

Landfill Gas Management System

VERTICAL GAS WELL



Gas extraction well on a capped section of the landfill

HORIZONTAL GAS WELL



Cluster of gas headers connected to horizontal gas extraction wells placed in the waste mass

SULFATREAT UNITS



Sulfatreat units to remove hydrogen sulfide in landfill gas before flaring, to reduce emission of sulfur compounds

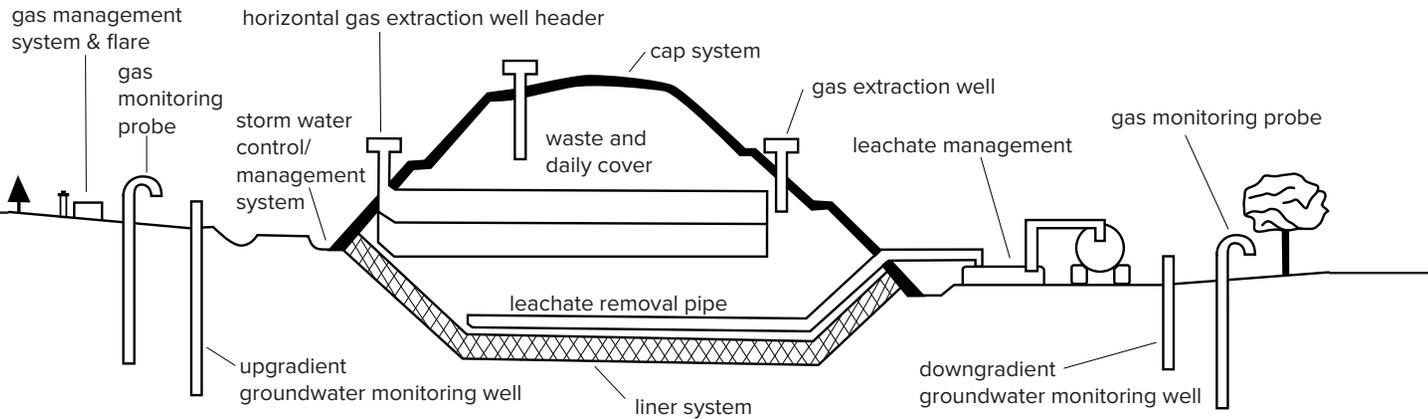
LANDFILL GAS FLARES



Gas flares: main flare in distant background and alternate flares in foreground. Alternate flares are used when main flare is undergoing maintenance



How a Landfill Works:



Landfill Leachate Management System

LEACHATE TRANSFER CHAMBER



Leachate chamber where leachate from various landfill sections is collected and treated with hydrogen peroxide before it is pumped to leachate storage tanks

LEACHATE STORAGE TANK



Leachate storage tank used for temporary storage of all leachate generated at the landfill. Foreground: tank containing hydrogen peroxide used to treat and reduce sulfur compounds in leachate, thus decreasing the levels of hydrogen sulfide gas (H₂S) in the leachate storage tank

LEACHATE TRUCK LOADING AREA



Leachate transfer by tanker truck for treatment and disposal at Bergen Point Wastewater Treatment Plant

2015-16

DEC Actions & Response to Increase in Complaints

The increase in complaints was due to odors attributed primarily to cutting and grading of the waste mass, to prepare the landfill for the Phase F capping project.

Implementation of corrective actions listed in the CAP commenced in 2015. See following poster for pictures.

DEC required the Town to identify all odor sources, evaluate management practices, and propose a Corrective Action Plan (CAP), which was submitted in 2015.



Department of
Environmental
Conservation

2018-19

DEC Actions & Response to Increase in Complaints

The Phase G capping project was significantly set back by an extremely wet season, causing a delay in connecting the gas extraction wells, and resulting in gas emissions from the area which was being capped.

The three-month delay in completing the Phase G cap led to an increase in odor complaints during the months of November and December 2018, and January 2019.

DEC issued a Notice of Violation in March 2019. A Consent Order with implementation schedule was signed on September 3, 2019.



Department of
Environmental
Conservation

Corrective Action Steps Initiated in 2015-2016

CAP Item I – Accelerated capping of inactive uncapped areas of the landfill



CAP Item II – Resealed landfill leachate side riser pump with new redesigned elevated leachate gravity pipe



CAP Item III – Pumping stations- Leachate transfer chamber



CAP Item IV – Landfill gas condensate collection and transfer systems



CAP Item V – Leachate tanks with newly installed hydrogen peroxide dosing equipment



The Corrective Action Plan listed five (5) major sources of odor identified during the investigation. The Town has taken the following corrective steps:

- I. Inactive uncapped areas of the landfill- Accelerated capping of approximately 48 acres of inactive uncapped landfilled areas
- II. Side riser pumps of the landfill leachate collection system – Resealed all 18 Cells 5&6 side riser pump chambers, installed industrial odor control spraying system, and improved scheduled maintenance of all chambers and pipes
- III. Pumping stations used for transferring leachate to the storage tanks – Revamped all three (3) Cells 5&6 force main pump stations by replacing existing pumps with new more robust ones
- IV. Landfill gas condensate – Resealed all six condensate pump vaults
- V. Leachate storage tanks – Installed a hydrogen peroxide dosing system to reduce sulfur compounds in the leachate

To further implement the CAP, the Town has also upgraded all landfill gas and leachate management infrastructure as follows:

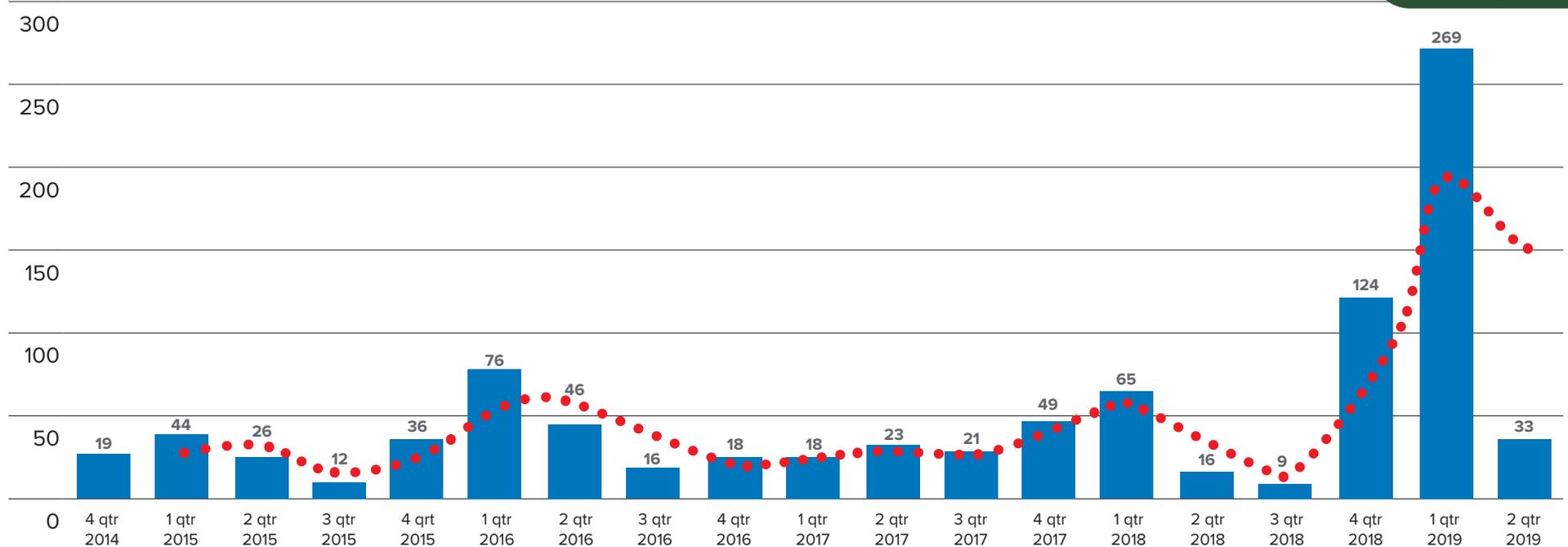
1. Redesigned the gas collection and control system (GCCS), including gas header design of the horizontal gas extraction wells, and design of the gas extraction wells, from the gas venting layer just beneath the final cap's geosynthetic liner
2. Revised procedures for balancing the GCCS
3. Modified condensate collection vaults at the SulfaTreat facility and elsewhere to better control odorous releases
4. Repaired minor gas leaks at the SulfaTreat facility and throughout the GCCS
5. Redesigned the leachate collection and transfer system
6. Installed additional vertical wells to better control odor releases from uncapped waste

DEC started a rigorous monitoring program to verify the effectiveness of the CAP measures implemented:

1. On-site H₂S monitoring – Three times a week, using a Jerometer, Town consultants measure on-site H₂S levels at the 5 major sources of odor identified in the CAP
2. Off-site H₂S monitoring – DEC uses Acrulog instruments to continuously monitor off-site H₂S levels. One instrument is placed at the Frank P Long Intermediate School, and the second at Pallets-R-U, on East Woodside Avenue, across from the leachate tanks

Historical Trend of Complaints with DEC Response

2015 to Date



2015/2016 - The increase in complaints was related to landfill gas emissions during the cutting and grading of the waste mass to prepare that section of landfill for the Phase F capping project. See following posters for additional details and DEC response

2018/2019 - DEC's investigation concluded that this increase in complaints was related to stalled construction activities caused by the extremely wet season during the Phase G capping project. This resulted in a three-month delay in connecting the newly-installed gas extraction wells to the gas collection and control system designed to safely manage landfill gas emissions. See following posters for details

Sources & Causes of Odor Episodes at the Landfill

Landfill Cap Construction Issues

Unusually Wet Weather Issue:

- Washouts
- Damage to gas pipes
- Delay in activating gas collection system



Barrier protection layer washout after an unseasonably wet weather and heavy rains delaying completion of cap construction



Gas collection pipe damaged due to shifting of soil and washouts

Limited preventive measures, as weather conditions are unpredictable

Landfill Fine Grading Issue:

- Old waste disturbed



Cutting and fine grading the side slopes before placement of cap system (water spraying is for dust control)



Dump truck placing soil on the side slopes to cover the waste that was disturbed during fine grading before placement of the landfill cap



Dozer spreading soil cover on the waste mass that was disturbed for fine grading before placement of landfill cap

Limited Preventive measures include:

- Re-cover exposed waste with soil the same workday

Trench For Liner Anchor Issue:

- Old waste disturbed



Anchor trench for geomembrane is made by digging into the old waste



Landfill cap geomembrane is anchored by filling the anchor trench with soil

Landfill Infrastructure Issues

Gas Management Issue:

- Power failure
- Equipment breakdown



Main flare



Backup flares with main flare in background

Contingency measures include:

- Auto flare re-ignition
- Auto dialing standby personnel
- Using back-up flares

Leachate Management Issue:

- Power failure
- Equipment breakdown



Hydrogen peroxide (H₂O₂) dosing equipment at the leachate transfer chamber



Leachate storage tank with H₂O₂ dosing tank & equipment in foreground

Contingency measures include:

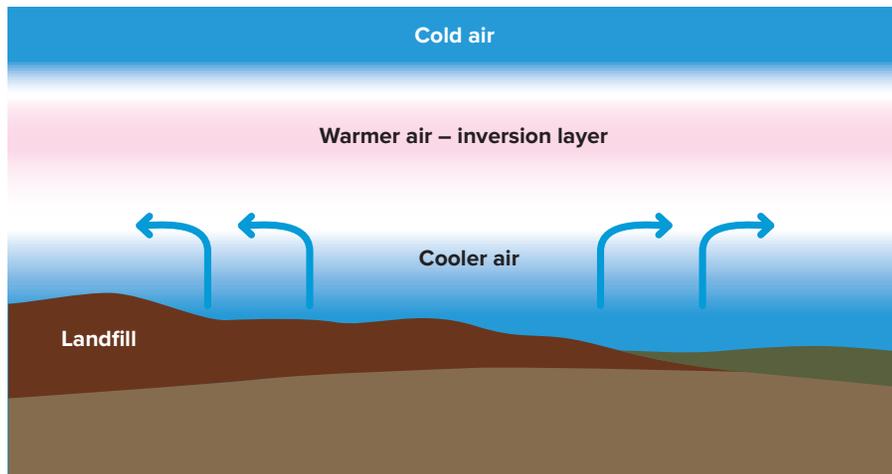
- Manual H₂O₂ dosing if needed
- Continuous H₂S monitoring in storage tank
- Automatic adjustment of H₂O₂ dosage

Special Off-Hour Monitoring for Hydrogen Sulfide by DEC



Monitoring in spring & winter 2018

- DEC staff used a handheld instrument called a Jerome meter
- The Jerome can detect low concentrations of hydrogen sulfide around the level that most people smell
- DEC staff sampled for hydrogen sulfide late at night and early morning during periods of possible temperature inversions



Temperature inversion – A layer of warm air traps a layer of cool air close to the ground, preventing air mixing and keeping emissions close to the ground

Enforcement

- The Jerome is used to measure violations of the New York State hydrogen sulfide standard, which is 10 parts per billion (ppb) for 1 hour
- Staff conducted 23 monitoring events on 17 dates
- Hydrogen sulfide was detected but not under conditions for violation of the standard



Odor Sources

Off-Site Continuous Hydrogen Sulfide Monitoring by DEC

Continuous measurements of hydrogen sulfide

- In 2017, 2018, and 2019, DEC installed instruments that record hydrogen sulfide (H₂S) every 10 minutes
- These instruments (OdaLog and Acrulog) only work during the warmer months
- During the cooler months, staff use a handheld Jerome meter
- OdaLogs and Acrulogs are effective screening tools because they operate on a continuous basis; however, they cannot be used as an enforcement tool because of potential interference with other gases (such as vehicle emissions)



Frank P Long H₂S Results (OdaLogs and Acrulogs)

Year	Number of Readings	Number of H ₂ S Detections	Percentage of H ₂ S Detections (%)
2017	17,465	47	0.27
2018	21,100	2	0.009
2019 (as of 7/25)	11,056	9	0.08

Pallets-R-Us H₂S Results (OdaLogs and Acrulogs)

Year	Number of Readings	Number of H ₂ S Detections	Percentage of H ₂ S Detections (%)
2017	19,027	585	3.1
2018	21,100	146	0.69
2019 (as of 7/25)	12,451	162	1.4



Locations for Hydrogen Sulfide Monitoring

Main Mitigation Goals at the Brookhaven Landfill



- **Minimize potential for nuisance conditions**
- **Optimize infrastructure design and operation**
- **Minimize equipment downtime**
- **Enhance hydrogen sulfide monitoring on-site and off-site**
- **Accelerate covering and capping inactive areas**
- **Improve cover material quality and placement**
- **Improve waste management**
- **Optimize system maintenance**

Future Actions as Required by the Order on Consent

Executed on September 3, 2019



- The Town will complete an expedited holistic evaluation of the landfill during peak odor-producing conditions to identify any new or previously unidentified landfill odor sources.
- The Town will provide an addendum to the Corrective Action Plan that will include, but not be limited to, the following items:
 - o Enhanced operating and intermediate cover material protocol
 - o Design details for improved H₂O₂ dosing equipment at the leachate tanks, feed pumps, etc. and complete construction of final design
 - o Investigation of secondary H₂O₂ pretreatment system for the west side Cell 5 pump station
 - o Amendments to the landfill Operation and Maintenance Manual to include: intense waste screening, revised cover material plan, and reduced active landfilling areas
 - o Alternative daily cover material (ADCM) reduction plan
 - o Enhanced ADCM testing and screening protocol, including strict sulfur parameter guidelines
 - o Enhanced air monitoring plan, including intensified testing at the active Cell 6 fill area and off-site
 - o Conceptual design details for replacement of the existing flare
 - o Conceptual design details for updating the landfill gas collection and control system