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Tank 16 Residuals Sampling

Sampling and Analysis Approach for the Tank 16 Primary and Annulus Residual Materials

April 17, 2013

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Presentation to the South Carolina Department of Health and Environmental Control

SRR-CWDA-2013-00055 Rev 1

Presentation Outline

- Meeting Purpose
- Tank 16 Background Information
- Sampling Challenges
- Sampling Options Evaluation
  - Primary Liner Residuals Sampling Approach
  - Annulus Residuals Sampling Approach

Meeting Purpose

Meeting Purpose:

Present an overview of the Tank 16 operational history as it relates to residual material distribution and volumes.

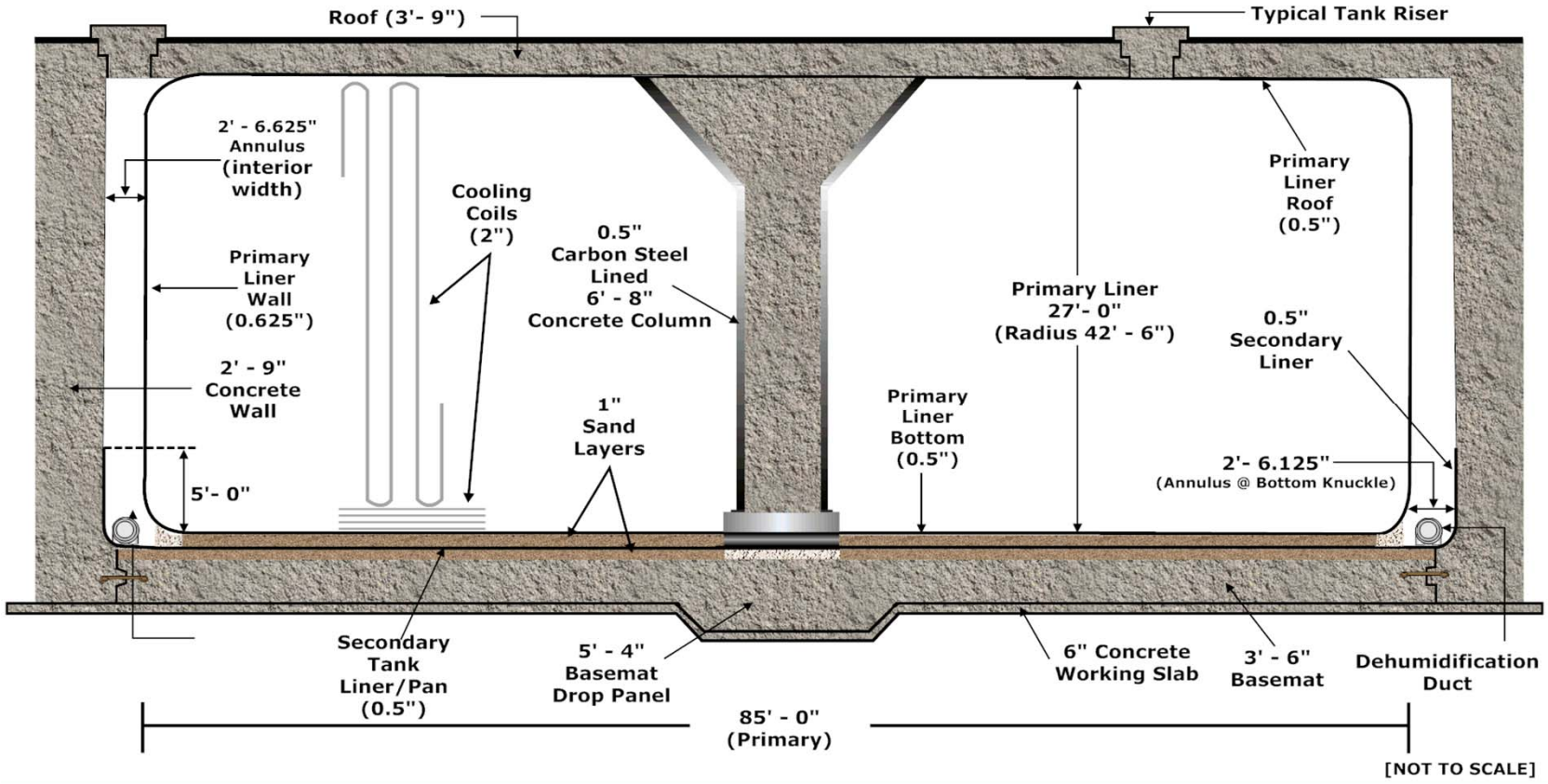
Describe the sampling approach and factors evaluated in the selection decision.

Final Sampling Approaches to be used.

First implementation of the Agency-approved Liquid Waste Tank Residuals Sampling and Analysis Program Plan (LWTRSAPP) and the Liquid Waste Tank Residuals Sampling – Quality Assurance Program Plan (LWTRS-QAPP).

Tank 16 Background

Tank 16 is a Type II Waste Tank, with an annulus containing a secondary liner and dehumidification duct.



Operational History Summary

- Tank 16 put into service in May 1959.
- Leakage into the annulus was discovered within six months of first waste receipt.
- Extensive investigation of the leak mechanism.
  - Significant quantities of sand (20 ft^3) were introduced into the annulus
  - Numerous cleaning campaigns in the tank primary and annulus.
- Tank 16 was removed from service in March 1972.
  - More detail was presented in the : "*Proposal to Cease Waste Removal Activities in Tank 16 and Enter Sampling and Analysis Phase"* recently presented to the agencies. [SRR-CWDA-2013-00041, Rev. 1]

Tank 16 Sampling Challenges

Tank 16 presents challenges for residual characterization due to:

- Characteristics of the material in the annulus requiring characterization (an estimated 3,300 gals. Insoluble NaAlSi compounds.)
- Minimal material in the primary (an estimated 300 gals)

The first Type II tank. Sampling access complicated by "field-to-fit" cooling coils.

The first tank in the H-Area Tank Farm being sampled for closure.

What are the DQOs?

We are sampling to characterize the residual materials within the footprint of the waste tank in order to enable tank inventory determinations to support waste tank closure decisions.

- Comparison against Class C concentrations.
- Removal of HRRs to the Maximum Extent Practical.
- Decontamination to the extent technically practicable from an engineering perspective.

The characterization data is an input to the Special Analysis (SA) to assess constituent long-term fate and transport. The SA enables the prediction of future sustained conformity with the performance objectives.

- For Tank 16, two inventories are needed.

Sampling Approach Selection

The problem was deciding on the "best" approach for residuals characterization.

- "Best" meaning: *The approach that meets the DQOs and has acceptable impact on the sample analysis upper 95% confidence limit for the mean concentration (UCL95) but also considers time, material accessibility, cost, and ALARA.*

The LWTRSAPP and LWTRS-QAPP will be implemented for the Tank 16 sampling.

Populations for Sampling

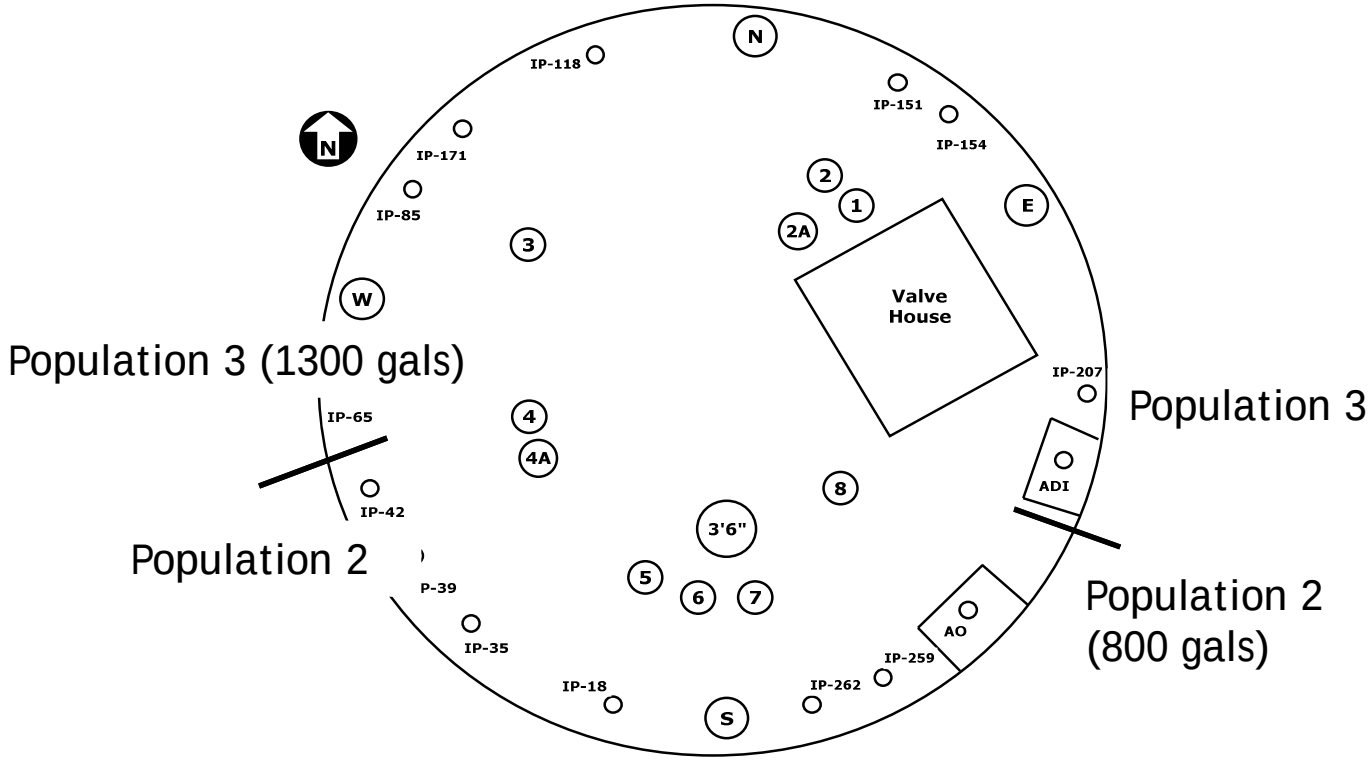
One primary tank population identified for sampling.

Three annulus populations identified for sampling.

Annulus Pop.	Location	Characteristic	Estimated Volume (gallons)
1	Material inside the dehumidification duct	Visually consistent with salt (supernate) material	1,200
2	Material outside the dehumidification duct in the southern annulus sector (Tank South to Station 5+00 and Station 23+00 to Station 27+00)	Sample analysis (1 in 2011) and visual inspections show it is consistent with sand (silica) material	800
3	Material outside the dehumidification duct in the northern annulus sector (Station 5+00 to 23+00)	Sample analyses (3 in 2011) and visual inspections show it is consistent with sand (silica) material	1,300

Tank 16 Annulus Populations

Populations inside the Tank 16 annular residuals



Population 1 = Material inside the duct (1200 gals)

Statistical Evaluation of Six Possible Sampling Approaches

1. **Baseline Compositing** – 15 samples from primary (composited into 3 samples for analysis) and 15 samples from annulus (composited into 3 samples for analysis).
2. **Combined Compositing** – 15 samples total from the primary and annulus (composited into 3 samples for analysis).
3. **Reduced Baseline Compositing** – Similar to Option 1, but with less than 15 samples in the annulus (composited into 3 samples for analysis) and less than 15 samples in the primary (composited into 3 samples for analysis).

Statistical Evaluation of Six Possible Sampling Approaches

4. **Composited and Discrete Analysis** – 15 samples total, (composited into 3 samples for analysis) but with some limited number of discrete samples individually measured for key constituents.
5. **Composited Annulus and Discrete Primary** - 15 samples from the annulus (composited into 3 samples for analysis) and 3 to 5 discrete samples analyzed from the primary.
6. **Discrete Annulus and Discrete Primary Sampling and Analysis** – Approximately 5 discrete samples from the primary and at least 5 discrete samples from the annulus.

Statistical Analysis Results

Sampling Option	Description	Impact Description
1 (Lowest Impacts)	**Baseline Compositing** 15 samples from annulus 15 samples from primary	Since the sampling follows the LWTRSAPP and Liquid Waste Tank Sampling – Quality Assurance Program Plan (LWTRS-QAPP), the impact on the uncertainty would be low (i.e., generally the same as that for Tanks 5 and 6). The approach is applicable for the three material populations in the annulus. This would provide the lowest UCL95.
3	**Reduced Baseline Compositing** <15 samples in annulus <15 samples in primary	This would raise the UCL95's from the Baseline Compositing Case. However the increase in the UCL95 for 3 or 4 locations per composite sample does not substantially raise the UCL95 based on the input assumptions. Decreasing from 5 to 4 locations per composite sample is expected to increase the UCL95 1.18 times the actual analyte concentration. Decreasing to 3 locations per composite would raise the UCL95 to 1.20 times the actual analyte concentration.

Statistical Analysis Results

Sampling Option	Description	Impact Description
5	**Composited Annulus and Discrete Primary** 15 samples in annulus 3 to 5 samples in primary	This uses the same sampling plan for the annulus as Option 1, but uses discrete sampling in the primary liner. Therefore, the UCL95 for the annulus is the same as Option 1, but the UCL95 for the primary liner is the same as Option 6, which has a higher UCL95 than Option 1. In the primary liner, using only 3 discrete samples is expected to raise the UCL95 approximately 39 % over Option 1, while using 5 discrete samples is expected to only raise the UCL95 by approximately 12 % over Option 1.
6 (Highest Impacts)	**Discrete Annulus and Discrete Primary Sampling and Analysis** ≥5 samples in annulus ±5 samples in primary	This sampling option is the same as Option 5 for the primary liner. Taking 5 discrete samples in the annulus is expected to raise the UCL95 by approximately 12 %.

Statistical Analysis Results

Sampling Option	Description	Impact Description
4 Unknown Impacts	**Composited and Discrete Analyses** 15 samples total from primary and annulus used for compositing. Some discrete samples analyzed for key radionuclides and chemicals.	This sampling option results in a systematic error when the overall concentration of an analyte is used as an estimate for just the annulus or just the primary liner. The addition of supplemental discrete samples for key constituents can make this sampling option equivalent to Option 6 in the instance where additional discrete samples were obtained. Those analytes not measured in the supplemental discrete samples will have a systematic error of unknown size.
2 Unknown Impacts	**Combined Compositing** 15 samples total from primary and annulus	This sampling option results in a systematic error when the mean overall concentration of an analyte is used as an estimate for just the annulus or the primary liner. The size of the systematic error varies and is unknown.

Sampling Approach Selection

Additional factors considered in the sampling options selection:

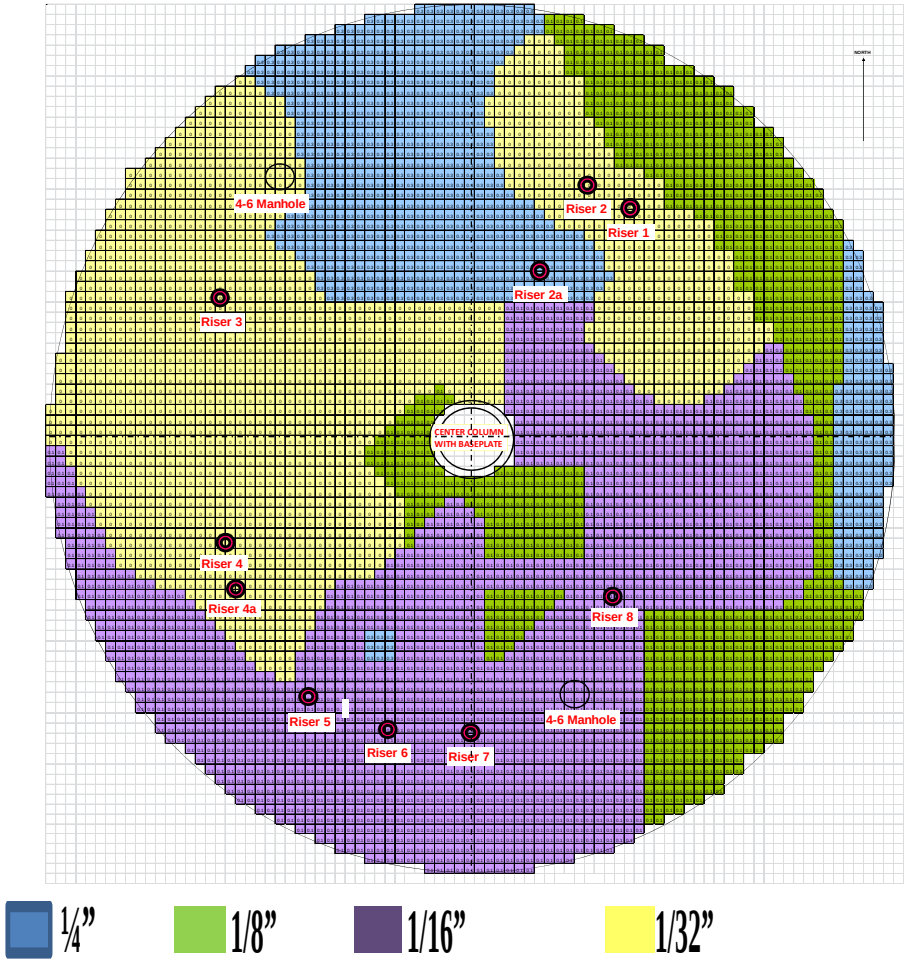
- Uncertainty (impact on the UCL95)
- Sampling Representativeness
- Special Analysis input requirements
- ALARA (minimize the number of access points used for sampling and number of samples transported)
- Consistency with Tank 5 & 6 sampling (i.e., follow the LWTRSAPP, implement the LWTRS-QAPP)
- Schedule and analytical costs

Sampling Approach Selection

Option 5 was selected as the "best" approach considering most of the inventory is in the annulus residuals and recovery inside the primary liner could be problematical (low-volume condition)

Option	Description	
5	**Composited Annulus and Discrete Primary** 15 samples in annulus 3 to 5 samples in primary	Discrete sampling for the low-volume condition in the primary liner. 15 samples (3 arrays of 5 samples) for the annulus.

Primary Liner Sampling Challenges

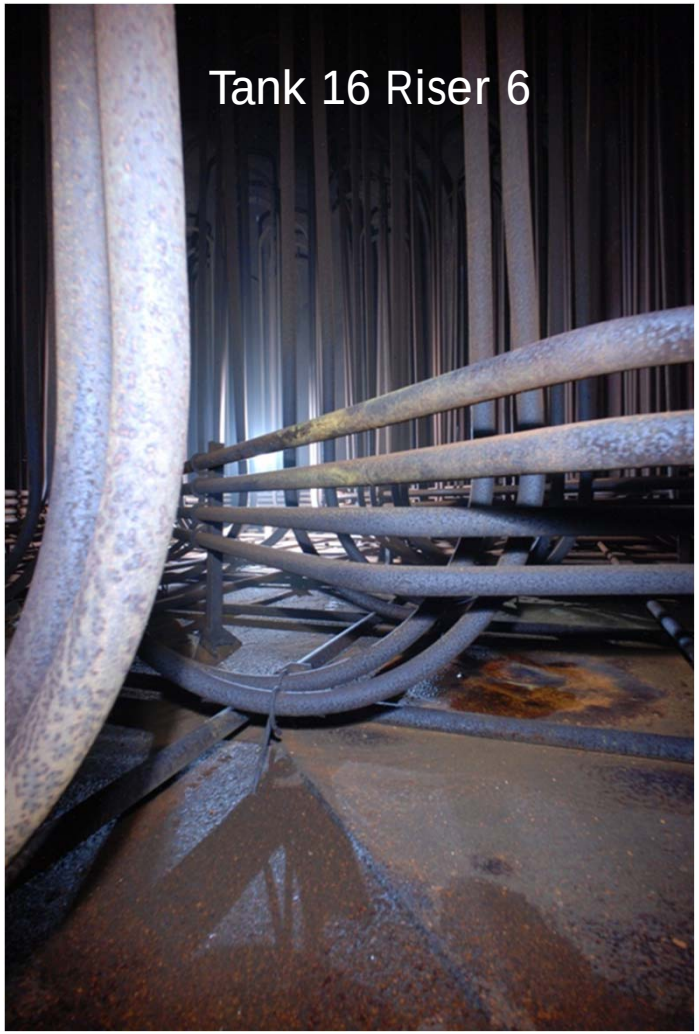


Primary Liner

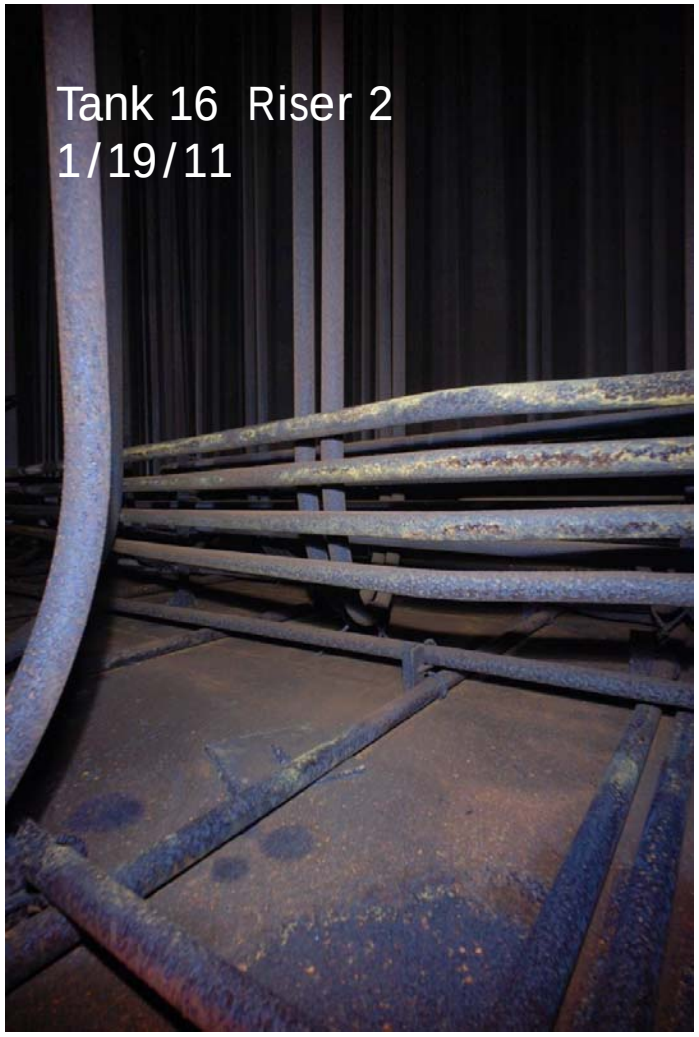
- Low-Volume Condition
- One, well-mixed population.
- Residuals thickness is estimated at ¼-inch or less for the entire liner floor.

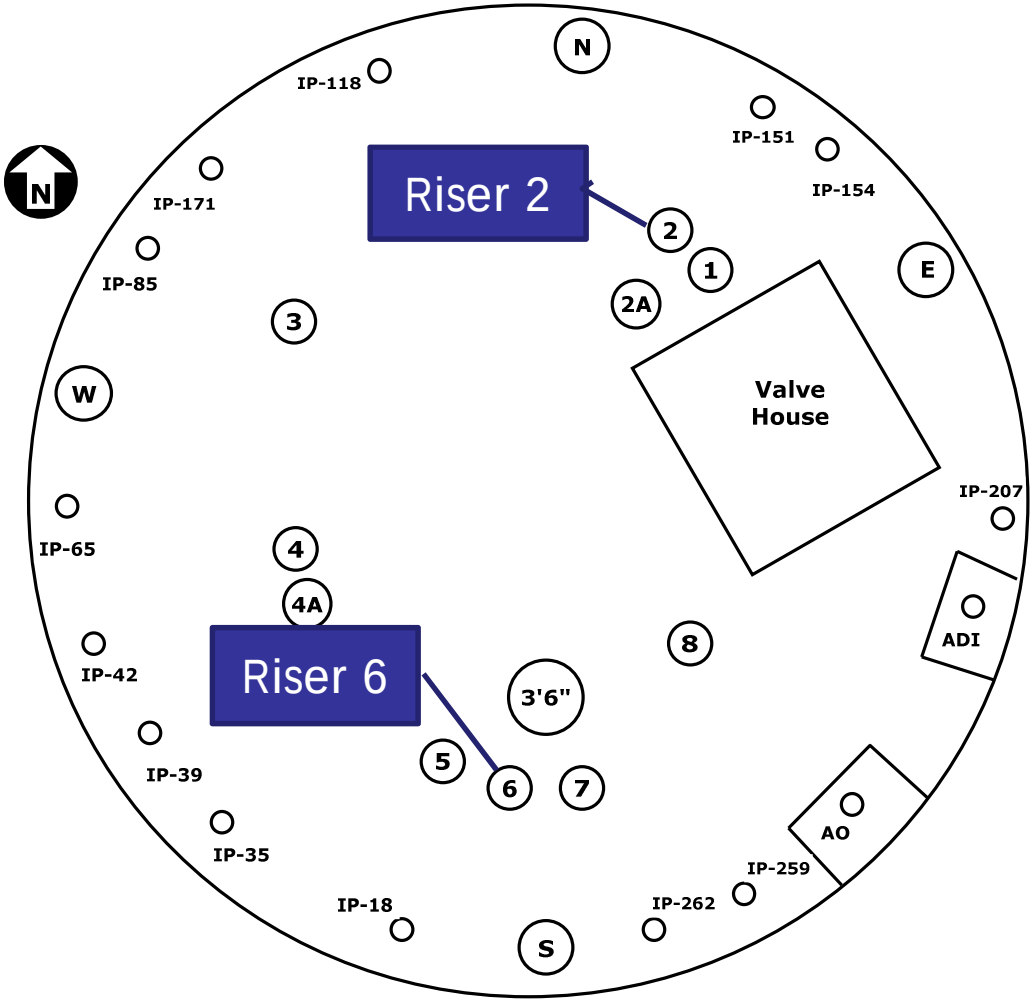
Primary Liner Sampling Challenges

Type II tanks contain ~30,000 linear feet of 2-inch diameter cooling coils that run both horizontally and vertically within the tank. The installation of the coils were "field-to-fit"

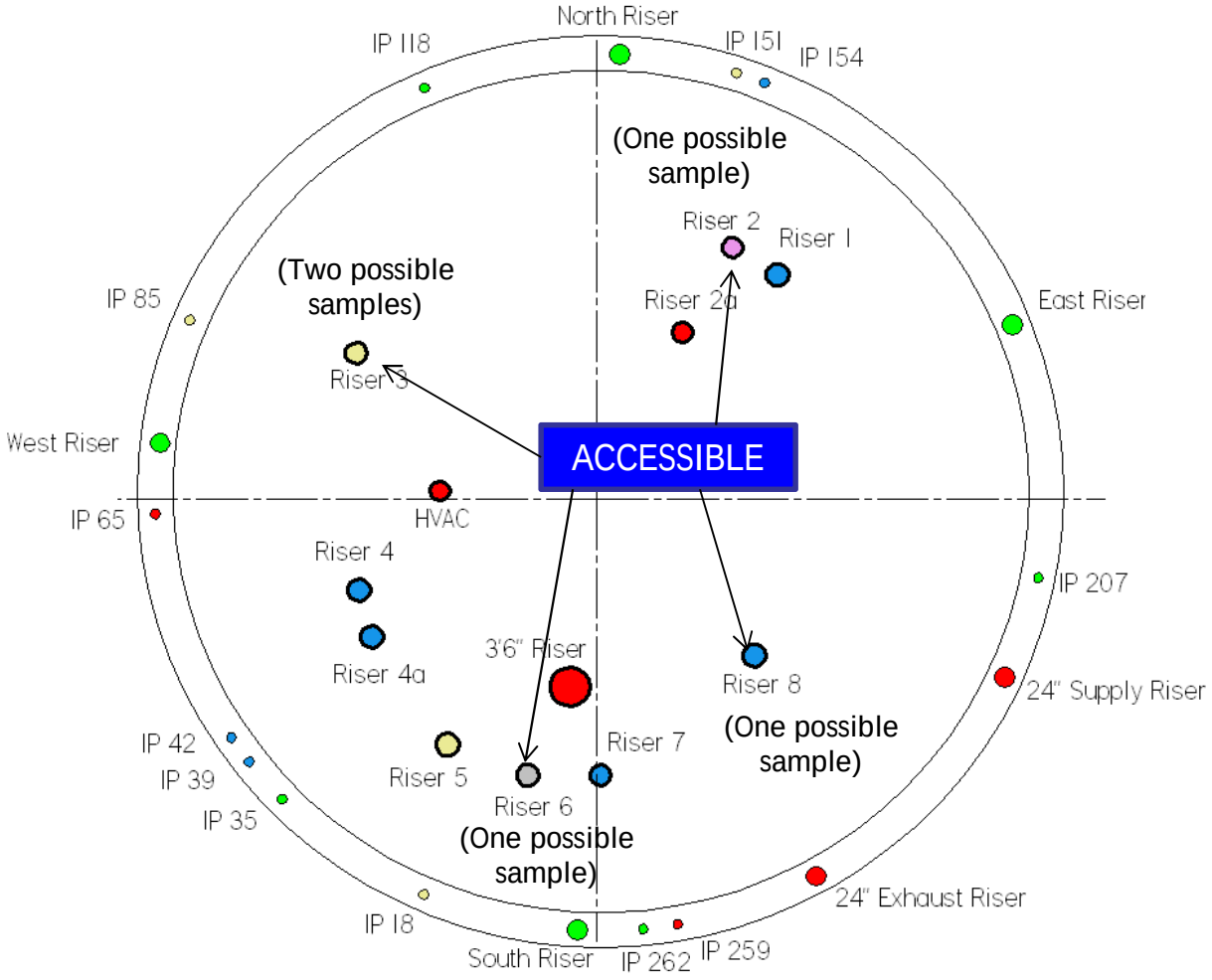


Primary Liner Sampling Challenges

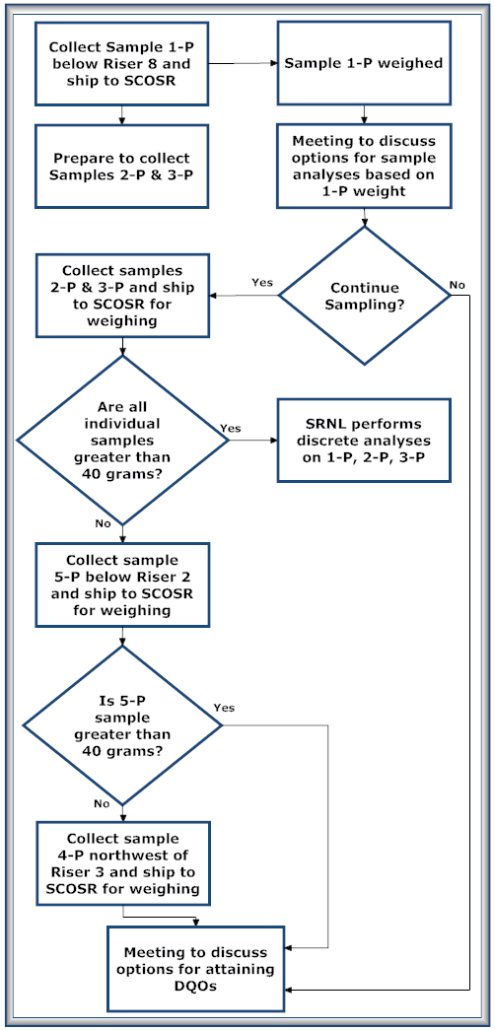




Primary Liner Access



Primary Liner Sampling Approach



Access the most promising area first (Riser 8) and decide how to proceed based on sample recovery.

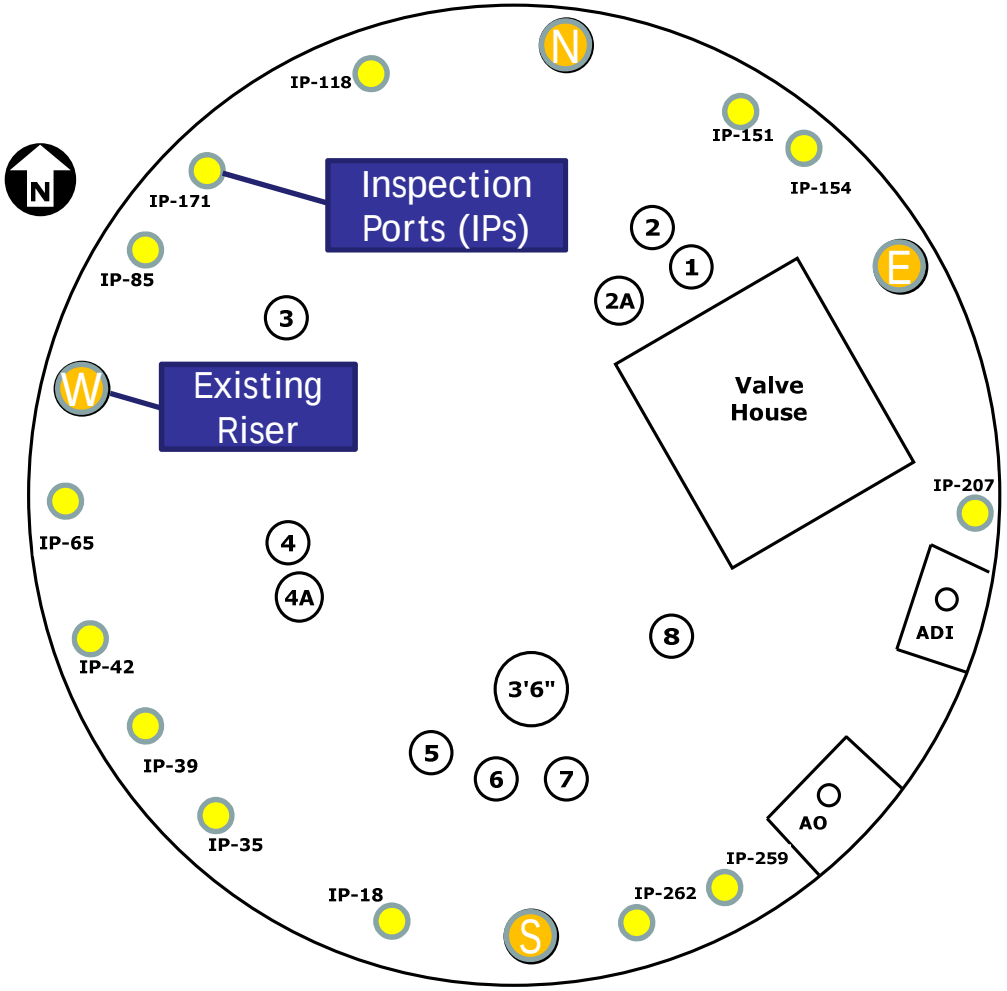
- Continue with next two discreet sample locations (Risers 6 and 3)?
- Collect the two alternate samples (Riser 2 and 3 near wall)?
- Decide on compositing?
- Adjust analyte list and MDAs?

Team decision at critical points.

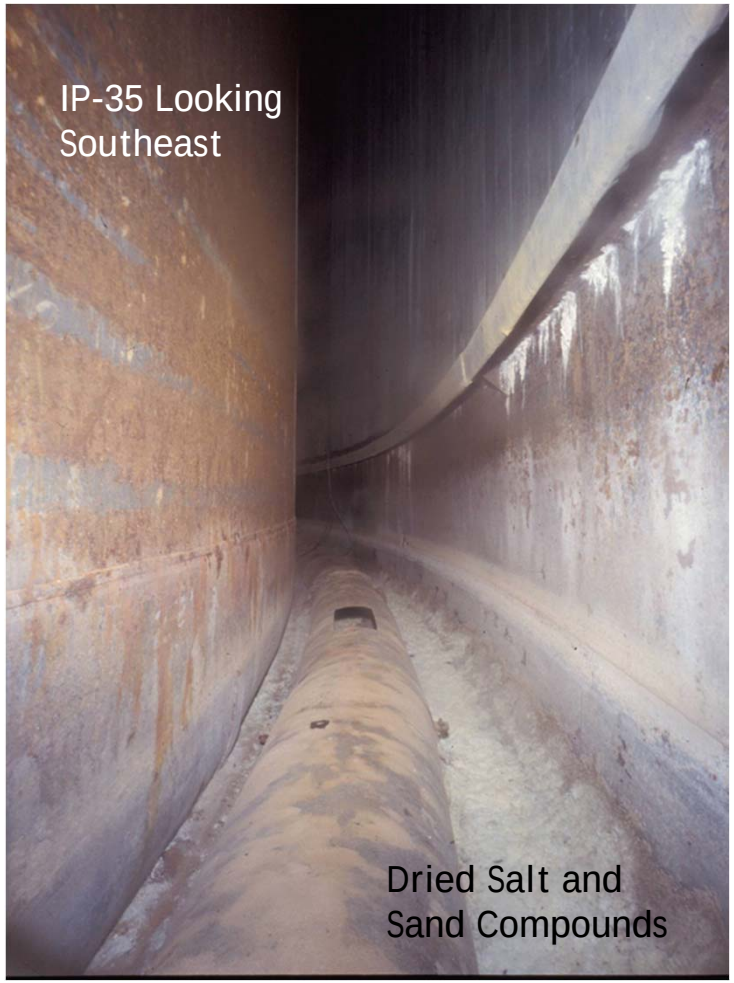
Agencies informed of final path forward.

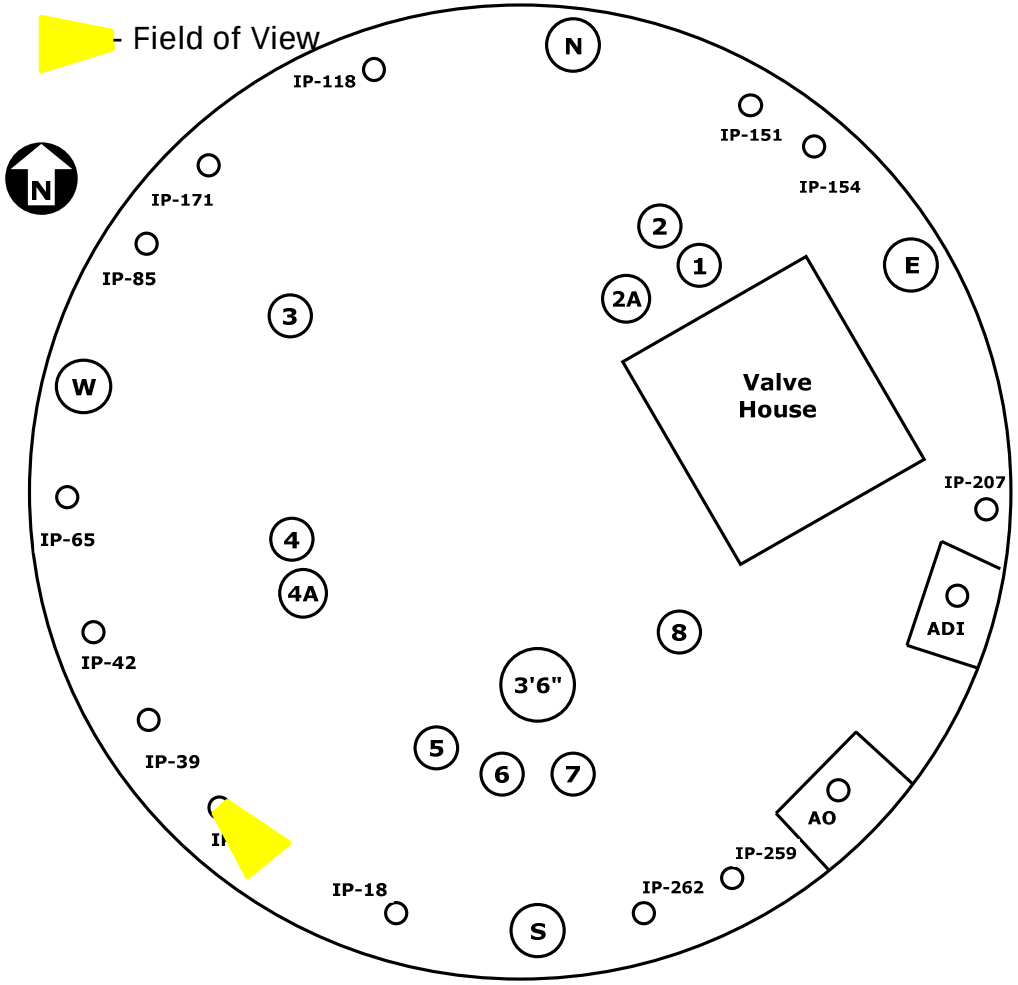
Annulus Sampling Challenges

Tank 16 is unique. Thirteen additional 6” diameter inspection ports (IPs) were added to the original four annulus risers to permit better observation and access following the discovery of active leak sites.

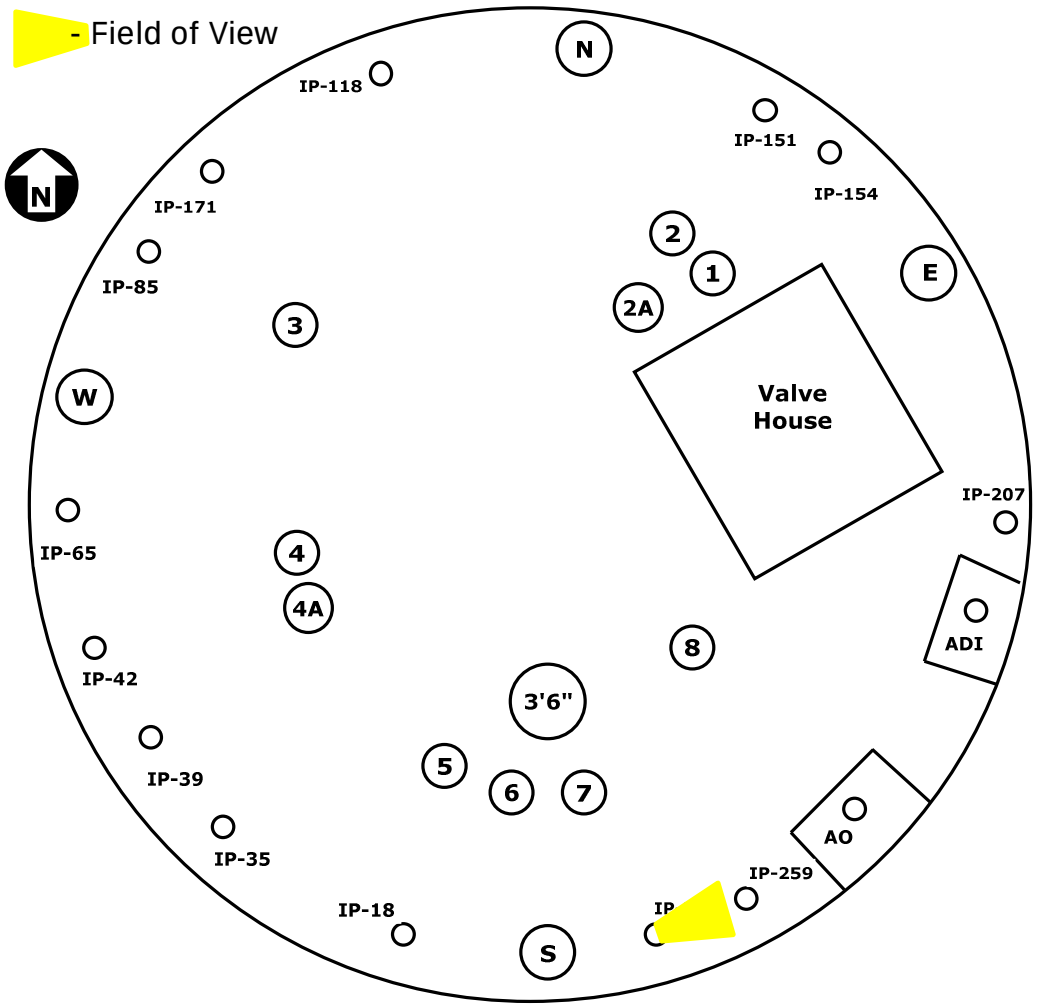


Annulus Sampling Challenges





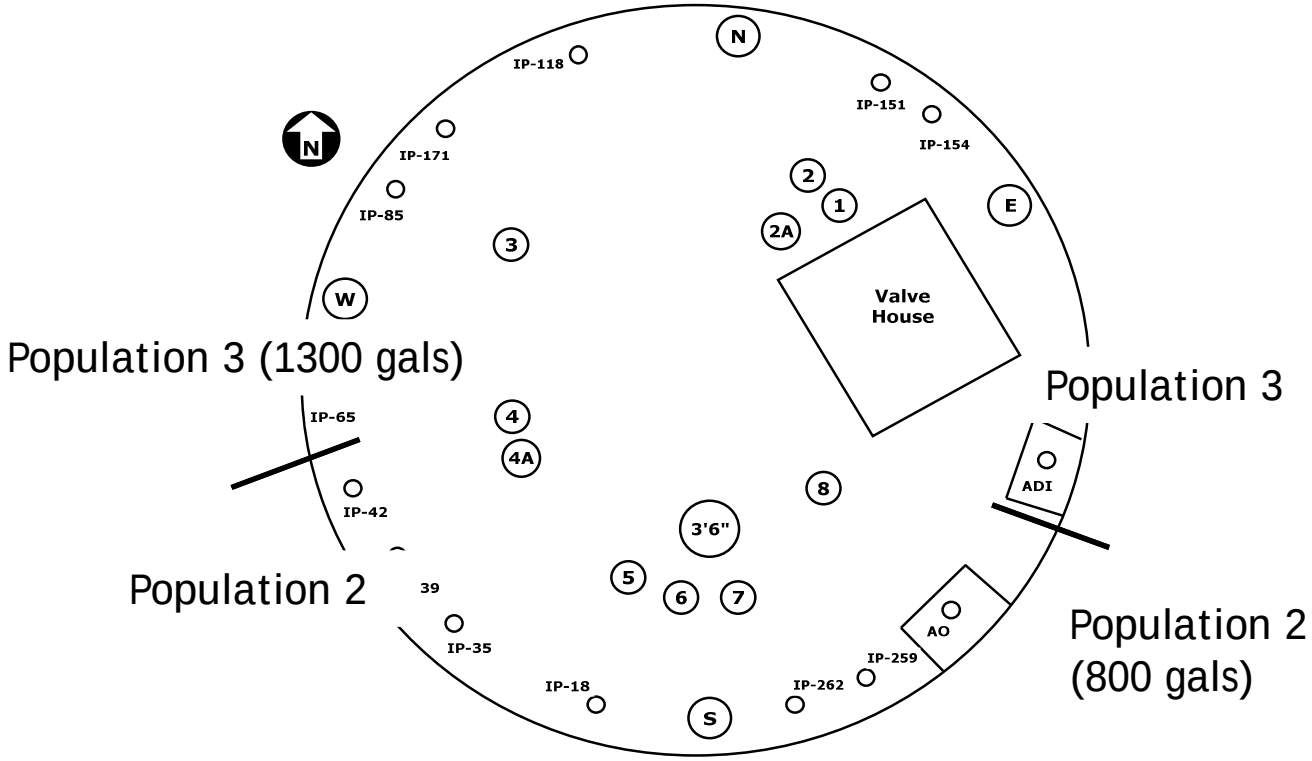
Annulus Sampling Challenged



Annulus Sampling Challenges

Tank 16 Annulus Populations

Sampling Populations in the Tank 16 annulus residuals

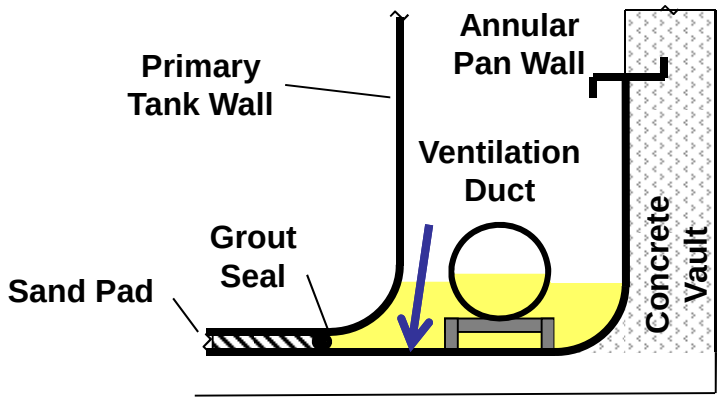


Population 1 = Material inside the duct (1200 gals)

Tank 16 Annulus Populations

The LWTRSAPP approved approach was used to design the three sampling arrays each with five samples for composite sample construction.

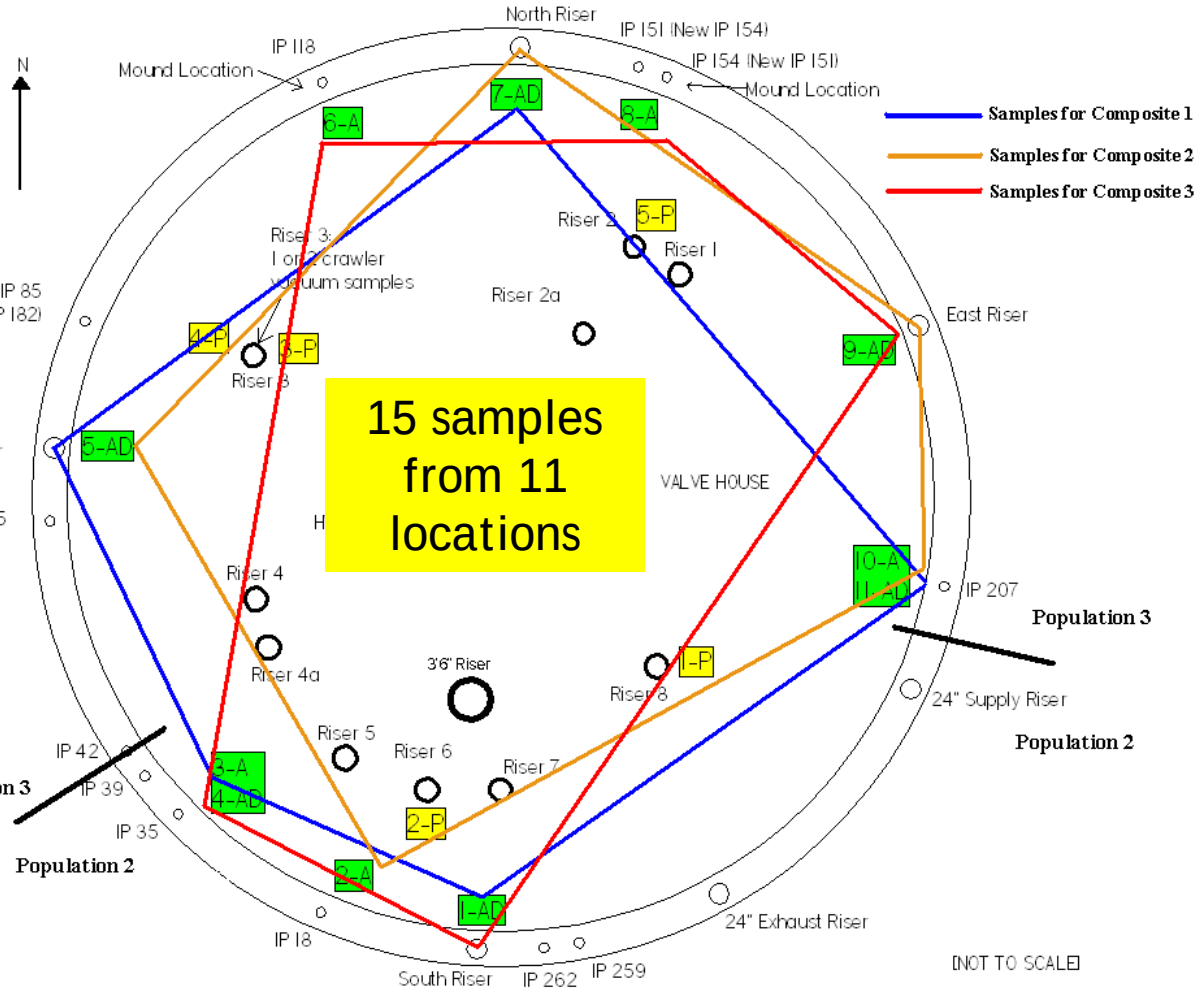
- Samples will be collected from inside and outside the duct.
- For samples outside the duct, the space between the liner and the duct is bored into to get as much penetration as possible. The disturbed material is collected using a vacuum.



Annulus Sampling Arrays for Compositing

#	Location
1-P	Riser 8
2-P	Riser 6
3-P	Riser 3
4-P	Riser 3
5-P	Riser 2
1-AD	South Riser
2-A	IP 18
3-A	IP 35
4-AD	IP 35
5-AD	West Riser
6-A	IP 118
7-AD	North Riser
8-A	IP 154 (New IP 151)
9-AD	East Riser
10-A	IP 207
11-AD	IP 207

Notes:
Annulus: 11 Samples
Primary: 3-5 Samples
A: Annulus
P: Primary
D: Inside the duct



Opportunity for Improvement

In 2011, samples of the annulus material were collected from the Tank 16 N, S, E, and W risers.

- Samples were initially collected to study material properties in order to evaluate and identify alternatives for removing additional annulus material, and not for final residuals characterization.
- The collection, transport, and sample transfer to laboratory containers was equivalent to that planned for the upcoming characterization sampling.
- Except for radioactive decay, the material in the annulus and in the four sample jars has not changed or been modified since sample collection.
- The Sample Location Determination Report identified the four risers as possible sampling locations for creation of the annulus composite samples.

Opportunity for Improvement

Because neither the condition of the samples nor the annulus residuals have changed, SRR is considering using the 2011 samples for the final tank characterization.

This would decrease the number of new annulus samples to collect from 15 to 11.

By using the four samples, project savings can be realized by:

- Schedule acceleration
- Sampling cost reduction
- Lowering worker exposure
- Generation of less Investigation-Derived Waste (IDW)

Summary

- We are implementing the LWTRSAPP and LWTRS-QAPP.
- Unknown degree of success for primary liner sampling.
- Agencies kept informed of progress and decisions.
- We do not expect problems with the annulus sampling.
- Sampling of the primary starting late April. Annulus sampling follows in Late May.

Current Status

Documents in preparation to support the Tank 16 sampling dates:

- Tank 16 Radiological and Chemical Screening
- Sample Location Determination Report
  - Will include the decision on use of 2011 samples
- Tank-Specific Sampling and Analysis Plan (TSAP)
- Technical Task Request (TTR)

Sampling equipment being procured and modified as necessary.

Tank 16 Residuals Sampling

QUESTIONS?