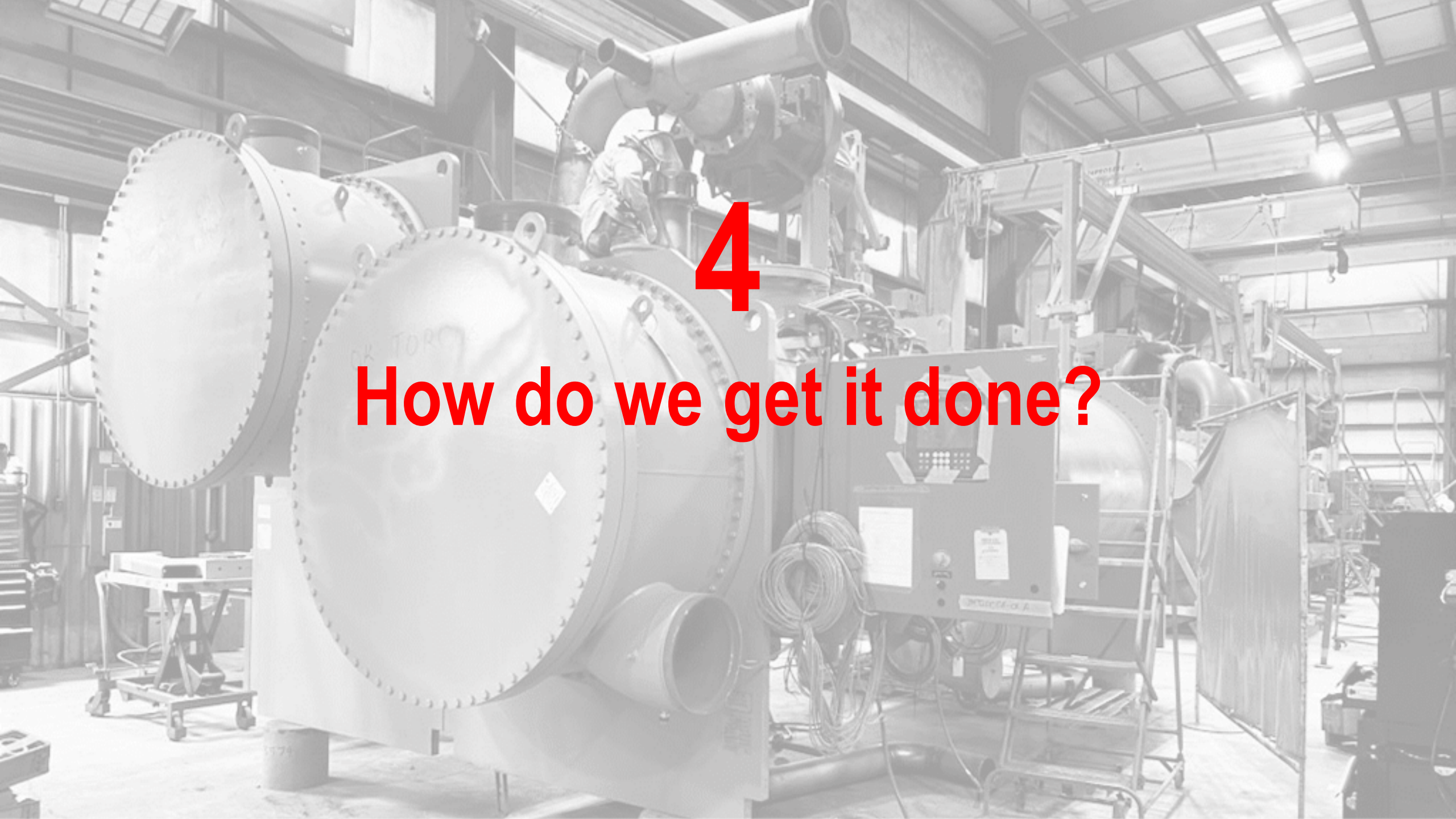
3

Predictive

NSU Central Energy Plant Preventative Maintenance

3. Predictive

- Forecast the future.
- Tools available today.
- Monitoring the chiller approach can help identify issues.
- Pressure transducers across the Spirotherm, wye strainer, and heat exchangers help predict the frequency of maintenance needed.
- The electricians also perform infrared analysis on the starters, bus bars, and breakers all to forecast the future and of course we also do the regular standard oil and refrigerant analysis compared to baseline.



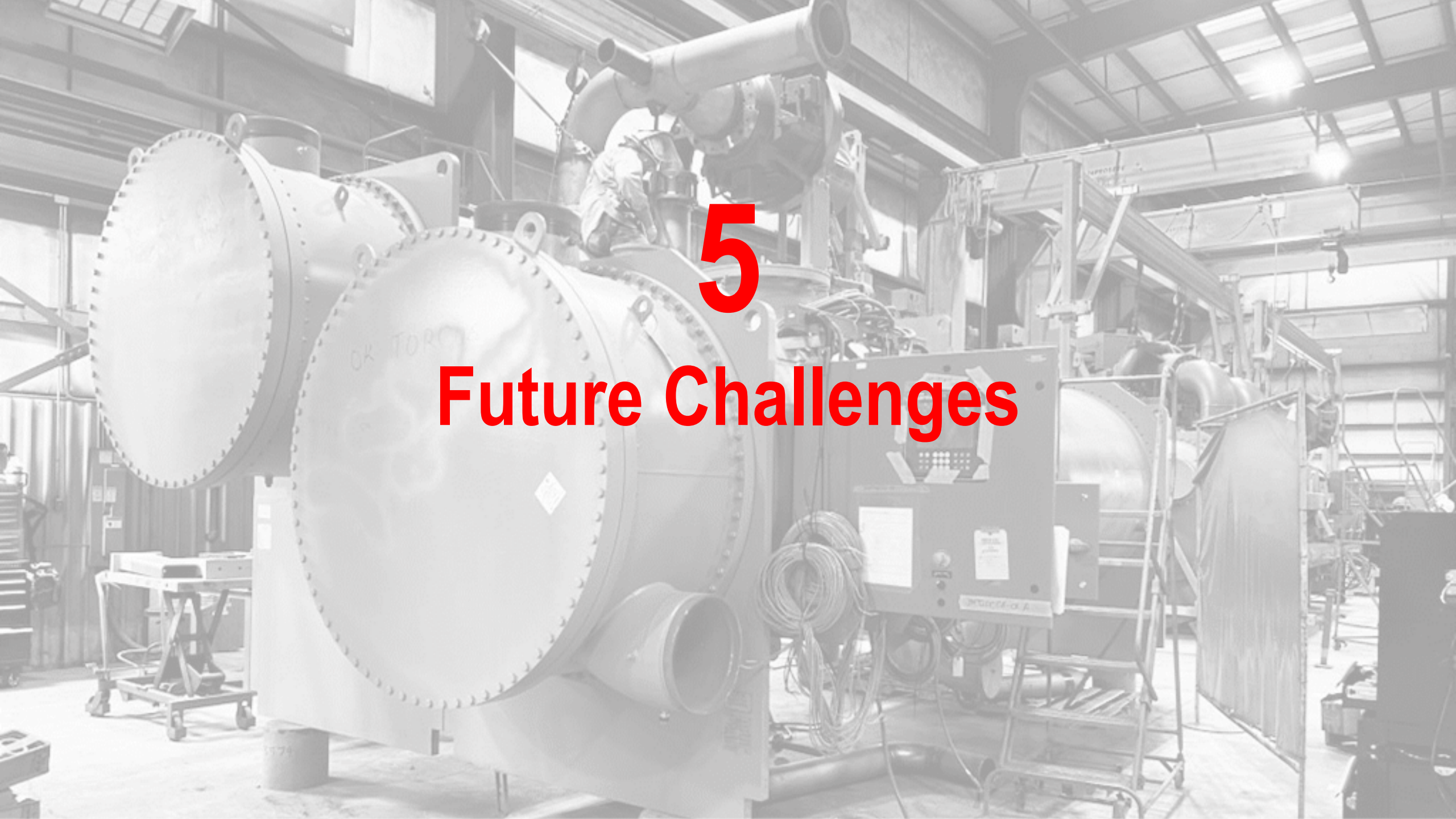
4

How do we get it done?

NSU Central Energy Plant Preventative Maintenance

4. How Do We Get it Done?

- Hill York has maintained this plant for the past 16 years with seasoned full time plant operators
- We bring in other resources to address a myriad of needs, preventative maintenance, and repairs.
- The plant takes more than 5,000 hours annually to service and maintain.
- We leverage the power of the Alerton building automation system to gather data and alert issues as they arise.
- The plant is a 24/7/365 responsibility that we are humbly entrusted with.

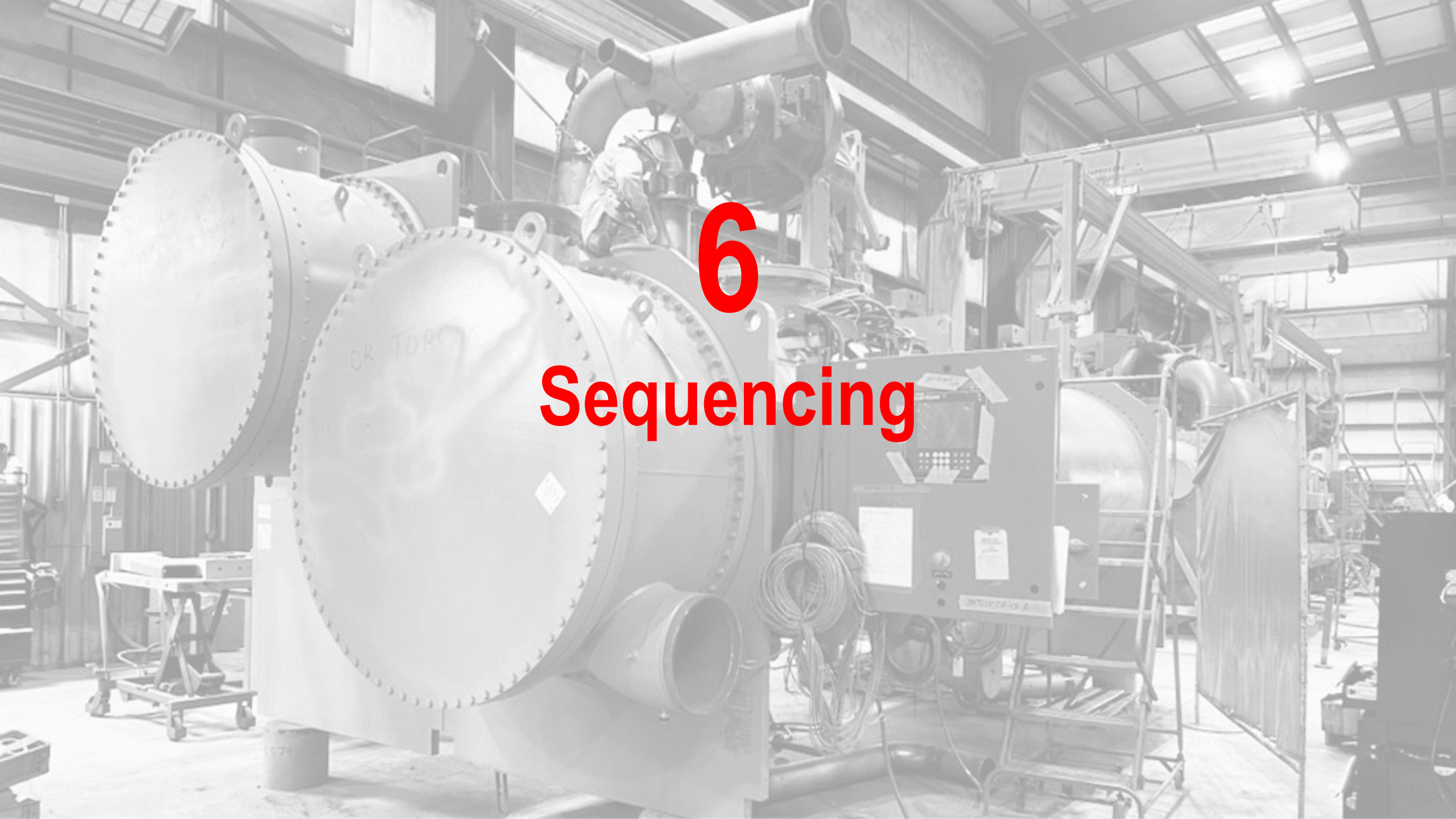


5
Future Challenges

NSU Central Energy Plant Preventative Maintenance

5. Future Challenges

- Flexibility
- Reclaimed Water
- Additional load
- Plant age and maturity



6
Sequencing

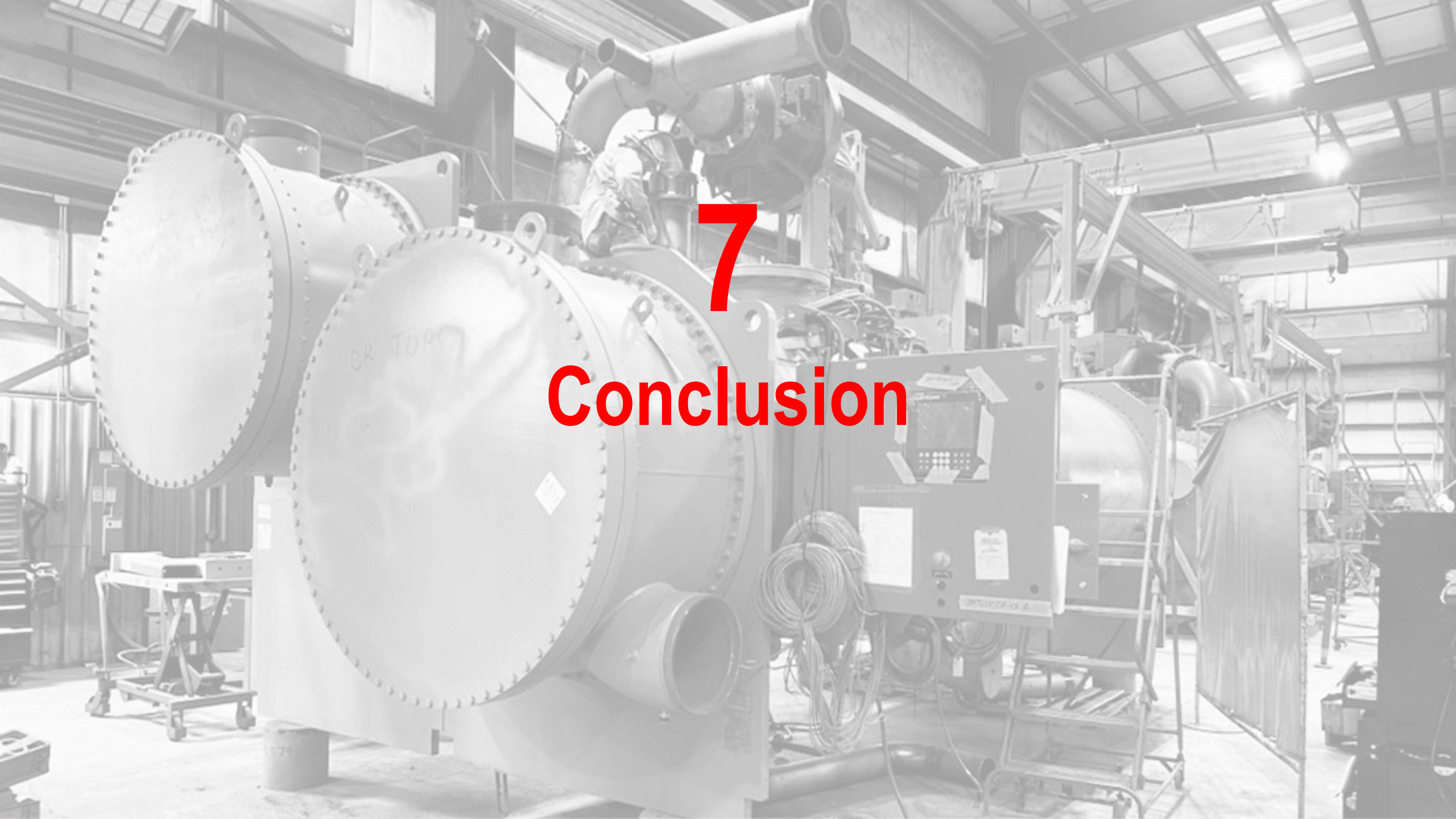
NSU Central Energy Plant Preventative Maintenance

6. Sequencing

Make sure the sequence of each task is scheduled correctly.

Phasing:

- Make sure all relationships are accurate.
- Participation from ALL contractors, suppliers and stakeholders is required to successfully schedule, phase and sequence a project.
- Procurement of materials is important.
- Weekly updates and managing milestones.
- Don’t plan to finish on the last day.



7
Conclusion

NSU Central Energy Plant Preventative Maintenance

7. Conclusion

Critical Factors:

- Exceptional project team
- Define goals and objectives
- Communication
- Weekly updates and managing milestones
- Safe & sustainable

Building of Chiller # 5 Progress
May 13, 2024

Building of Chiller # 5 Progress
May 13, 2024

Building of Chiller # 5 Progress
May 11, 2024

Building of Chiller # 5 Progress
May 11, 2024

Building of Chiller # 5 Progress
May 11, 2024

Building of Chiller # 5 Progress
May 11, 2024

Building of Chiller # 5 Progress
May 11, 2024

CT Material Delivery
June 17, 2024

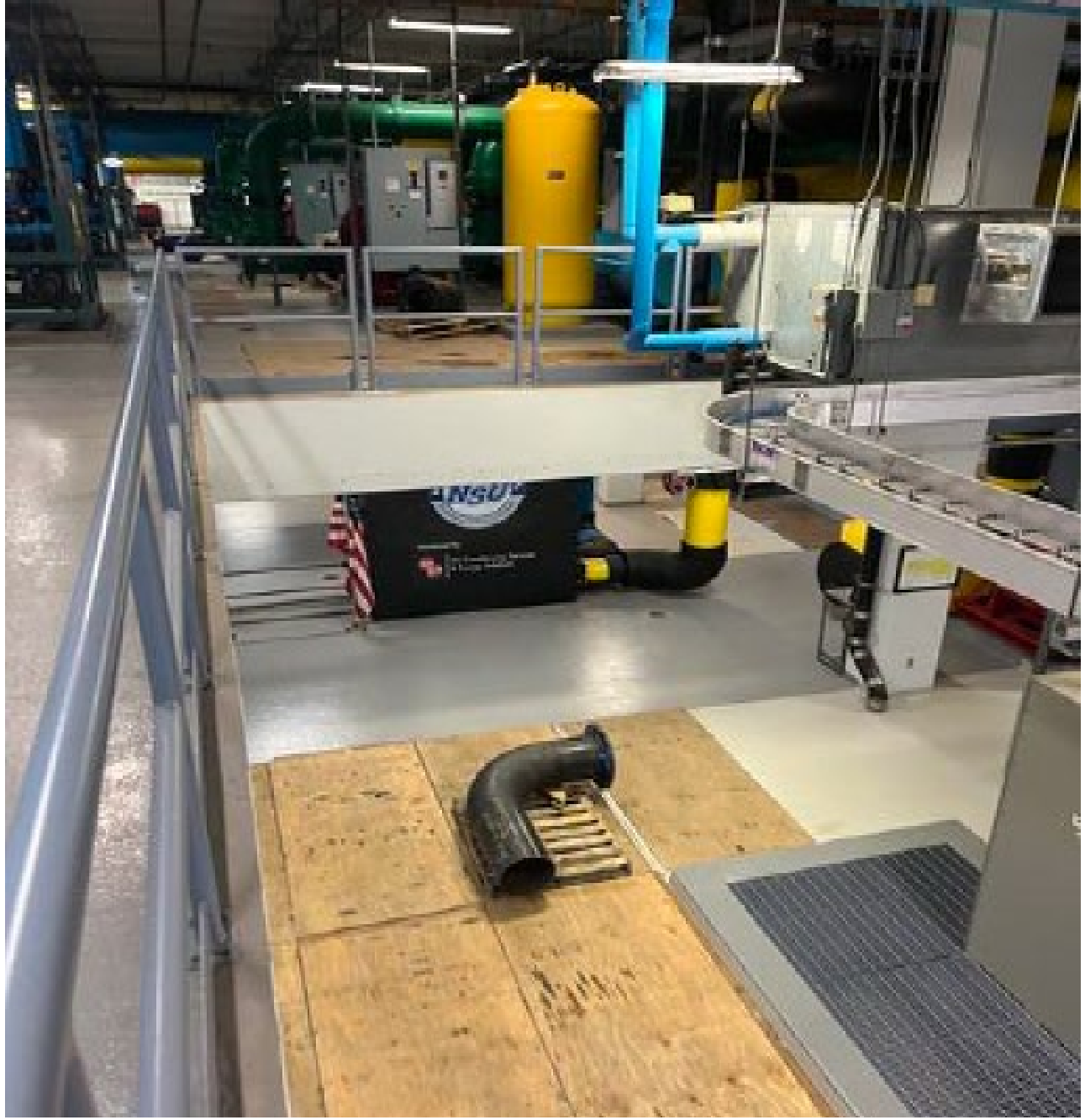
CT Material Delivery
June 17, 2024

CT Material Delivery
June 17, 2024

Pump Delivery
May 6, 2024

Pump Delivery
May 6, 2024

Pump Delivery
May 6, 2024



Set CDW Pumps
May 6, 2024

Set CDW Pumps
May 16, 2024

Set CHW Pumps
June 4, 2024

Set Glycol Pumps
June 4, 2024

Set Glycol Pumps
June 17, 2024

Set CDW Pumps
June 4, 2024

Set CDW Pumps
June 4, 2024

Set CDW Pumps
June 4, 2024

Set CDW Pumps
June 4, 2024

Set CDW Pumps
June 4, 2024

Set CHW Pumps
June 17, 2024

Set Glycol Pumps
June 17, 2024

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THANK YOU!

Questions & Answers

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NSU Central Energy Plant Preventative Maintenance

1. Case Study: NSU Central Energy Plant Expansion

Transition: The effort to accomplish this transition started with chiller #2, which was completed in April 2022.

- During this first month, we utilized 50,705 gallons of reclaim water that would have otherwise been used as domestic.
- Out of an abundance of caution and as recommended by NSU's water treatment consultant, H2Omeyer, the team had decided to initiate reclaim water transition to only one system (chiller #2) on a trial basis for a duration of three (3) months.
- After the trial period, chiller #2 was opened and inspected for any damage from corrosion and/or deposition.
- Initiating the one chiller trial basis impacted the return on investment (ROI) but some of the expenses were "one-time costs" that would either be incurred anyway (annuals, Eddy current testing) or apply to all three (3) chillers in preparation for reclaim feed.