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Performance of Enhanced Low Volume Mixing Jets for Salt Dissolution – Development, Deployment, Results, and Benefits to SRS - 22173

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ABSTRACT

The Savannah River Site (SRS) Tank Farms have 51 underground waste tanks (43 of them active) used to store and process liquid waste. There are four different tank types -Type I, Type II, Type III/IIIA, and Type IV – with capacity ranges from approximately 2,840,000-5,03,000 liters (750,000-1,330,000 gallons). Access into the waste tanks is limited by available waste tank openings or risers. Tank 37H is a Type IIIA tank with an approximate capacity of 4,940,000 liters (1,300,000 gallons) and an inner diameter of approximately 25.9 meters (85 feet) located in H-Tank Farm (HTF). Tank 37H was placed into service in 1977.

Tank 37H is currently serving as one of two available 242-25H Evaporator concentrate drop tanks (Tank 37H and Tank 30H). The 242-25H Evaporator is primarily used to reduce the volume of H-Canyon wastes and sludge washing decants associated with sludge batch preparation. The 242-25H Evaporator receives waste from the feed tank (Tank 32H) and evaporates water from the waste, thereby producing a concentrated waste stream that is sent to either Tank 37H or Tank 30H. In July 2019, while the 242-25H Evaporator was operating, a routine recycle transfer from Tank 37H to Tank 32H revealed a high level of saltcake in Tank 37H during a camera inspection. This level of saltcake limited operation of the 242-25H Evaporator due to available space in Tank 37H. A saltcake dissolution and removal plan was developed, implemented, and executed to remove sufficient saltcake from Tank 37H to mitigate the available space constraints. SRS has successfully used low volume mixing jets (LVMJs) throughout the Tank Farms and during past Tank 37H salt dissolution campaigns. A LVMJ is a liquid mixing eductor that is designed to entrain surrounding liquid inside the waste tank with the introduction of an external source of water through the discharge nozzle. This allows the addition of dissolution water while simultaneously mixing with the waste tank liquid to promote the dissolution of saltcake. This salt dissolution campaign was the first campaign to deploy enhanced LVMJs (eLVMJs). A traditional LVMJ is designed to operate at a pressure of 6.9 bar (20 psig), a flow rate of 6.3E-4 cubic meters per second [10 gallons per minute (gpm)] and is predicted to have an effective dissolution radius (EDR) in the waste tank of approximately 3.4 meters (11 feet). The eLVMJ is designed to operate at a pressure of 13.8 bar (140 psig), a flow rate of 1.7E-3 cubic meters per second (26.5 gpm) and is predicted to have an EDR of 6.4 meters (21 feet). Essentially, the eLVMJs are a more powerful and more efficient version of the LVMJs.

The goal of the recent Tank 37H saltcake dissolution and removal campaign was to dissolve saltcake to restore Tank 37H as the primary 242-25H Evaporator concentrate drop tank while producing salt solution for future Salt Waste Processing Facility (SWPF) salt feed batches. To accomplish the saltcake dissolution campaign, the eLVMJs were deployed and utilized in a batch operation mode. Batch operation included water additions with the eLVMJs, followed by transfers out of the tank to remove the saltcake interstitial liquid and the salt solution created during dissolution. Through this process the saltcake level in Tank 37H was lowered to allow restoration of Tank 37H as a concentrate drop tank for an extended period and produced viable salt solution for future SWPF feed. To track the performance of the eLVMJs during the salt dissolution campaign, the following methods were used to collect data: saltcake level soundings, density profiles of the created salt solution, and saltcake topography mapping. The results showed that the eLVMJ EDR increased approximately 3.0 meters (10 feet) compared to an LVMJ [EDR for LVMJ and eLVMJ are 3.4 meters (11 feet) and 6.4 meters (21 feet), respectively]. This

greater EDR allows a larger volume of the waste tank to be mixed, increasing the effectiveness for salt dissolution.

eLVMJs will continue to be used on Tank 37H and other waste tanks for future salt dissolution campaigns (e.g., Tank 29H). eLVMJs may also be applied to other bulk waste removal projects where other salt dissolution equipment and methods may not be viable. The methods, data collected, and lessons learned from the first deployment of eLVMJs on Tank 37H will be applied to future salt dissolution campaigns to promote successful operations. Overall, the eLVMJs have the potential to reduce the time required to perform salt dissolution while continuing to generate high quality salt solution for processing at SWPF.

This paper discusses the development and deployment of eLVMJs for bulk salt dissolution activities, the results and the benefits of using eLVMJs to achieve SRS Liquid Waste mission.

INTRODUCTION

Tank 37H is a Type IIIA waste tank, with construction completed in 1977. Type IIIA waste tanks consist of concrete vaults which contain a primary waste tank with a secondary containment (annulus). The primary tank has a diameter of 26 meters (85 feet) and a height of 10 meters (33 feet), with a maximum operating capacity of 4.9 million liters or 9.5 meters (1.3 million gallons, 372 inches) and a nominal fill factor of 13,287 liters/meter (3,510 gallons/inch). The primary tank is constructed of ASTM A516, grade 70, hot-rolled carbon steel. The primary tank rests on a 0.15 meter (6 inches) thick concrete insulating slab, which is radially grooved to allow airflow to cool the primary tank bottom. The secondary liner has a diameter of 27 meters (90 feet) and a height of 10 meters (33 feet) and is constructed of the same material as the primary tank. The capacity of the annulus is approximately 666,609 liters (176,100 gallons). The roof support for the primary tank is provided by a steel-lined center column, which is 2.0 meters (6.5 feet) in diameter and is integrated into the base slab of the vault. This design reduces stress on the primary tank bottom by supporting the weight of this column on the base rather than the tank itself, as is the case for Type I and II waste tanks. The vault is the concrete casing around the steel liners. The vault roof thickness is 1.2 meters (48 inches), the wall thickness is 0.76 meters (30 inches), and the base slab thickness is 1.1 meters (42 inches). The entire vault rests on a 0.1 meter (4 inches) thick concrete working slab. A layout of the Tank 37 tank top (overhead view) with equipment locations is shown in Figure 1 [1].

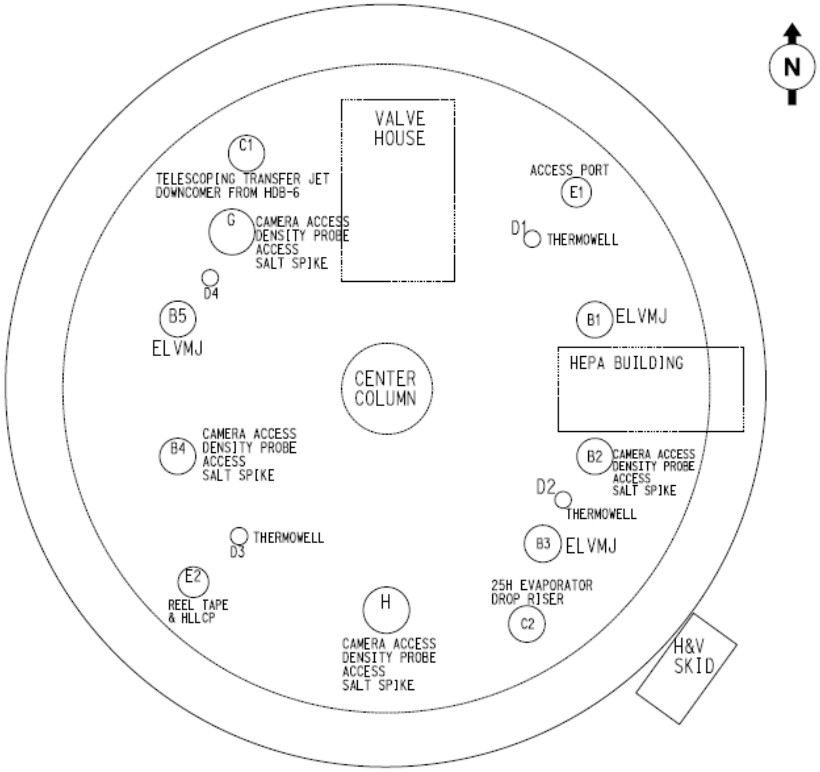

Fig. 1. Tank 37H Riser Diagram.

Tank 37H is currently serving as one of two available 242-25H Evaporator concentrate drop tanks (Tank 37H and Tank 30H). The 242-25H Evaporator receives waste from the feed tank (Tank 32H) and evaporates water from the waste, thereby producing a concentrated waste stream that is sent to either Tank 37H or Tank 30H, depending on which tank is selected as the drop tank. Evaporator operation reduces the volume of waste since storage space is limited. Waste is stored in tanks prior to processing for permanent disposal through either the Defense Waste Processing Facility (DWPF) or the Saltstone Production Facility (SPF). The evaporated water (overheads) produced by the evaporators is processed through the Effluent Treatment Project (ETP). The 242-25H Evaporator is primarily used to reduce the volume of canyon wastes and sludge washing decants associated with sludge batch preparation, while the 242-16H Evaporator is primarily used to reduce the volume of DWPF recycle receipts [1]. Saltcake forms in the waste tanks when the evaporator concentrate cools and crystalizes. A saltcake mound forms under the evaporator concentrate drop riser, resulting in an uneven saltcake topography in the waste tank and more challenging saltcake removal. To support 242-25H Evaporator operations, Tank 37H periodically undergoes saltcake dissolution and removal campaigns to recover and maintain an adequate working volume for continuous and efficient operation of the evaporator system.

The goal of the 2020 Tank 37H saltcake dissolution and removal campaign was to remove the maximum amount of saltcake (at least 0.8 meters), reduce the evaporator drop receipt riser mound height, and produce quality salt solution that could be used for future SWPF salt feed batches. The starting bulk saltcake level inside the tank prior to eLVMJ deployment was 7.5 meters (294 inches) and the starting evaporator concentrate drop riser mound was 7.6 meters (298 inches). Past Tank 37H salt dissolution campaigns have used LVMJs, but the recent campaign was the first to deploy eLVMJs.

DESCRIPTION

Development

A LVMJ is a liquid mixing eductor installed at the end of an adjustable piping assembly. They are designed to entrain the surrounding liquid with incoming well water to prevent stratification and perform even dissolution of the saltcake surface. LVMJs achieve simultaneous water addition and mixing for saltcake dissolution inside of waste tanks. An eductor is shown below in Figure 2.

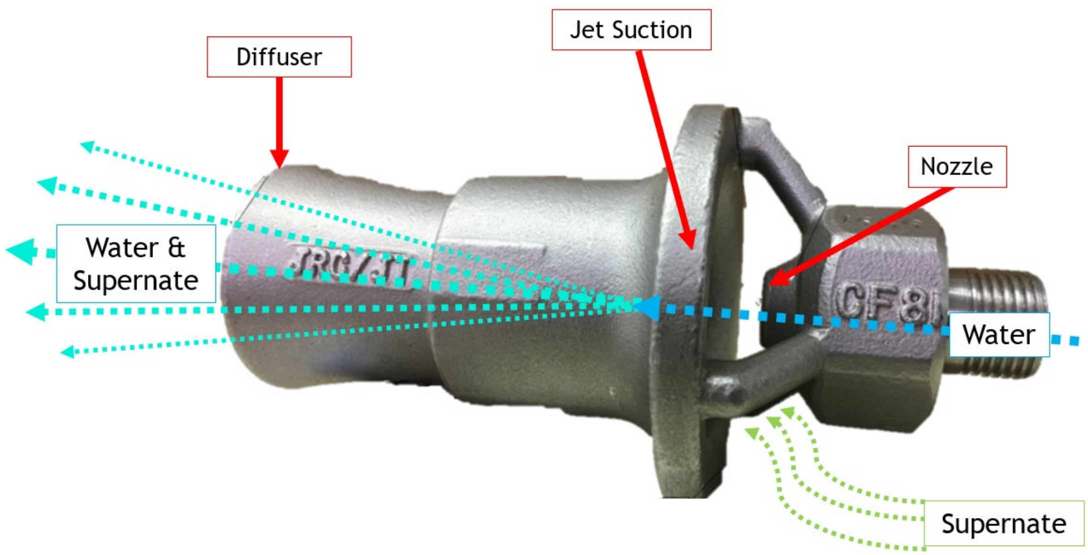

Fig 2. Low Volume Mixing Jet Components.

During the 2015 Tank 37H salt dissolution campaign, two of the three installed jets were bent during salt soundings (see Figure 3). A salt sounding is where the jet eductor is slowly lowered down to the saltcake surface, and the corresponding height of the jet is read to determine the height of the salt under the eductor. A decision was made to replace all 3 LVMJs with new ones that utilized an improved design to prevent bending. As shown in Figure 3, the original design consisted of an elbow to position the educator discharge parallel to the saltcake. As an improvement to prevent bending of the eductor, the elbow was replaced with a sturdier reducing tee and a thick protective plate was added.

Fig 3. Physical Changes to Low Volume Mixing Jets after Deformation of Original Tank 37H Low Volume Mixing Jets.

These new LVMJs were also hydrotested at a higher pressure than the existing jets, to allow a higher operating pressure. A higher operating pressure correlates to a higher flow rate, and a higher flow rate means a longer plume and EDR from the jet. The higher flow rate LVMJs are referred to as eLVMJs. For nominal LVMJ operation on Tank 37H, all three LVMJs were operated simultaneously for a cumulative flow rate of 1.9E-03 cubic meters per second (30 gpm), or 6.3E-04 cubic meters per second (10 gpm) per LVMJ. For nominal eLVMJ operation, each eLVMJ was operated independently and provided the maximum flow rate of the system, ideally 1.7E-03 cubic meters per second (26.5 gpm) (accounting for losses). Such operation requires a higher water supply pressure with the benefit of substantially increased plume length and mixing. As shown in Table I, at a flow rate of 6.3E-04 cubic meters per second, a LVMJ is predicted to have a plume length of approximately 3.4 meters (11 feet). At a flow rate of 1.7E-03 cubic meters per second, an eLVMJ is predicted to have a plume length of approximately 6.4 meters (22 feet), an additional meter more than the original LVMJ. The increased water supply to fewer jets is expected to result in a greater mixing length and, therefore, more targeted and effective salt dissolution in the waste tank. Figure 4 and Table I also summarizes the mixing volumes of LVMJs and eLVMJs. The mixing volume is defined as the LVMJ discharge volume that encapsulates the LVMJ fluid discharge where the velocity exceeds 0.028 cubic meters per second (one foot per second). For an LVMJ at 6.3E-04 cubic meters per second, it is predicted to achieve a mixing plume of 3.4 meters, which equates to a mixing volume of 409 liters (108 gallons). For an eLVMJ at 1.7E-3 cubic meters per second, it is predicted to achieve a mixing plume of 6.4 meters, which equates to a mixing volume of 4,686 liters (1,238 gallons). The eLVMJ mixing volume is approximately 11 times greater than a single LVMJs. Table I summarizes the changes made from the original LVMJ to the eLVMJ.

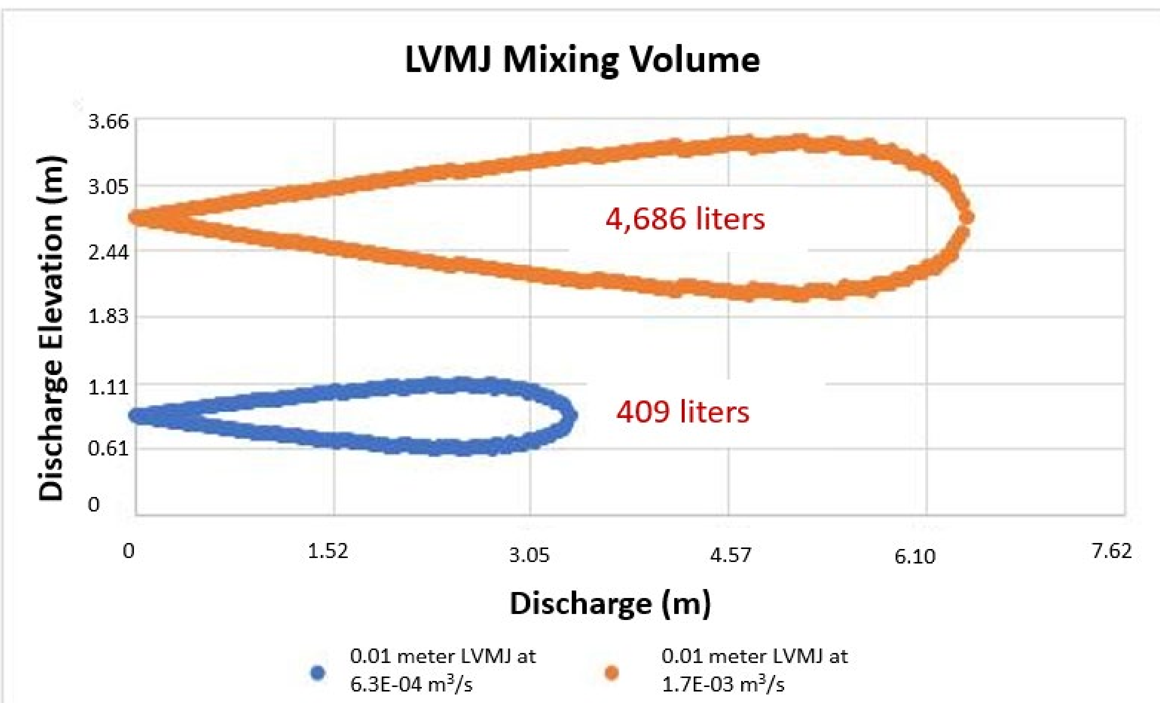

Fig 4. Discharge Elevation (meters) vs Distance (meters) For LVMJ Mixing Volumes of 6.3E-04 cubic meters per second and 1.7E-03 cubic meters per second.

Another key difference between previous Tank 37H salt dissolution campaigns is the method of operation. Traditionally, Tank 37H LVMJs were operated in a semi-continuous dissolution method. This semi-continuous dissolution method involved adding water to Tank 37H via all three LVMJs while simultaneously transferring salt solution out of the waste tank. The eLVMJs were operated in a batch operation method. The batch operation method involved adding water to Tank 37H via each eLVMJ separately to target specific locations in the waste tank. After the water addition was completed, the "soak period" was allowed to help further promote salt dissolution in Tank 37H. A typical soak period was approximately four days. After the soak period, the salt solution was transferred out of Tank 37H.

Given the conditions of Tank 37H and the uneven salt topography, it was decided to use the batch operation method to index the eLVMJs at the higher salt mounds and utilize their predicted plume length. Each batch of the campaign consisted of approximately 5 steps: indexing the jet eductors toward the highest mounds in the tank; operating the Dissolution Water Skid and adding well water at the desired flow rate through the jets; initiating a four day soak period to allow the solution to come to saturation; assessing the saturation utilizing a density profile of the tank; and transferring the salt solution to another tank for storage via a telescoping transfer jet and interstitial liquid removal, or draining of the saltcake. This process was repeated for fourteen batches of the campaign. Figure 5 shows a layout of the eLVMJs and their expected dissolution radius for the campaign.

TABLE I. Tank 37H Low Volume Mixing Jets vs. Tank 37H Enhanced Low Volume Mixing Jets

		Original Tank 37H Low Volume Mixing Jet (LVMJ)	**Tank 37H Enhanced Low Volume Mixing Jet (eLVMJ)**
System	**Design/Test Pressure**	6.89/10.34 bar (100/150 psig)	13.79/20.68 bar (200/300 psig)
	Design of Educator Discharge	0.0095 m (3/8 in) elbow positioned parallel to saltcake	0.0064 m (½ in) reducing tee 0.013 m (¼ in) thick protective plate
	Preferred Method of Operation	Semi-continuous Operate 3 LVMJs	Batch Operate 1 or 2 eLVMJs
Individual Mixing Jet	**Operating Pressure**[1]	1.4 bar (20 psig)	9.7 bar (140 psig)
	Operating Flow Rate[1]	6.3E-04 m^3/s (10 gpm)	1.7E-03 m^3/s (26.5 gpm)
	Effective Dissolution Radius[1]	3.4 m (11 ft)	6.4 m (21 ft)
	Mixing Volume[2]	409 L (108 gal)	4,686 L (1,238 gal)

[1]Manufacturer Data

[2]Mixing Volumes calculated in SRR-LWE-2019-00106 Rev. 0 [2]

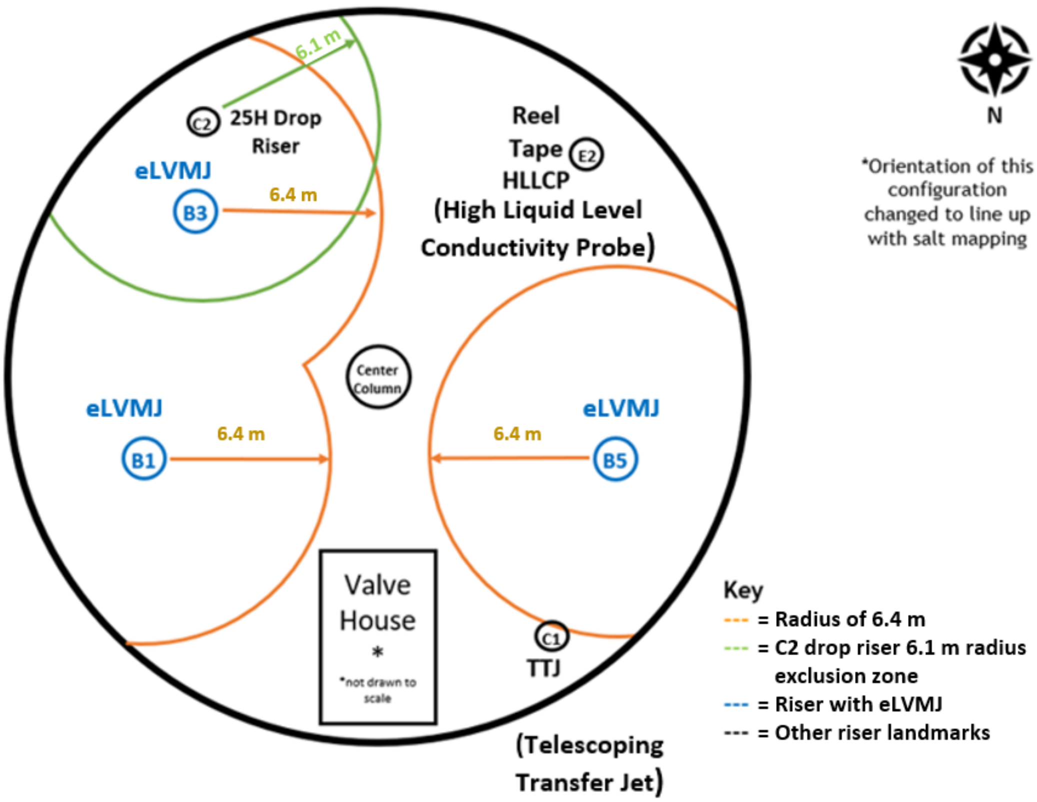

Fig 5. Tank 37H Salt Dissolution Tank Top Layout

Deployment

For a continuous water source to the mixing jets, the Dissolution Water Skid (DWS) was utilized. The DWS provides the well water sources to the mixing jets, as well as provides a motive force and process controls for transferring water from the well water tanks to the waste tank. The DWS has been used for past LVMJ campaigns, so it also needed to be upgraded to support enhanced operations due to the increase in differential pressure across the eductor. Modifications were made, most notably an increase in the pump capacity to support the higher pressures. The DWS is also required to satisfy Engineering Safety Basis Evaluation requirements for providing a continuous water source to the mixing jets. The Tank 37H Salt Dissolution Campaign set-up consisting of the DWS and eLVMJs is shown in Figure 6.

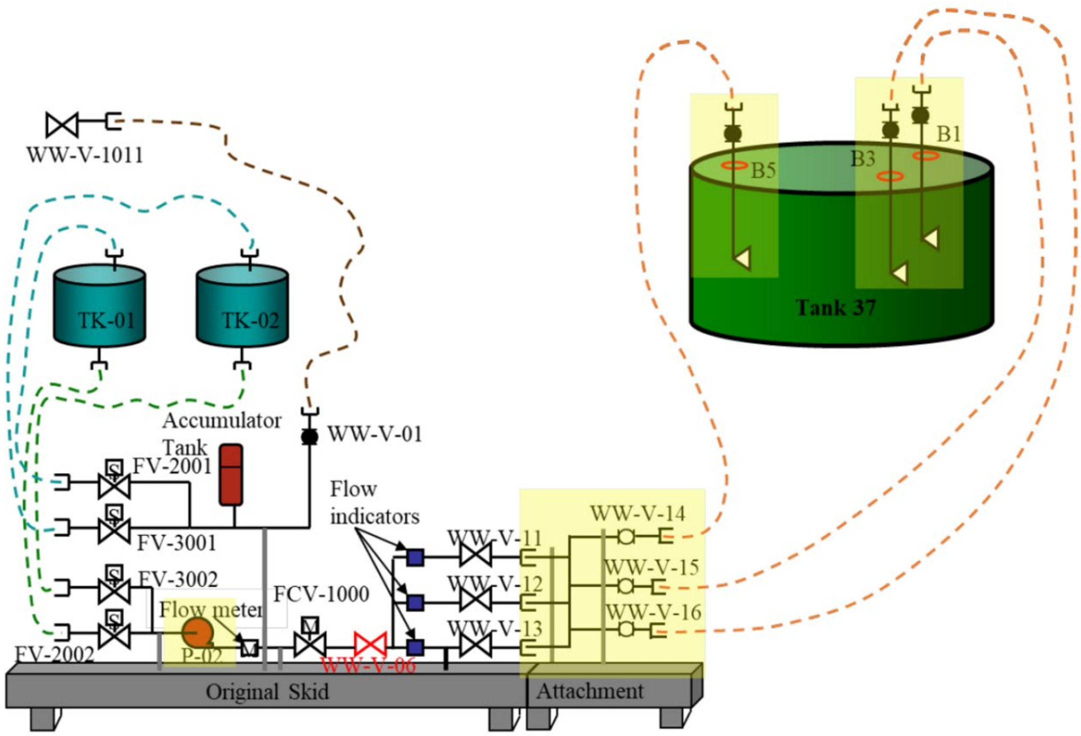

Fig 6. Tank 37H Salt Dissolution Set-Up with Dissolution Water Skid and eLVMJs.

Data Analysis Methods

As this was the initial deployment of eLVMJs, it was important to track their progress throughout the campaign. Four methods of data collection were used to track their performance: salt soundings, density profiles, salt topography mapping, and tracking of the bulk saltcake level (BSL).

First, salt soundings were performed via the bottom plate of the eLVMJs. The new protective design was successful in protecting the jet educator through multiple soundings, and salt level was tracked after each batch to track dissolution progress.

Second, density profile data was collected after each batch soak period to assess saturation. This density data was also utilized in a mass balance calculation to determine the amount of saltcake removed.

Third, video inspections of the waste tank were performed to support mapping of the saltcake topography and measurement of the saltcake height. The saltcake topography mapping allowed tracking of the salt levels in various parts of the tank, to view the EDR of the eLVMJs and track the BSL. During transfers out of Tank 37H, camera inspections were performed at pre-determined liquid levels in the tank. From the camera inspection, correlation to the known waste tank liquid levels and various landmarks (e.g., riser location, cooling coils, etc.) were utilized to support mapping of the saltcake topography.

Lastly, the BSL was tracked after each batch. The BSL is defined as follows: when supernate coverage is being removed from the waste tank containing saltcake, the BSL is the level within the tank where supernate coverage is at a minimum and further liquid removal will uncover sufficient saltcake, requiring consideration as interstitial liquid removal (ILR), and ILR requires a flammability evaluation. To determine the BSL after each batch, the results of the salt topography mappings were utilized.

DISCUSSION

Data Analysis Results

Table II outlines a summary of each of the fourteen batches during the Tank 37H salt dissolution campaign, including the BSL, the volume of water added, and the duration of the soak period.

TABLE II. Tank 37H Salt Dissolution Batches #1 - 14 – Well Water Additions via the DWS and eLVMJs

Start Date of Batch	Batch	Bulk Saltcake Level	C2 Drop Riser Mound Height	Final Tank Liquid Level	Water Volume Added	Soak Period Duration
		m	m	m	L	d
11/3/2020	1	7.46	7.56	7.55	178,973	9.75
11/17/2020	2	7.46	7.34	7.31	133,280	2.21
11/23/2020	3	7.20	7.23	7.28	205,017	5.92
12/3/2020	4	6.95	7.07	7.08	144,814.	5.51
12/12/2020	5	6.85	6.96	7.03	161,360	4.39
12/20/2020	6	6.75	6.85	6.93	177,849	7.02
12/30/2020	7	6.75	6.83	6.90	184,231	4.63
1/6/2021	8	6.70	6.78	6.85	151,344	4.87
1/14/2021	9	6.70	6.73	6.80	47,866	4.67
1/24/2021	10	6.65	6.70	6.78	210,241	5.34
2/5/2021	11	6.60	6.65	6.70	194,119	5.13
2/15/2021	12	6.45	6.44	6.50	150,870	17.80
3/8/2021	13	6.29	6.37	6.55	235,845	6.04
3/19/2021	14	6.22	6.19	6.35	179,798	4.20

During salt dissolution, salt soundings were performed between batches by lowering the eLVMJs.Not all eLVMJs were operated during each batch, and as a result do not have a salt sounding for that batch. The cumulative change in salt level for each eLVMJ is reported in Table III. The B1 Riser eLVMJ had a saltcake reduction of 1.83 meters (72 inches), the B3 Riser eLVMJ had a saltcake reduction of 1.60 meters (63 inches), and the B5 Riser eLVMJ had a saltcake reduction of 0.95 meters (37.5 inches).

TABLE III. eLVMJ Salt Soundings

Batch	B1 Riser eLVMJ Salt Sounding	B3 Riser eLVMJ Salt Sounding	B5 Riser eLVMJ Salt Sounding
	m	m	m
Pre-Batch #1	7.11	7.47	6.16
Post Batch #1	7.01	7.16	-
Post Batch #2	6.60	7.01	-
Post Batch #3	5.84	6.91	6.05
Post Batch #4	-	6.76	-
Post Batch #5	-	6.71	-
Post Batch #6	5.69	6.60	5.74
Post Batch #7	-	6.45	-
Post Batch #8	-	6.40	-
Post Batch #9	-	6.27	-
Post Batch #10	-	6.22	-
Post Batch #11	5.54	6.10	5.59
Post Batch #12	5.44	6.02	5.51
Post Batch #13	-	5.87	-
Post Batch #14	5.28	5.87	5.21
Change in Saltcake Level	Δ 1.83	Δ 1.60	Δ 0.95

Utilizing the density profiles collected after each batch, a mass balance was performed to calculate the mass of saltcake dissolved and transferred out of Tank 37H during the salt dissolution campaign. It is estimated that 1,413,917.21 kg of saltcake were dissolved and transferred out of Tank 37H during Batches #1 – #14. This mass of dissolved saltcake correlates to 1.41 meters (55.43 inches) of saltcake removed from Tank 37H. Following this campaign that employed the batch operation method, the following data points were collected: (1) average saltcake level in Tank 37H is estimated to be 5.88 meters (231.43 inches), (2) approximately 3,054,00 liters (806,800 gallons) of salt solution was transferred out of Tank 37H with an average density of 1.27 kg/L, (3) the overall dissolution ratio was 3.31 liters of water added for every 1 liter of saltcake dissolved in Tank 37H. Due to jet dilution during transfers and post transfer flushes, the receipt tank (Tank 35H) of Tank 37H salt solution is expected to have a density slightly lower than 1.23 kg/L.

In addition to the data points mentioned, topography maps of the waste in Tank 37H were created before, during, and after the completion of the Tank 37H salt dissolution campaign. The three-dimensional (3-D) waste topography maps (3-D maps) confirmed the amount of saltcake dissolved. Additionally, the 3-D maps acted as visual aids for determining the overall progress during the Tank 37H salt dissolution campaign and provide a visual estimate of the eLVMJ effective dissolution radius. To provide a comparison against the Tank 37H material balance, the initial BSL is defined as the saltcake level prior to Batch #1 at a level of 7.47 meters (294 inches) (October 27, 2020) and the final saltcake layer is immediately following Batch #14 at a level of 6.30 meters (248 inches) (March 27, 2021). In addition to the 3-D waste topography maps, after each batch a two-dimensional (2-D) waste topography map (2-D map) was created. The 2-D maps were utilized in redefining the BSL and providing an overall understanding of the saltcake topography in Tank 37H [1].

The post transfer levels for both 2-D maps are estimated within the level range of the jet suction height and the height where the reel tape became stuck on the saltcake and stopped responding to liquid level changes. Using this and other information, the following assumptions were made in creating the 3-D maps [1]:

- The "Out of Camera View" area for Pre-Batch #1 is a continuation of the 7.40 meters (291.21 inches) level based on the Post Batch #1 2-D map.
- The post transfer level for Pre-Batch #1 equals 7.11 meters (280 inches) based on the B1 Riser saltcake sounding taken on 10/28/2020.
- The liquid levels around the eLVMJs are equal to the saltcake soundings taken prior to the Post Batch #14 DWS additions (B1 Riser – 5.44 meters (214 inches), B3 Riser – 5.87 meters (231 inches), B5 Riser – 5.51 meters (217 inches)).
- Th area around G Riser and C1 Riser for Post Batch #14 are equal to the original hydrolanced level of 0.89 meters (35 inches).
- The post transfer level for Post Batch #14 is 5.84 meters (230 inches). This is based on the following: the TTJ suction being at an elevation of 5.18 meters (204 inches), 0.56 meters (22 inches) of supernate coverage above the jet suction in the last camera inspection, and additional 0.10 meters (4 inches) for conservatism (5.18 meters + 0.56 meters + 0.10 meters = 5.84 meters).
- The "Out of Camera View" area for Post Batch #14 is equal to the post transfer level (230 inches) [1].

In the tank solids mapping presented in Figures 7 and 8, the view is shown down on to the tank top, and the colors correlate to the liquid level in the tank when the saltcake was seen, which was estimated to be the height of the saltcake in that area. The white space with a red outline was out of the camera range, and the white space without a red outline was an area that was not exposed during the transfer and stayed covered with liquid. The eLVMJs were mainly indexed towards the south of Tank 37H to target the higher saltcake level and the saltcake mound under the evaporator concentrate drop riser. Assessing each salt mapping after each batch, an estimated EDR of approximately 6.71 meters (22 feet) was produced during the campaign.

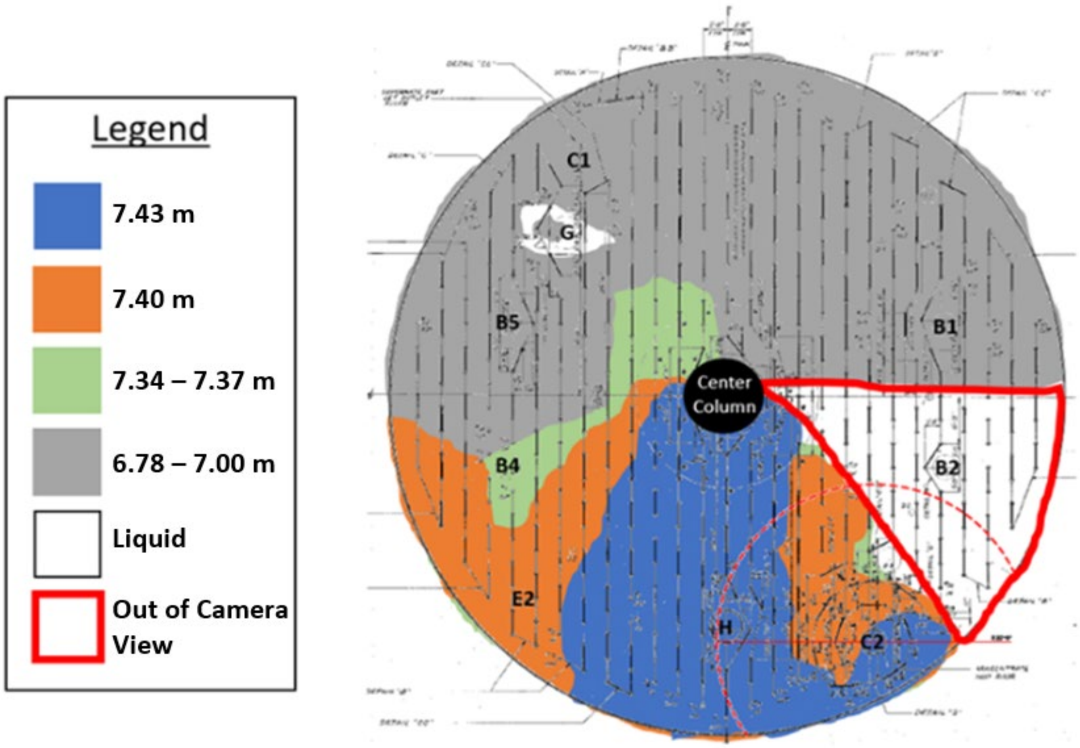

Fig 7. Tank Solids Mapping via Camera Inspections for Pre eLVMJ Operation.

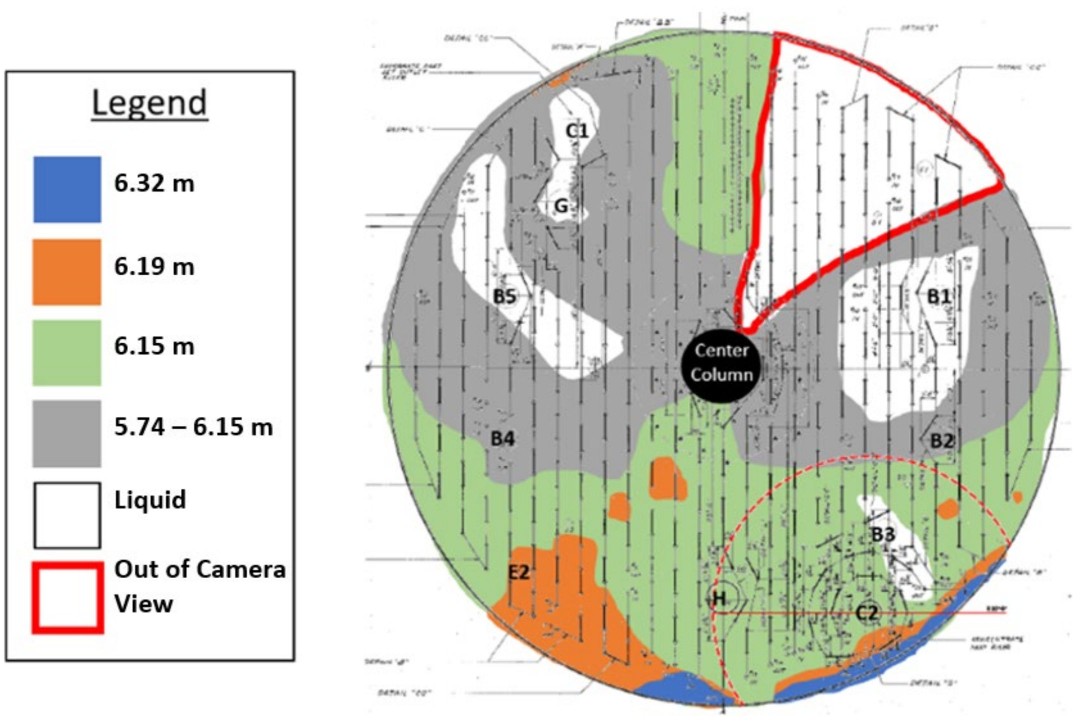

Fig 8. Tank Solids Mapping via Camera Inspections for Post eLVMJ Operation.

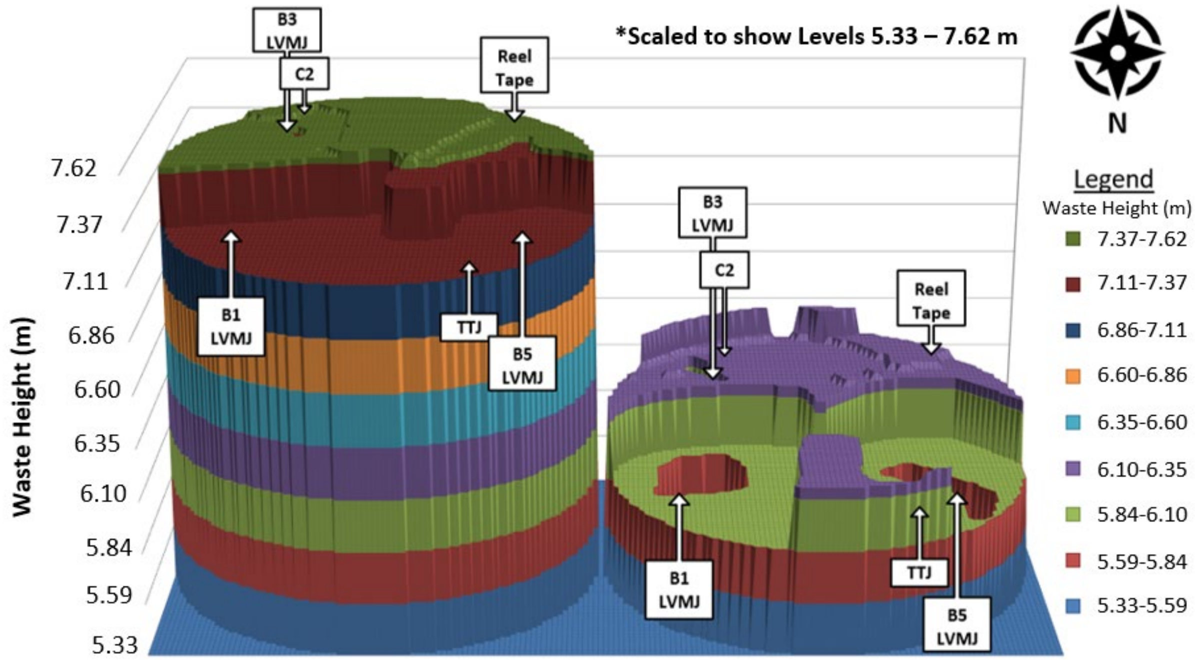

Fig 9. Tank 37H Solids Mapping for Pre Batch #1 eLVMJ Operation (left) and Post Batch #14 eLVMJ Operation (right).

Combining salt mapping and using Microsoft Excel, a 3-D mapping of the salt in the tank can be produced to view the effectiveness of the eLVMJs. Important note, this is scaled to only the top part of the tank, it does not show the total height of saltcake left in the tank. As seen on the left side of Figure 9 (representing the initial Tank 37H waste topography prior to eLVMJ operation), the starting campaign level is uneven in the tank, with the south side of the tank having the highest levels. On the right side of Figure 9 (representing the final Tank 37H waste topography following eLVMJ operation) the saltcake level became more level throughout the campaign (purple area). Additionally, due to more frequent operation of the B1 Riser and B5 Riser eLVMJs, the overall EDR of the eLVMJ is clearly shown. Per the 3-D salt mappings, it is shown the saltcake level was reduced by approximately 1.27 meters (50 inches) in Tank 37H with the use of eLVMJs, and the EDR around the eLVMJs was approximately 6.71 meters (22 feet).

CONCLUSIONS

The two enhancements made to LVMJs proved to be successful during the Tank 37H salt dissolution campaign. First, the physical design changes including the protective plate prevented deformation of the jet during salt soundings. Second, utilizing a higher pressure and flow rate through a single jet increased the effective dissolution radius from 3.4 meters (11 feet) to 6.71 meters (22 feet). Other benefits of the eLVMJs include that they may be adjusted (lowered/raised and rotated) for targeting salt mounds and are an additional method for salt dissolution when installation of mixing pump(s) is not practical.

Utilizing data collected from the campaign, the following were final estimates on how much salt was removed during the campaign. Three different methods were utilized to estimate the total dissolved saltcake during the operation of eLVMJs in Tank 37H:

1. Conservative engineering estimation of the BSL showed a reduction of 1.24 meters (49 inches).

    a. Initial BSL of 7.47 meters (294 inches)
    b. Final BSL of 6.22 meters (245 inches)
    c. Total reduction of 1.24 meters (49 inches)
2. Mass balance calculation utilizing density profiles after each batch calculated a reduction of 1.41 meters (55.43 inches).
3. The difference in field readings of salt soundings showed an average reduction of 1.4 meters (55.02 inches). The Salt Soundings were recorded as follows:
    a. B1 Riser eLVMJ
        i. Initial salt sounding of 7.11 meters (280 inches)
        ii. Final salt sounding of 5.28 meters (208 inches)
        iii. Reduction of 1.83 meters (72 inches)
    b. B3 Riser eLVMJ
        i. Initial salt sounding of 7.47 meters (294 inches)
        ii. Final salt sounding of 5.87 meters (231 inches)
        iii. Reduction of 1.60 meters (63 inches)
    c. B5 Riser eLVMJ
        i. Initial salt sounding of 6.16 meters (242.5 inches)
        ii. Final salt sounding of 5.21 meters (205 inches)
        iii. Reduction of 0.95 meters (37.5 inches)
    d. E2 Riser Reel Tape
        i. Initial salt sounding of 7.40 meters (291.3 inches)
        ii. Final salt sounding of 6.19 meters (243.7 inches)
        iii. Reduction of 1.21 meters (47.6 inches)

Per the Electronic Morning Report, approximately 3,145,637 liters (830,992 gallons) of dissolved salt solution from Tank 37H was transferred into Tank 35H throughout the campaign with an average density of salt solution of 1.27 g/mL. Overall, the eLVMJs proved to be efficient and effective at accomplishing the campaign main goals of lowering the BSL, reducing the height of the evaporator concentrate drop riser mound, and producing quality salt solution for future SWPF salt feed batches.

REFERENCES

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