# DUF6 Facility Design Lessons Learned

2019 Department of Energy
Project Management Workshop
*"Technology Implications"*

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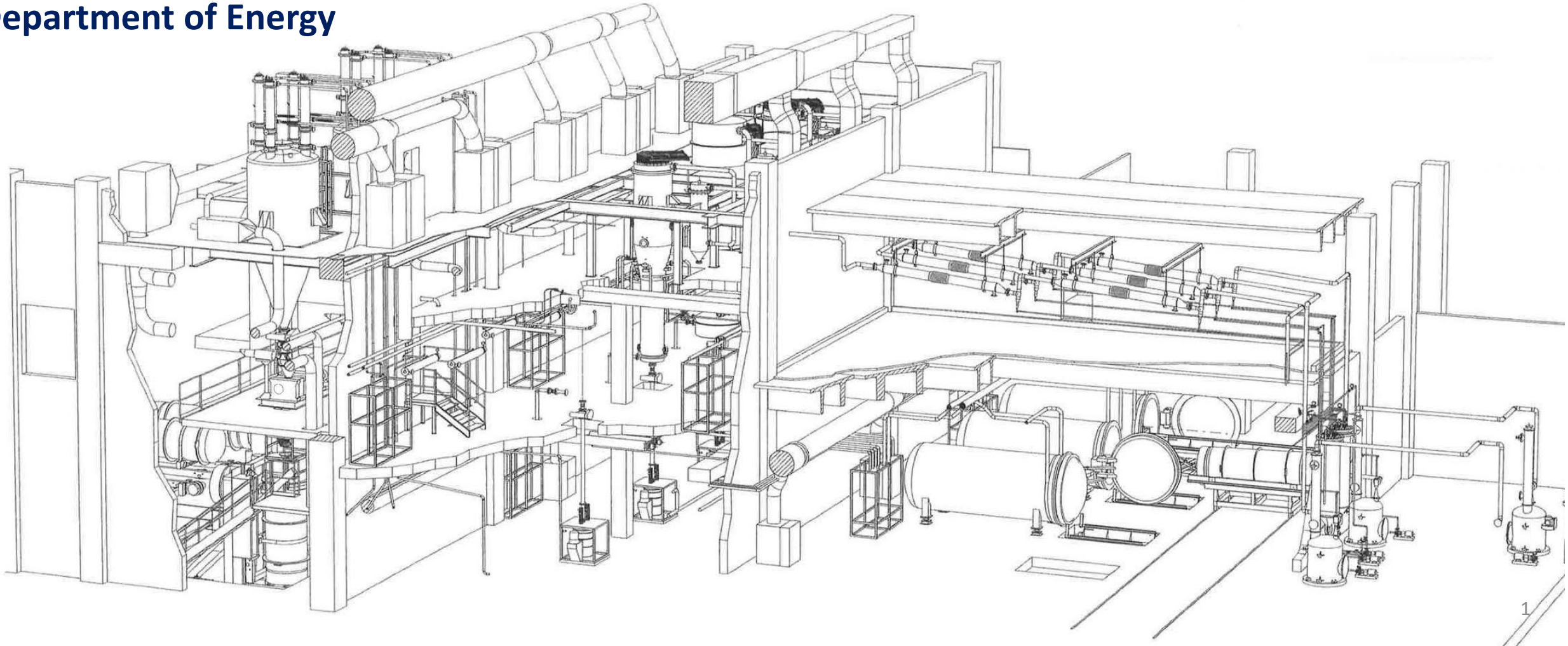
**Federal Project Director**
**Department of Energy**



# Depleted Uranium Hexafluoride ($DUF_6$) Project

## $DUF_6$ Mission

Operate conversion facilities to safely convert $DUF_6$ into a more stable chemical form (oxide) for beneficial reuse or disposal thus reducing immediate and future risk to workers and surrounding community.

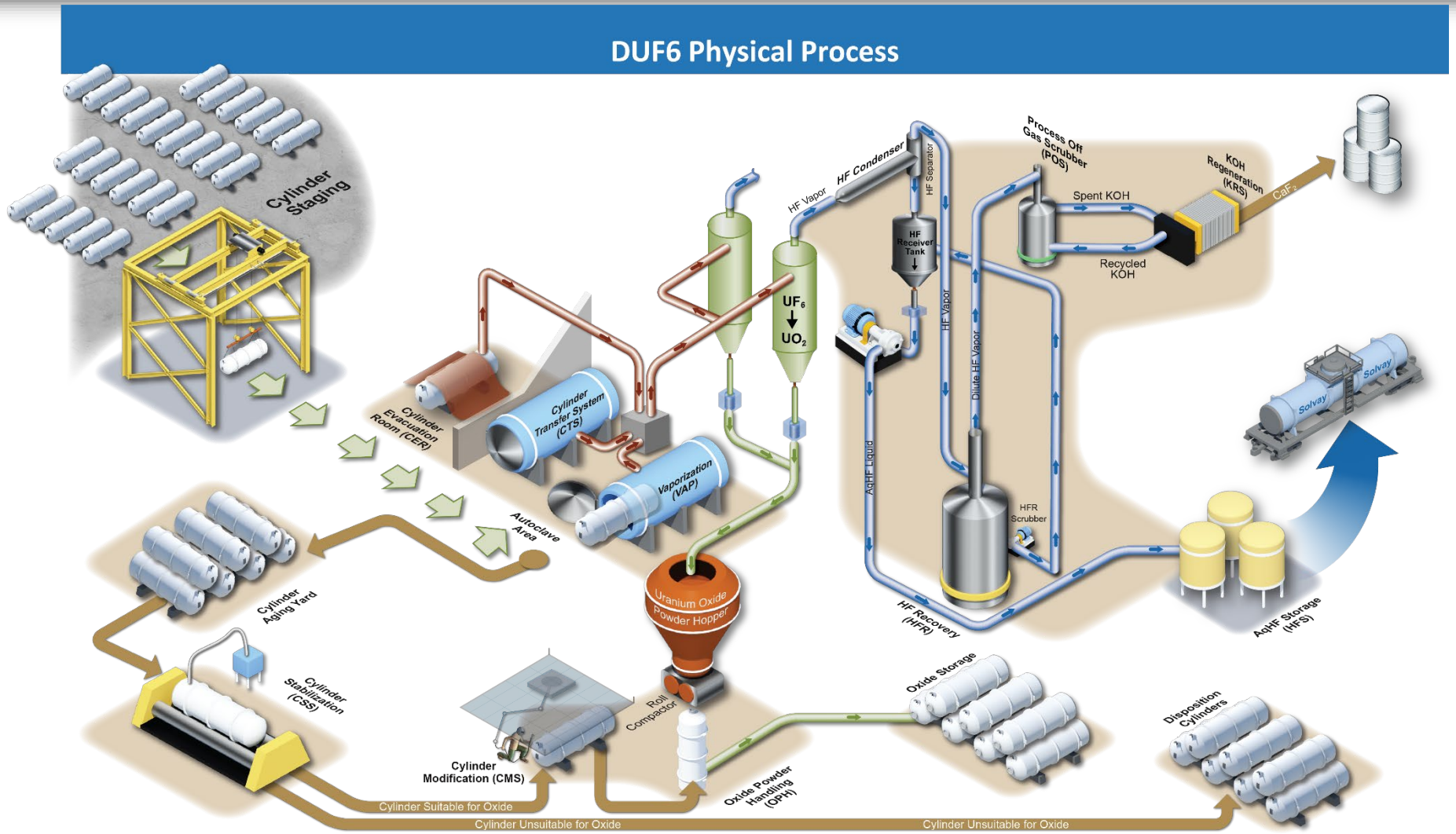
## Conversion generates two products:

- Uranium Oxide
- Aqueous Hydrofluoric Acid

# $DUF_6$ Project

- $DUF_6$ resulted from the uranium enrichment process at DOE's three Gaseous Diffusion Plants.
- 67,000 14-ton DUF6 Cylinders in storage at the beginning of the Project.
- Two DUF6 Conversion Facilities constructed to convert $DUF_6$ into stable uranium oxide.
- Construction started in 2004. Operations began in 2010 (Portsmouth) and in 2011 (Paducah).

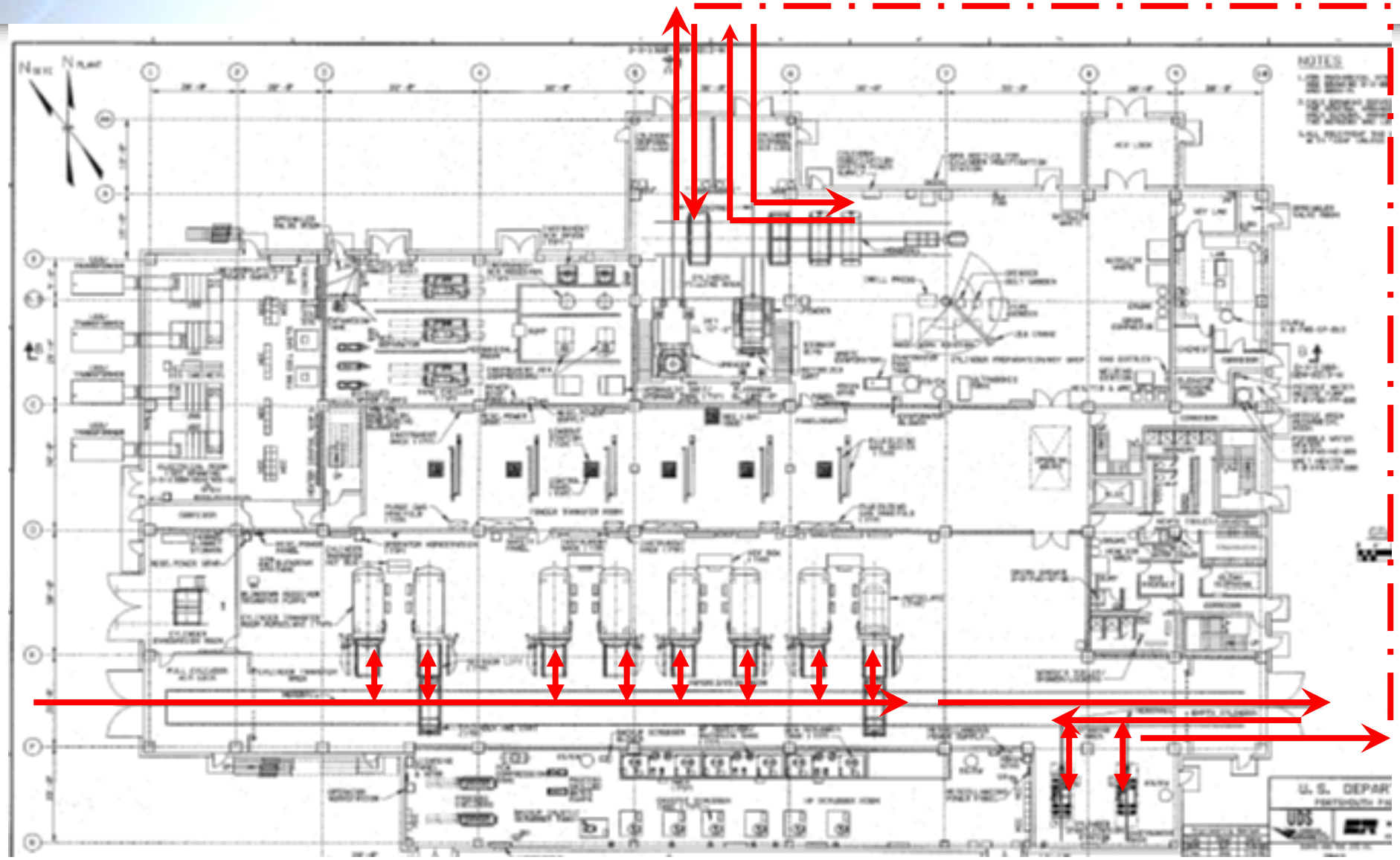
# $DUF_6$ Project



# Post Construction Plant Reconfiguration and Retrofit

- **Safety**
- **Maintainability**
- **Reliability**

# Safety



# Safety

## Removed Filters in KOH Recovery Building

# Safety

There is a future project to install double blocks and bleeds around equipment in the HF storage section of the plant.

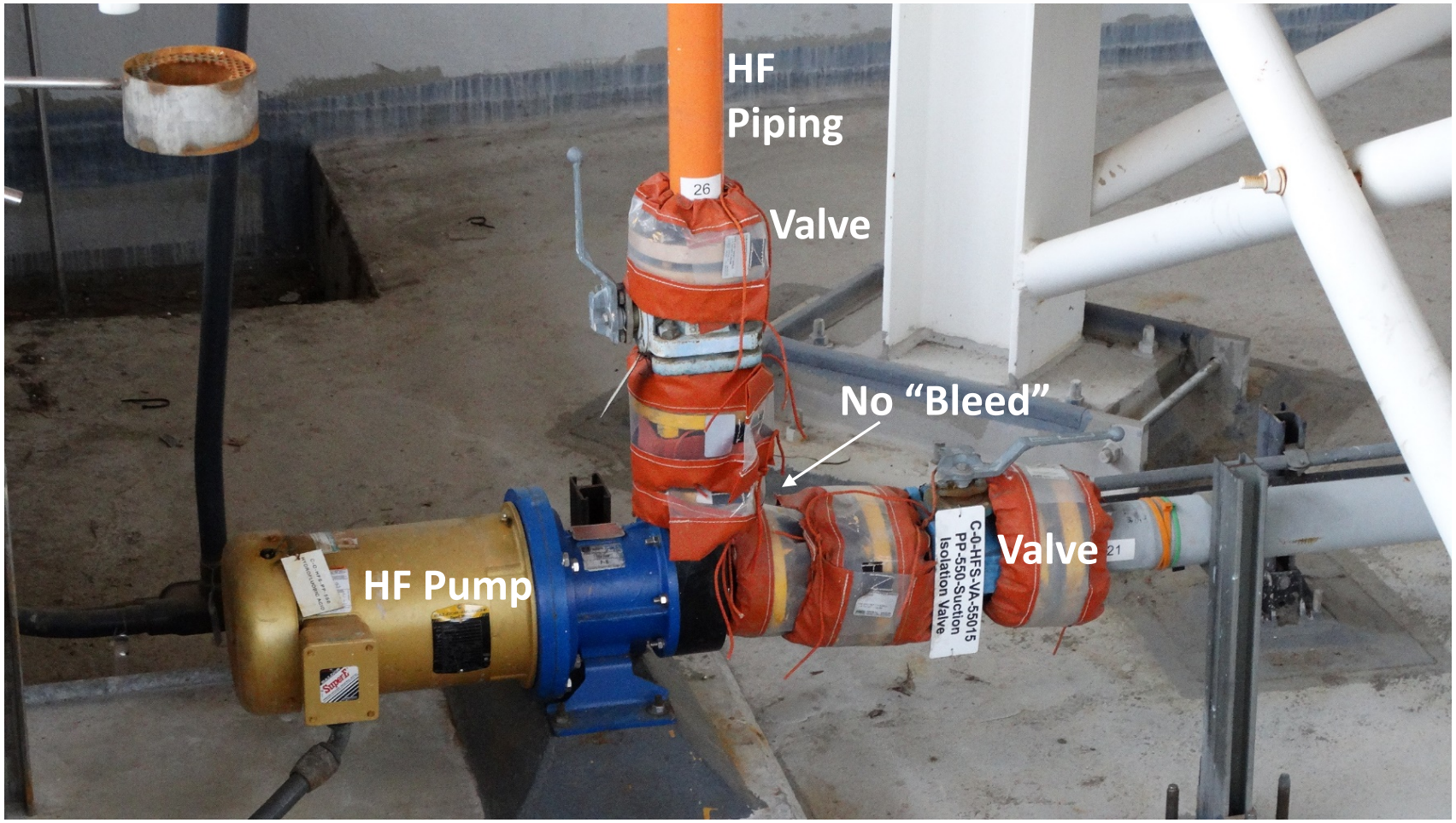



Photo of single block around HF pumps

# Safety

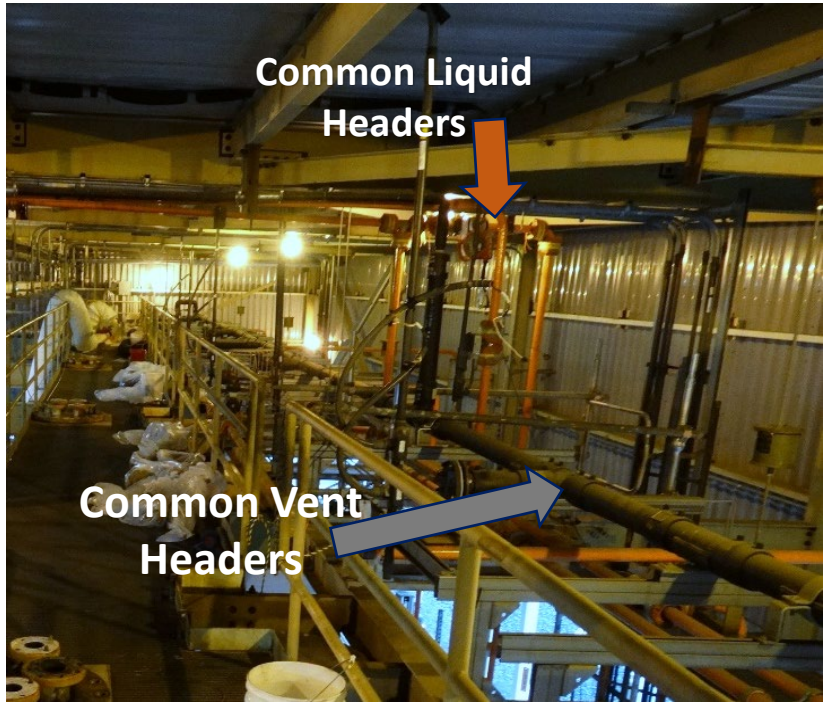
# LOTO

| 10. Tag No. | 11. Energy Isolating Device | 12. Device Status | 13. Lockable (Yes/No) | 19. Aligned/ Locked/ Tagged By | 37. Concurrent Verification By | 20. Independen Verificatio By |
|---|---|---|---|---|---|---|
| 45 | X-2-HFR-VA-5032 | Process Offgas | NO | KR | | RK |
| 46 | X-0-IAS-VA-049D | CLOSED | YES | KR | | RK |
| 47 | X-2-HFR-VA-5102 | CLOSED | NO | KR | | RK |
| 48 | X-0-IAS-VA-049J1 | CLOSED | YES | KR | | RK |
| 49 | X-3-HFR-VA-5022 | Process Offgas | NO | KR | | RK |
| 50 | X-0-IAS-VA-049E | CLOSED | YES | KR | | RK |
| 51 | X-3-HFR-VA-5032 | Process Offgas | NO | KR | | RK |
| 52 | X-0-IAS-VA-049F | CLOSED | YES | KR | | RK |
| 53 | X-3-HFR-VA-5102 | CLOSED | NO | KR | | RK |
| 54 | X-0-IAS-VA-049K1 | CLOSED | YES | KR | | RK |
| 55 | X-1-HFR-VA-5234 | CLOSED | YES | KR | | RK |
| 56 | X-1-POS-VA-6090 • | CLOSED | YES | KR | | RK |
| 57 | X-1-POS-VA-6012 | CLOSED | YES | KR | | RK |
| 58 | X-1-POS-VA-601D1 | CLOSED | YES | KR | | RK |
| 59 | X-1-HFR-VA-5232 | CLOSED | YES | KR | | RK |
| 60 | X-1-HFR-VA-5211 | CLOSED | YES | KR | | RK |
| 61 | X-1-HFR-VA-5210 | CLOSED | YES | KR | | RK |
| 62 | X-1-HFR-VA-5212 | CLOSED | YES | KR | | RK |
| 63 | X-1-HFR-VA-5213 | CLOSED | YES | KR | | RK |
| 64 | X-1-HFR-VA-5205 | Aligned to TK-520 | YES | KR | | RK |

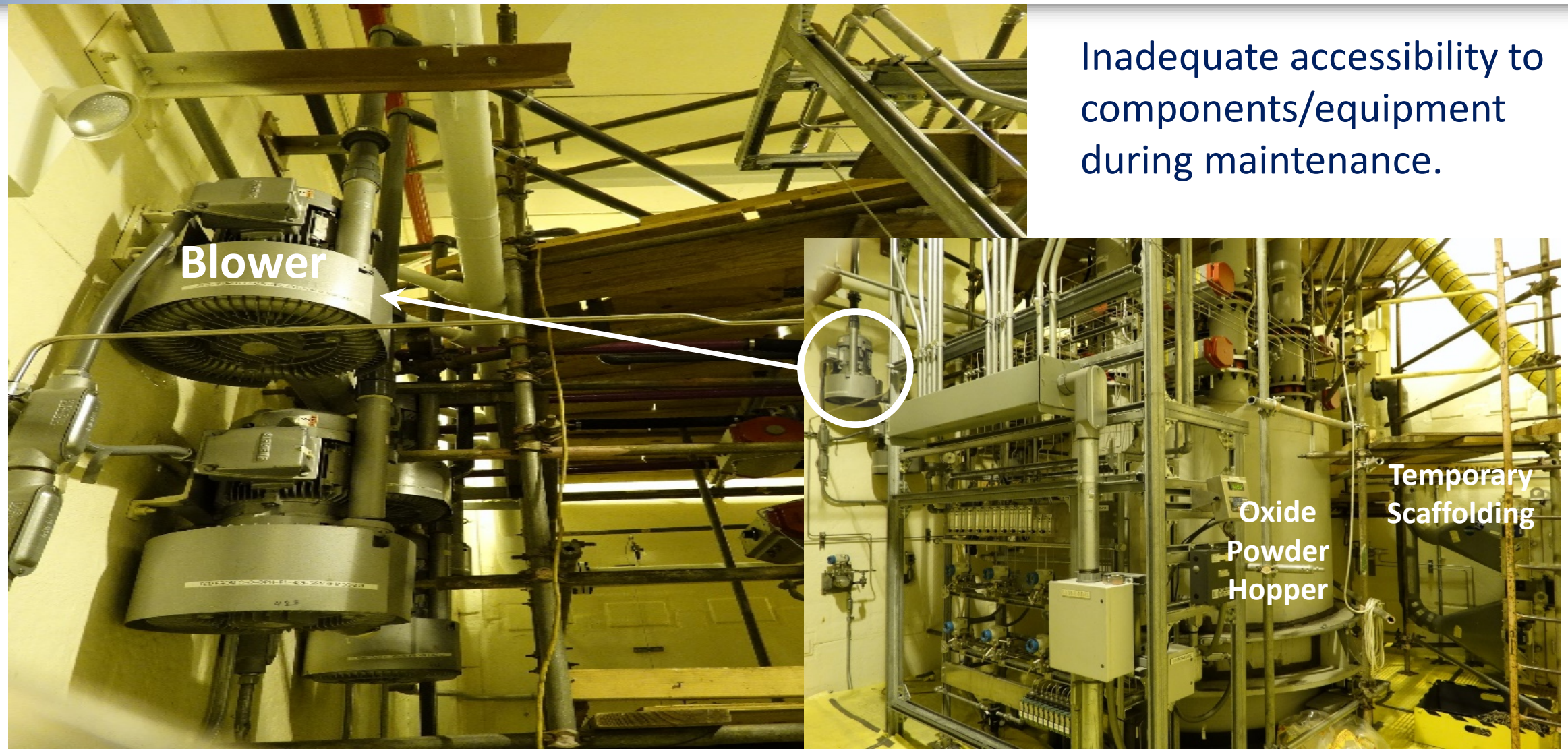
# Maintainability

## Insufficient Isolation Capability

Individual Hydrogen Fluoride Tanks cannot be taken out of service.

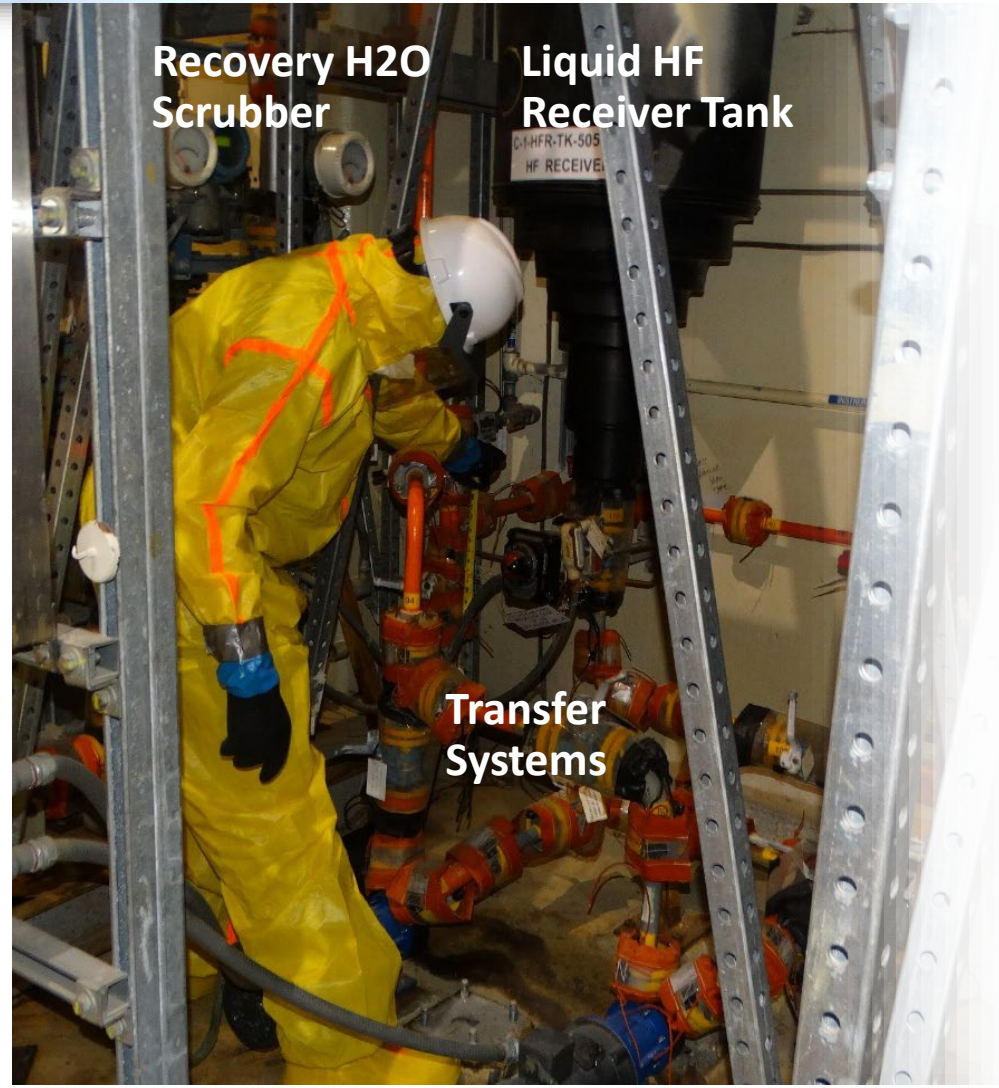


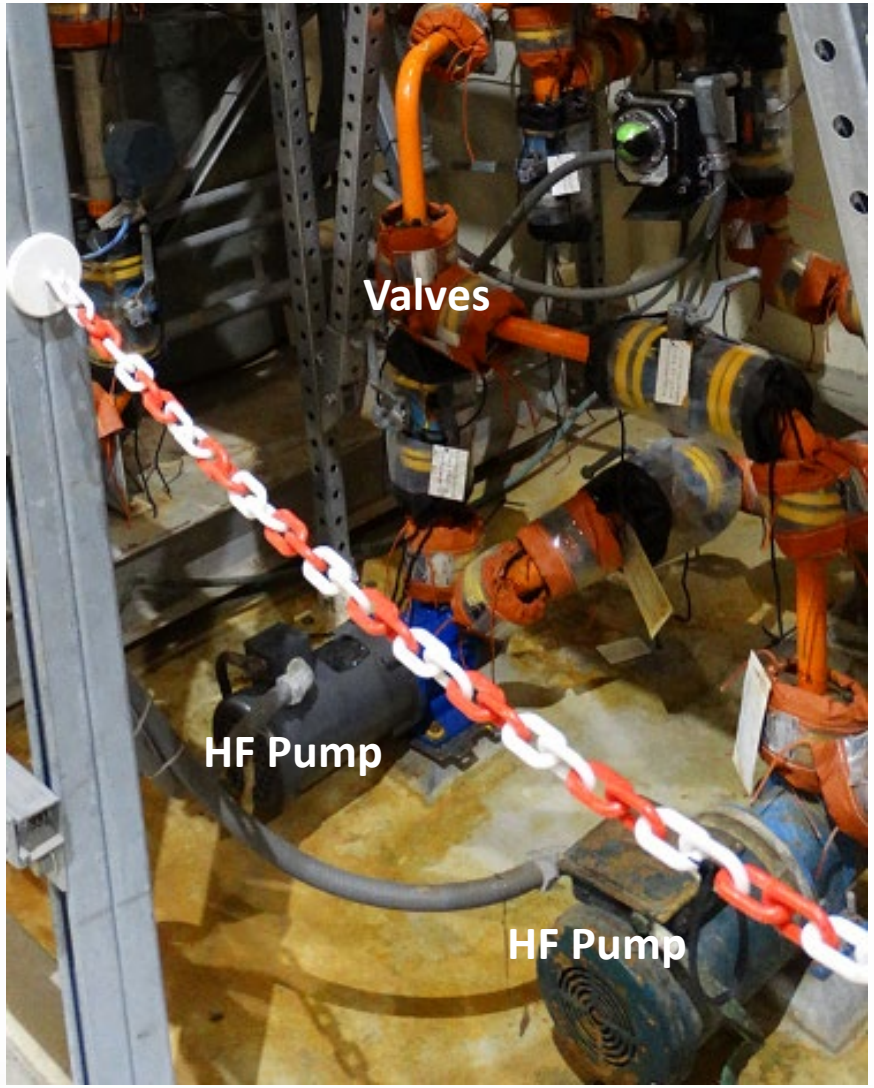

# Maintainability




Inadequate accessibility to components/equipment during maintenance.

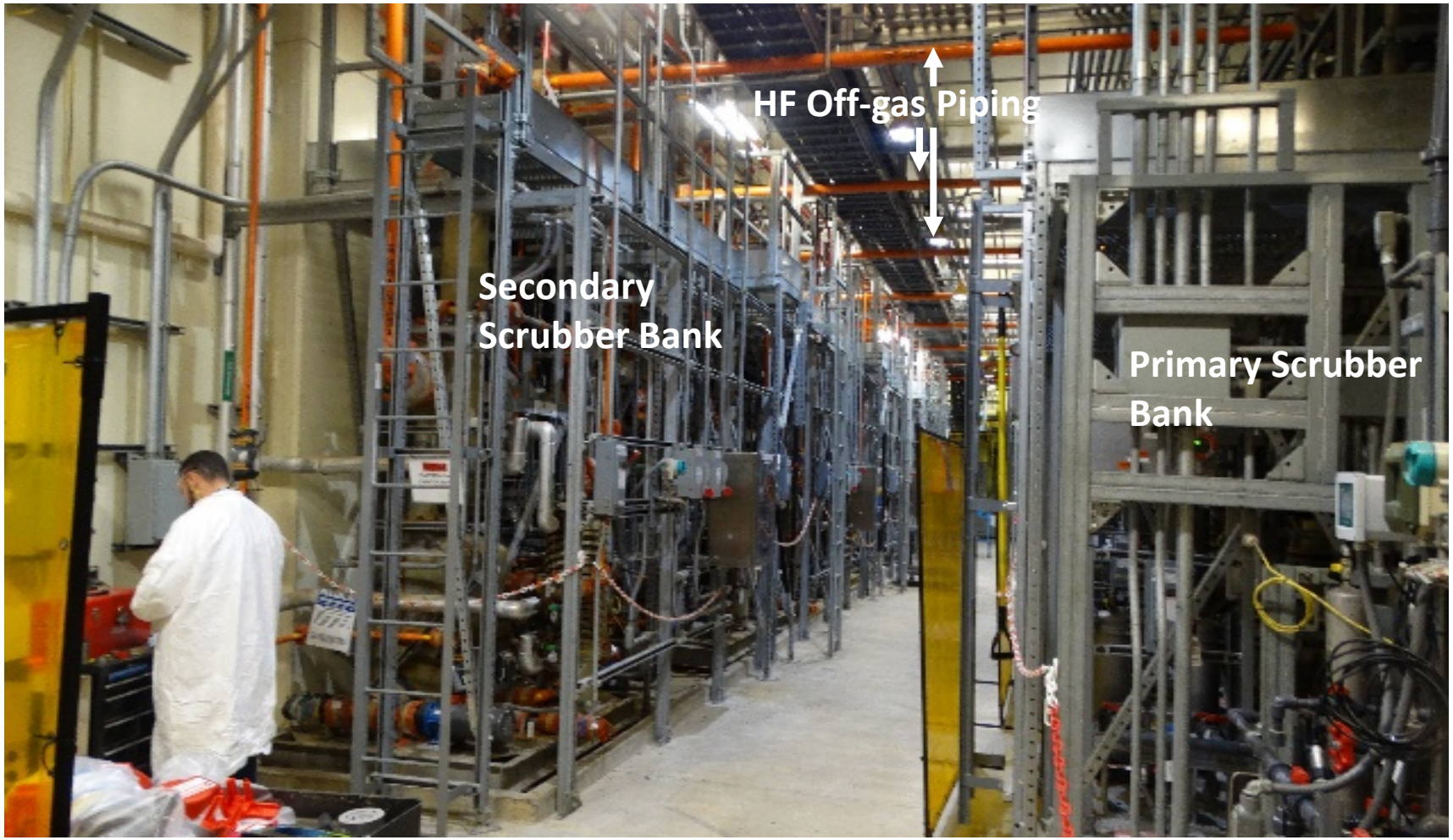
# Maintainability



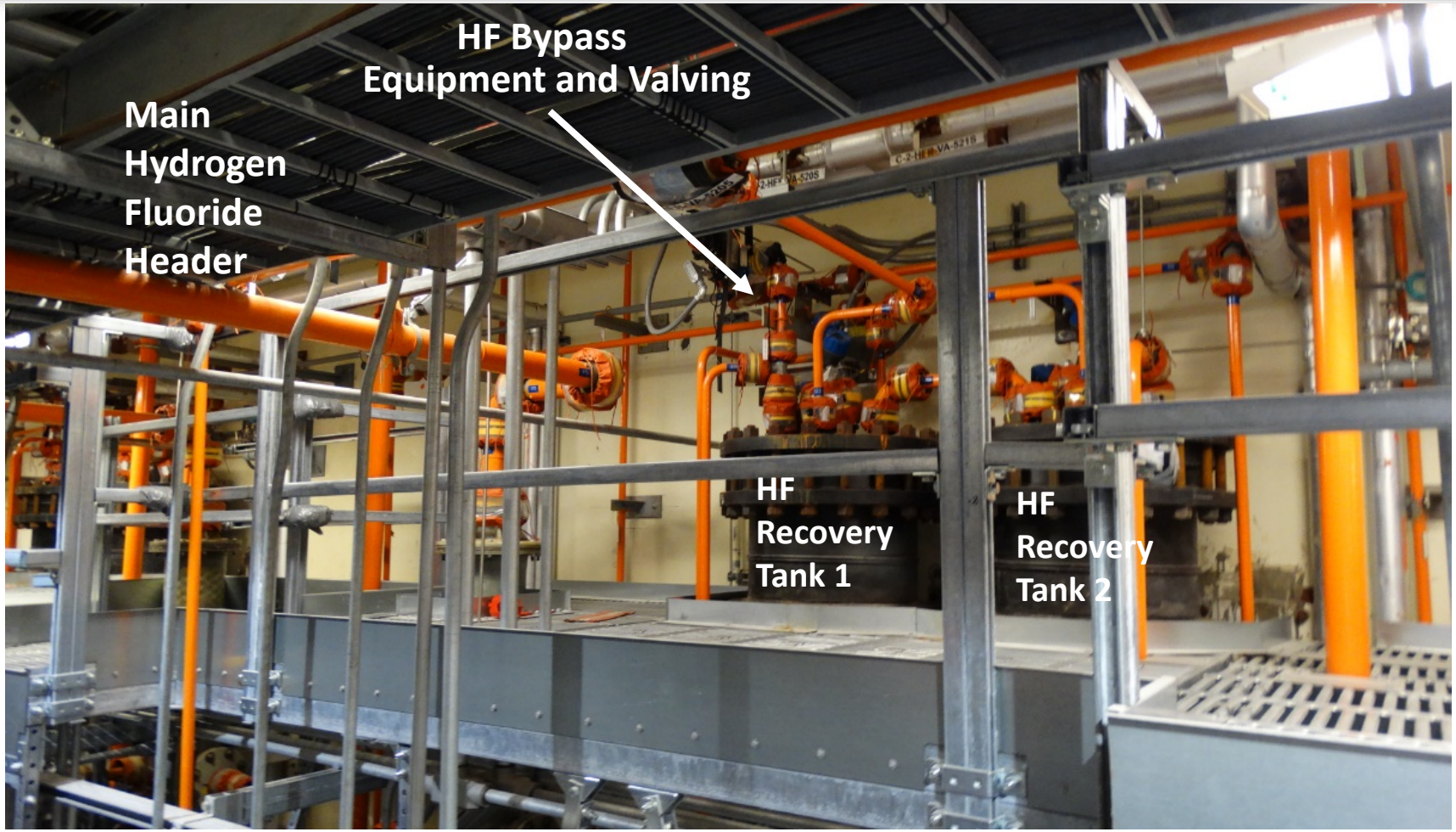
# Maintainability

## HF Recovery and Off-Gas Scrubber Systems



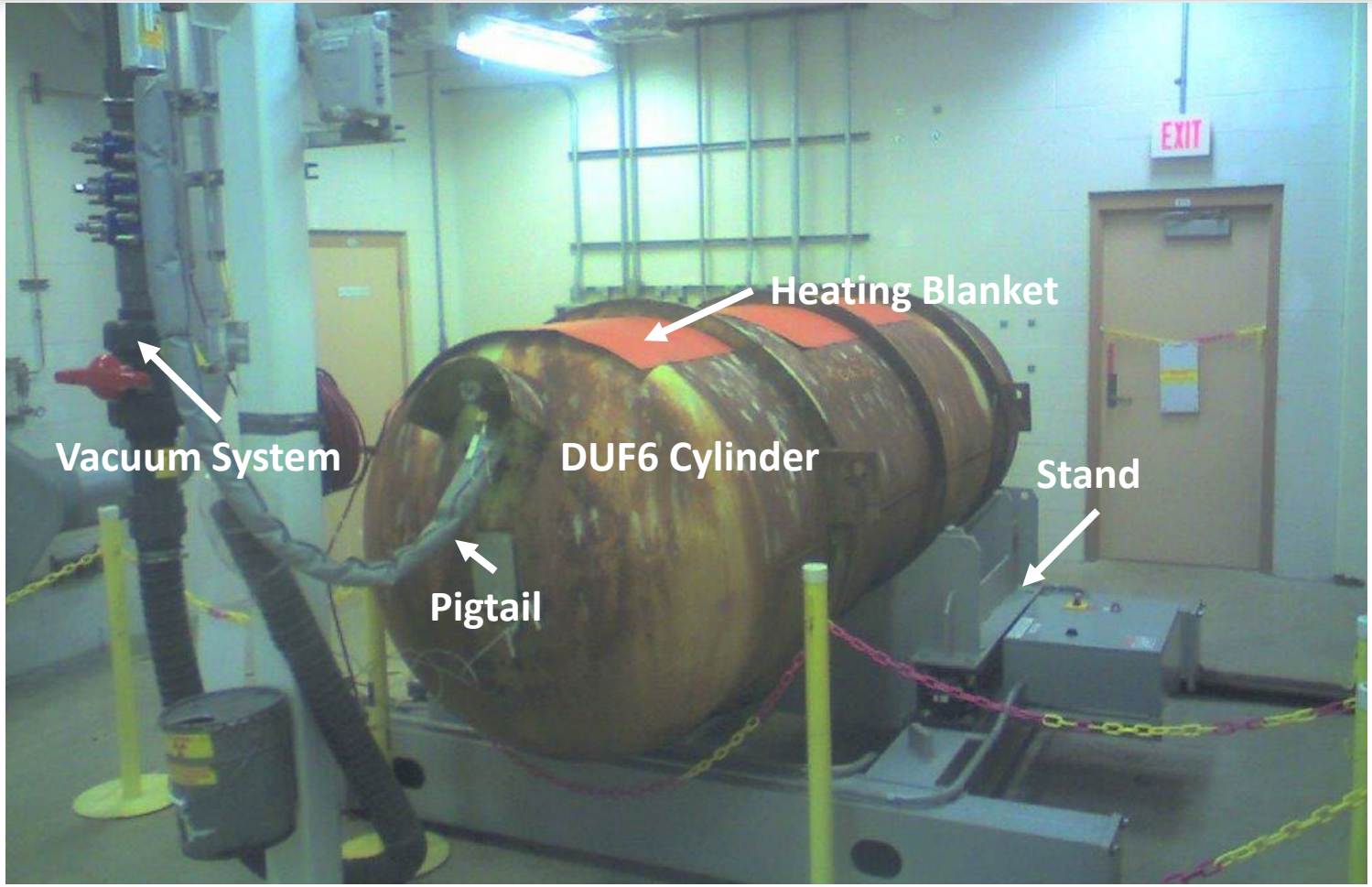
# Maintainability

Permanent scaffolding replaced temporary scaffolding.




Hydrogen Fluoride Recovery System.

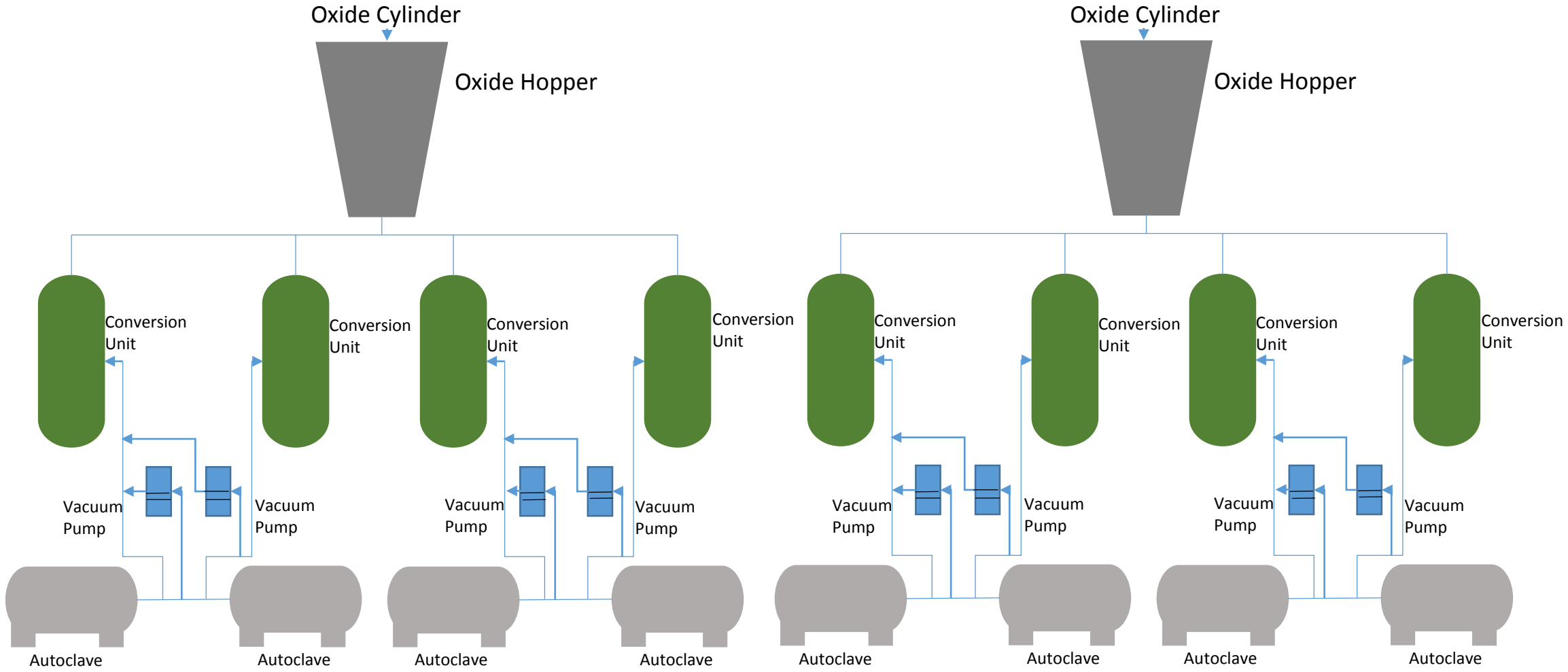
# Reliability



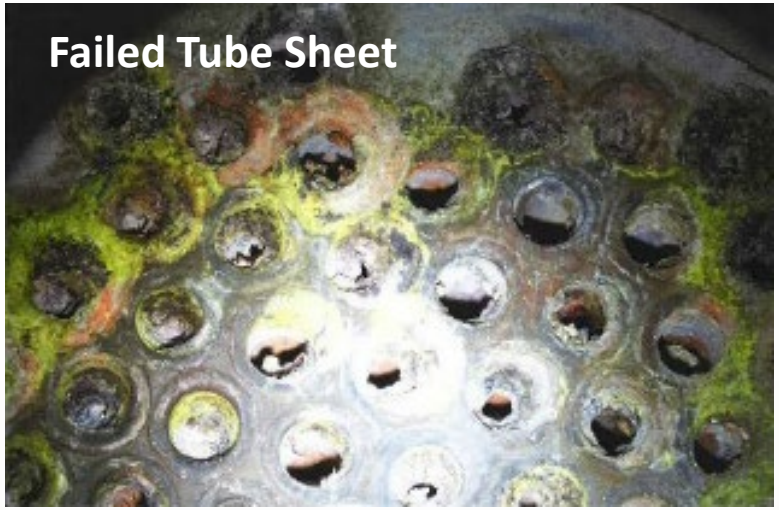

**Cylinder Evacuation Room (CER)- Design didn't work**

# Reliability

## ➢ No Bypass / Common Header

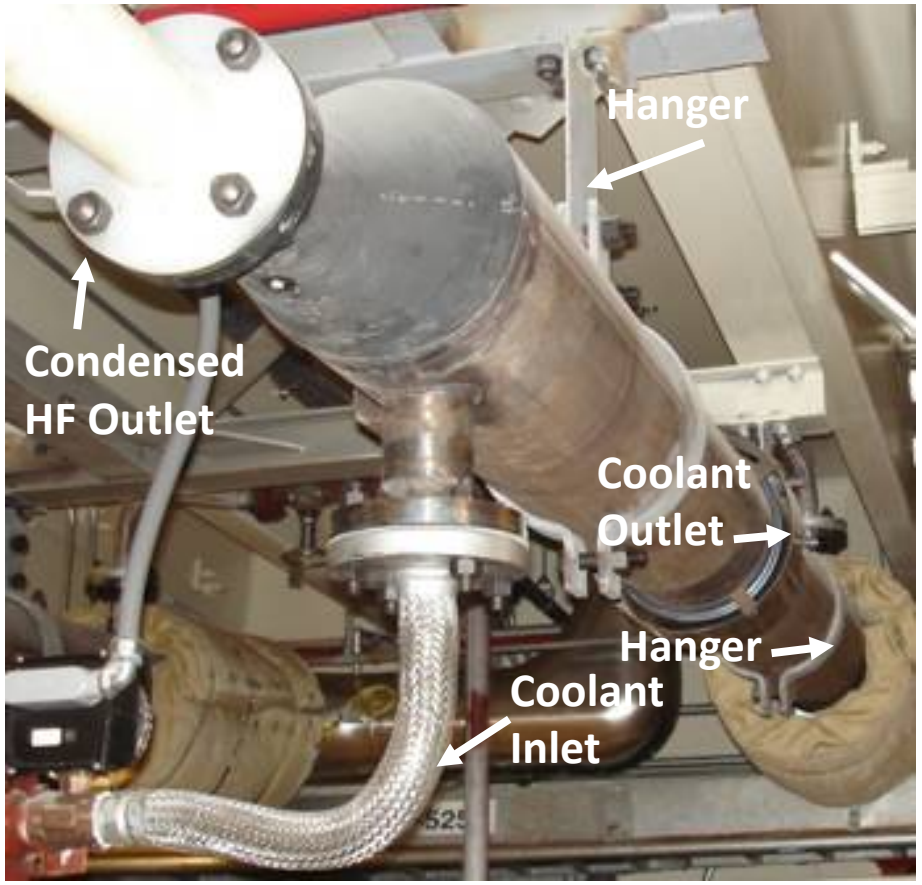


# Reliability




## Prototype Condenser


## Original Condenser



# Reliability

**Outdoor Cranes-Before**

**Outdoor Cranes-After**

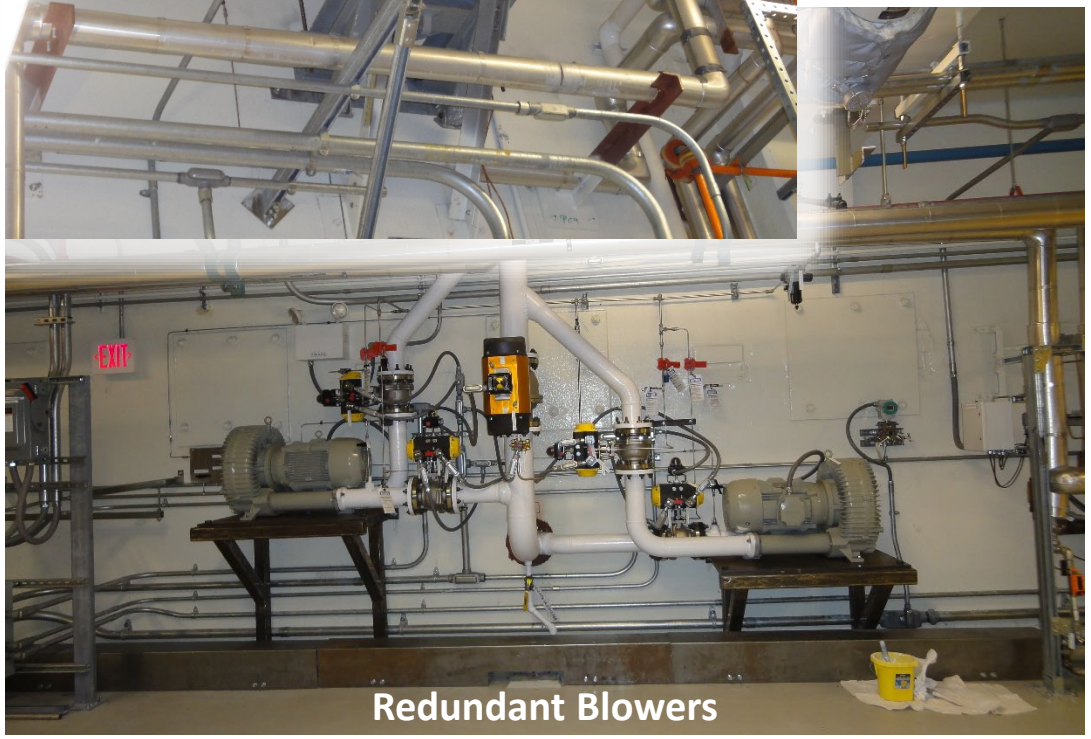
# Reliability

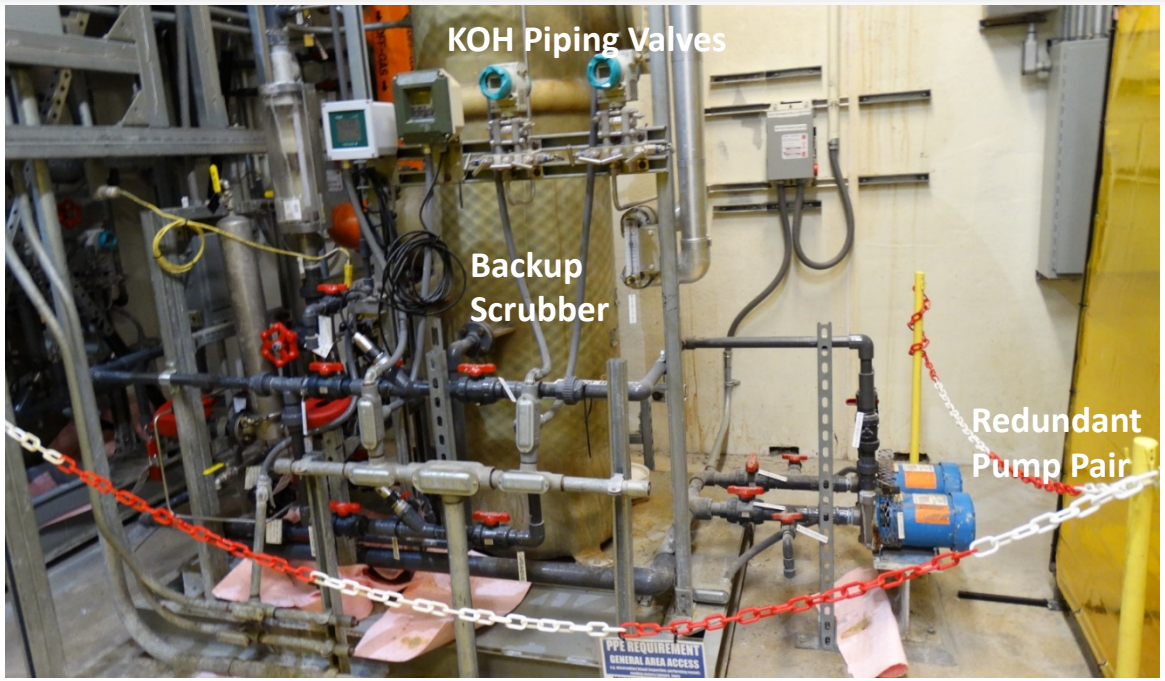

HF detection system for HF transfer line.

Only one crane in the VAP area.

## Single Point Failures

# Reliability

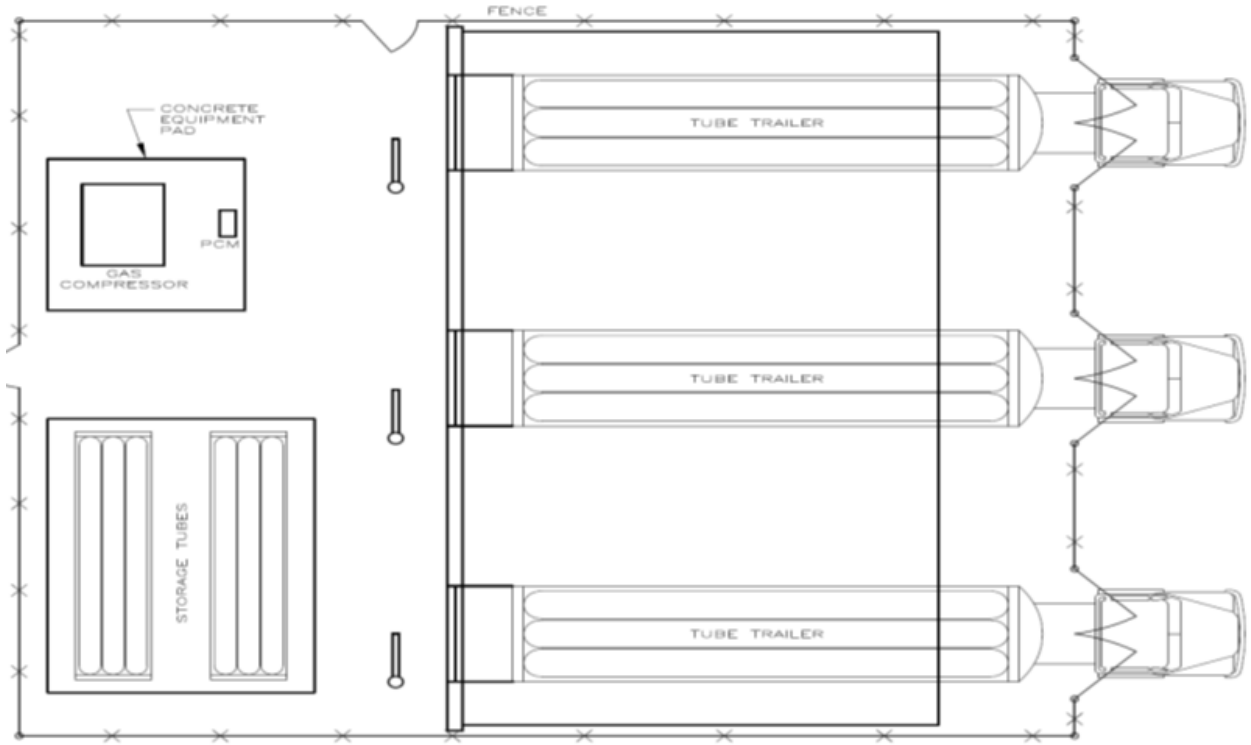

- Secondary scrubber was designed with one scrubber recirculation pump and one blower.
- Added a redundant scrubber recirculation pump and a redundant blower.

# Reliability


- Obsolete when DUF6 Plant Started
- Capacity Degraded
- Design Issues.

# Reliability


Single Point Failure




Tube-Truck/Tank
Backup Supply System

# Conclusion

The Project is spending tens of millions of dollars in retrofits to improve safety, maintainability and reliability.

These retrofits if factored in on the front end of the design would have reduced the Projects operations and maintenance costs.