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# Hanford Vit Plant: Ensuring data security at the world's largest radioactive waste treatment plant

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PI / Waterfall Administrator

**AVEVA**



# Waste Treatment Plant



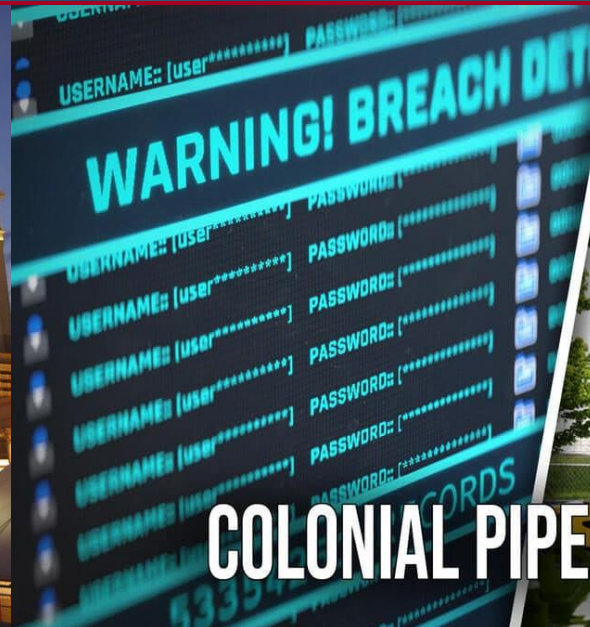
## Ensuring Data Security at the World's Largest Radioactive Waste Treatment Plant

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# What does Data Security mean in your Organization?



**COLONIAL PIPELINE BREACH**



**FEATURE STORY**

**MGM RESORTS CYBER ATTACK  
LAS VEGAS**



**solarwinds**



# 1942 - 1987



## ■ History of Hanford <sup>1</sup>

- Manhattan Project begins
- 586 sq mi of land in Eastern WA
- Startup in the early 1940s
- Production stopped in 1987
- Cleanup begins at Hanford Site



<sup>1</sup> <https://www.hanford.gov/page.cfm/HanfordHistory>  
photo - <https://www.hanfordchallenge.org/whatishanford>

# Hanford Waste Treatment Plant



- Hanford Waste Treatment Plant <sup>3</sup>
  - Bechtel contracted to build Waste Treatment Plant
  - The Waste Treatment Plant spans 65 acres on the central part of the site
  - Massive scale
    - 5x the size of the system at Savannah River <sup>4</sup>
- What is Vitrification <sup>2</sup>
  - Vitrification is accomplished by mixing waste from Hanford's underground tanks with glass-forming materials in high-temperature melters. As the materials are heated to 2,100 degrees Fahrenheit, the waste is incorporated into the molten glass. This “liquid glass” is poured into stainless steel canisters to cool.

Photo - <http://www.energyca.org/site-profiles/hanford-site>

<sup>2</sup> <https://www.hanfordvitplant.com/vitrification-101>

<sup>3</sup> <https://www.hanfordvitplant.com/vit-plant-faq>

<sup>4</sup> <https://melterheatup.hanfordvitplant.com/melters-101/>

# PI System at Hanford Waste Treatment Plant

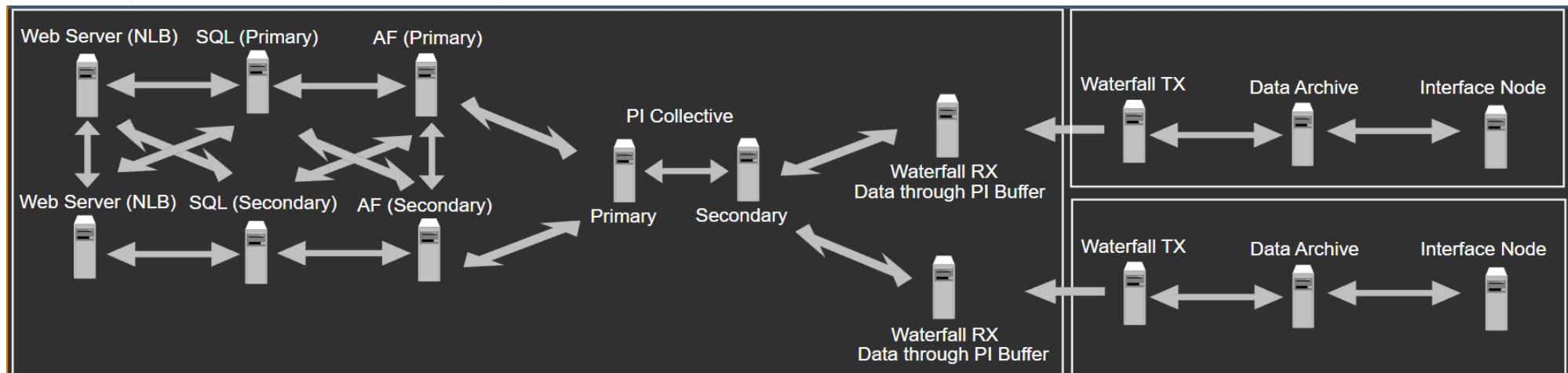


- <https://melterheatup.hanfordvitplant.com/https://melterheatup.hanfordvitplant.com/>



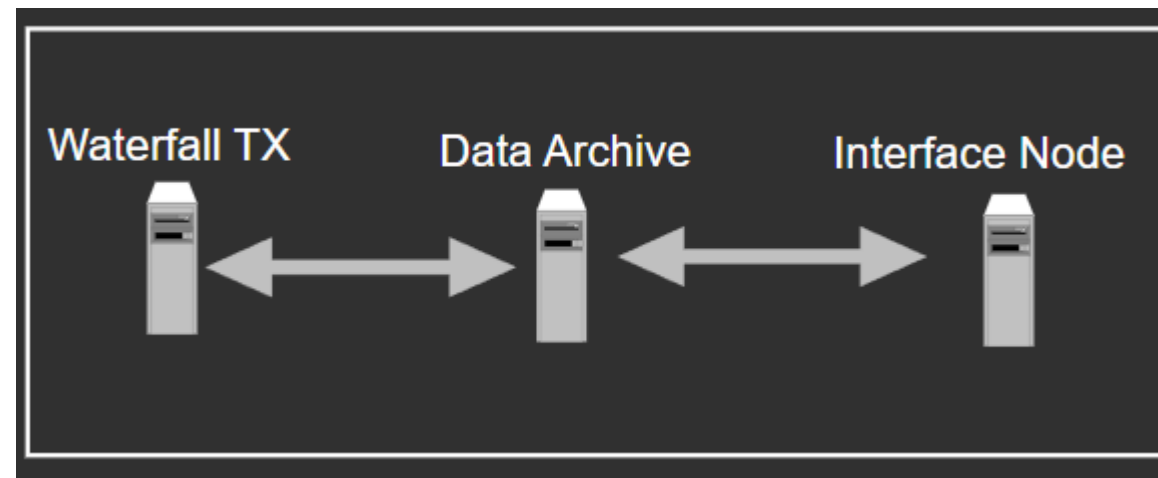
# Mitigating Risk of Cyber Attacks

- How do you keep your Operations and Data Secured?
  - Control system network isolation
  - Disaster recovery
  
- Isolated Control System Network
  - Completely internal to the plant
  - No connections to the outside world
  
- Production Network
  - Secured through MFA



# Isolated Control System Network

- Two redundant networks in separate data centers
- AVEVA PI Interface server
  - Collects all data from the control system historian servers
  - OPCDA
  - RDBMS
- AVEVA PI Server data archive
- Waterfall TX Server
  - Receives data and sends across the unidirectional gateway to the Waterfall RX server





# Bridging the Gap with Waterfall Solutions

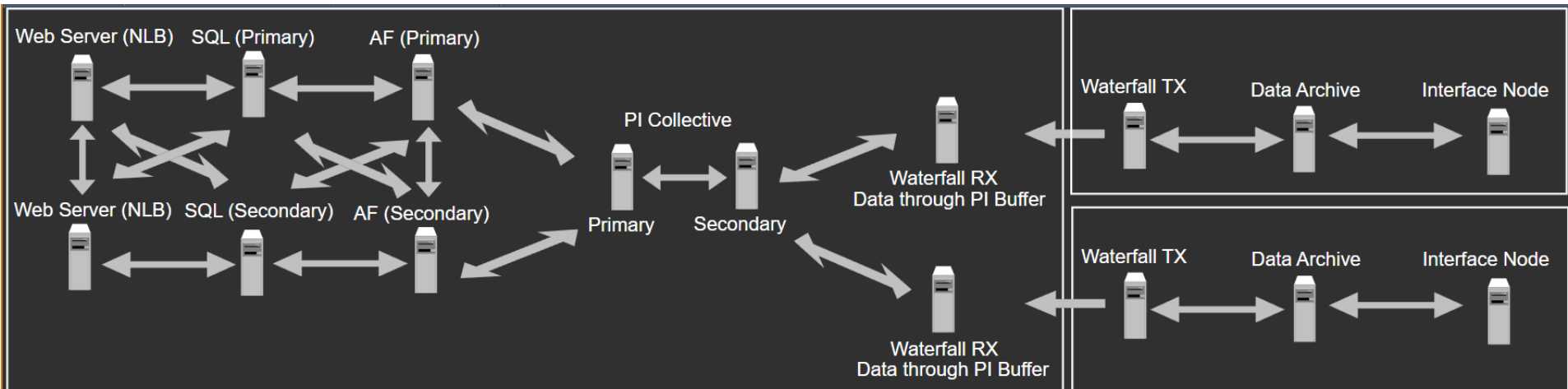
- Waterfall Solutions Unidirectional Gateway bridged the gap between an isolated control system network and the production network
- Waterfall's technology provides no path back to the industrial network while allowing full data flow
  - Waterfall TX Server
  - Waterfall Unidirectional gateway
  - Waterfall RX Server
  - Data flows across seamlessly

Image from <https://waterfall-security.com/technology-and-products/>



# Production Network

- Data received by Waterfall RX Server
  - PI Buffer has to be utilized to send to collective
- PI Collective
  - Two AVEVA PI data archives
- AVEVA PI Server asset framework
  - Two asset framework servers utilized AVEVA PI recommended clustering
- SQL Servers
  - Two SQL Servers supporting AVEVA PI Vision (high availability)
- Web Servers
  - Three web servers on an NLB to distribute load



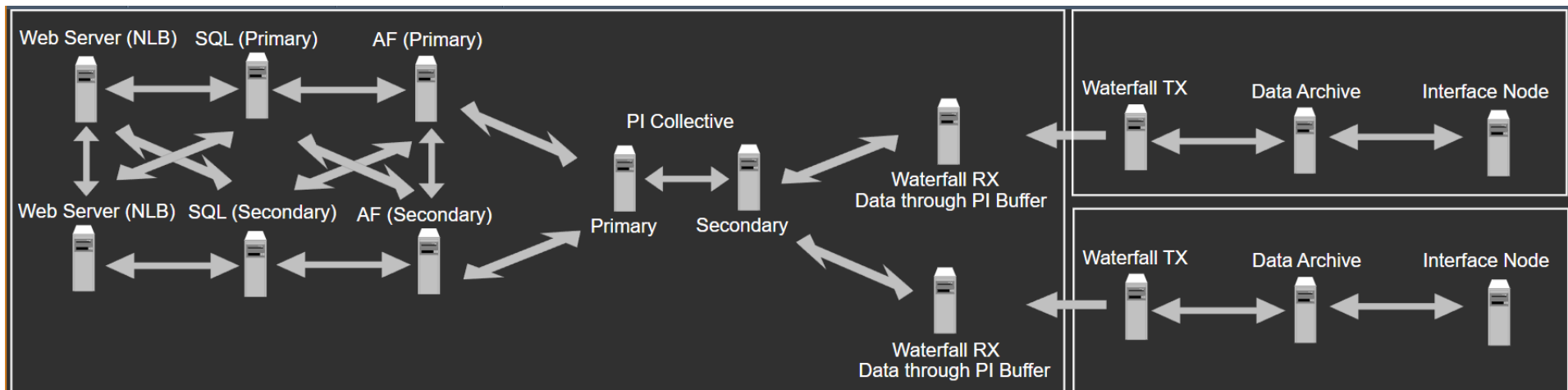
# Production Data Visualization

- 3 Methods to view data

- AVEVA PI Vision
- SQL Server Reporting Service
- AVEVA PI Data Link (future addition)

- Control system view replication

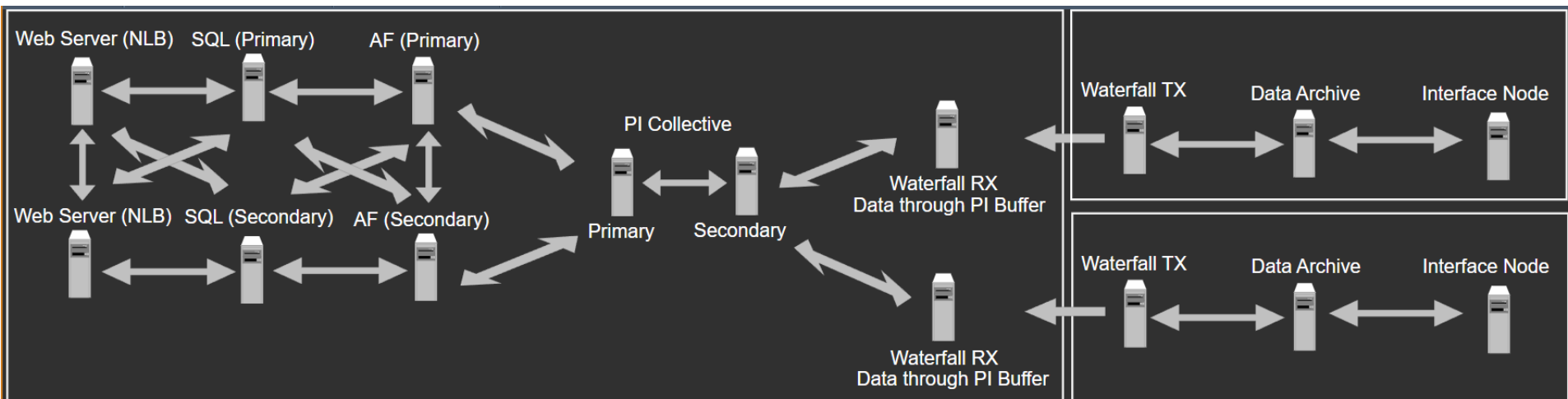
- Users have built screens that completely replicate what can be viewed in the control room control system





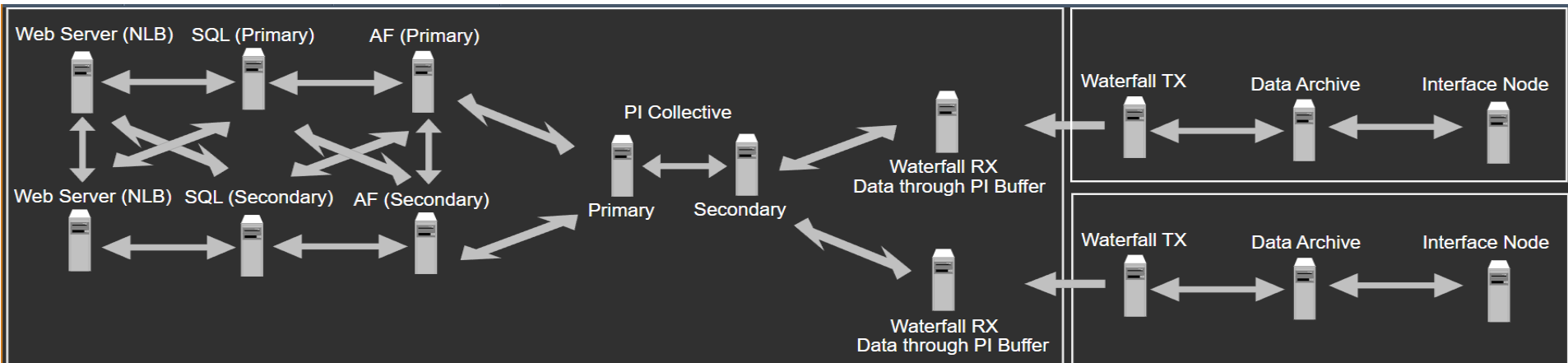
# Disaster Recovery Planning

- Covid-19 delayed data availability on the Production and Test networks at the Waste Treatment Plant
  - At the time, all servers and AVEVA PI Vision display building were on a system on a separate network with internet access
  - Automated backup system was NOT yet available
- Needed a process to rebuild or reconfigure any or all servers on the AVEVA PI System
  - How quickly can a server be rebuilt/replaced if it was completely lost?
  - **GOAL** – have the entire AVEVA PI System available within 24 hours



# Disaster Recovery Planning

- Developed disaster recovery plans in 2020
  - Documented settings, configuration, and screenshots of all AVEVA PI Systems and software
    - Included SQL Server backups for AVEVA PI Vision,
    - AVEVA PI Server asset framework XML,
    - AVEVA PI Vision web.configs
    - AVEVA PI Interface settings
    - Waterfall Unidirectional Gateway configurations
  - Completed first iteration of database backups and documentation in late November 2020



# Lessons Learned from Solarwinds

## ■ Solarwinds Incident

- AVEVA PI Vision's SQL database had been sharing a SQL Server with Solarwinds PROD database
  - All AVEVA PI Vision displays were gone
- December 15, 2020 – enacted use of disaster recovery plan
- New SQL server and AVEVA PI Vision databases were needed for recovery
  - Without the AVEVA PI Vision database backup, we would lose 500+ AVEVA PI Vision displays amounting to three years of work





# Lessons Learned from Solarwinds

- Despite having our network secured from direct access, data breaches can still find their way in
- How can this be applied to your AVEVA PI System?
- Disaster recovery plans will lessen downtime
- Analyze your system regularly to see if there are gaps to fill so you can be prepared!





# Questions?



## Ductwork

# 2,100 TONS

WTP requires 2,100 tons of ductwork and contains ducts that measure up to five feet in diameter.



## Piping

# Seattle to Portland

WTP requires 1,021,000 feet of piping. If laid end-to-end it would stretch more than the distance from Seattle, Washington, to Portland, Oregon.



## Rebar

# THREE HUNDRED POUNDS

WTP uses #11 rebar in places, which measures 1 3/8 inches in diameter and weighs 5.313 pounds per foot. A section of #11 rebar typically measures 14 to 60 feet long and can weigh more than 300 pounds.

## Concrete

# 264,000 cubic yards

WTP requires 264,000 cubic yards of concrete, which is enough concrete to fill 80 Olympic-sized swimming pools.

## Structural steel

# 41K TONS

WTP requires 41,000 tons of structural steel, which is the equivalent of more than four Eiffel Towers.



## Walls

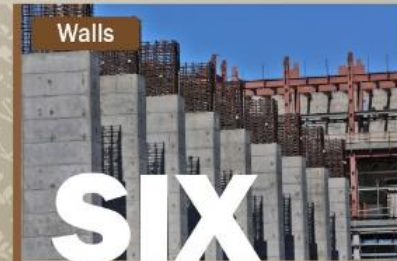
# SIX feet thick

WTP facility walls are made of concrete reinforced by rebar and are up to six feet thick in places.

## Cable

# 1,013 miles

WTP requires 5,351,000 feet of cable. If laid end-to-end, it would stretch 1,013 miles, more than the distance from Seattle, Washington, to Salt Lake City, Utah.



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<https://www.hanfordvitplant.com/newsroom/media-library>