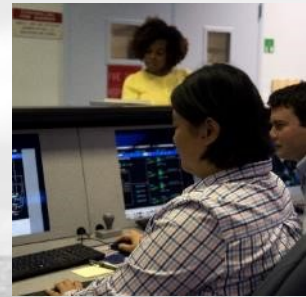


September 25 2018  
CAB - Full Board Meeting

# STATUS OF THE 3H EVAPORATOR SYSTEM

Bill Barnes  
SRR-TFO-2018-00054



# 3H Evaporator Background

## ■ Purpose

- Provide status update of the 3H evaporator

## ■ Background

- 3H is the largest evaporator on site
- Began Operations in 2000
- Can create well over 1 million gallons of tank space gain in a year
- Essential for Sludge Batch Preparation
- The pot and the steam chest are manufactured from Alloy G-3 (Hastelloy®)
- Original design life of 30 years
- Pot Leak Discovered in February, 2016

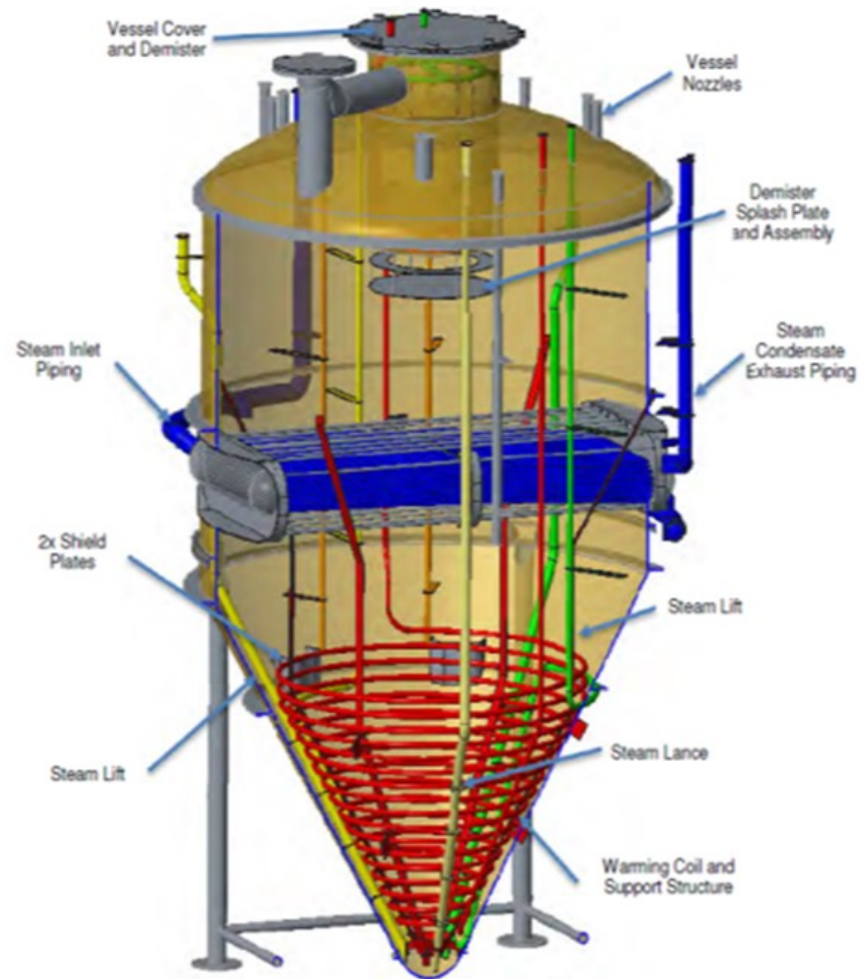
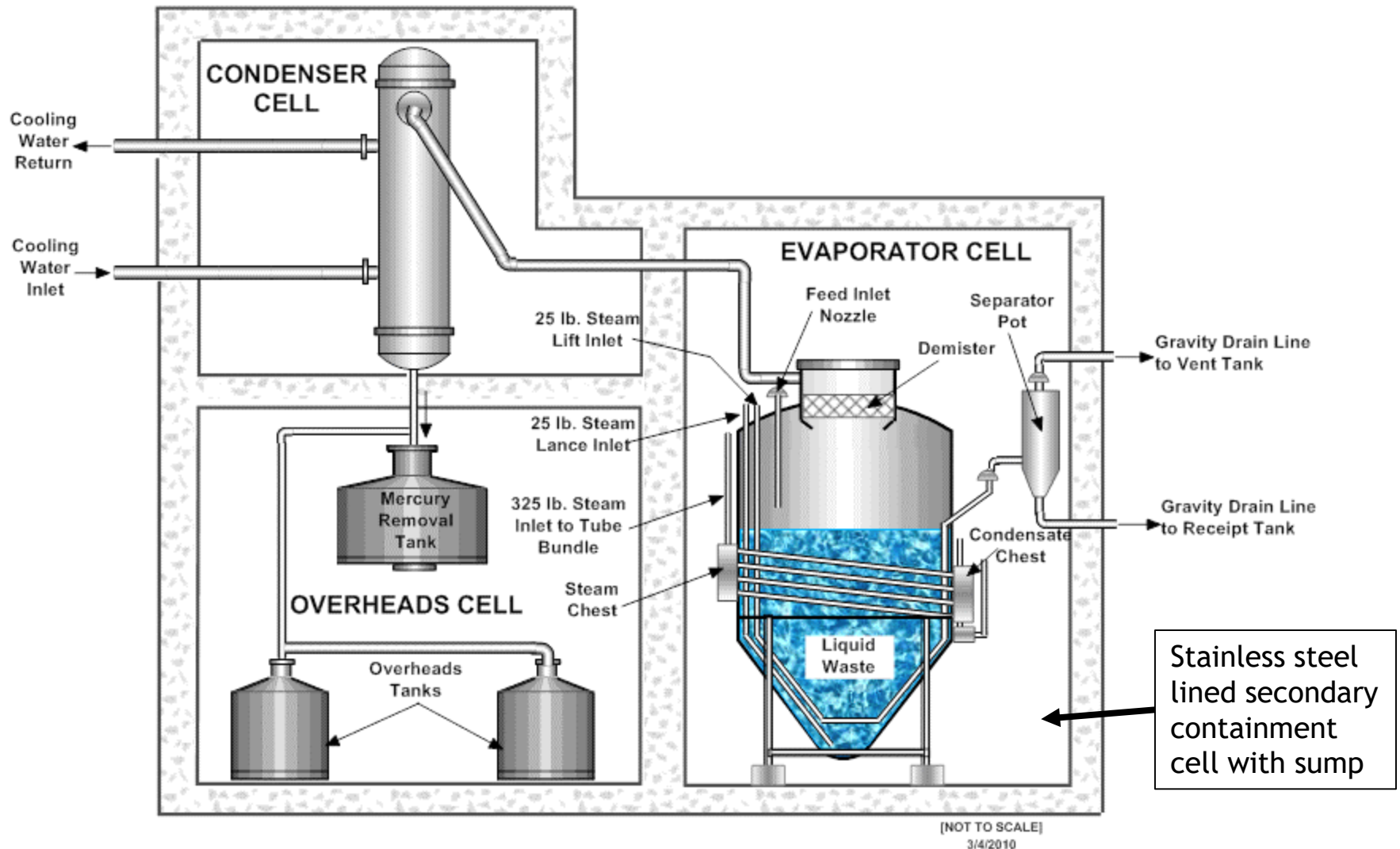


Illustration of 3H Evaporator

# 3H Evaporator System

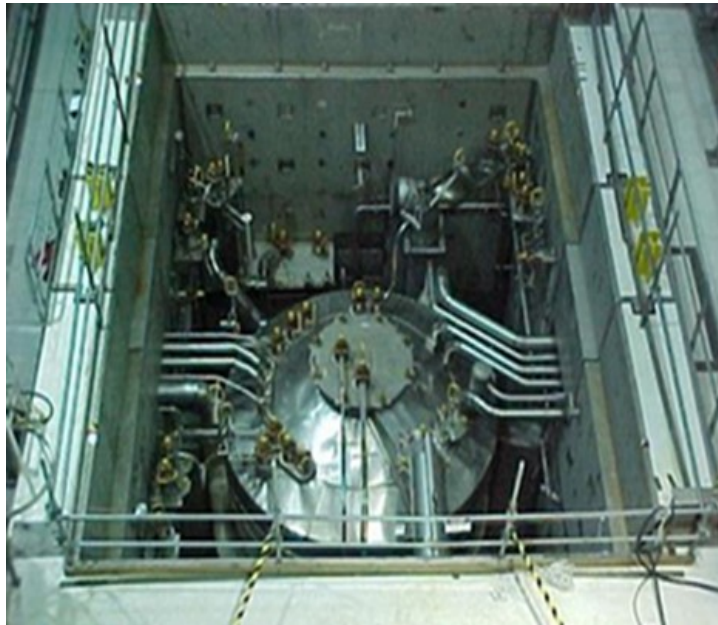




# 3H Evaporator System



3H Evaporator Without  
Insulation



3H Evaporator Installed in Cell



3H Evaporator Building

# 3H Evaporator Pot Leak Discovered

- On February 17, 2016, the 3H was shutdown after salt waste was discovered in the stainless steel-lined concrete cell
  - Leaked ~3000 gallons into secondary containment
  - Leak rate 150 gallons/day
- Extensive testing was performed to pinpoint the source of the leak
  - Including the remote removal of the encased insulation on the cone of the pot using robotics
- Leak site location was confirmed on February 28, 2017 after insulation removal



Picture taken during removal of the stainless steel-wrapped insulation on the cone of the evaporator pot

# 3H Evaporator Repair of Original Leak Site



Original Leak Sites



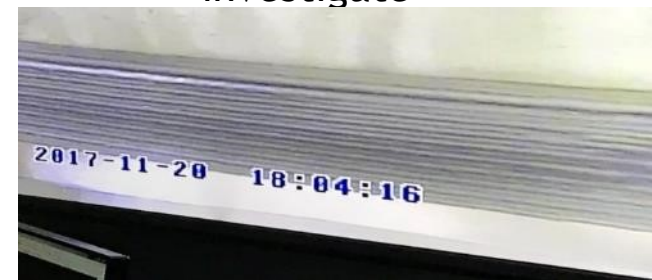
Robotic welding of cap to evaporator vessel



Robotic welding of cap to evaporator vessel



Installed Cap



Final Weld

- Welding/Repair at bottom of cone successful
- Restarted 12/13/17 and operated ~55 hours
- Identified two new weep sites 3-5 ft. above repair cap at weld seams
  - No leaks at repair site
  - Shutdown to investigate

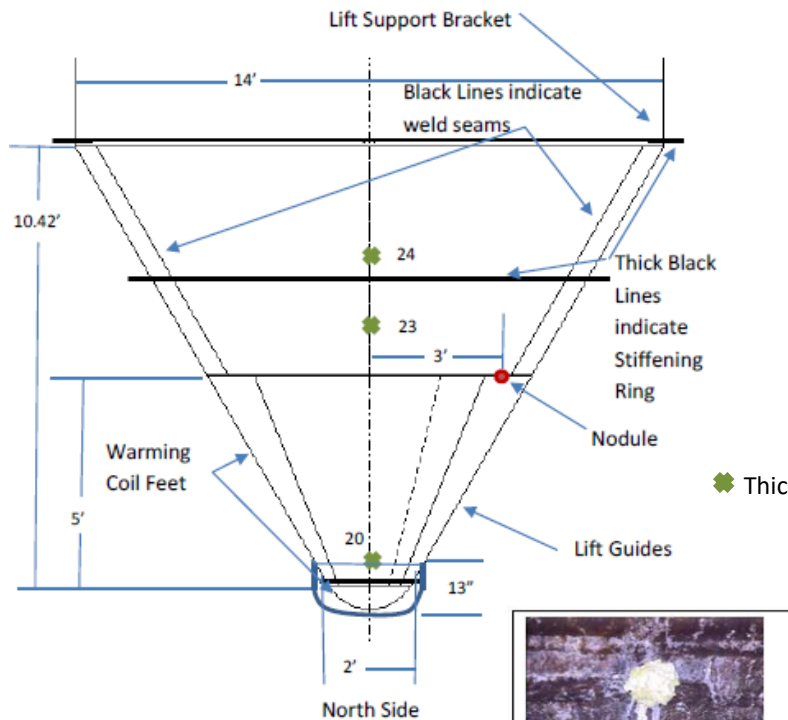


# Video of Robotic Repair

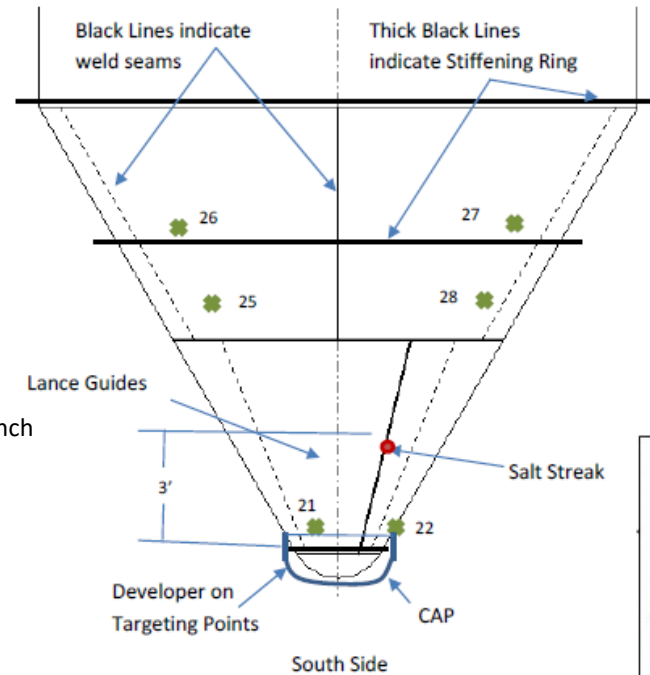


Split Screen Video of Robotic Welding In Cell

# Two Newly Identified Leak Sites



North Leak-site (the nodule)



South Leak-site (the salt streak)



## Results of Expert Reviews

- Leaks are at welds
- Leaks are approximately the diameter of a human hair (~3 mils); calculated leak rate of  $<1/10^{\text{th}}$  gallon per day per leak site
- Inspections showed dry material and salt nodule formation, minimizing the amount of salt waste outside of the pot
- Most likely cause is undetected weld discontinuities or defects during original manufacture
- Leaks sites will not grow during continued operation; if they are cracks, there is insufficient energy to drive crack growth
- The vessel is still structurally sound

# 3H Evaporator Systems Engineering Alternatives Analysis

- **Evaluated 19 Options against the following criteria:**
  - Salt Waste Processing Capacity, Regulatory Impact, Safety Basis Impact, Operability/Dose, System Impact, Cost, Schedule,
- **Four leading options**
  - Continue Operations with Enhanced Surveillance
  - Repair Evaporator Leak sites
  - Replace with New Evaporator
  - Alternate Path for DWPF Recycle
- **Recommended option - Operate with Enhanced Surveillance**

# Operation with Enhanced Surveillance

- Minimal risk when compared to extended storage of waste in aging underground HLW storage tanks
- Significant personnel radiological exposure would be encountered for repair or replace options
- Repair or Replacement option would first require operation under enhanced surveillance
- Repair and replace options are greater than 1 year (repair) & 2 year (replace) and extend time to empty waste from tanks
- Cost to repair ~ \$3M, Cost to replace >\$12M
- Restoring operation quickly minimizes impact to Salt Processing and overall System Plan



# Importance of Having 3H in Service

- A primary mission of 3H is to support Sludge Batch Preparation by evaporating off the wash water needed to prepare batches
- Having 3H in service to prepare Sludge Batch 10 allows for waste removal to continue (true risk reduction)
- Supports sustained MCU/SWPF operation & safely maintain progress towards emptying HLW from aging storage tanks while permanent options are made ready (if needed)
- Enhanced Surveillance operation balanced minimal risk posed by small and well controlled releases of waste into the evaporator cell vs. potential risk posed by extending storage of waste in aging HLW tanks.

# Why is Operation of 3H Low Risk?

- Unlike previous LW evaporators, the 3H System is fully enclosed within a building to prevent contamination events during cell entries and to minimize impacts of weather
- The evaporator pot sits within a concrete cell that is fully lined with stainless steel to ensure containment and to facilitate decontamination
- The cell contains a sump which has dip tube level indication as well as a conductivity probe for liquid detection
- The cell also has an under-liner sump with a conductivity probe
- The cell ventilation system includes HEPA filtration and is continuously monitored for contamination in the discharge
- Area radiation monitors would detect increased radiation rates

- Controls have been implemented to safely operate the 3H evaporator
- 3H Operations have resumed
- Periodic cell inspections indicate minimal leak rates as predicted by expert reviews
  - ~1 gallon of leakage since startup
- 3H evaporator space gain >300K gallons achieved since restart
- Sludge Batch 10 preparation continues



Leak site on 7/26/18



Leak site on 8/14/18



- The original discovered leak site at the bottom of the cone area of the 3H pot has been successfully repaired
- Two new small weep sites discovered on the cone have been evaluated and controls put into place to safely operate
- Operation of the 3H evaporator under enhanced surveillance balances the minimal risk posed by small and well controlled releases of waste into the evaporator cell compared to the potential risks posed by extending the time waste is stored in aging underground HLW tanks
- Although not anticipated, if the evaporator leakage rates exceed evaluated safe levels, 3H evaporator operations will be suspended.
- Spare 3H pot procurement is in progress as a contingency.