

# MEGADISTRIBUTORS

## Peering Into The Black Box

The use of Biological products to degrade FOG in the Grease Interceptor

Based on a paper written by **Gabby Everett, Ph.D.**



# What do we prefer NOT to be....

- Reacting Dangerous goods interventions & call outs !!



# Why Do We Need Grease Interceptors?

- Stop FOG from flowing into the municipal system where they can block major sewer lines – Remember the London fatberg, the size of 20 Elephants!! We have seen significant versions up in Auckland too (@13 tonne)



Science alert

# Why Do We Need Grease Interceptors?

- Fats can also form fatty acids which will degrade sewerage infrastructure
- FOG causes backups and blockages that inconvenience the public



- FOG can also cause offensive odours to your customers and the public

# Enhancing the Performance of the Grease Interceptor

- Grease interceptors are static systems that are designed to allow FOG float to the service and fat free effluent to flow to the municipal sewerage system. FOG is periodically removed from the Interceptor by a contractor.
- The advent of Biological products potentially allows operators to **enhance** the performance of the grease trap to prevent blockages, make the interceptor easier to clean and extend the service frequency.

# Enhancing the Performance of the Grease Interceptor

- Initial bench testing in the laboratory showed promising results however these often failed to be replicated in the field.
  - Early bacteria blends converted the fats to the fatty acids and liquified them, these products then flowed into the municipal treatment plants putting extra load on the systems and potentially causing corrosion problems in the public infrastructure.
  - Bacteria were dosed in spore form and they needed to “**wake up**” and form a viable biomass before they could become effective. The “wake up” time is at least 4 hours and in a busy grease trap the bacteria are washed through the interceptor before they have an chance to digest waste.
  - **The physical conditions in the interceptor did not support the bacteria.**
    - Too Hot
    - pH >8.5 or <4.5
    - Lack of available oxygen

# BioAmp – the NCH solution

- The BioAmp system was launched in the year 2000.
  - BioAmp delivers **live** bacteria at the exponential stage of their life to avoid the “wake up” time, so the bacteria go to work straight away.
  - The BioAmp is programmed to dose into the drain lines at a time of low activity to avoid attrition from other chemicals
  - The BioAmp FreeFlow contains pseudomonas species that are one of the best producers of the fat degrading lipase enzyme
  - **Our company then regularly services these units ensuring it operates at maximum efficiency and uses fresh bacteria feedstock**

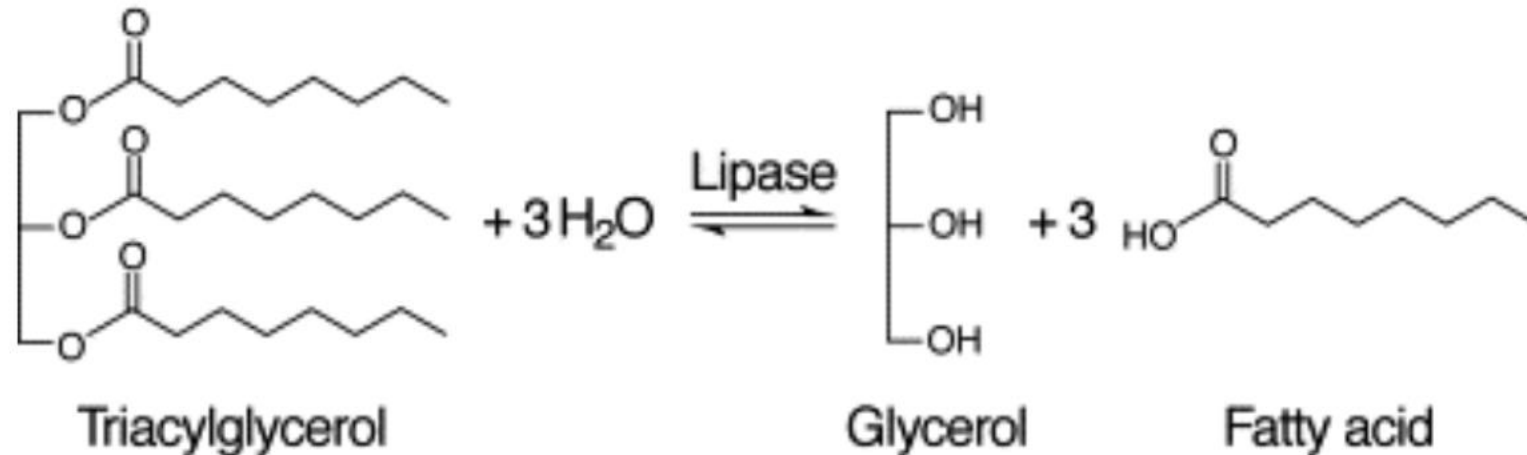
# Questions Still Unanswered

- Despite improved outcomes there were still projects where the BioAmp did not deliver the results we expected; so we started asking questions:
  - What is the mechanisms of action of our bacteria?
  - Dosage – how much bacteria do we need to add to the system to achieve X% FOG reduction?
  - What places and situations should be avoided
    - Nature of effluent
    - Interceptor turnover



# Mechanism of Action

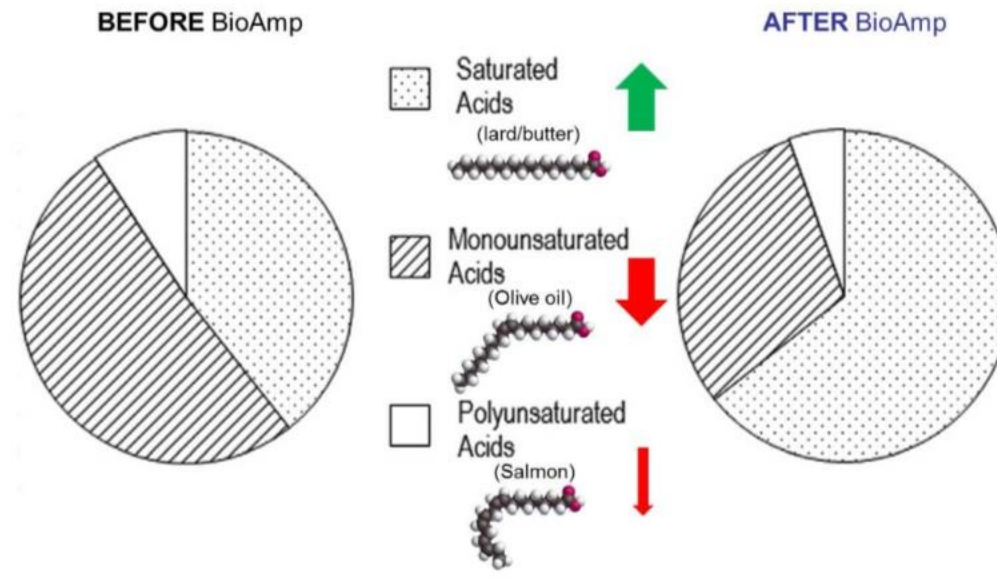
- The *Pseudomonas* species used in the NCH FreeFlow produces Lipase enzymes that breakdown the fats to fatty acids using the process shown below



- As discussed earlier fatty acids cause a number of issues to the municipal infrastructure so the NCH FreeFlow blend contains a number of bacteria species specially selected for their ability to **quickly degrade the fatty acids**. This can be thought of as a **1,2 punch**; lipase breaks up the larger fats and NCH specialized fatty acid degrading bacteria break up the smaller fatty acids.

# Understanding the Mechanism of Fatty Acid Degradation

Pennsylvania University analyzed their dining room grease interceptor before and after the application of NCH Biologicals. Researchers found that after the application of the bacteria there was a fall in unsaturated fatty acids and a rise in saturated fatty acids



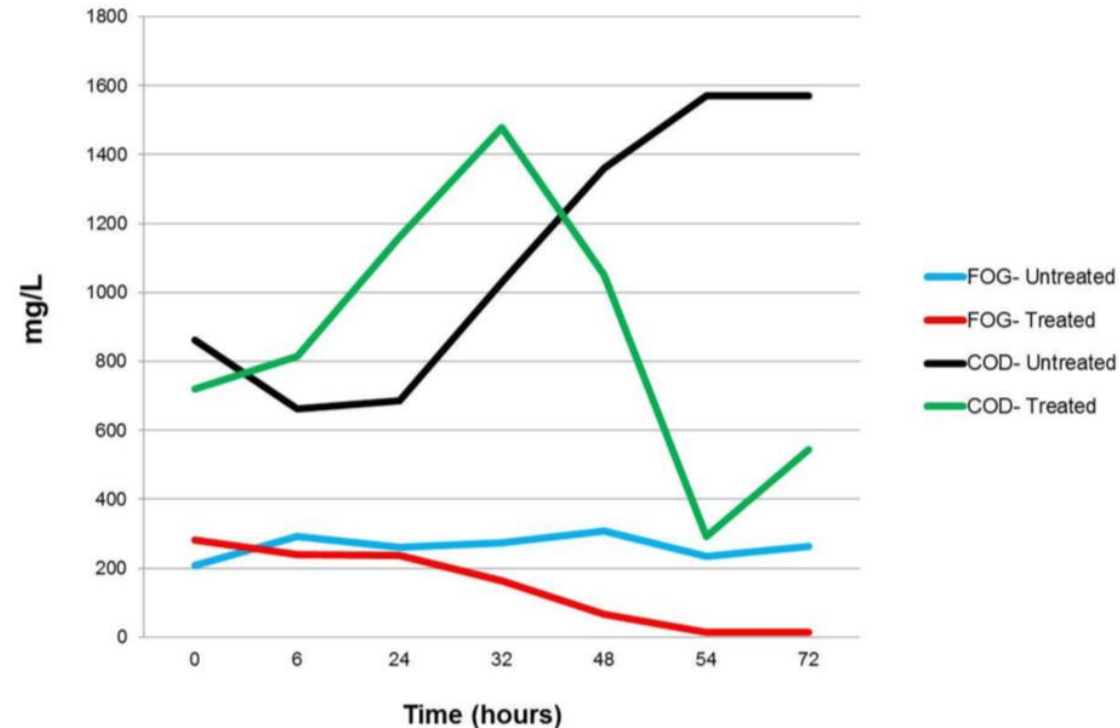
# Understanding the Mechanism of Fatty Acid Degradation

This indicates that fatty acid degradation involves the hydrogenation of double bonds as unsaturated fatty acids are converted to saturated fatty acids. We hypothesize that the apparent COD is higher than the apparent COD of an unsaturated fatty acid suggesting that whilst the FOG of a treated system may reliably decrease the COD may increase.

NCH tested this hypothesis in the laboratory by measuring FOG and COD measurements of fully emulsified oil with and without treatment with biologics

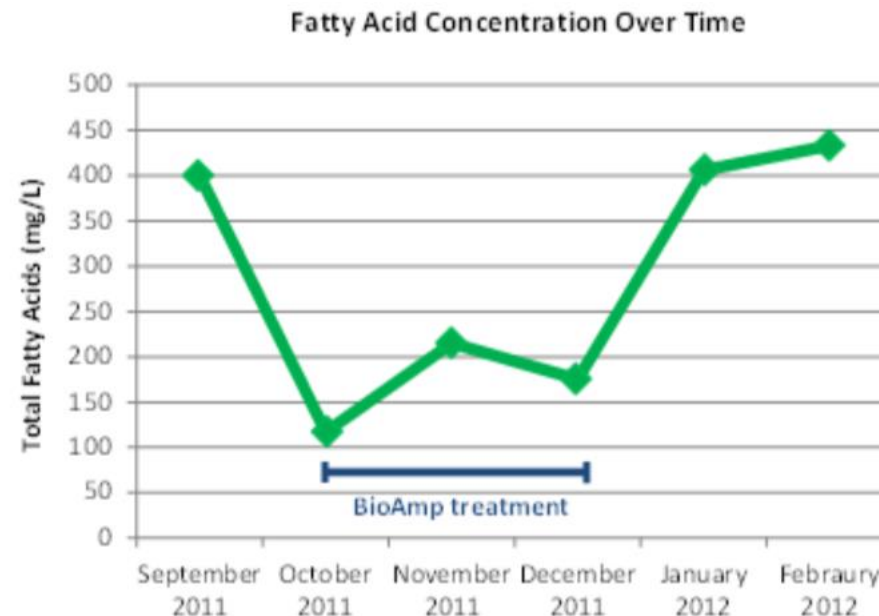
# Understanding the Mechanism of Fatty Acid Degradation

As expected, the FOG decreased in the treated system whilst the COD increased, in fact it more than doubled before quickly decreasing below the levels seen in the untreated system.



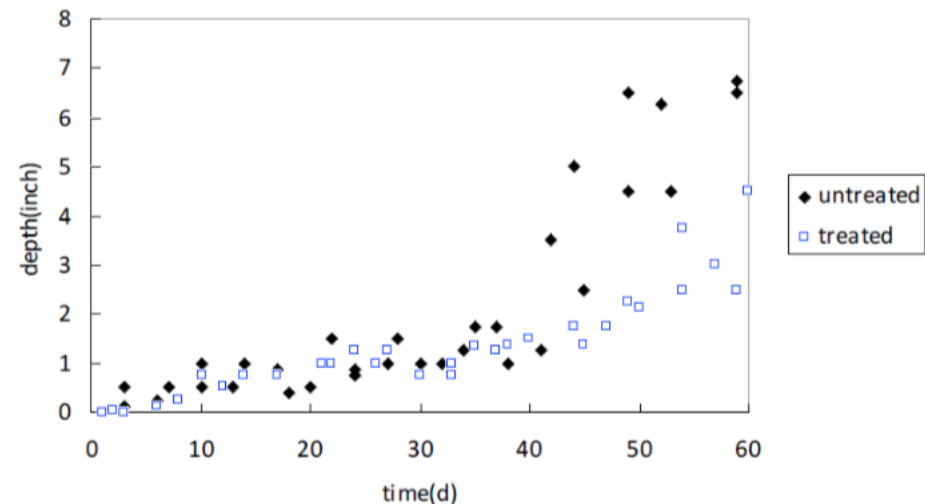
# Fatty acid levels in the treated system over time

Over time the COD of the treated system drops, presumably because the bacteria mediated degradation of the fatty acids that contribute to the COD. **We tested this presumption over a longer time frame, and we found that the fatty acid concentration dropped by nearly 60% during the treatment period.**



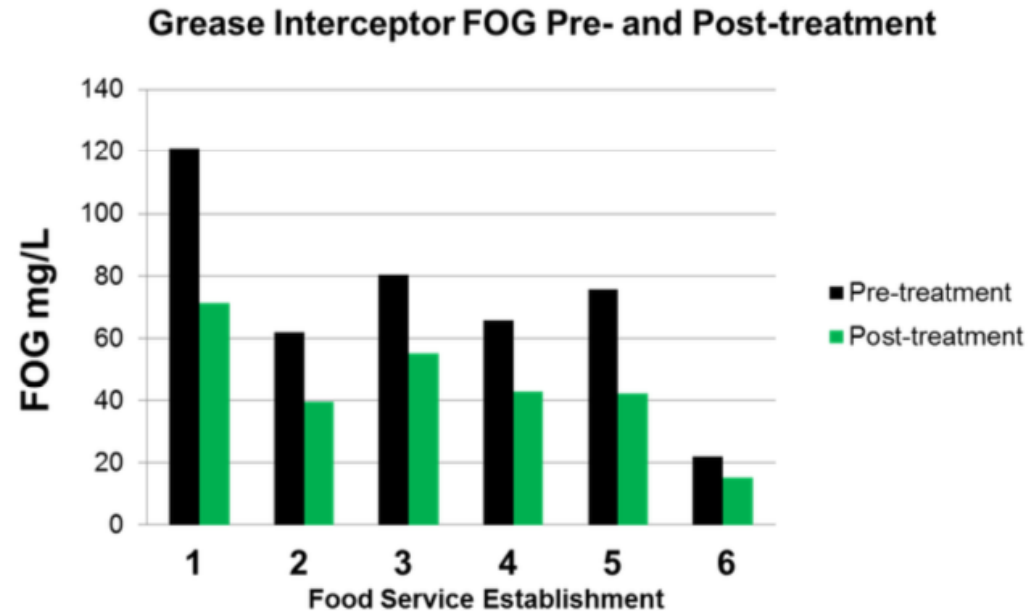
# Reductions in the Grease Crust in the interceptor

Studies carried out by North California State University suggests that the NCH Bacteria degrade FOG before it can congeal and contribute to the grease cap. Researches at the university performed daily measurements at a popular Italian restaurant with and without treatment and they observed a 60% decrease in the thickness of the grease cap, this also resulted in a reduction of odours around the facility.



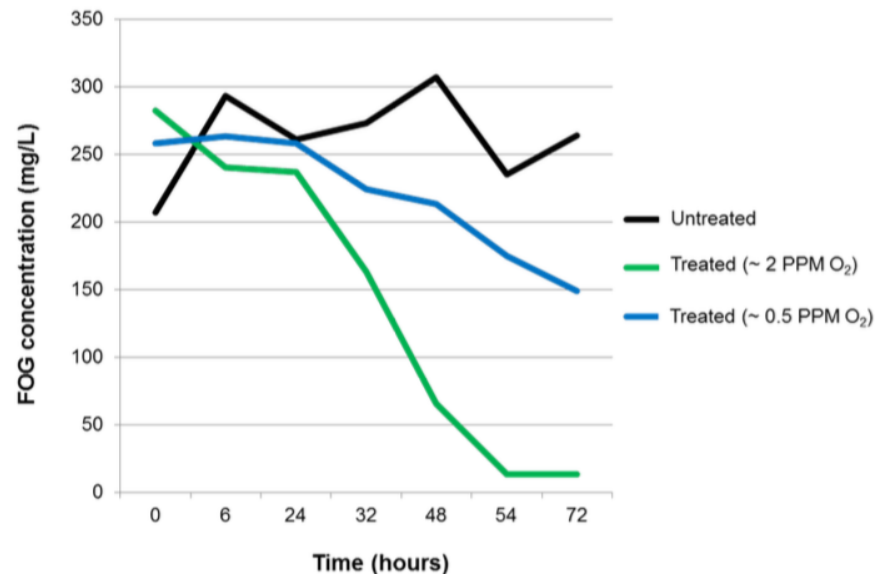
# What Influences the Performance of Biological Products?

We studied the outcomes at a number of similar sites treated with the same quantity of BioAmp product and we found there was a wide variation in performance.



# Role of Dissolved Oxygen

Further work carried out at NCH Laboratories showed that the availability of dissolved oxygen has a major impact on FOG degradation. The experiment used a synthetic grease interceptor fluid with the test running over 3 days and the same dose & blend of bacteria solution. The only variable was the level of dissolved oxygen: **Results show that an oxygenated system will degrade FOG 8 X's faster than a system with no oxygen**





# What Influences DO in the Grease Interceptor?

Dissolved oxygen enters the grease interceptor as new effluent flows from the kitchen. As effluent enters the interceptor oxygen levels start to fall. A low turnover provides a long residence time for the bacteria to digest FOG but as the DO is used by the bacteria consuming the waste the FOG degradation rates slow.

**Ideal turnover to preserve optimum DO levels is in the range of 2.5 – 8 times per day. Turnover rates faster than 8 times per day does not give the bacteria enough time to degrade the FOG**

# What do you Need to Effectively Use Biologicals to Degrade FOG

- Grease interceptor turn over 2.5 – 8 times per day
  - pH 5.5 – 7.5
  - Temperature 25 °C - 35 °C
- A blend of bacteria species that have a proven ability to breakdown the FOG and Fatty Acids
- A supplier who services the equipment and is knowledgeable of the change requirement of your process

# Grease Interceptor Calculator

## Turnover Rate

Interceptor Volume	
<input type="text" value="1000"/>	gallons
Monthly Water Usage	
<input type="text" value="150000"/>	gallons per month
<input type="text" value="5000"/>	gallon per day
<input type="text" value="50%"/>	Industry Factor
<input type="text" value="2500"/>	Kitchen Usage/Day (gal)
Industry Factor	
50%	FSE, QSR
10%	Hospital
10%	School/Univeristy
15%	Hotel

Turnover Rate
<input type="text" value="2500"/>
<input type="text" value="1000"/>
<input type="text" value="2.5"/>

Kitchen Usage (gal)	Grease Interceptor Volume (gal)								
	1000	1500	2000	3000	5000	7500	10000	15000	20000
1000	1	0.7	0.5	0.3	0.2	0.1	0.1	0.1	0.1
1500	1.5	1	0.8	0.5	0.3	0.2	0.2	0.1	0.1
2000	2	1.3	1	0.7	0.4	0.3	0.2	0.1	0.1
2500	2.5	1.7	1.3	0.8	0.5	0.3	0.3	0.2	0.1
3000	3	2	1.5	1	0.6	0.4	0.3	0.2	0.2
3500	3.5	2.3	1.8	1.2	0.7	0.5	0.4	0.2	0.2
4000	4	2.7	2	1.3	0.8	0.5	0.4	0.3	0.2
5000	5	3.3	2.5	1.7	1	0.7	0.5	0.3	0.3
6000	6	4	3	2	1.2	0.8	0.6	0.4	0.3
7500	7.5	5	3.8	2.5	1.5	1	0.8	0.5	0.4
10000	10	6.7	5	3.3	2	1.3	1	0.7	0.5
12500	12.5	8.3	6.3	4.2	2.5	1.7	1.3	0.8	0.6
15000	15	10	7.5	5	3	2	1.5	1	0.8
20000	20	13.3	10	6.7	4	2.7	2	1.3	1
25000	25	16.7	12.5	8.3	5	3.3	2.5	1.7	1.3
30000	30	20	15	10	6	4	3	2	1.5

Ideal
Adequate
Not ideal

GI sized too small, too much flow

## Temperature

Temp in Influent Side of GI	<input type="text" value="89"/>	°F
Temp in Effluent Side of GI	<input type="text" value="85"/>	°F

Too cold	Adequate		Ideal			Too Hot			
>60	65	70	75	80	86	95	100	105	110

## pH

pH in Influent Side of GI	<input type="text" value="5.9"/>
pH in Effluent Side of GI	<input type="text" value="5.5"/>

Acidic	Adequate		Ideal				Basic	
<4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	>8.0

**NZ**  
**Plumbing and Building Services LTD**  
PO Box 418 • Whangamata 3643  
nzplumbing@slingshot.co.nz

4/04/19

To Whom it may concern,

It is our pleasure to write this recommendation for Mega Distributors. We have looked after the Plumbing and Drainage maintenance for the Princes Wharf location managed by Docklands Property Management for over ten years now. Managing the waste from the various restaurant outlets at this location has been outsourced during this time and been a very expensive and ineffective method often resulting in a build up of fat content blocking the waste pipes and causing additional services to be called in to resolve the issues.

Since installing the Bio Unit product supplied by Mega Distributors we no longer have these issues and the cost of running the system is half what it was before installation. The Bio Unit system is a clean and environmentally safe product to use. Our client is very happy with the overall result and we in turn are happy with the product and the service that Mega Distributors provides to us. We continue to recommend this product to our commercial clients with confidence.

We will be happy to validate our recommendation over the phone if required.  
Please do not hesitate to call.

**NZ Plumbing and Building Services LTD**  
Managing Director  
Robbie Metcalfe  
021 02611003

Letter of Recommendation.

# About NCH

- NCH was established in 1919 supplying maintenance chemicals to industry.
- Developed the BioAmp system in 2000, now with over 20,000 units in operation in The USA, Europe, Asia, Australia & New Zealand
- Clients include Hilton Hotel Group, Shangri~La, Accor Group
- This presentation is based on a white paper written by Gabby Everett, Ph.D. a Senior Biotechnology Scientist at NCH. This paper draws on third party tests and our own internal data based on 19 years experience with the patented BioAmp system