



## **INTEGRATING** COGENERATION INTO A HISTORIC ARMY PROVING GROUND



# **IDEA**2017

## Sustaining Our Success

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108<sup>TH</sup> ANNUAL CONFERENCE & TRADE SHOW  
June 26-29 | Fairmont Scottsdale Princess | Scottsdale, AZ

# Introduction

**New Combined Heat and Power (CHP) Plant built adjacent to an existing WWI era boiler plant servicing the Aberdeen Proving Ground Edgewood Area**

**\$40 Million construction project funded through an Energy Savings Performance Contract (ESPC) executed by Johnson Controls, Inc.**

**Construction completed during the Fall of 2016**

**Annual Energy and Cost Savings:**

- **CO<sub>2</sub> Reduction: 22,571 tons**
- **Cycle Efficiency: 74%**
- **Cost Savings: \$4.5 Million**

# Facility Background



**Aberdeen Proving Ground was established in 1917 and is the U.S. Army's oldest active proving ground**

**Edgewood Area, the site of the new CHP Plant, is located 10 miles south of Aberdeen and was originally built to develop and test chemical agent munitions**

**The site is ~13,000 acres and is located along the Western Shore of the Chesapeake Bay**

**The facility is primarily used for research and development of non-medical chemical and biological defense**

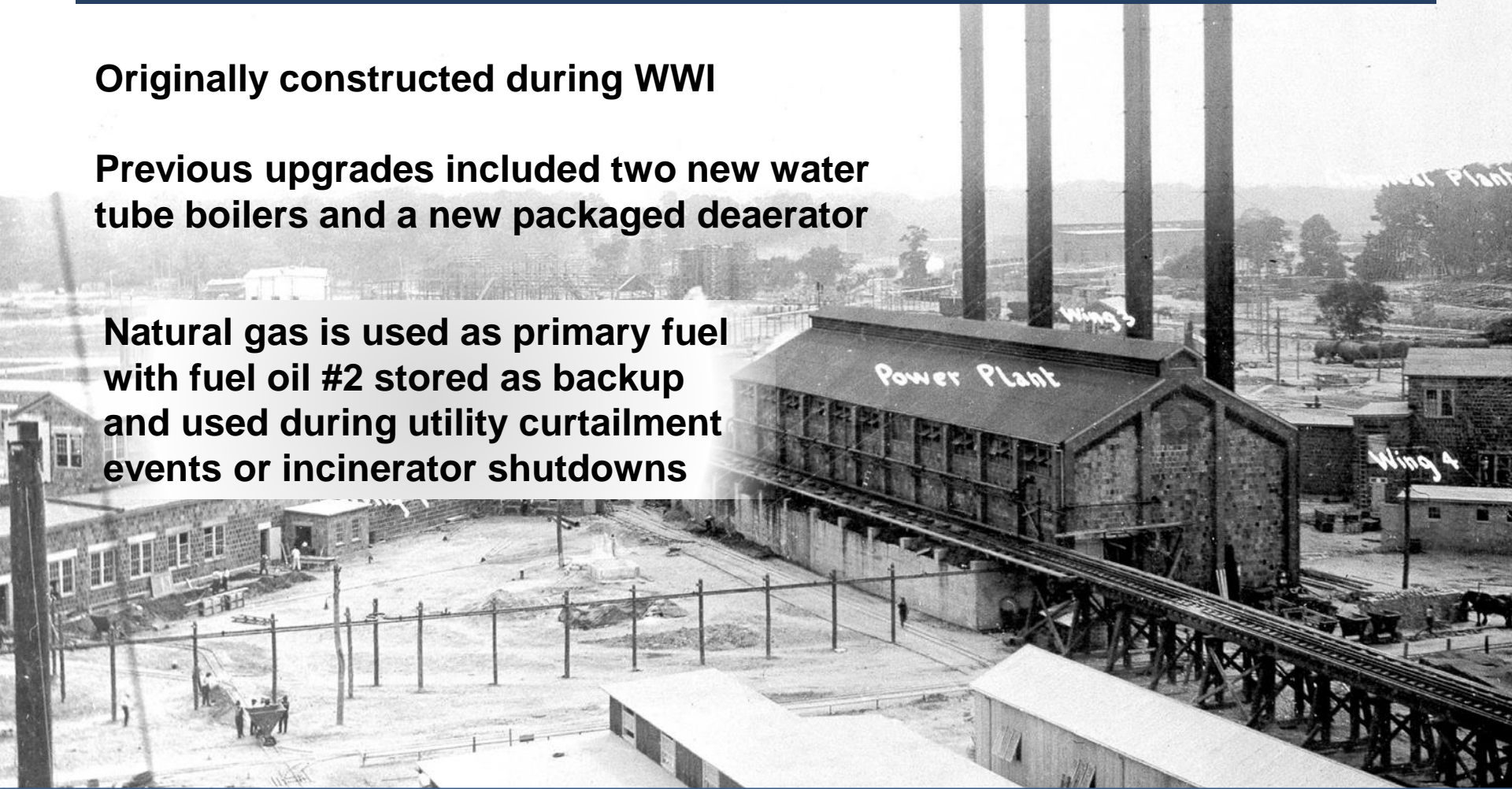


# Existing Boiler Plant

**Originally constructed during WWI**

**Previous upgrades included two new water tube boilers and a new packaged deaerator**

**Natural gas is used as primary fuel with fuel oil #2 stored as backup and used during utility curtailment events or incinerator shutdowns**



# Existing Steam System Limitations

- **Ageing boiler plant with capacity limitations**
- **Army previously purchased supplemental steam from a local county waste incinerator**
- **Incinerator required significant capital investment to remain operational and Army was not willing to renew an agreement**





# Project Mission

With plans to shut down the local incinerator, the army sought a sustainable solution to meet the following goals:

- Increase the boiler plant steam generation capacity to provide an additional 95,000 lb/hr of 350 psig steam to the facility
- Meet the Army's Net Zero Initiative
- Increase operating flexibility and thermal resiliency
- Minimal impact to the local community

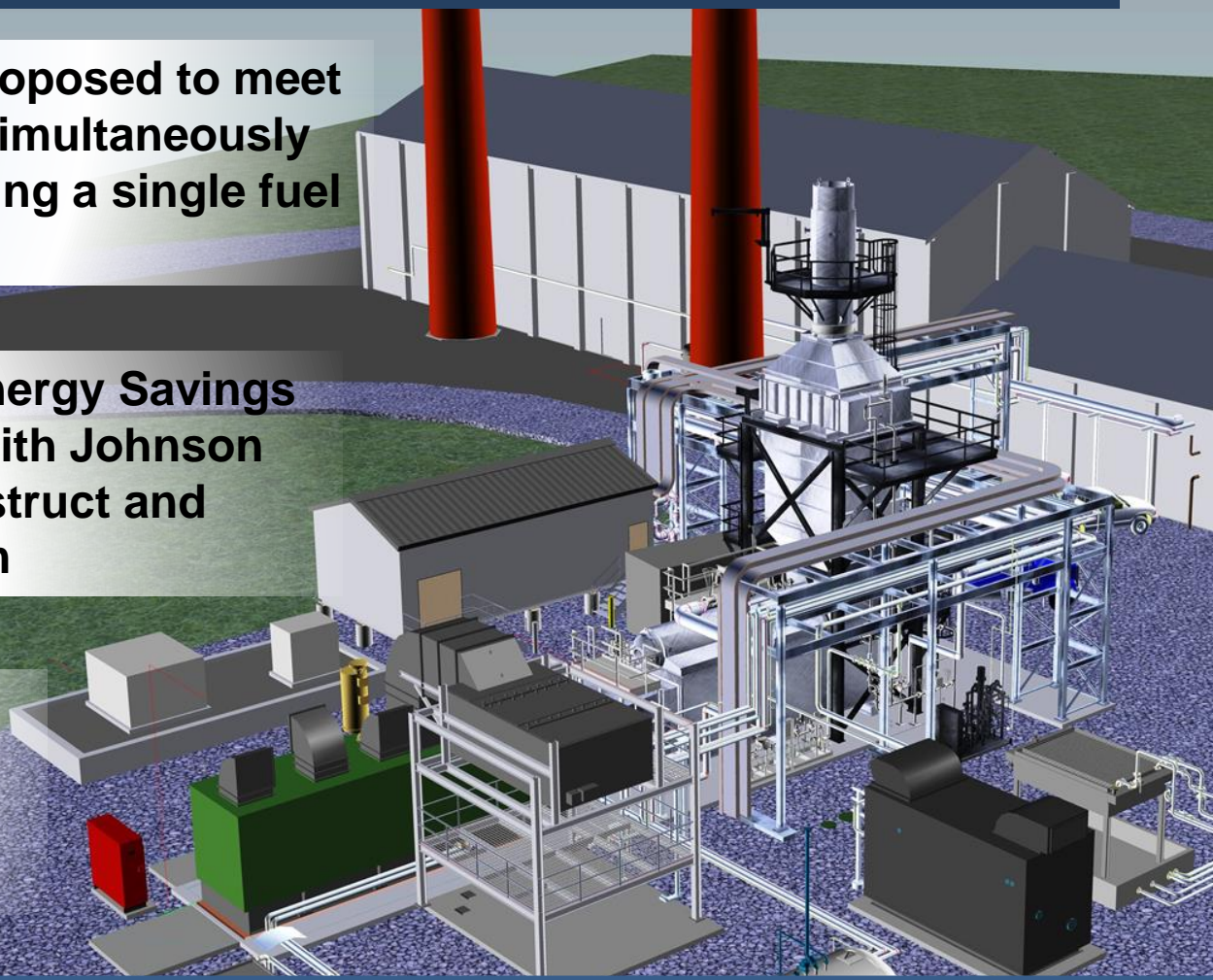


# Project Execution

**A new CHP Plant was proposed to meet the steam needs while simultaneously producing electricity using a single fuel source**

**The Army entered an Energy Savings Performance Contract with Johnson Controls to design, construct and maintain the new system**

**Additional funding was provided from grants from the DOE and the local utility BGE**

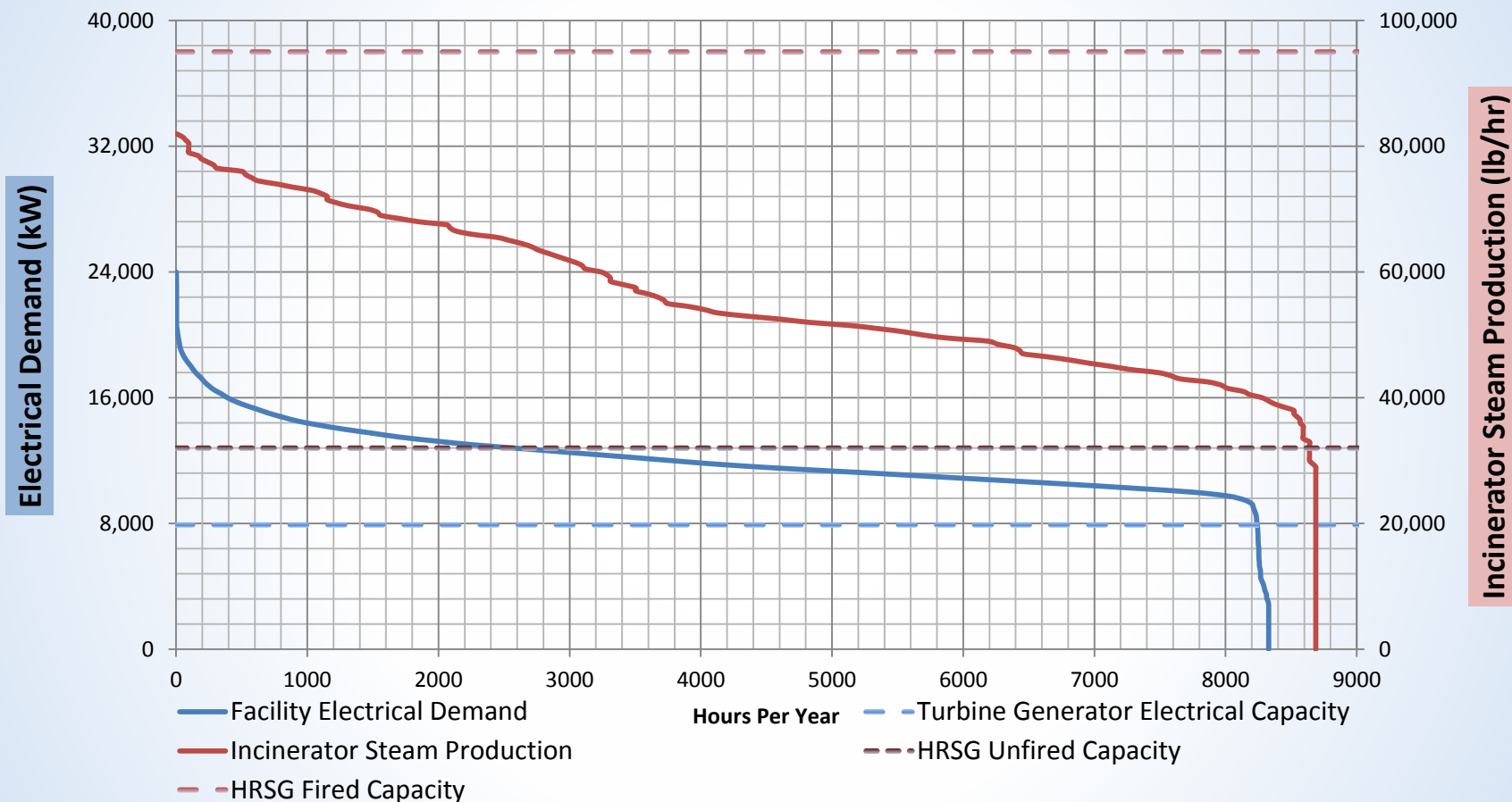


# Facility Utilities: Electrical & Thermal Loads

- **Electricity is provided to the Post via two 33 kV feeders**
- **Electrical Infrastructure is owned and maintained by a private company**
- **Site electrical load ranges from approximately 8 to > 20 MW**
- **350 and 125 psig steam is distributed throughout the facility**
- **Steam load ranges from approximately 30,000 – 140,000 lb/hr**
- **No central chilled water system**



# Facility Electrical Demand and Incinerator Steam Production Load Duration Curves



# New Combined Heat & Power Plant

**The new CHP prime mover was selected based on the facility's base electric and thermal loads**

**Nominal 7.9 MW dual fuel combustion turbine generator**

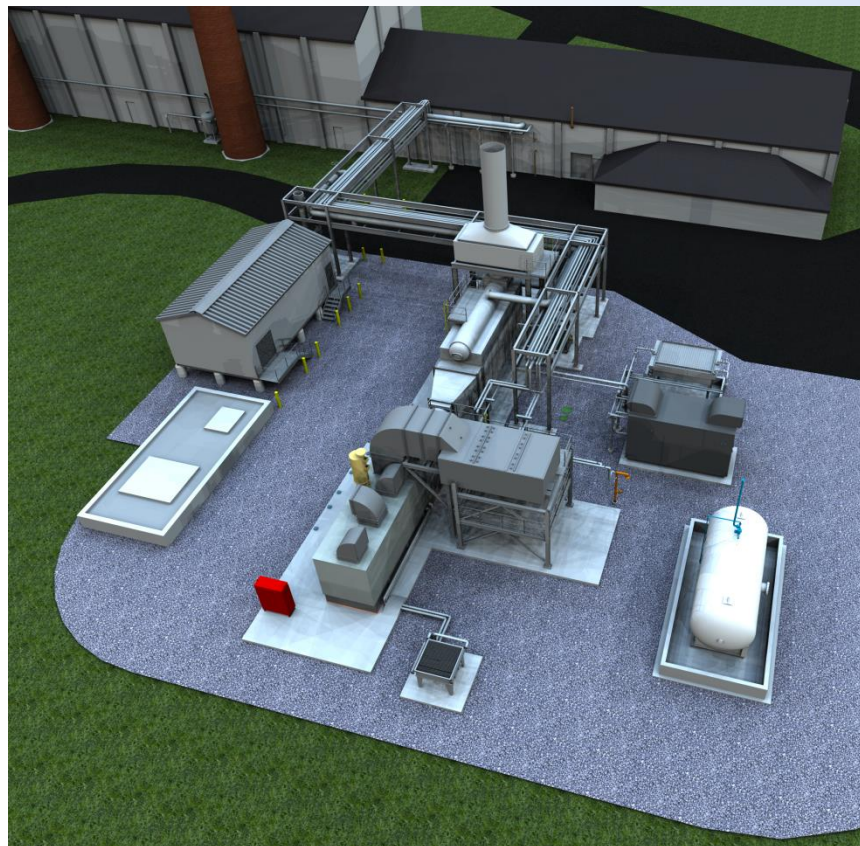
**Heat recovery steam generator (HRSG) with natural gas duct burners**

**Selective Catalytic Reduction (SCR)**

- Ammonia storage & forwarding pumps
- Vaporization and injection system

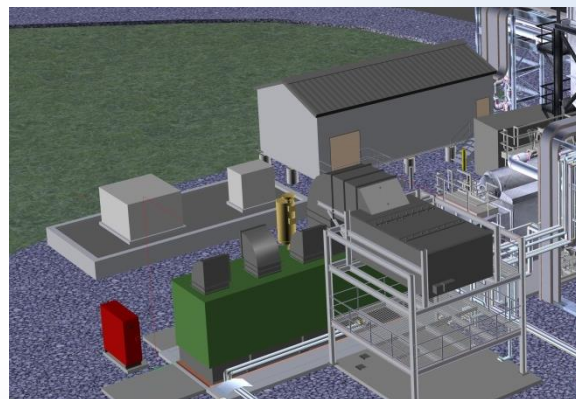
**Prepackaged fuel gas compressor**

**New CHP Plant installed outdoors due to existing plant conditions and new equipment footprint**



# Electrical Upgrades and Utility Interconnection

- **New Integrated Power Assembly to contain 4,160v switchgear, motor control center, control system hardware**
- **CHP project was relying on the installation of new a 33 kV switchgear lineup to be installed as part of separate project; however, funding was delayed**
- **New 33 kV switchgear was added to the CHP project to tie into the existing system**
- **Electrical interconnect required coordination with both the private company owning the facility's electrical infrastructure and the local utility**





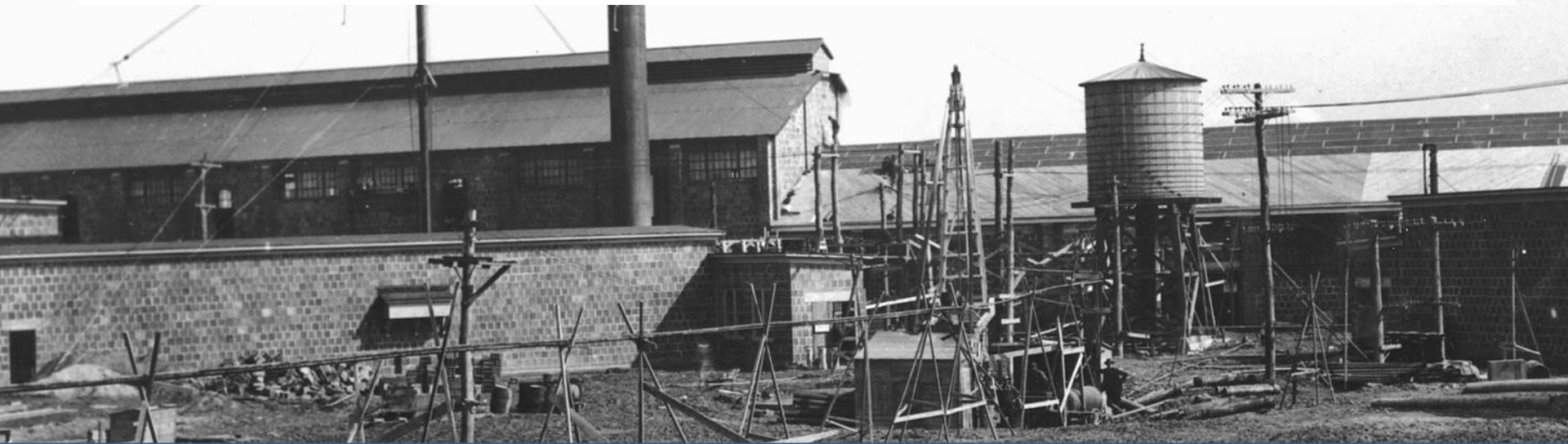
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# Site Challenges

**During the 1980s the site was added to the EPA's national priorities list for most serious uncontrolled or abandoned hazardous waste sites**

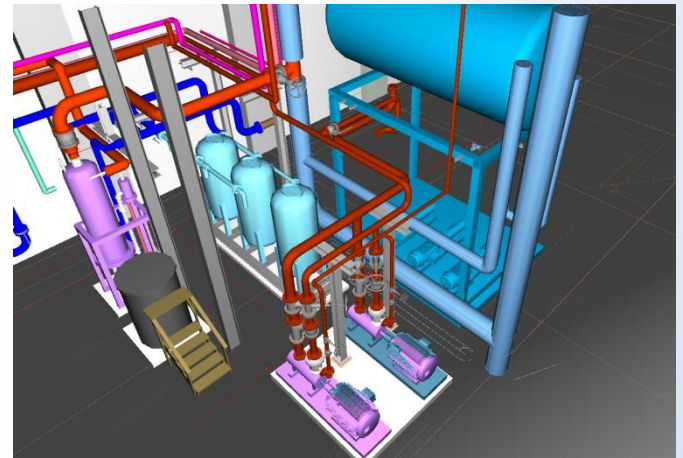
**Existing boiler plant water treatment system was completely replaced and new design considered a range of aquifer water vs. wells and surface water**

**Existing boiler plant auxiliary equipment required significant upgrades**



# Boiler Plant Upgrades

- Replaced water softening equipment and installed a new condensate polishing package
- Replaced boiler chemical feed system
- Installed new intermittent and continuous blowdown skids to serve the new HRSG
- Installed new Boiler Feedwater Pumps adjacent to the existing packaged deaerator
- New CHP Plant Control System (PCS) Integration





# Fuel Oil System Upgrades

Existing fuel oil system consists of two large above ground fuel oil tanks

The system was split such that one tank remained to serve the existing boilers and the other tank was retrofitted to serve the new turbine with higher grade ultra low sulfur diesel

## Tank retrofits included:

- Floating suction installed within the existing tank
- Fuel oil pumps
- Fuel oil filter and conditioning skid

# Lessons Learned

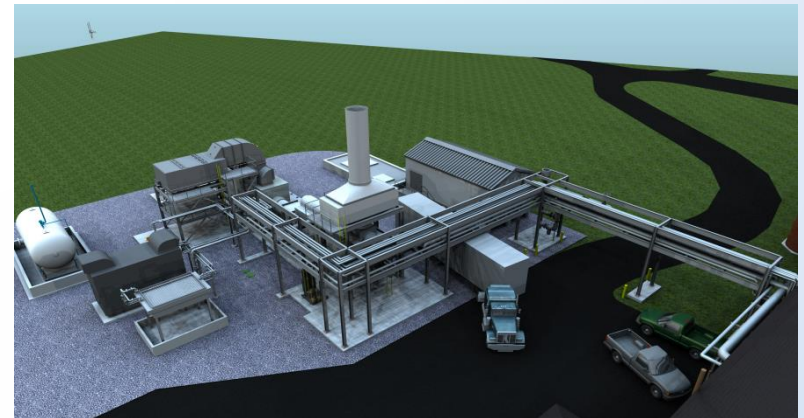
**Reliance on another parallel project for upgrades to equipment critical to the project mission can cause significant impact to project cost and schedule**

**Maintain constant contact with utilities as requirements can change through the life of the project**

**Understanding of site existing conditions**

**Dual fuel functionality provides greater thermal resiliency but will impact air emissions and permitting**

**CHP Projects are not typical building system energy efficiency projects and require a different approach for scheduling procurement of equipment and contractors**



# QUESTIONS?



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