



# **Red Hill Bulk Fuel Storage Facility Update**

**Board Meeting  
September 24, 2018**

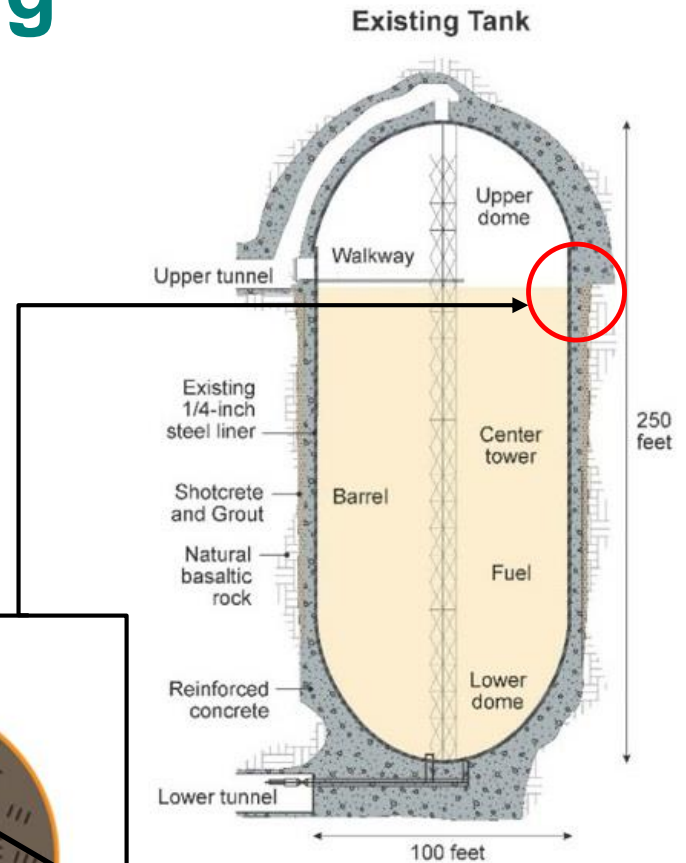


## Today's Discussion

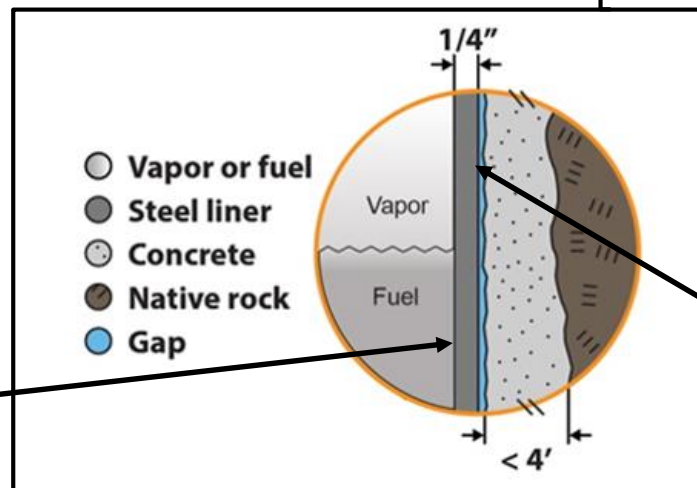
- Visual Examination of Steel Liner Samples (Coupons) Removed from Red Hill Bulk Fuel Facility Tank 14
- Tank upgrade alternatives (TUA) discussion to date and timeline
- Next steps

## Study Condition of Existing Tank

- Examine fuel side and back side of tanks.
- How well is non-destructive evaluation (NDE) techniques able to identify need for tank repairs



Fuel side of liner



Back side of liner

## Tank 14 Coupon Viewing

- June 18 -22, 2018 Navy removed ten 12" X 12" coupons from Tank 14
- June 25, 2018 Coupons viewed by regulatory agencies and interested subject matter experts (SMEs)



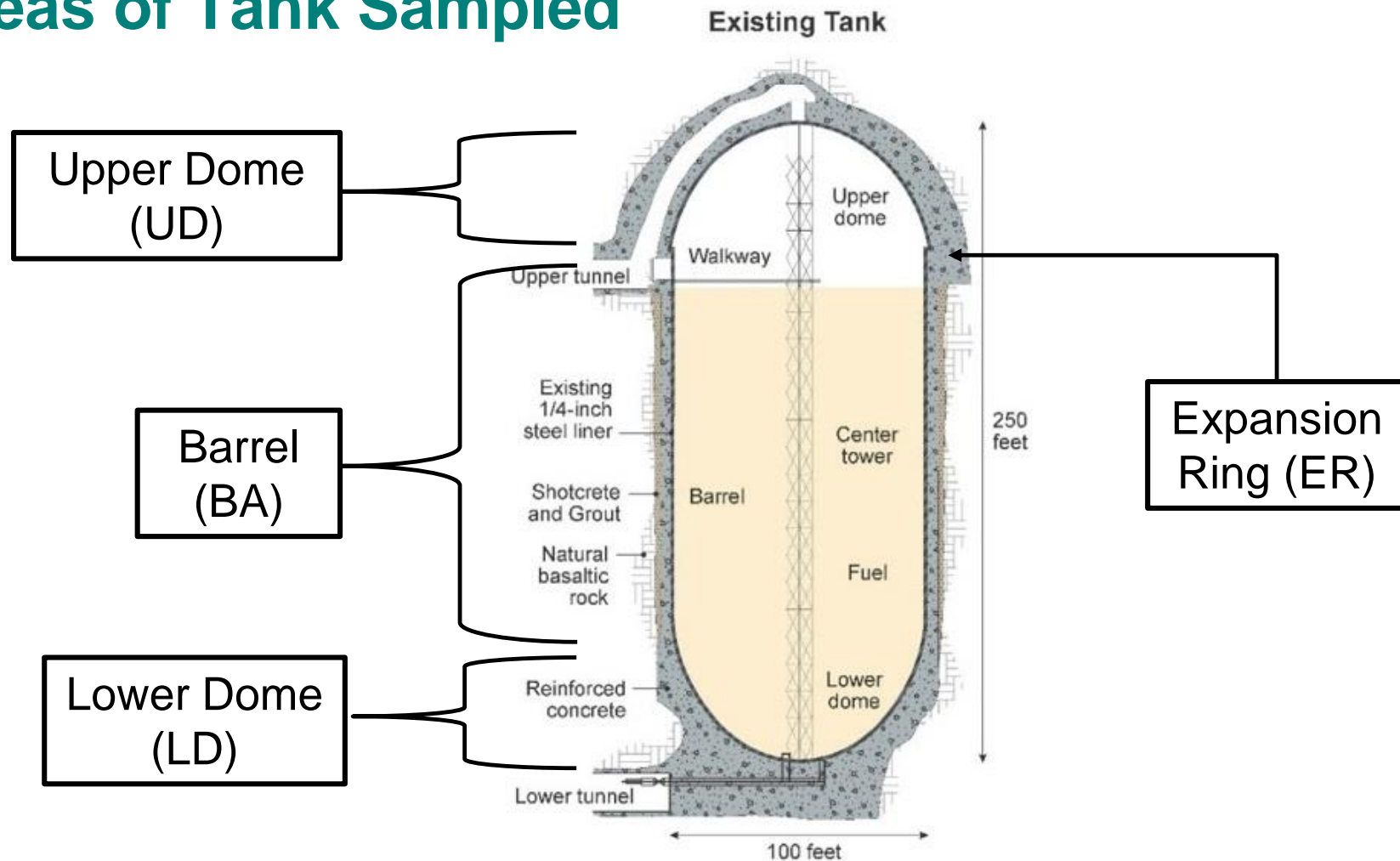
Coupons with  
Fuel Side Up



Coupons with  
Back Side Up

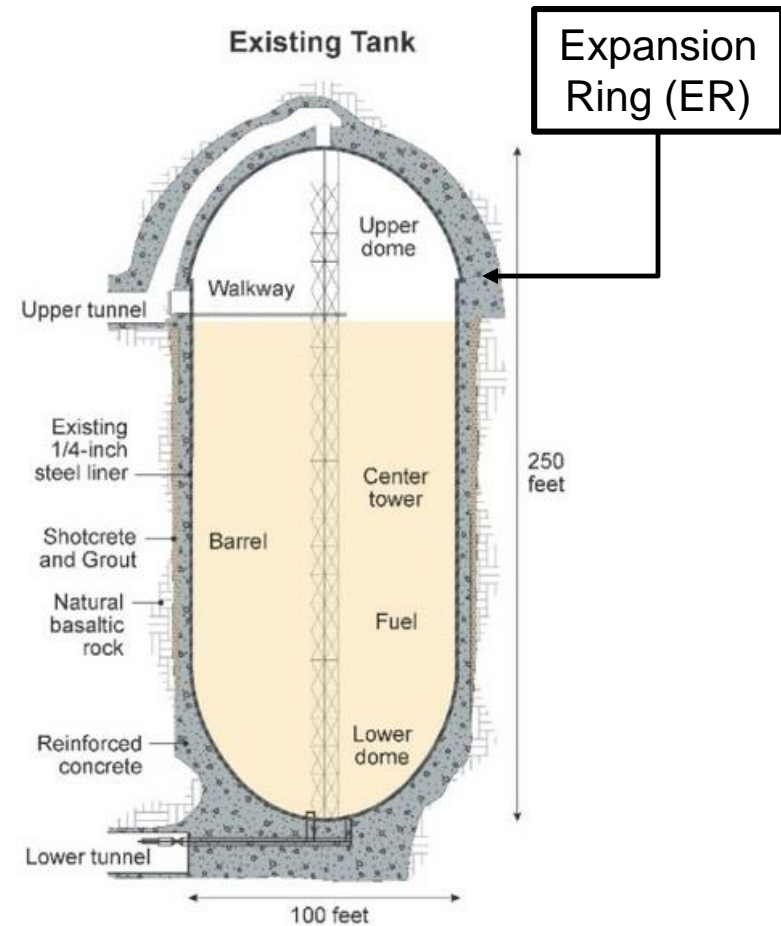


## Areas of Tank Sampled

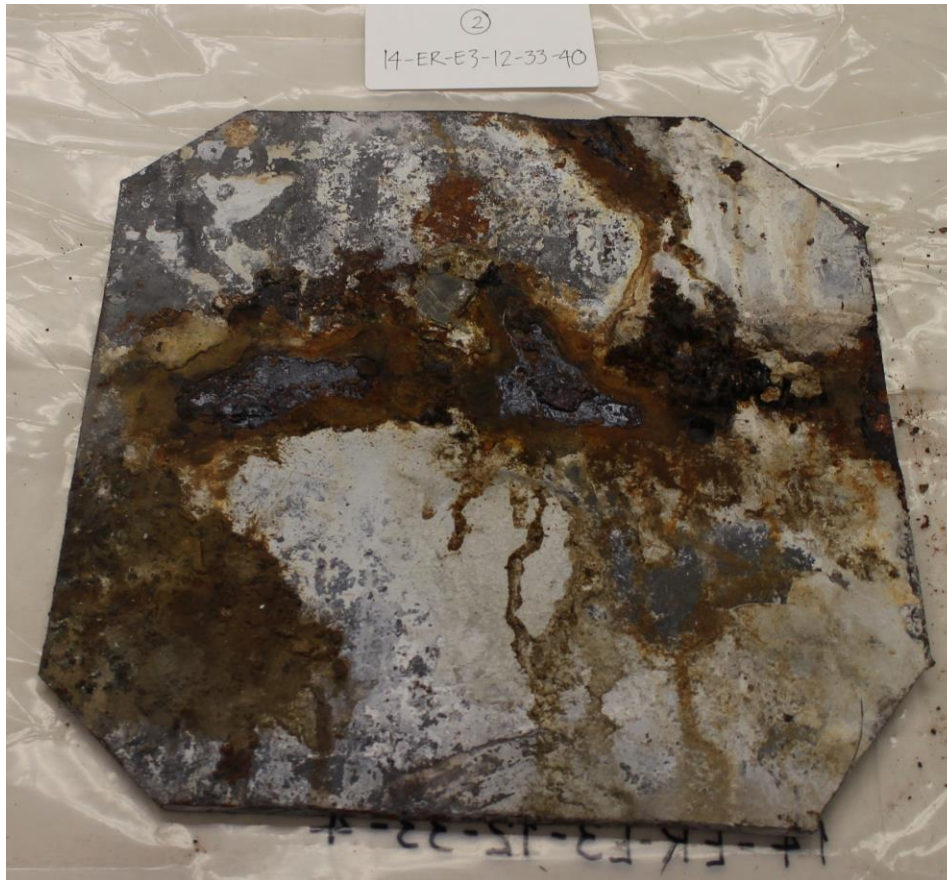




## (Coupon #2) Expansion ring – fuel side



## (Coupon #2) Expansion ring – back side



### NDE Prediction:

- Remaining thickness: 0.150" to 0.157"

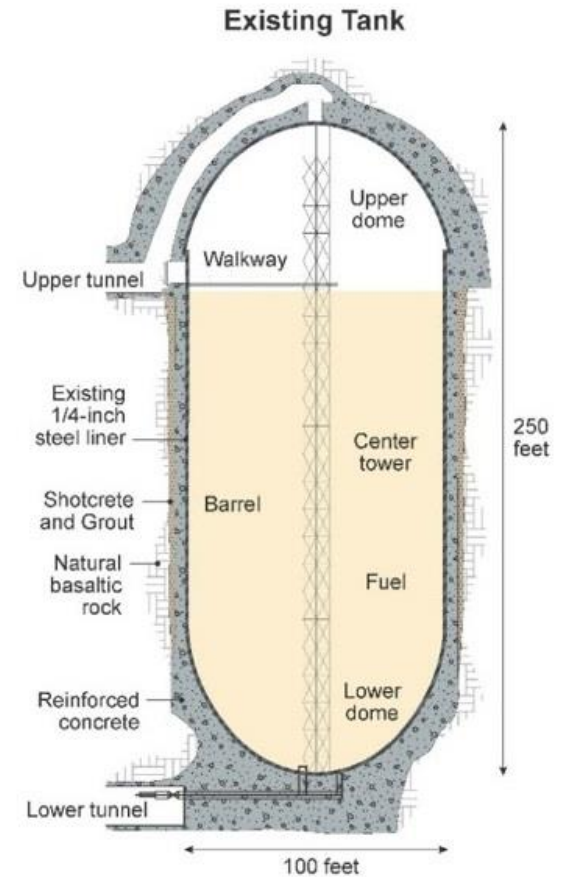
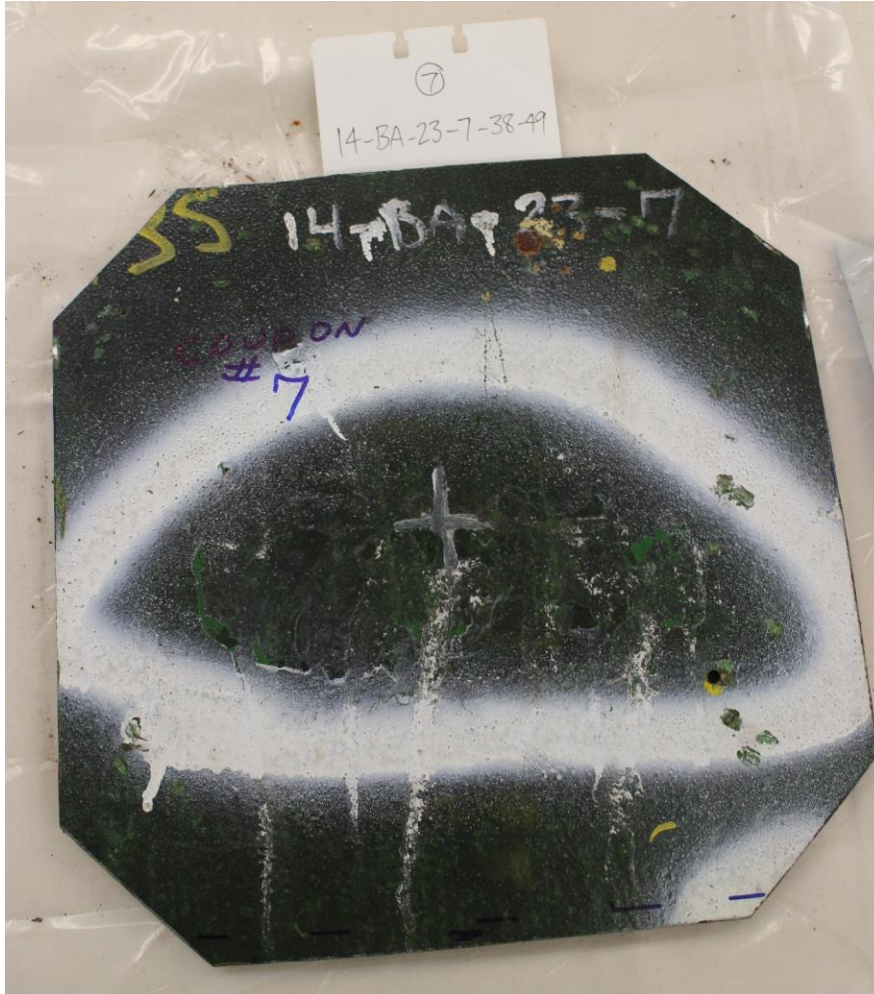
### June 25<sup>th</sup> Observations:

- Apparent remaining thickness:  
3mm = 0.118"



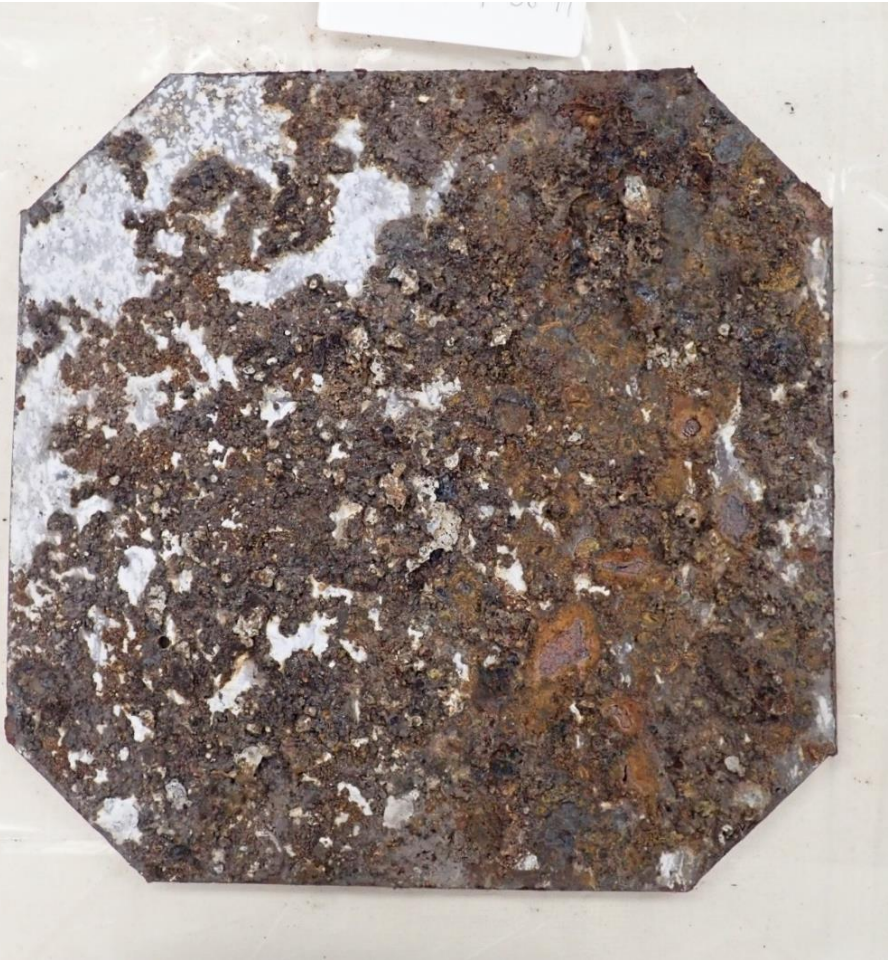


## (Coupon #7) Barrel – fuel side





## (Coupon #7) Barrel – back side

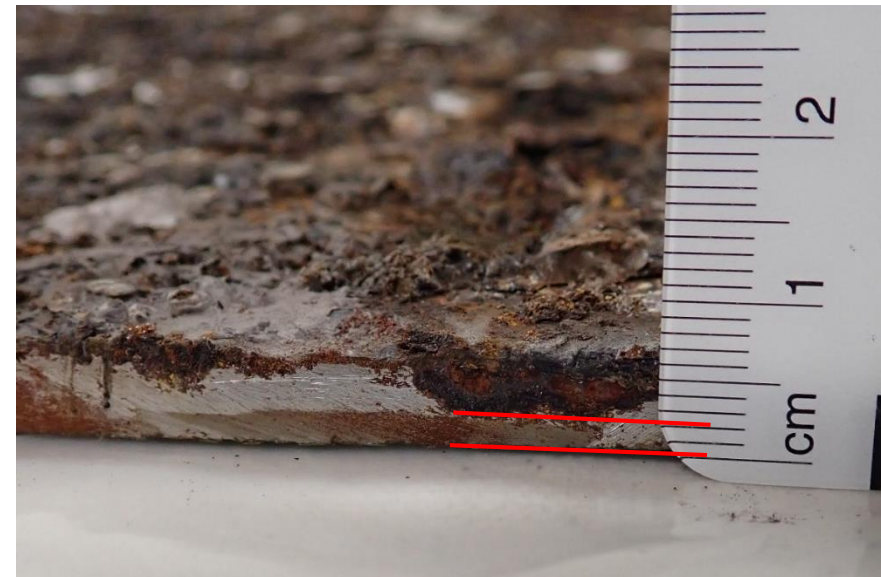


### NDE Predictions:

- Minimum remaining thickness:  
0.135" to 0.187"

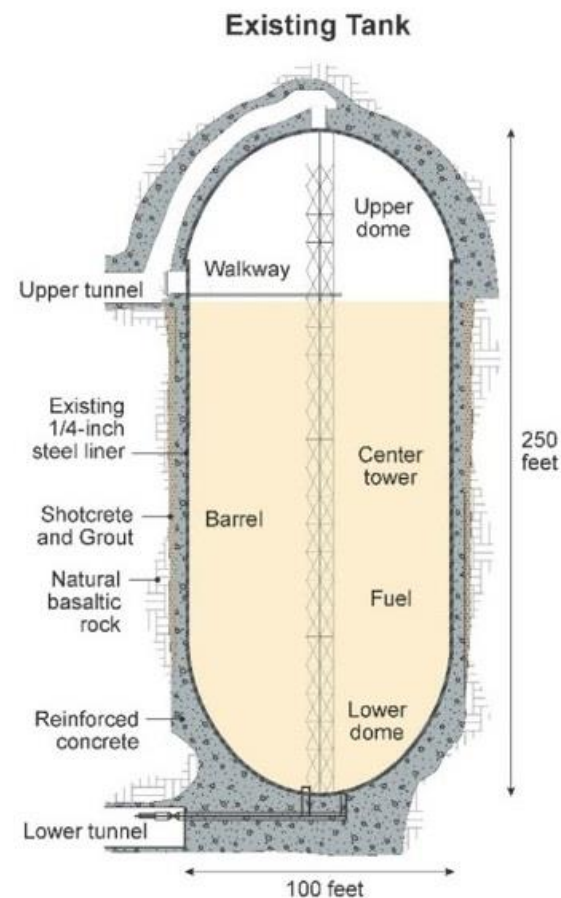
### June 25<sup>th</sup> Observations:

- Apparent remaining thickness:  
2mm = 0.079"





## (Coupon #10) Lower dome – fuel side



## (Coupon #10) Lower dome – back side

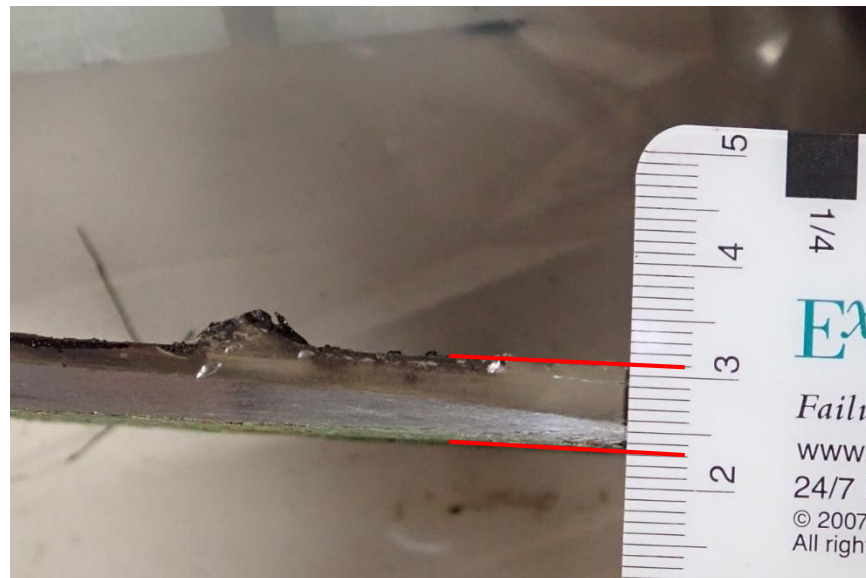


### NDE Predictions:

- Remaining thickness expected to exceed 0.200"

### June 25<sup>th</sup> Observations:

- Apparent remaining thickness: 6.3mm = 0.25" (full original thickness)





## Coupon Review

- Presence of backside corrosion
  - Half of the coupons exhibited considerably more corrosion than others [Coupons # 1 (UD), 2 (ER), 3 (ER), 7 (BA) and A1(BA)].
  - Potential for through-wall pitting, and associated fuel leaks, is a concern.
- Staining on Backside of Steel
  - Deposits on the backside of some coupons suggest hydrocarbon-staining. [Coupon # 2 (ER), 3 (ER), 7 (BA), 10 (LD) and A1 (BA)]
  - Chemical analysis by independent lab will determine nature of staining.

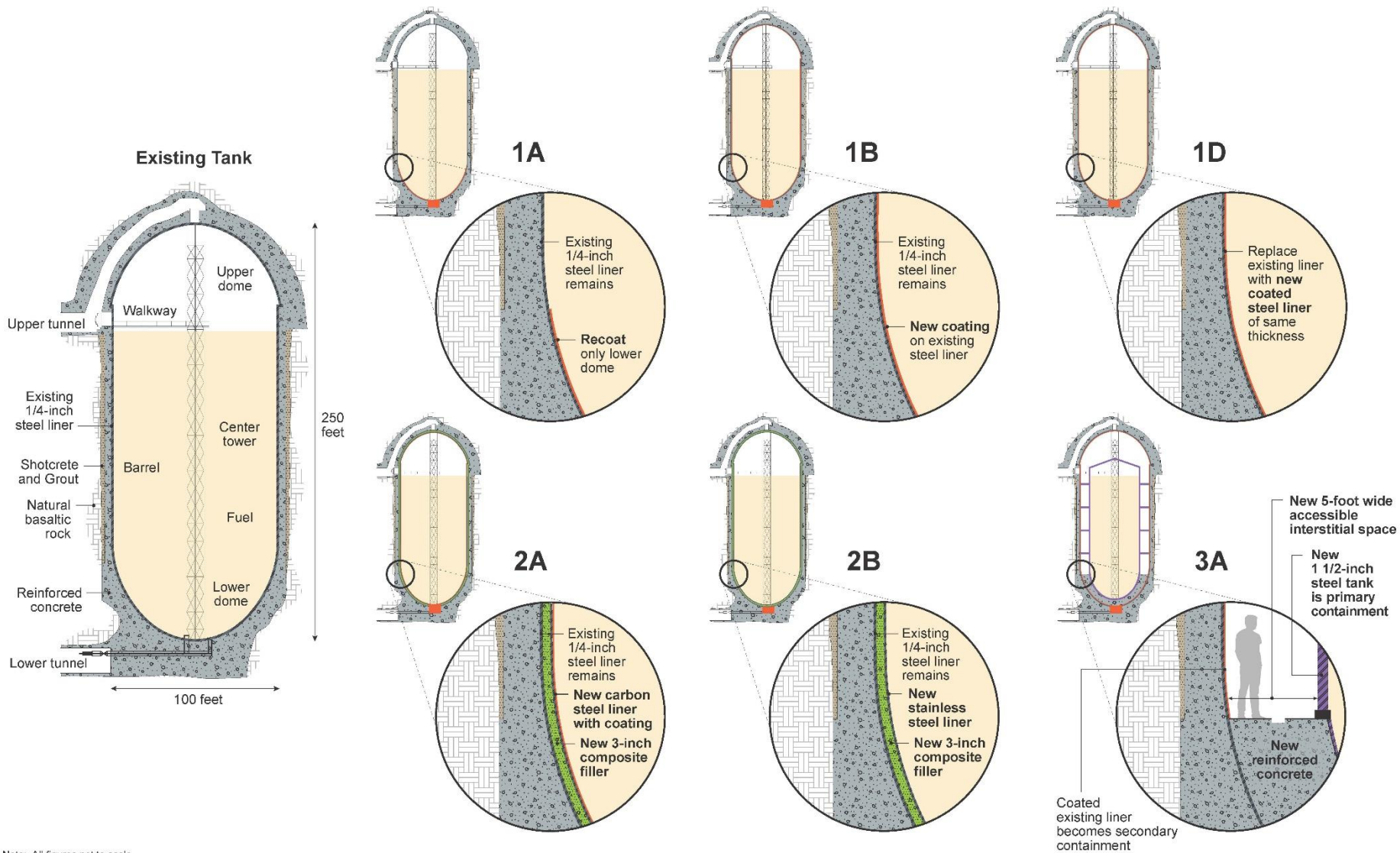


## Coupon Review – cont.

- Current NDE Technique Appears to Underestimate Remaining Wall Thickness
  - Corrosion pit depths measured on the cut specimen edges suggest that NDE techniques were not able to locate and measure the thinnest wall of the coupon.
- Work continues under Red Hill Administrative Order on Consent (AOC) to understand tank condition and reach decision on tank upgrade alternative (TUA) selection.

# Tank Upgrade Alternatives

Adapted from: Navy, Red Hill AOC SOW Section 3.0 Tank Upgrade Alternatives (TUA), Red Hill Fuel Storage Facility, NAVSUP FLC Pearl Harbor (PRL), Hawaii, Final Report, December 2017; <https://www.epa.gov/red-hill/tank-upgrade-alternatives-red-hill>



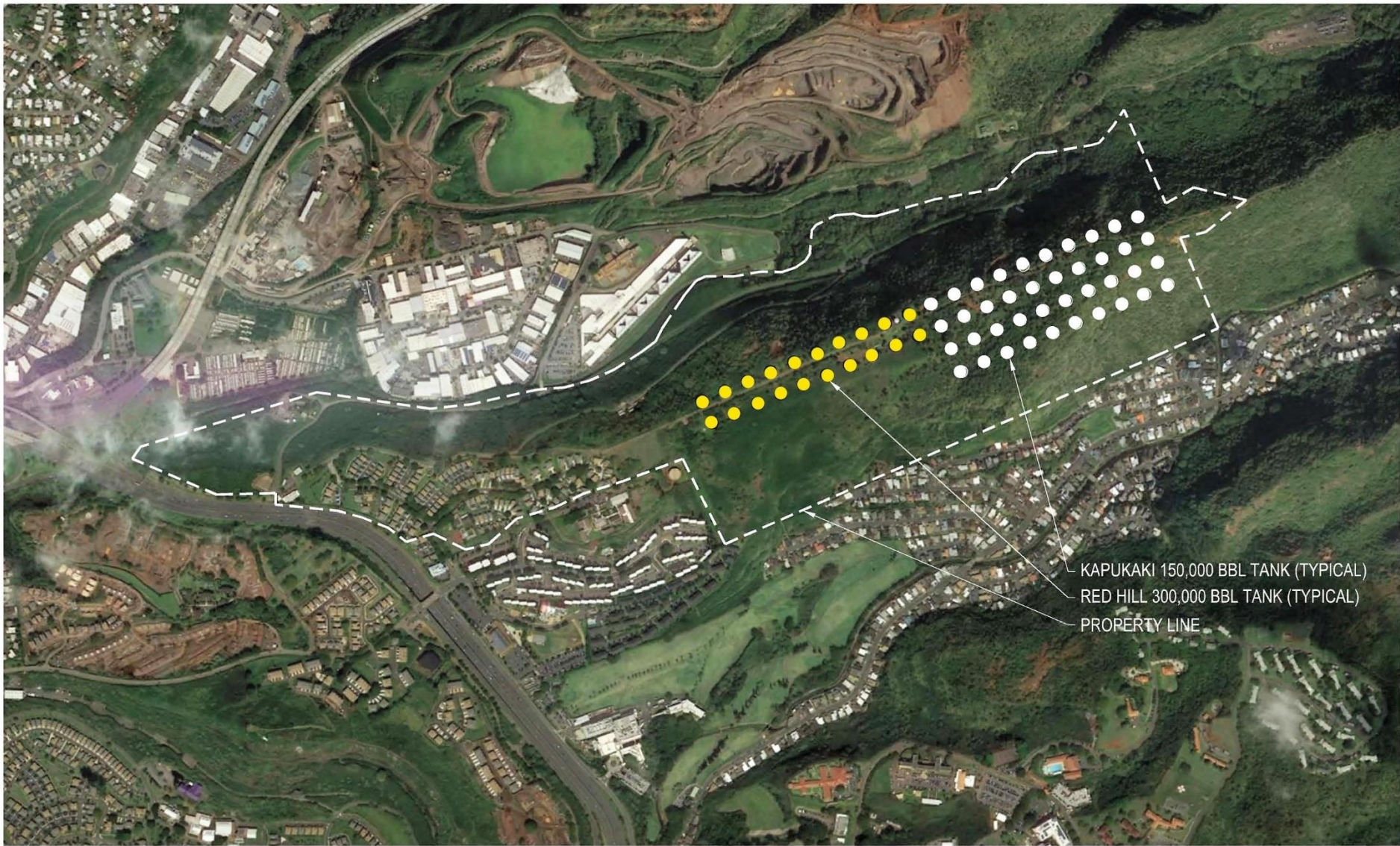


Figure 7.1-1 Kapūkaki Tank Layout



## Tank Upgrade Alternatives

Source: Star Advertiser, March 19, 2018

| 1   | 2  | 3  | 4   | 5   | 6   | RELOCATION                                    |
|---|--|--|---|---|---|---|
| Restoration of existing tank                  | Restoration of existing tank plus interior coating | Remove existing liner, install new steel liner with interior coating | Composite tank (double wall), carbon steel, with interior coating | Composite tank (double wall), stainless steel | Tank within a tank (carbon steel), full interior and exterior coating | New tanks/ replacement elsewhere              |
| <b>COST PER TANK</b><br>\$10M to \$25M        | <b>COST PER TANK</b><br>\$25M to \$100M            | <b>COST PER TANK</b><br>\$100M to \$250M                             | <b>COST PER TANK</b><br>\$25M to \$100M                           | <b>COST PER TANK</b><br>\$100M to \$250M      | <b>COST PER TANK</b><br>\$100M to \$250M                              | <b>COST PER TANK</b><br>\$100M to \$250M      |
| <b>NUMBER OF TANKS</b><br>18 at 100% capacity | <b>NUMBER OF TANKS</b><br>18 at 100% capacity      | <b>NUMBER OF TANKS</b><br>18 at 100% capacity                        | <b>NUMBER OF TANKS</b><br>20 at 88% capacity                      | <b>NUMBER OF TANKS</b><br>20 at 88% capacity  | <b>NUMBER OF TANKS</b><br>20 at 80% capacity                          | <b>NUMBER OF TANKS</b><br>40 at 100% capacity |
| <b>COMPLETION DATE</b><br>2031                | <b>COMPLETION DATE</b><br>2037                     | <b>COMPLETION DATE</b><br>2038                                       | <b>COMPLETION DATE</b><br>2040                                    | <b>COMPLETION DATE</b><br>2037                | <b>COMPLETION DATE</b><br>2038  | <b>COMPLETION DATE</b><br>2051                |
| <b>COST RANGE</b><br>\$180M to \$450M         | <b>COST RANGE</b><br>\$450M to \$1.8B              | <b>COST RANGE</b><br>\$1.8B to \$4.5B                                | <b>COST RANGE</b><br>\$500M to \$2B                               | <b>COST RANGE</b><br>\$2B to \$5B             | <b>COST RANGE</b><br>\$2B to \$5B                                     | <b>COST RANGE</b><br>\$4B to \$10B            |

Source: U.S. Navy

Single wall

Composite wall

Interstitial space  
Double wall

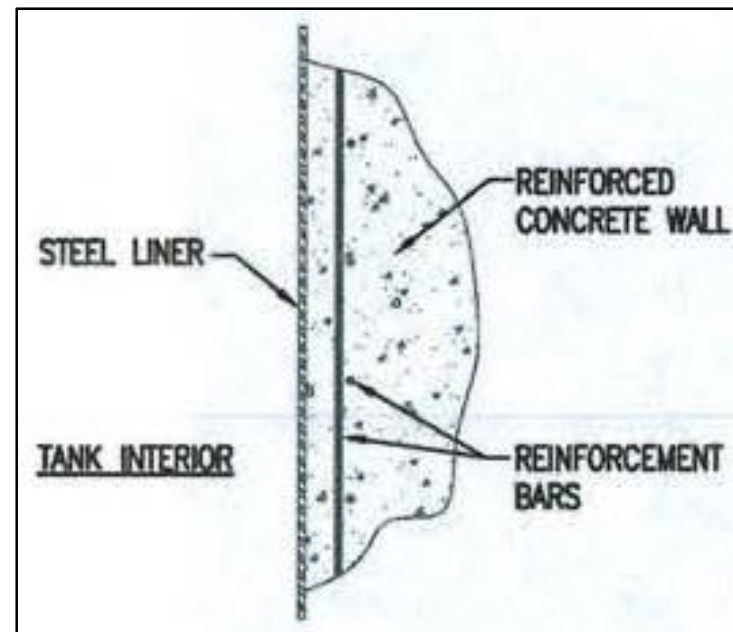
“Cut and cover”  
Double wall



## Tank Wall Types and Differences

### Single wall

- Existing 1940 single ¼ inch wall separating fuel and environment
- Cannot inspect or maintain back side of the wall
- Back side of wall subject to potential groundwater contact and corrosion

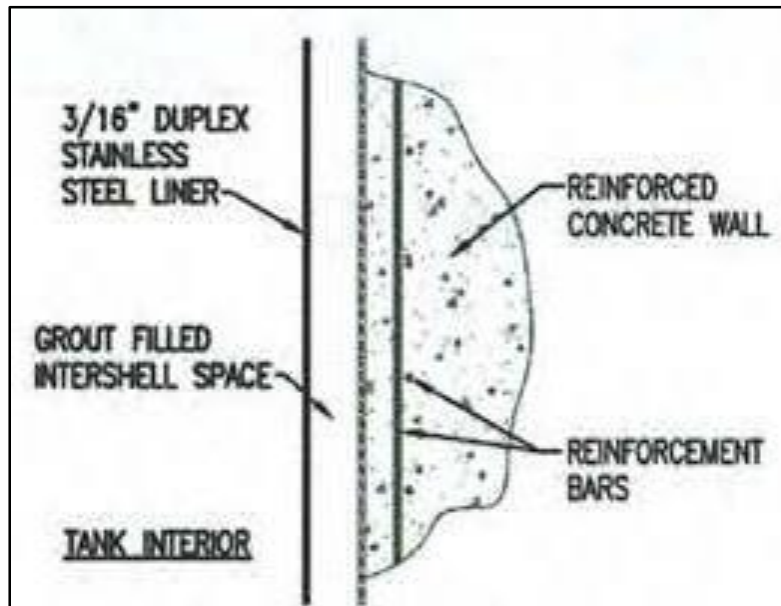




## Tank Wall Types and Differences – cont.

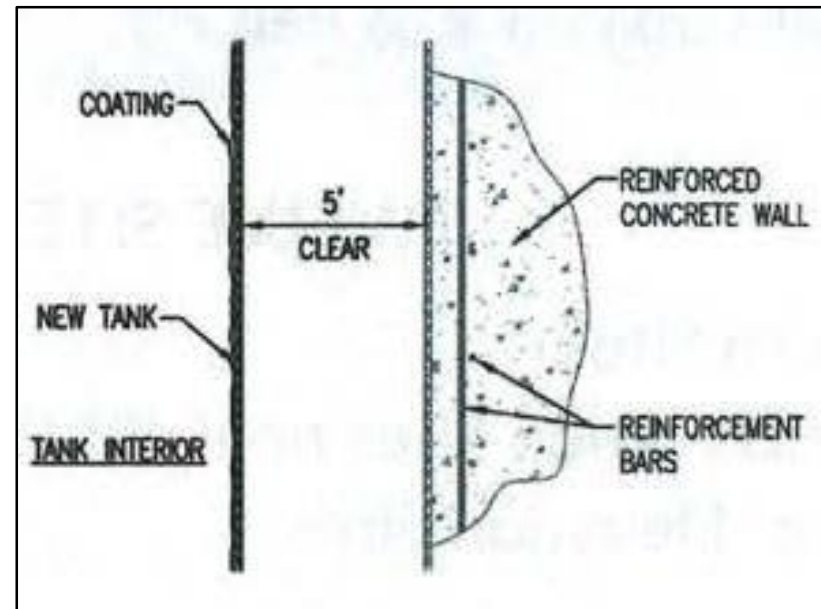
### Composite Wall

- Two walls with 3 inch space filled with cement



### Interstitial Double Wall

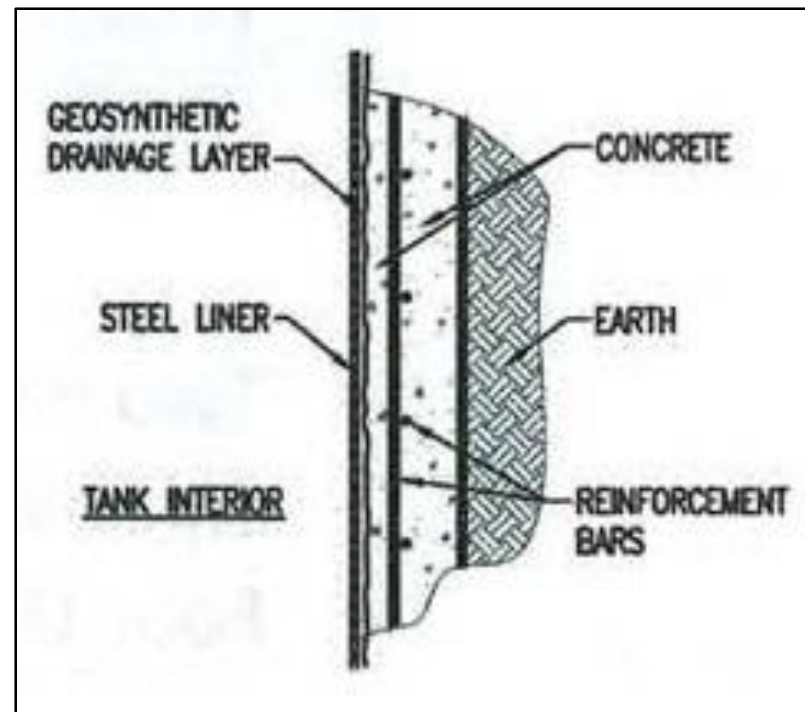
- Two walls with 5 ft. space in between to collect leaked fuel, inspect and maintain inner wall.



## Tank Wall Types and Differences – cont.

### “Cut and Cover” Double Wall

- New steel liner, geosynthetic drainage layer and concrete design
- Steel liner is one wall, concrete is the second wall
- No interstitial space to inspect between new steel liner and concrete
- Back side of wall in contact with environment







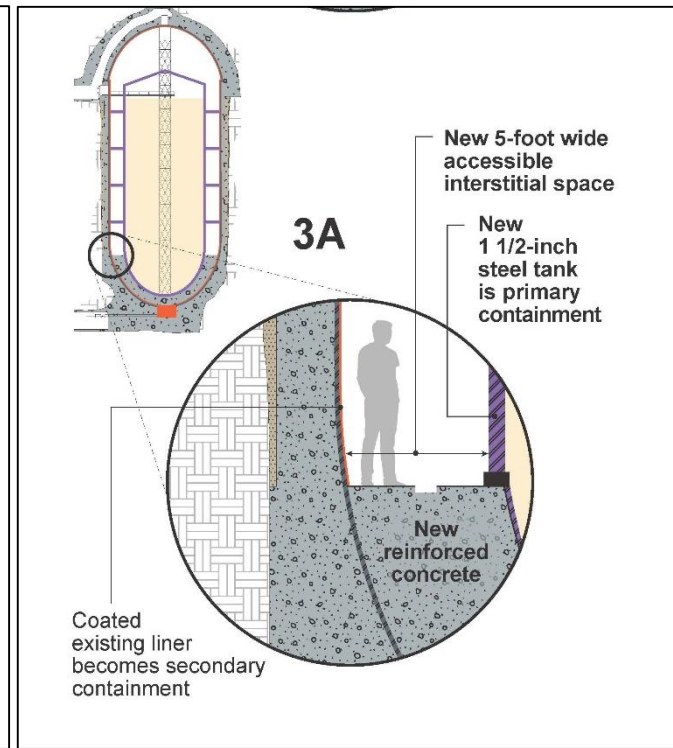
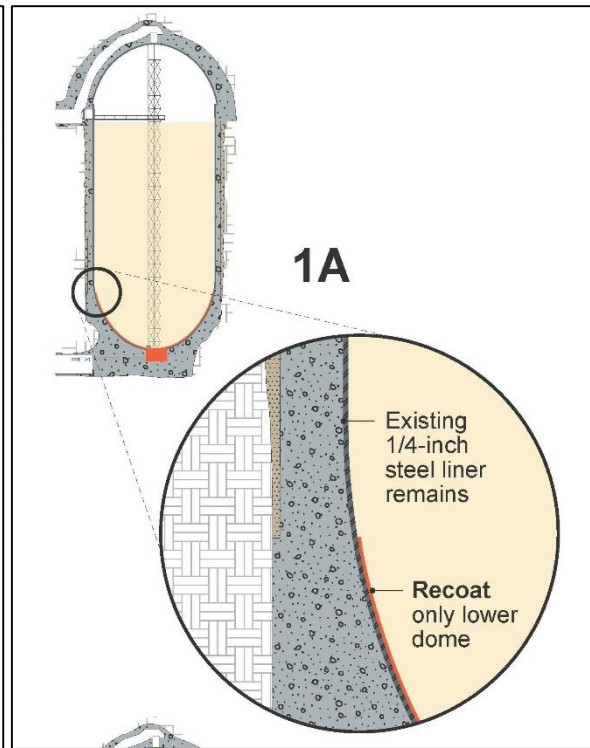
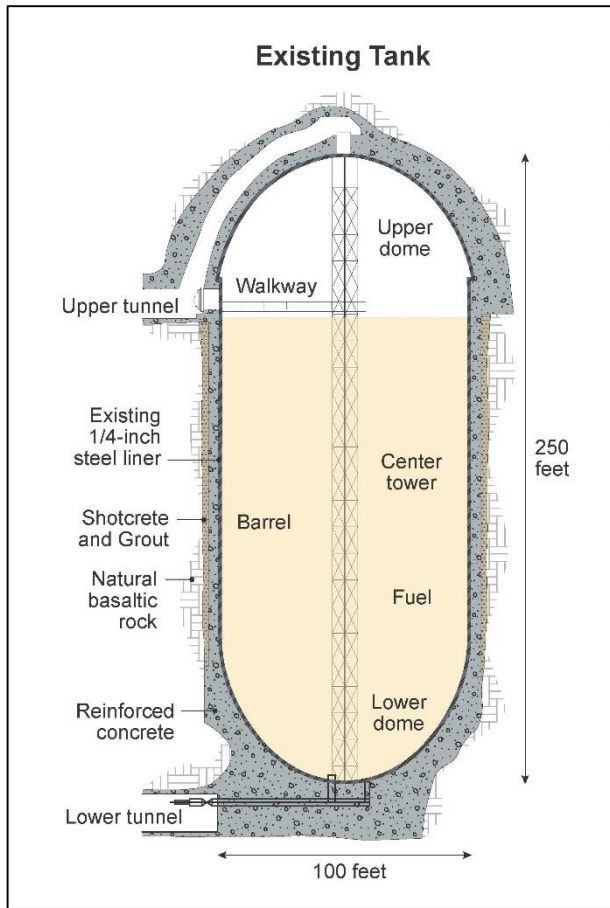
## Navy Reasons For TUA Way Forward

- Annual tank tightness testing since 2008 show no failed results
- Red Hill meet or exceed best practices for petroleum terminals and bulk fuel storage facilities based on 2016 inspection.
- Each tank's online fuel inventory system continuously measures tank level down to 1/16 of an inch.
- Ground water protection plan monitors soil vapor beneath all tanks, quarterly groundwater sampling and monthly oil/water interface measurements.
- 2014 fuel release is only reportable release from Red Hill since establishment of underground storage tank regulations in 1988.
- The 2014 release from Tank 5 due to human error, not tank failure.

**\*Data does not support above reasons**



## Single wall v. Secondary containment





## Next Steps

- Navy to prepare and submit final TUA report for regulatory agencies review and approval.
- Navy TUA report will include Navy recommended TUA for regulators / public consideration.
- Anticipate TUA report and community meeting – end of 2018 / early 2019.
- Under AOC, TUA decision revisited every 5 years.
- BWS will submit formal comments on recommended TUA following review of final TUA report and attend TUA community meeting.

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**Board of Water Supply**  
City and County of Honolulu

# Questions/ Discussion

