Juniper Ridge Landfill
Gap Assessment - Summary of Observations, Findings, and Recommendations
January 2025

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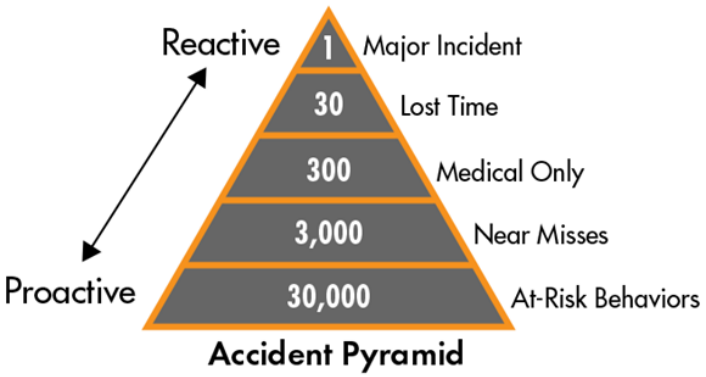
INTRODUCTION & APPROACH

Blue Ridge Services Montana, Inc. (BRS) was contracted by the State of Maine Bureau of General Services (State) to perform a Gap Assessment of the Juniper Ridge Landfill (JRL) which is operated under an operator service agreement with Casella Waste Systems, Inc. (CWS)

This Gap Assessment was intended to identify high priority areas within current operations where safety and operational improvements are necessary. A Gap Assessment provides an opportunity to proactively assess health and safety conditions before any existing hazards develop into major incidents. According to the Heinrich model (see image), if seemingly minor incidents and safety risks are left uncorrected, they can eventually lead to major injuries and even fatalities. While the numbers associated with each level of the pyramid will vary, BRS's goal was to aid JRL in identifying and controlling even minor operational risks – which will result in a reduced potential for major injuries, liability, and expenses in the future.



This Gap Assessment was not intended to be a regulatory compliance or safety audit nor a comprehensive operational review. Gap Assessment findings and recommendations are primarily based on the BRS team's decades of experience working with hundreds of solid waste operations, solid waste industry standards, and best management practices.

Basic site-specific information was requested and gathered through a questionnaire and several data requests. An on-site assessment was conducted by BRS Operations Consultant Jason Todaro in October 2024. An online, initial presentation of findings and recommendations was provided to State staff January 2025.

The following report summarizes the high priority observations, findings and recommendations developed over the course of this project.

GAP ASSESSMENT OBSERVATIONS, FINDINGS AND RECOMENDATIONS

Facility Overview

Observations & Findings

In comparison to similar sized landfills, we found the JRL to be thoughtfully configured, well-engineered, maintained, and operated. During our assessment of the JRL, we noted the following examples that met or exceeded industry standards.

- The landfill entrance, scale area and support buildings appeared to be well maintained, functioned as intended and presented a positive image.
- The paved and unpaved access roads were in sound condition which allowed customers to safely and efficiently access the facility in all weather conditions.

- The primary landfill heavy equipment fleet was modern, appeared to be in sound condition and was maintained well.
- The redundant heavy equipment within the fleet minimized operational service disruptions.
- The landfill heavy equipment operators appeared to be skilled and capable of performing their respective tasks.
- Use of waste derived and spray-on (foam) alternative daily cover (ADC).
- landfill airspace utilization performance exceeded the industry standard.
- Effective site grading and stormwater management.
- Investment in capital improvement projects.

Capital Improvements

Observations & Findings

Through observations and discussions with CWS, we learned of the following capital improvement projects that have been executed at the JRL.

- Significant gas collection network, gas plant, and gas distribution tie in
- Landfill final cover (capping) project
- Landfill liner development project
- Geosynthetic intermediate cover

These investments all provide significant environmental protection to the surrounding community and ensure the landfill is operated in a compliant manner. The planning engineering and execution of these investments appeared to be in line with other similar projects we have observed throughout the Country.

Landfill Airspace Utilization

Observations and Findings

Airspace is the landfill's primary resource, however there are significant costs related to producing each cubic yard of lined airspace. The following benefits can be achieved by utilizing landfill airspace efficiently:

- Prolong the overall life of the landfill and each individual phase.
- Ability to postpone costly future liner and final cover projects.
- Increased revenue per cubic yard of airspace filled.

Throughout the industry, landfill airspace utilization performance is measured in a variety of ways, most notably as an airspace utilization factor (AUF). An AUF is calculated by identifying the tons of landfilled waste that goes across the scales (over a specified time frame) divided by the total cubic yards of airspace consumed within the same timeframe.

As shown in the adjacent table, CWS provided their annual AUF's for the past five years. It is acceptable to have some variation in performance from year to year. The five-year average indicates that within this time frame an AUF of .83 tons (1,660 pounds) of waste was placed in every cubic yard of airspace at the JRL. We consider performance above .70 tons (1,400 pounds) per cubic yard to be above industry standard. This performance metric indicates that CWS has efficiently utilized the airspace resource at the JRL.

Date	AUF
June 2020	0.93
June 2021	0.76
June 2022	0.80
June 2023	0.90
May 2024	0.78
Average	0.83

Landfill Traffic Management and Spotting

Observations & Findings

While on-site, we found the paved access roads were properly constructed, were in sound condition which allowed customers to safely and efficiently access the facility in all weather conditions. The length of the paved access road allowed mud and debris to be tracked on-site rather than leaving the property and negatively impacting the surrounding community. The all-weather access roads were properly graded and constructed with plenty of rock/aggregate which also allowed customers to safely and efficiently access the facility in all weather conditions.

While on-site, we did not observe a dedicated spotter that provided direction to customers at the active tipping area. It is our understanding that commercial customers are required to have and utilize radios when on-site at the JRL. We were told that all of the communication and direction with the commercial drivers occurs solely over the radio. While on-site, we found minimal signage and directional delineation (cones, barricades, etc.) as we traveled to and approached the active tipping area.

Considering the relatively large deck that was available to tip customers, only four customers were allowed to dump at a time. This tipping configuration led to less-than-ideal delays and queues for customers waiting to dump their loads. The configuration also caused the bulldozers to use a non-traditional approach of peeling the loads perpendicular to the length of the trailer as they were being ejected from the live floor trailers. Not only was this process inefficient it created an unsafe condition with the bulldozers working too close to the customers' trailers and potentially the drivers.

Recommendations

Tipping areas are typically the busiest and most hazardous areas at any landfill. At times that is also true for the JRL, especially when considering the seasonal and daily fluctuations in customer transactions/tonnage. Given the sites average daily tonnage we recommend utilizing a dedicated spotter during peak tonnage hours. Standard Operating Procedures (SOP) should be developed for spotting customers and JRL staff should be trained and uniformly abide by these SOP.

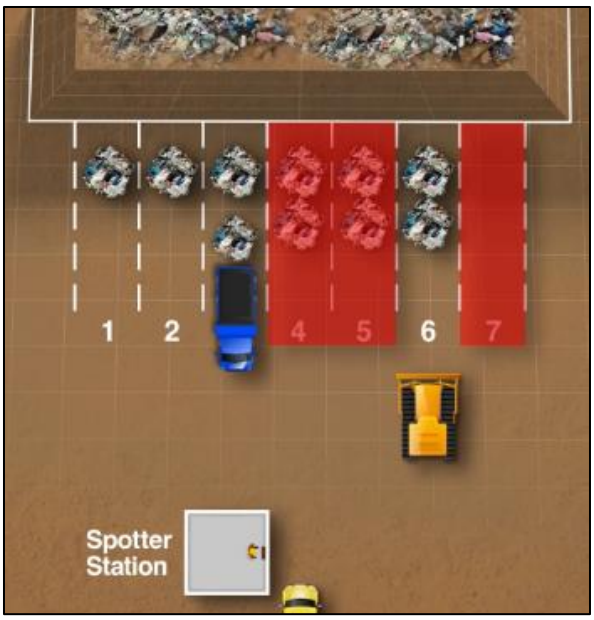
We recommend that the spotter consistently utilizes a fixed spotter station strategically positioned at the active tipping area. This spotter station could be a mobile spotter station (see example), vehicle, or concrete barriers. From the safety of the spotter station, the spotter can greet each customer, visually check loads, and provide verbal (face to face) direction. We recommend that the spotter stay in or is physically protected by the spotter station at all times, as this is the only way to truly protect them from hazards. When properly positioned, a spotter can adequately provide direction while viewing what is taking place at the tipping area.

It is important that the spotter does not assume too much liability by providing excessive direction to customers. We recommend that the spotter provide verbal direction in relation to which tipping slot the customer should utilize and occupy. For example, a spotter may direct a customer to occupy the slot "on the passenger side of the blue truck" that is currently unloading. The customers shall follow the spotters' general directions while maintaining responsibility for the safe operation of their respective vehicles. In addition to the spotter, a combination of signage and delineation (cones, barriers, large equipment tires) should be utilized to direct and communicate the JRL expectations, spacing requirements, and guidelines to customers.

In conjunction with the recommended spotter practices, during peak hourly tonnage we recommend that the JRL implement a "typewriter" tipping pattern. A typewriter pattern requires that once a row on the tipping floor is started, the adjacent tipping slots are occupied and eventually cleared by landfill heavy equipment in a consistent and logical manner (either left-to-right or right-to-left). Directing a customer to a tipping slot out of sequence is discouraged as this minimizes the predictability and intent of the pattern. Referencing historic hourly tonnage, we recommend calculating the total number of tipping slots required to accommodate historic, peak hourly tonnage at the JRL. Anticipating the appropriate amount of tipping slots will minimize customer queues and safety issues traditionally encountered during peak hourly tonnage.

The typewriter tipping pattern has many additional benefits: First it allows the drivers, spotters, and heavy equipment operators to anticipate where the next load is going to be spotted. By maintaining a minimum of a two-slot safety

buffer (approximately 40-feet), the typewriter tipping pattern allows vehicles to remain a safe distance from the heavy equipment as they clear the tipping area and integrate waste into the working face. This safety buffer also prevents heavy equipment from having to "sneak" in-between two vehicles to hastily push the loads to make room for the next inbound vehicle. The standardized pattern also allows uniform practices from one staff member to the next, minimizing confusion and inconsistent practices. The adjacent illustration provides a generic example of a typewriter tipping pattern (working right to left). The red areas illustrate the safety buffers that should always be maintained on either side of the heavy equipment and the customers' vehicles.



Implementation of a typewriter tipping pattern at the JRL could eliminate the inefficient and unsafe practice of peeling the loads perpendicular to the length of the trailer as they were being ejected from the live floor trailers. When properly implemented, a typewriter tipping pattern would safely create more tipping slots which would minimize customer queues and wait times.

Daily Waste Cell Construction

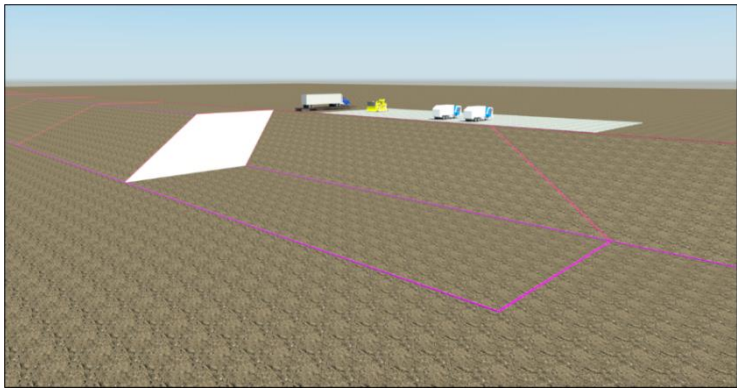
Observations & Findings

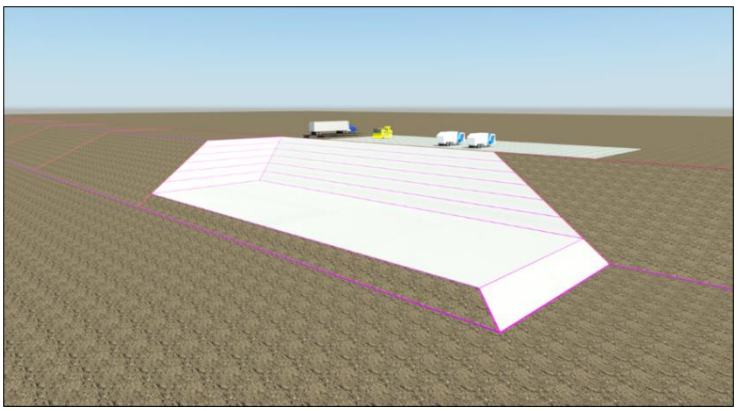
While on-site we observed a traditional advancing face, daily waste cell construction technique. It appeared that sludge was being mixed with waste by the heavy equipment on the tipping floor and deposited on the working face slope. While common in our industry, an advancing face requires compaction to take place primarily on the slope which sacrifices density (compaction). The geometry associated with an advancing face does not optimize the ratio between the daily waste volume and surface area that requires cover soil or ADC each day. As shown in the adjacent photo, it appeared that existing soil (and waste derived ADC) was not stripped or removed at the toe of the advancing face before new waste was placed and compacted. Leaving thick lenses of compacted soil (or waste derived ADC) between the lifts of waste can be a contributing factor to leachate seeps and landfill gas compartmentalization.

Recommendations

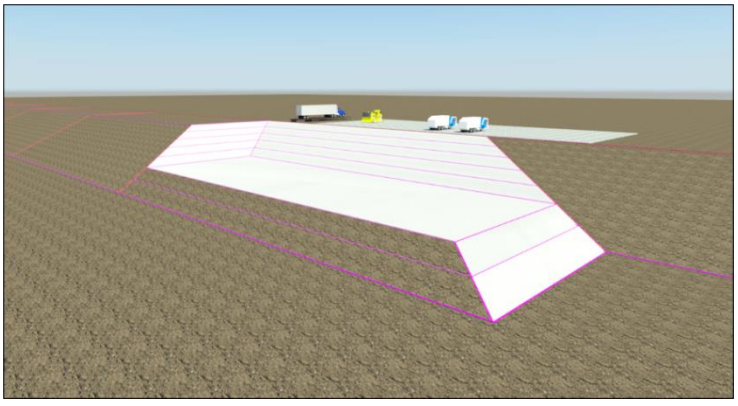
Selecting the best daily waste cell construction method can be a complex task. Many of the major factors are inter-related. For example, to minimize the use of cover soil (on each lift of waste), a very thick lift would be preferable. However, a thick lift, when combined with uphill pushing results in the heavy equipment having to work much harder. Similarly, a steep working face will minimize the surface area, but will also slow the compactor, thus resulting in decreased density. In the following paragraphs, we will present what we believe are the most significant issues related to daily waste cell construction.

The first issue is related purely to geometry, and the fact that a small daily waste cell will have a higher percentage of surface area than that of a larger weekly working face. As the working face size increases, the surface area increases as a squared function (i.e., length x width), whereas the volume increases as a cubed function (i.e., length x width x depth). So, to take maximum advantage of this economy of scale, we recommended that the JRL consider transitioning toward constructing a weekly "pancake", where each day's waste is stacked on top of the previous days. This type of cell construction is most efficient when used in conjunction with an alternative daily cover (ADC) such as a spray on or landfill tarps. A properly executed weekly pancake can increase compaction, minimize heavy equipment hours while minimizing surface area which over time will require less ADC and cover soil.

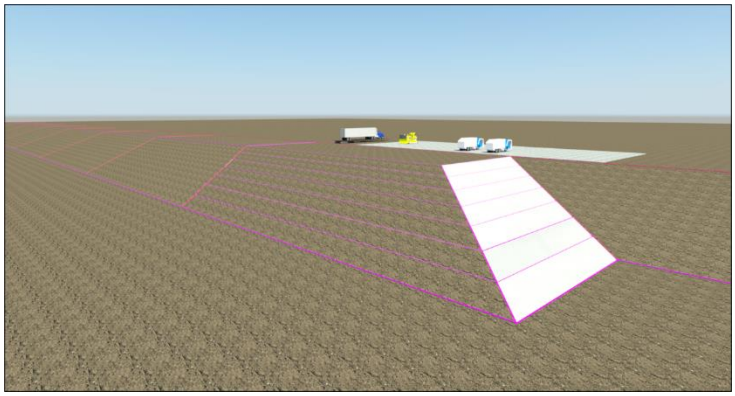




At the beginning of a new weekly pancake, all previously placed cover material (soil or waste derived ADC) on the footprint and slope below (or above) the tipping floors are stripped and stockpiled. Once the cover material has all been stripped, waste can be spread horizontally across the stripped area and compacted. Once the initial lift of waste has been spread and compacted, the compactor(s) briefly vacates the horizontal surface allowing the bulldozers to push (always pushing sludge downhill) a thin lift of sludge across the compacted waste surface. Once the bulldozers have finished pushing the sludge a lift of waste shall be spread across the sludge before the compactor(s) resumes compaction. This process eliminates the need for mixing the sludge with waste on the tipping floor, enhances density (compaction) and prevents the compactor(s) teeth from coming in contact and plugging with sludge. This process would be repeated throughout each day and each weekly pancake. At the end of the first day, the exposed waste surfaces are covered with spray on ADC (white surfaces). Only the one slope receives salvaged cover soil or other suitable cover material.



Each subsequent day, more waste (and sludge) is placed and compacted on the horizontal surface. At the end of each day spray on ADC and salvaged cover soil are utilized for cover.



Once the horizontal surface reaches the desired elevation, the horizontal surface would finally be covered with soil, and the one slope surface would be covered with spray on ADC. The next day, the entire weekly process would be repeated at the adjacent footprint. Please note: the completion of the weekly pancake does not have to occur on any specific day …or on any set time of day. It is simply completed when it reaches the desired elevation – and if it does not reach grade or is not ready to receive cover soil by the end of the day spray on ADC is reapplied. To identify the ideal weekly cell dimensions, number of tipping slots, and spray on ADC requirements for a weekly pancake, we recommend performing an optimum working face geometry assessment.

Cover Soil & ADC

Observations & Findings

It is our understanding that the JRL has little on-site cover soil and relies on a combination of C&D fines, contaminated soil, and spray on foam ADC for cover. The current cover soil practices appeared to be compliant, functioned as intended and we did not observe any deficiencies in cover integrity. In comparison to the traditional practice of using cover soil, this combination of cover materials is beneficial in terms of landfill airspace utilization.

Recommendations

As previously mentioned, it appeared that existing soil (and waste derived ADC) was not stripped or removed at the toe of the advancing face before new waste was placed and compacted throughout the day. Leaving thick lenses of compacted soil (or waste derived ADC) between the lifts of waste can be a contributing factor to leachate seeps and landfill gas compartmentalization. We recommend that CWS explore the process of removing compacted soil (or waste derived ADC) before new waste is placed and compacted throughout each day.

Heavy Equipment Fleet

Observations & Findings

Overall, the primary landfill equipment fleet was modern, appeared to be in sound condition and was well maintained. The redundancy within the fleet allowed uninterrupted services for scheduled or unplanned equipment downtime. The heavy equipment operators appeared to be skilled and capable of performing their respective tasks.

Recommendations

In comparison to the industry and respective daily landfill tonnage at the JRL, we were surprised at the decision to rely solely on smaller (D6) sized bulldozers. We recognize that this may be an operational preference, but larger (D8) sized bulldozers could be more cost effective at pushing and spreading waste than several smaller (D6) bulldozers.

While on-site, we observed the 836 compactors pushing, mixing and spreading waste and sludge. Given their specialized nature and significant owning and operating cost, we suggest allowing the compactors to focus solely on compacting and occasionally trimming waste. Optimizing the use of the compactors can increase waste density and potentially prolong the life of the landfill. Ideally, the bulldozers would be more appropriately tasked with mixing, pushing and spreading waste into the daily waste cell.

Litter Control

Observations & Findings

Excessive litter can be costly and cumbersome to clean up and can lead to issues with neighbors and regulatory compliance. While on-site, we did not observe any excessive accumulation of wind-blown litter or litter blowing off-site. It appeared that CWS relied on portable litter fences (7 sections) and some permanent litter fences to contain wind-blown litter.

Recommendations

When properly deployed, portable litter fencing can be highly effective at containing litter at the point of generation, minimizing its distribution throughout the site. When utilized, it is important that portable fences be tightly arranged, free of gaps and downwind of and as close to the active tipping area(s) as possible. In our experiences, we have found that portable litter fencing is the most crucial component of an effective litter control campaign. We recommend that CWS invest in enough portable litter fences to adequately surround the downwind portions of the active tipping areas.

As a secondary litter control measure, we recommend utilizing temporary litter fencing. When strategically placed, this type of fencing is effective at containing surface litter that has migrated beyond the portable litter fencing zone. Typically, this type of fence consists of t-posts and welded wire fencing, 4-6' high. The use of horizontal and/or vertical litter traps can be incorporated into the fence design, trapping litter, and

containing it within the fence. To be as effective as possible, this fencing needs to be periodically de-constructed and repositioned to the most effective locations. Dependent on on-site conditions and topography a series of temporary litter fences may be needed to collect and contain surface blown litter.

The permanent litter fencing should be considered the last and final layer of litter containment. The permanent fencing should capture any residual litter that has migrated beyond the portable and temporary fencing zones.

If not in place, periodic and regular maintenance and cleaning procedures should be in place for all types of litter fencing. Litter fencing is most effective when wind is allowed to flow freely through the fence, once the fence becomes saturated with litter, the dynamics of the fence change and litter could potentially be blown above or around the fence.

Dust Control

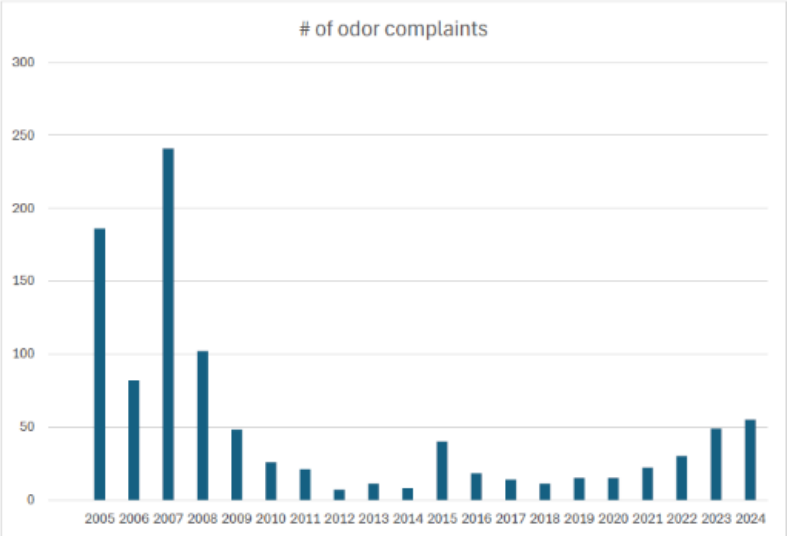
Observations & Findings

While on-site, dust control measures included frequently wetting the paved and unpaved access roads with a water wagon. Dust was further reduced by keeping the surfaces of the paved roads free of dirt and buildup. During our time on-site, we did not observe and dust issues that could potentially impact the surrounding community.

Odor Control

Observations & Findings

While on-site, we toured the surrounding community to gain a perspective of potential odor impacts to neighbors that are in close proximity to the JRL. We were told that the closest neighbor to the JRL property boundary was approximately 2,700'. The JRL has a network of detectors and a SCADA system to detect and report Hydrogen Sulfide odors near the landfill.



We were told that CWS has a 24-hour odor line where an odor complaint for the JRL can be recorded. Thes complaints are then documented in an odor complaint log and staff are available for a call back and site visit when requested. The CWS management team and Maine DEP are notified immediately when a complaint is recorded, and

CWS has weekly odor meetings discussing game plans and remedies. The adjacent table shows the odor complaints that have been logged between 2005-2024. We were told that the rise in complaints between 2019-2024 coincides with the increased disposal rate of MSW bypass and sludge. Considering the average daily tonnage and the fact that 9% of the average daily tonnage is sludge, we consider the recent number of complaints to be low. Not to be dismissive toward these complaints, but it is typical for landfills with significant odor issues to have complaints numbering in the thousands per month.

While on-site we observed and noted that some specific loads of sludge from a particular municipality smelled significantly more odorous than the other loads. We were also told that sludge is accepted during a limited schedule which ensures that it can be adequately covered each day. The current process of mixing and bulking the sludge does have the potential to generate odors.

Recommendations

We recommend that CWS investigates the odorous sludge loads to determine if there is an issue with the customers process that is contributing to the odors. If these odors loads continue to be accepted at the JRL, we recommend developing specific procedures to minimize their potential odor impacts. We also recommend that CWS explores the process of placing alternating lifts of waste and sludge using the pancake daily waste cell construction method. Based on our experience, we have found that this process doesn't aerate the sludge and generate odors as much as the current process of bulking every load of sludge with waste on the tipping floor and working face slope.

Regulatory Compliance

Observations and Findings

We requested and received a three-year history (February 18, 2022 – February 18, 2025) of regulatory areas of concern and notices of violation from the Maine Department of Environmental Protection (MDEP). It is our understanding that July 12, 2024 MDEP issued the following request for compliance.

- "Requiring a compliance schedule and framework to meet the requirements of Mandeep's interpretation of Maine law changes regarding the statutory definition of "Waste generated within the State."."

Our understanding is that this request for compliance has been resolved and there were not any other documented regulatory compliance issues within the last three years.

Safety Planning, Documentation and Training

Observations and Findings

While on-site we did not observe any safety issues and there was evidence of a safety culture that protected employees and customers. We noted the following safety measures that were in place while we were on-site.

- Personal Protective Equipment (PPE) for staff (hard hats, high-vis safety apparel, footwear)
- Strict requirement for customers to wear high-vis safety apparel when on-site
- Adequate spacing between customers at the tipping area
- Radio communications with customers

We requested, received and reviewed the following safety plans and documentation that were in place for the JRL.

- Annual safety training schedule
- 4-year history of safety training documentation
- Landfill Safety Manual
- Health and Safety Manual
- New employee safety orientation
- Accident and Injury Reporting handout
- Safe work guidelines

We found the above plans and documentation were in line with industry standard practices. The content and subject matter were relevant and indicated that safety at the JRL is prioritized by CWS.