Protein Matrix
industrial grease remediation

Pilot Study Report:
Dewick Dining Hall (Tufts University)
Prevention of Fat, Oil, and Grease Buildup in Grease Traps

Executive Summary

From October 2014 through June 2015, researchers at Tufts University performed a pilot study in cooperation with Protein Matrix LLC, testing the latter's novel plant protein-based formulation known as Industrial Grease Remediation (IGR). IGR was designed to be a complete solution to fat, oil, and grease (FOG) issues within the wastewater industry – preventing buildup in grease traps and lift stations without harming infrastructure or downstream treatment processes. As a result of treatment of the two most problematic grease traps within Tufts University's main dining hall, FOG buildup in the traps and pipes was reduced while effluent pH remained constant, demonstrating that restaurants can safely reduce grease trap maintenance through the use of Protein Matrix IGR.

Protein Matrix Industrial Grease Remediation Technology

Traditional treatment methods for fats, oils, and grease (FOG) buildup fall into two categories: physical removal (cleanouts) or chemical treatment with bacteria, enzymes, caustics and solvents. The use of these chemicals in grease traps is often discouraged, even forbidden in some wastewater treatment systems. Caustics and solvents can be hazardous, corrosive, and toxic and lead to the formation of large "slugs" of FOG that can block downstream collection systems and negatively impact wastewater treatment processes. On the other hand, biological products such as bacteria and enzymes can be effective, but only to a limited extent: while these technologies may function in one specific environment, any change in condition may lead to FOG crashing out of solution and resolidifying in difficult-to-access areas.

Unlike the aforementioned treatment chemicals, Protein Matrix IGR reduces fat, oil, and grease accumulation in grease traps and interceptors by emulsifying and then converting FOG into a highly flowable byproduct that does not re-accumulate downstream. IGR is a green formulation derived from agricultural products and contains no bacteria or enzymes. In addition, it is biodegradable, nonflammable, non-carcinogenic, nontoxic to fresh and saltwater organisms, and NSF/ANSI 60 certified for use in wastewater and potable water systems.

Pilot Study Narrative

Dewick Dining Hall, the largest commissary at Tufts University, serves 8,000 students per day. Within its kitchen are four 60-80 gal grease traps, two of which handle extensive FOG (one connected to the main dishwash sink for all savory prep work and another to the dishwash sink in the bakery). These traps are cleaned quarterly, at which time each trap usually contains a 6-inch thick "mat" of solidified FOG. While the traps were not due to be cleaned for two additional months at the start of the pilot study, each still contained significant FOG buildup (see Table 1).

To determine whether Protein Matrix IGR would eliminate FOG after heavy accumulation (replacement for a physical cleanout), we dosed the liquid into impacted traps nightly. Three spray nozzles were incorporated into a custom-designed cover, allowing for a conical spray of Protein Matrix IGR onto the solidified FOG in the traps – in this case, 25 oz. each night after kitchen operations had ceased, in order to allow IGR maximum time to react with the solidified FOG surface. While at first IGR was able to soften the hardened and crusty exterior of the FOG mat, it was unable to fully penetrate the mat's dehydrated "skin" without agitation. After light agitation, however, the hardened "skin" was broken down by the nightly dosing regimen into a flowable liquid with porridge-like consistency.

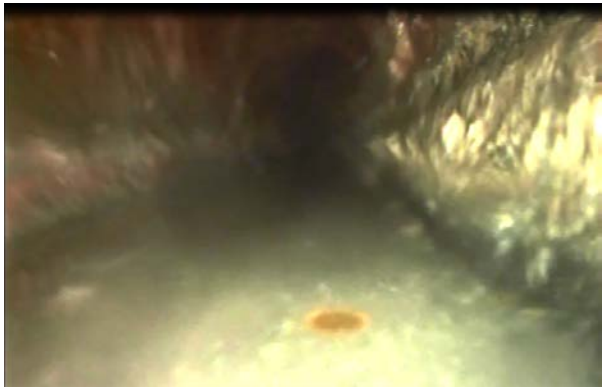
To assess the efficacy of Protein Matrix IGR for long-term maintenance, the grease traps were cleaned out in late February, and over the next four months, sampled and analyzed for FOG on a weekly (in-house) and monthly (third-party) basis, with visual observations made bimonthly. Throughout this time, no FOG buildup was observed despite a continuous decrease in Protein Matrix IGR dosage from 25 to 20 to 14 oz. per trap per day, see Table 1. More telling are the corresponding videos (see attached files and links in Table 1), which clearly show that even four months after the cleanout, the stirrable (even splashable) trap contents are as clean as when the trap was initially pumped. This is in stark comparison with the month of buildup seen in Table 1, and the most striking evidence of Protein Matrix IGR's effectiveness in a food service setting.

Table 1. Effects of Protein Matrix IGR treatment on Tufts grease traps

	One month of FOG buildup pre-pilot	Four months of IGR treatment
Trap #1		Video 
Trap #2		Video 

As mentioned in the introduction, those municipalities that have banned the addition of biological materials into grease traps have done so due a variety of adverse downstream effects, including to the potential of those products to fail downstream, causing FOG to crash out of solution and resolidify in difficult-to-access areas. To investigate the condition-independence of Protein Matrix IGR and whether the IGR-FOG byproduct would solidify downstream, we videorecorded 1200 feet of pipe leading from the grease trap to the municipal sewer at the start and at the conclusion of the pilot. The condition of the pipes leading from the dining hall, especially with relation to FOG buildup, are seen in Table 2. For example, the figures labeled "A" in Table 2 show the same section of bellied pipe (an optimal location for a FOG "hot spot") halfway between the dining hall and the municipal sewer that contained significant silt and debris. Had the byproduct of the IGR-FOG reaction been a solid (or resolidifed), it would have accumulated in this location. Instead, we saw no additional FOG buildup.

Table 2. FOG buildup in Tufts pipes before and after 7-mo of Protein Matrix IGR dosage

Before Pilot	After Protein Matrix IGR Treatment
	
	

Per the Massachusetts Water Resource Authority (MWRA)'s request, trap effluent samples were collected and analyzed for pH and oil/grease (O/G) by an accredited third-party laboratory (R.I. Analytical – Warwick, RI). O/G and pH analyses were performed weekly for the first 10 weeks of the study, followed by monthly sampling for the final seven months (see Figures 2A and 2B). In addition, researchers at Tufts performed FOG analyses by EPA method 1664 to provide more data granularity (again, see Figure 2). As seen in the figures, the effluent pH remained relatively consistent and the O/G results, while erratic (to be expected given the nature of grab sampling for oil and grease on an intermittent basis), demonstrate a clearly evident downward trend. It is clear that the use of Protein Matrix IGR not only prevented FOG buildup within the trap, but also decreased the effluent O/G readings.

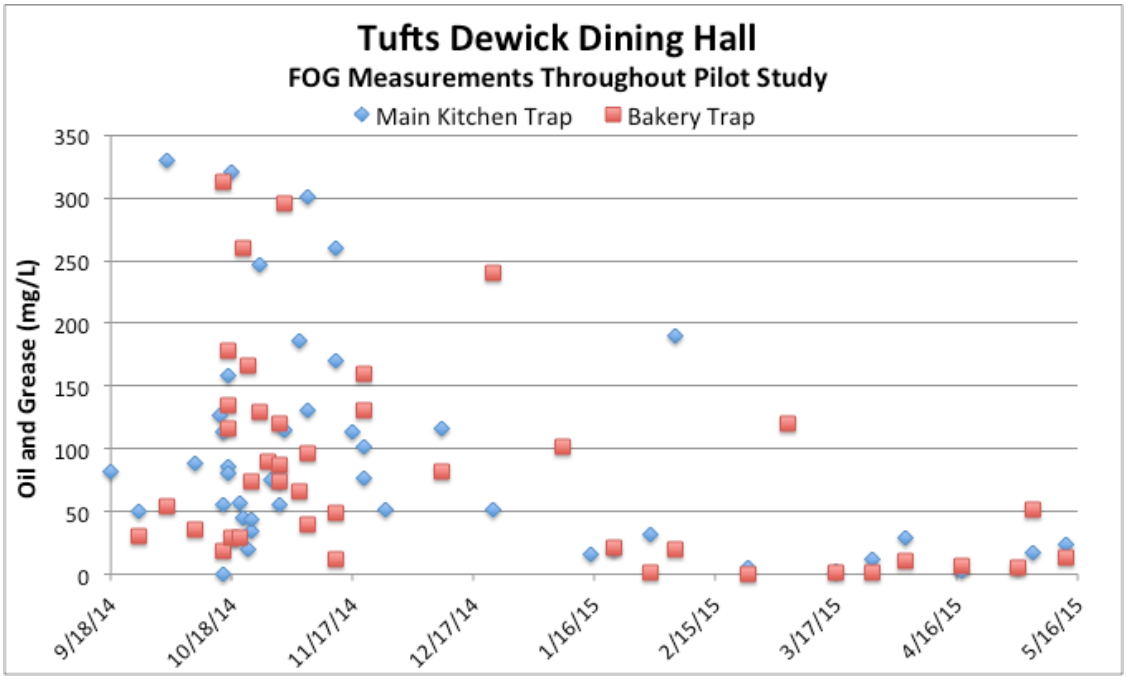


Figure 2A. Fat, oil, and grease measurements throughout Tufts study

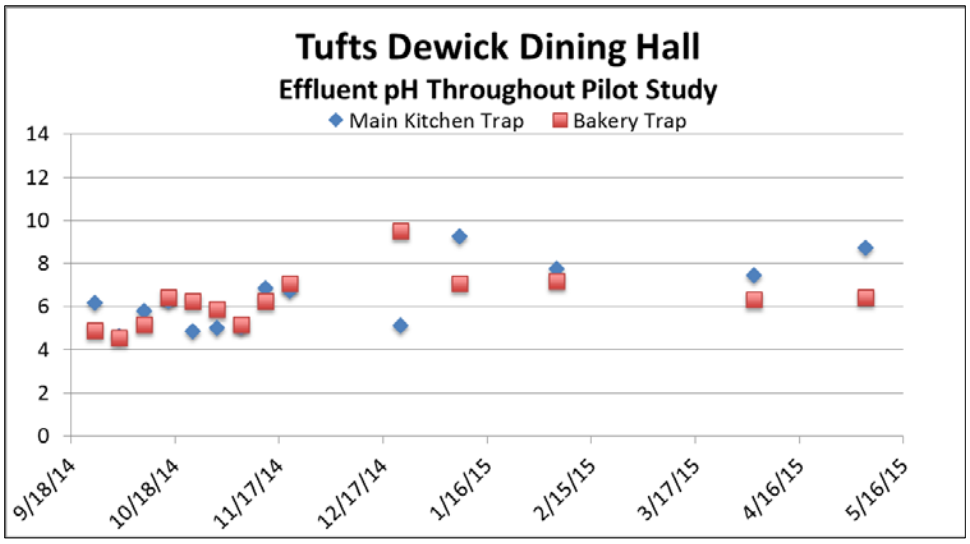


Figure 2B. pH measurements throughout Tufts study

Cost-Benefits

Capital costs for the Tufts grease traps were close to $1500, while their annual pumping costs were approximated at $2,000. For the dosage rates employed during this study, the annual Protein Matrix IGR material cost will range between $1,400 and $2,000, with an initial capital cost of $1,000. As such, it is clear that the use of Protein Matrix IGR at an optimized dosing rate can decrease FOG-related costs for a food service establishment (FSE), especially those with extreme FOG buildup or compliance issues.

However, Protein Matrix IGR treatment should not be seen as a simply a direct replacement for pumping GGI and hauling grease. Beyond eliminating pumping due to FOG, Protein Matrix IGR precludes the need for installation of an additional trap or interceptor in series, saving capital costs for an FSE. In addition, the threat of a clog and overflow due to a backed-up interceptor can lead to cleanup costs in the thousands of dollars, the increased insurance premiums that come with being suddenly classified as a "high risk" operation, and six-figure fines from local and state governments. In all, FOG abatement can be a high-risk proposition for an FSE, with little guidance from local governments beyond inspections and compliance limits. In contrast, by preventing FOG buildup, Protein Matrix IGR eliminates the need for interceptor cleanouts due to FOG, significantly lessens the risk of clogs and overflows, and allows a FSE to remain in compliance.

Conclusions

In this pilot study, Protein Matrix IGR treatment prevented FOG buildup in two problematic grease traps and the pipes between these traps and the municipal sewer. As such, the risk of clogs, overflows, and emergency calls due to FOG buildup were reduced. Water quality monitoring showed that effluent FOG readings decreased while pH remained constant. Through the use of Protein Matrix IGR, FSE can reduce regular grease trap maintenance while also remaining in compliance with FOG compliance programs and avoiding the correspondingly expensive fines from local governments.

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