Civil & Environmental Consultants, Inc.

Independent Engineering Peer Review and Evaluation of Septage Application

County of St. Clair, Michigan

Smiths Creek Landfill

April 2, 2026

Agenda

- Objectives of Review
- CEC and Review Team Experience
- Information and Documents Reviewed
- Summary of Findings
- Detail of Findings
- Recommendations

Objectives of Review

1

Assess cause of odors detected in the community and potential impact of septage application

2

Determine whether work of County's Consultant, CTI, was sufficient to prevent and remedy the odors

3

Recommend potential for future septage application and landfill procedures

CEC – Corporate Overview

Our Beginnings -

In 1989, four engineers and scientists came together with a singular vision:

- To be a people-first company
- To promote a culture where clients and employees enjoy working together
- To provide integrated services, high-quality work product, and be responsive to client needs

More than 36 years later, **Civil & Environmental Consultants, Inc. (CEC)** has **1,500+ team members** comprised of professional engineers (civil, geotechnical, environmental, chemical, mechanical, electrical, geologists, environmental scientists, architects, and surveyors) in offices nationwide. We are consistently ranked on Engineering News-Record's annual lists of the Top Design Firms and Top Environmental Firms in the nation. **We are Employee-Owned.**

CEC – Corporate Overview (cont'd)

Comprehensive Solid Waste Management Services -

- Siting Studies, Site Characterizations, Economic Feasibility Studies, and Siting Permit / Special Use Zoning Applications
- Solid Waste Facility Operations Audits and Consulting Services
- Landfill Engineering, Design, and Permitting
- Transfer Station & Material Recovery Facility Engineering, Design, and Permitting
- Landfill Gas Management & Treatment Systems Engineering, Design, and Permitting
- Renewable Energy Services
- CCR & Industrial Waste Management Services
- Operations & Maintenance of Control Systems (GCCS, LCS / LCRS, etc.)
- Due Diligence Services
- Hydrogeologic Investigations
- Waste Characterizations
- Construction Services

CEC Project Team – Key Staff

CEC - KEY STAFF		
CEC Staff Name	**CEC Staff Project Role**	**Industry Experience In Years**
Michael Beaudoin, PE	Principal Engineer on Project and Landfill Bioreactor Expert – Technical Review and Evaluation of Septage Application and Landfill Performance (i.e., gas production and settlement), and Recommendations. Acknowledged industry expert on the subject of distressed landfill conditions.	45
Debra Reinhart, PhD, PE	Academic Research, Expert, and Published Author on Bioreactors – Technical Review and Evaluation of Septage Application and Landfill Performance (i.e., gas production and settlement). Recognized leading researcher in the Municipal Landfill industry.	49
Kenneth Kruszinski, PE	Landfill GCCS & LCS Expert and Lead – Site Inspection of GCCS and LCS Infrastructure, Evaluation of GCCS Performance, and GCCS Recommendations.	39

Information and Documents Reviewed by CEC

2019 and 2025 Operating Permits
2013 Expansion Permit Application (Engineering Design, Narrative Reports and Plans, Design Drawings, etc.)
RDDP Permit Applications and Permits
RDDP Annual Reports 2008-2024
Waste Composition 2003-2024
Domtar Papermill Sludge Documentation
Liquid Levels and Cell Moisture Calculations (2006-2025)
2025 Liquid Management Plan for Vertical Gas Wells
CQA / As-Built Documentation for Cell Construction (2011-2024)
SEM Reports 2022- 2025
GCCS Information - 2024 Assessment Report, 2025 Implementation Plan, 2025 Gas Monitoring Data, 2025 Wellfield / Flare Tuning and Data Logs (Flow Rates, Vacuum, Pressure, Temperature) and Performance Charts, 2024 Gas Well Liquid Levels and Pumps, Gas Generation Model Information, Design Drawings, As-Builts, 2025 Proposed Southern Loop Expansion Drawing, etc.
Drone Reports and Surveys 2023-2025
Regulatory Correspondence (EGLE Violations and SCL Responses)

Summary of Findings

- Odors were produced by fugitive gas emissions caused by transitory insufficiency of the gas extraction system
- Odors were detected in the community due to presence of hydrogen sulfide contributed by a particular problematic waste stream
- Mitigation and remediation efforts have eliminated off-site odors
- Septage application does not appear to be a cause of the odors but also does not appear to result in a measurable bioreactor
- CTI is a competent landfill design firm
- Odors were avoidable in hindsight, but a reasonable level of due care was exhibited by CTI and the Smiths Creek Landfill

Cause of Odors

General Landfill Odor Causes

- Working Face – rarely get off site
- Leachate – rarely get off site
- Fugitive Gas – most common off-site detection

Odor Notations around Smiths Creek Landfill

- Began in late 2023
- Noted in surrounding community as resident complaints
- Usually indicated as rotten egg by inspectors

Probable Smiths Creek Odor Causation

- Temporary insufficient gas collection allowed gas to seep through cover and migrate away from landfill
- Unusually large volume of special waste containing sulfur products

Special Waste Contribution to Odor

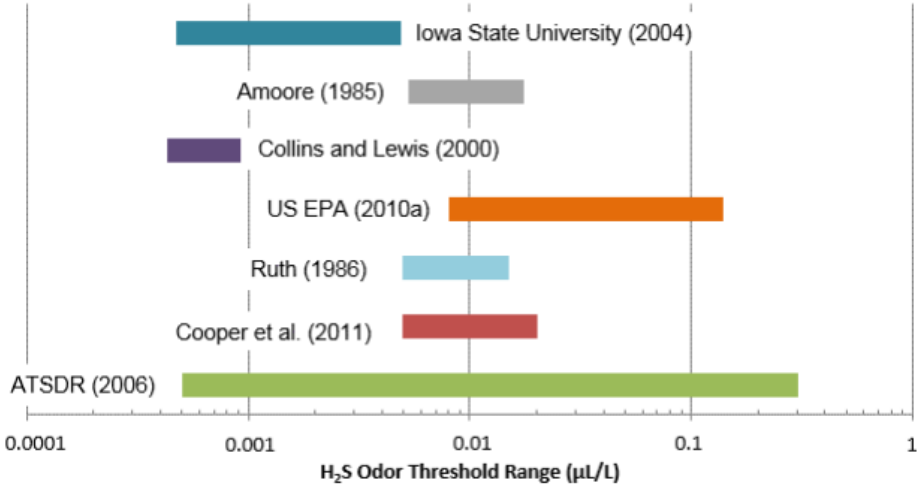
Rotten egg odor is usually caused by hydrogen sulfide present in landfill gas

Hydrogen sulfide has a very low odor threshold meaning that very small quantities will make gas odorous

Sulfur and derivatives present in higher concentrations in waste can result in hydrogen sulfide

Between June 2020 and March 2021, a significant quantity of Domtar paper mill sludge was accepted

Delay between when waste accepted and odors detected attributed to time needed to obtain anaerobic conditions in landfill and generate gas pressure to create fugitive emissions



Mitigation Efforts

A perimeter gas collection trench was installed around area with Domtar waste (Cell 8), improvements were made to vacuum supply, and soil cover improvements were made in early 2024

Drone flyovers of fugitive gas emissions show dramatic decrease in hydrogen sulfide emissions

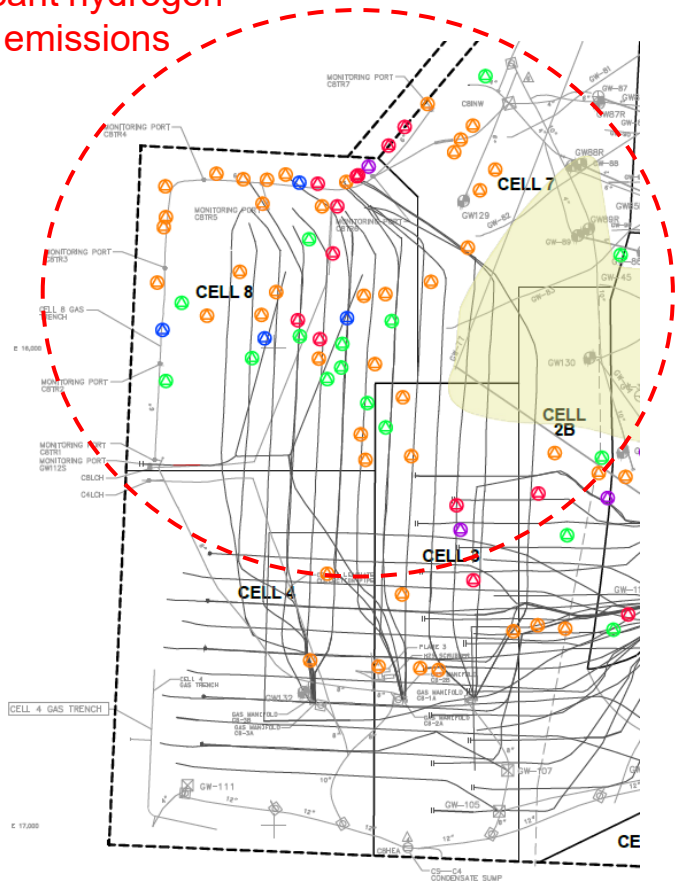
Community complaints near zero

CEC detected no gas odors during October 2025 site visit

Effectiveness of Mitigation Efforts – Drone Hydrogen Sulfide Surveys

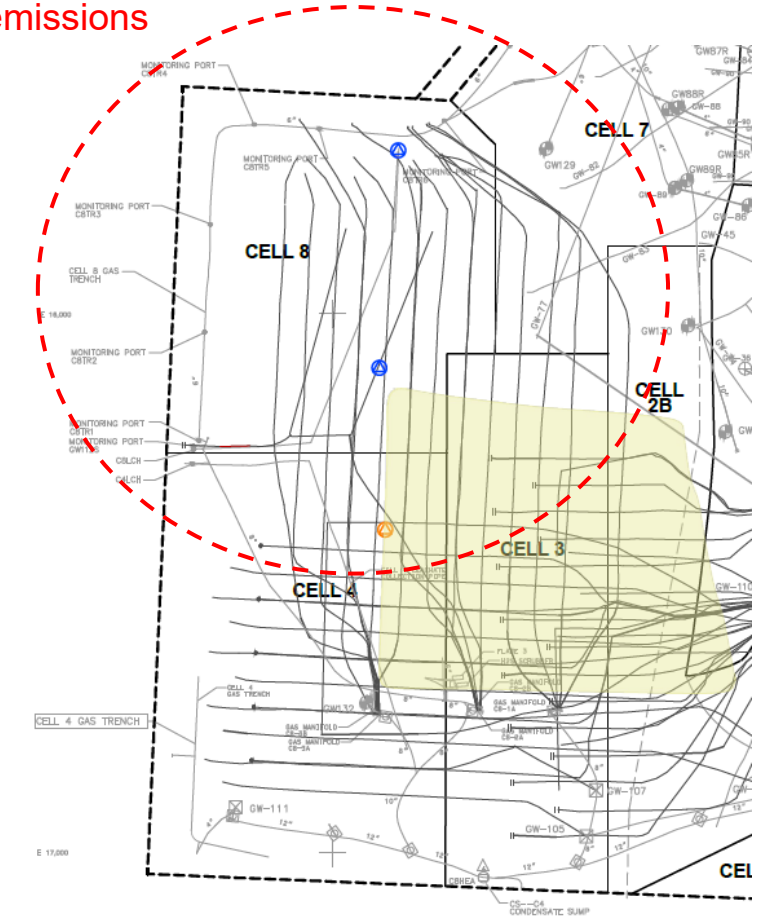
September 2023

Significant hydrogen sulfide emissions



July 2025

Virtually no hydrogen sulfide emissions



Description of Septage Application

- Septage is brought to site in tanker trucks
- Offloading occurs in a specially-constructed building
- Septage is pumped up into large bladders stored on the waste surface
- Liquid septage is applied to the landfill through a series of perforated pipes which are embedded in gravel

Evaluation of Septage Application

CEC spent a lot of effort evaluating this as potential contributor to temporary insufficient gas extraction episode

A stated objective of septage application was to create “bioreactor cells”

Bioreactor cells produce more gas than standard landfill area, potentially contributing to insufficient gas extraction (overwhelming the gas extraction system)

CEC evaluated the markers of bioreactor conditions including:

- Increased moisture content
- Accelerated waste settlement
- Enhanced gas production

Increased Moisture Content

- Using Cell 4 as an example it is evident that septage application was a minor contributor to the total moisture in the cell
- While septage was being applied in Cell 4, the overall moisture content decreased due to leachate extraction
- Moisture content did not reach the U.S. EPA recommended 40% value for a bioreactor
- CEC does not believe that the moisture content reached levels that would have markedly enhanced gas production or impaired gas collection

Table 2
Cell 4 Collective Liquid Balances
2015-2024

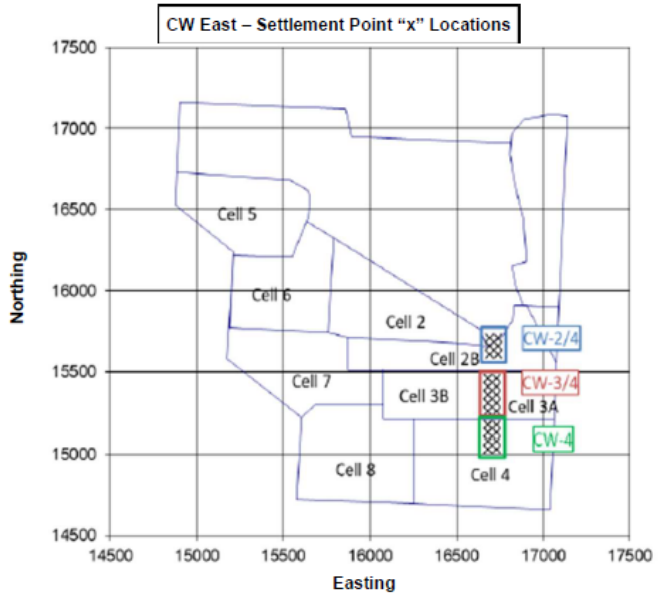
Liquid / Moisture Source	Volume (million gals)
Moisture As-Delivered in Waste (25% of total weight of waste)	81.7
Precipitation Infiltration	35.6
Septage Application	4.0
Leachate Extracted	-30.7
Total Existing	90.6

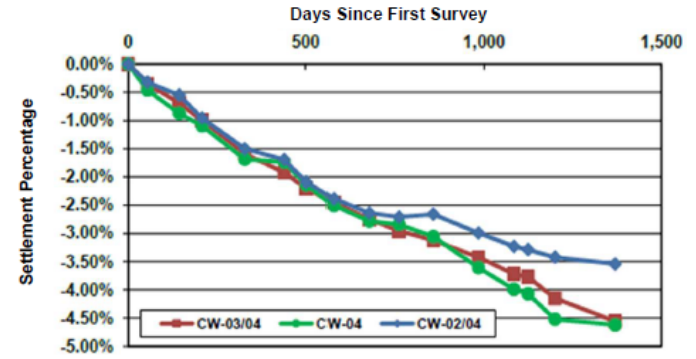
Source: Data above derived from Figure 5-3 in the SCL 2024 RDDP Annual Report.

Accelerated Waste Settlement

- Settlement measured on a septage application area referred to as ""CW East" indicated approximately 1.5% of the waste height per year
- This settlement rate is typical of non-bioreactor MSW landfills
- There does not appear to be evidence of significant accelerated settlement

Illustration No. 6 – CW East Settlement
Monitoring Point Locations and Monitoring Results





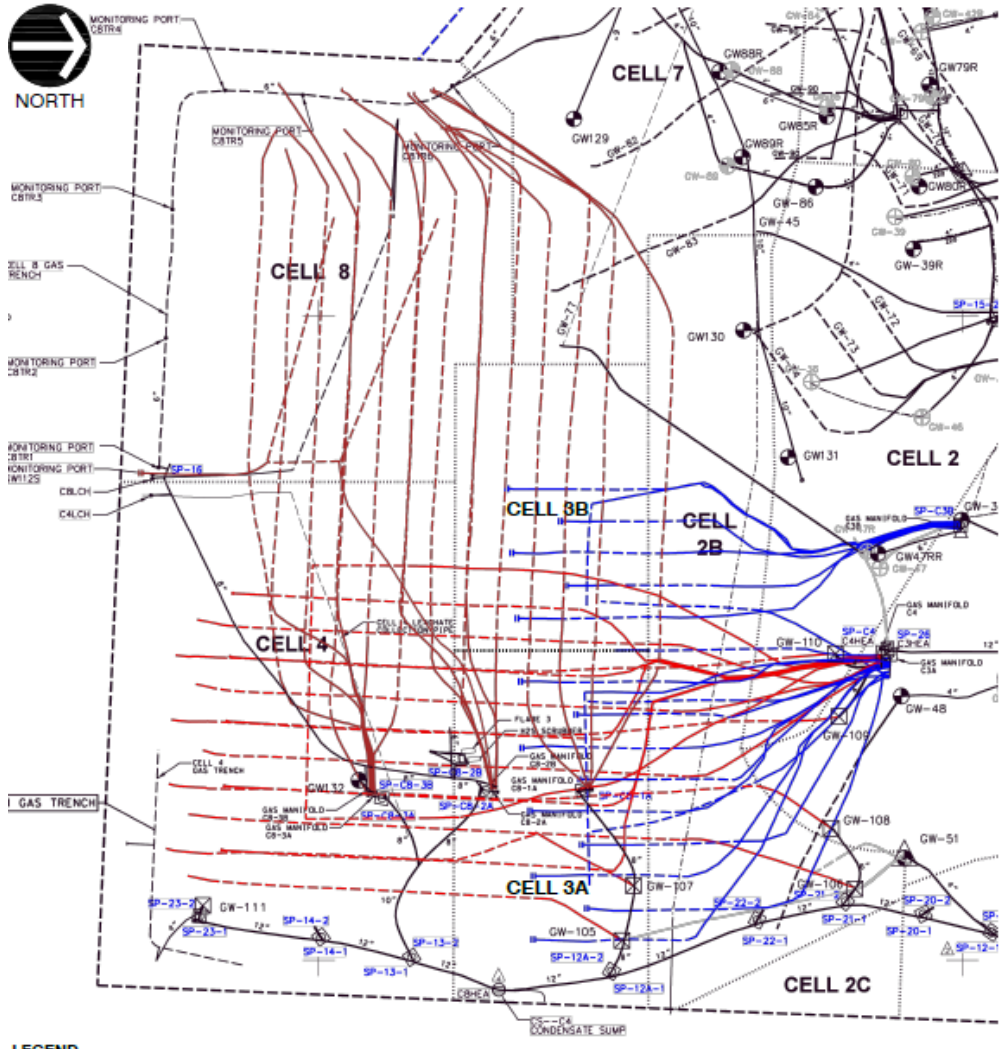
Source: Above CW East settlement figures obtained from SCL 2024 RDDP Annual Report.

Enhanced Gas Production

- Pockets of enhanced gas production may have occurred temporarily, but no evidence of significant impact of septage application

- Complex and overlapping network of horizontal collection pipes obscured gas extraction volumes attributed to “bioreactor” cells

- Septage contains some biological material but not enough to measurably increase gas production



Review of CTI Engineering Efforts

CEC's review of the work product and engineering analysis performed by CTI indicates a high level of competence in the waste management industry

CTI responded rapidly and appropriately to the odor issue and the regulatory agencies' requests and demands

The application of septage is an innovative technique to provide a service to the County but does not appear to have a desired bioreactor effect

It does not appear that the septage application contributed to the odors or harmed the landfill

Recommendations for Smiths Creek Landfill

1) Minor aesthetic improvements are recommended including increased labelling and signage

2) Landfill gas collection and control system (GCCS) improvements continue at the site. CEC suggests additional measures including:

- a) Creating a southern header loop equipped with header access risers
- b) Relocate the utility blower and hydrogen sulfide treatment vessel off landfill to south of site
- c) Install additional vertical gas collection wells in the southern portion of the site to augment horizontal gas collectors

3) Revise special waste approval process to include detailed procedures for approving sulfate-containing waste, wet waste, and potential heat-producing wastes

4) No need to discontinue septage application. Consider cost-benefit for future application.

Contact Information

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