

CASE STUDY: THE IMPACT OF CONSTRUCTION AND DEMOLITION DEBRIS SCREENINGS ON LANDFILL GAS QUALITY

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ABSTRACT

Most state and local governments promote the recycling of construction and demolition (C&D) debris to reduce the quantity of C&D directed to landfills. As a result, many C&D processing facilities are in operation, including 47 C&D materials recovery facilities in New Jersey.

A by-product of many C&D recycling operations is screenings, a material typically less than two inches in diameter produced through mechanical screening of C&D debris. C&D screenings are often used, with state approval, as alternate daily landfill cover. This paper presents a case study on the impact of C&D screenings on landfill gas (LFG) quality, and in particular on hydrogen sulfide (H₂S) generation.

The Pollution Control Financing Authority of Warren County (PCFAWC) owns and operates a regional landfill for the disposal of non-hazardous solid wastes in northwestern New Jersey. The landfill currently accepts approximately 1,000 tons per day of solid waste, including 150 tons per day of waste-to-energy facility ash.

From 1998 to 2004, the PCFAWC utilized C&D screenings in significant quantities as alternate daily landfill cover. In the fall of 2002, local residents began to complain about landfill gas odors in their community. A gas collection and control system was subsequently installed in 2003.

Landfill gas sampling conducted early in 2004 indicated H₂S levels as high as 11,600 parts per million by volume (ppmv). The U.S. Environmental Protection Agency (USEPA) estimates the average H₂S in LFG is 35.5 ppmv. The PCFAWC attributes the high concentration of H₂S to the use of C&D screenings. The high H₂S levels have created significant permitting and gas-to-energy challenges

for the PCFAWC. The PCFAWC discontinued the use of C&D screenings in the spring of 2004 and has noticed a steady decline in landfill gas H₂S concentrations.

This paper discusses the details surrounding the decision to use C&D screenings and the positive financial and operational aspects of the use of C&D screenings. The paper presents data on the impact of C&D screenings on landfill gas quality and demonstrates reductions in H₂S concentrations once the use of C&D screenings was discontinued.

BACKGROUND

Warren County District Landfill

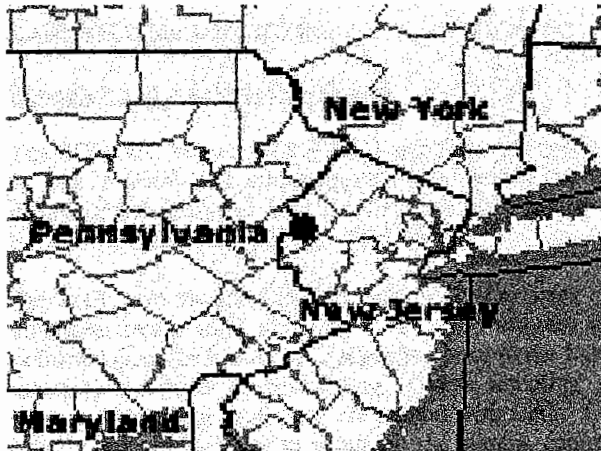
The Warren County District Landfill (WCDL) is located in White Township, Warren County, New Jersey. Warren County is located in northwest New Jersey. Figure 1 shows the general location of the WCDL.

The WCDL began operation in September 1990 and accepts municipal solid waste, construction and demolition debris, non-hazardous dry industrial waste, vegetative waste and animal/food processing waste. The WCDL is permitted for a 45 acre disposal area and a capacity of 4.5 million cubic yards.

From 1990 until 1997, the PCFAWC relied on New Jersey's system of regulatory flow control to ensure the finances of the landfill and the nearby waste-to-energy facility. In November 1997, New Jersey's system of regulatory flow control was ruled an unconstitutional violation of interstate commerce.

Beginning in 1998, the PCFAWC had to compete with local Pennsylvania landfills and reduced the disposal fee from \$99.43 per ton to \$45.00 per ton. In order to raise

**FIGURE 1
GENERAL LOCATION OF THE WCDL**



sufficient landfill revenues, the PCFAWC significantly increased the quantity of solid wastes accepted in the landfill. In 1997, the WCDL accepted approximately 225 tons per day (tpd) of solid waste. Currently the landfill accepts approximately 1,000 tpd of solid waste.

C&D Screenings

The State of New Jersey supports the USEPA solid waste management hierarchy which promotes recycling of solid wastes, including C&D. New Jersey has permitted the operation of 47 C&D materials recovery facilities within the state.

C&D recycling facilities recover a variety of materials from C&D including metal, wood, concrete, brick and paper. One by-product of many C&D recycling operations is screenings, a material typically less than two inches in diameter produced through mechanical screening of C&D debris. C&D screenings often include gypsum drywall which contains calcium sulfate.

Beginning in 1998, the PCFAWC began to use C&D screenings in significant quantities as alternate daily cover (ADC). The C&D screenings had the following benefits to the PCFAWC:

- Revenue (approximately \$10/ton);
- Performance (especially during periods of wet weather due to good drainage and traction); and,
- Convenience (the material was delivered to the working face)

The C&D screenings were approved by the New Jersey Department of Environmental Protection (NJDEP) for use as an ADC. The NJDEP required testing of the C&D

screenings as a condition of use. Among other required tests, the NJDEP required sulfate analysis to be performed and set a "target goal" of 3% of sulfate by weight for the C&D screenings. Monthly testing of C&D Screenings routinely indicated sulfate levels within the NJDEP goal.

Landfill Gas Odors

The PCFAWC had no odor complaints during the initial 12 years of operation. However, beginning in November 2002, the PCFAWC began to receive significant odor complaints. Local opposition to the landfill grew considerably as a result of the LFG odors.

An active LFG collection and control system (LFGCCS) was installed in March 2003 consisting of 5 LFG wells and a temporary stick flare. By March 2004, the LFGCCS had expanded to 24 LFG wells, connections to the leachate collection system, and a temporary stick flare. As of December 2004, the LFGCCS is comprised of 40 LFG wells, 23 tie-ins to the leachate collection system, and 1 horizontal collector. Construction is almost completed on an enclosed permanent flare.

LFG sampling began in March 2004 and indicated an exceptionally high concentration of H₂S (11,600 ppmv). In contrast, the USEPA estimates the average H₂S in LFG is 35.5 ppmv. C&D screenings were considered to be the source of the sulfate and their use as ADC was immediately ceased in March 2004. Additionally, the PCFAWC would not accept C&D screenings as a waste material at the WCDL.

Hydrogen Sulfide

In the anaerobic environment of a landfill, sulfate reducing bacteria produce H₂S from wastes containing sulfate. In the case of C&D screenings, the small particle size and corresponding increased surface area expose the sulfate reducing bacteria to a greater quantity of sulfate (from the gypsum) in a shorter period of time. The resulting combination of C&D screenings and sulfate reducing bacteria can create high quantities of H₂S in LFG.

High levels of H₂S in LFG can be problematic in several ways. First, H₂S is an exceptionally malodorous gas. Odor complaints and regulatory odor violations may result from high levels of H₂S in LFG.

Second, high H₂S can complicate LFG to energy projects due to the H₂S's corrosive nature. Third, high H₂S levels in LFG when combusted will create high levels of SO_x, which may create regulatory challenges.