WHITE PAPER REPORT

February 15, 2012

Removal of Fats, Oils, & Grease (F.O.G.) from Grease Traps and Lift Stations
By means of
Advanced Oxidation Processing (A.O.P.)
Using
The "Little John Digester"

Prepared for: **Randy McGuffin of DO2E Waste Water Treatment**

Prepared by: **Dr. J.H. Wakefield, Consultant, Chemical and Environmental Engineer/Analytic Chemist**

Scenario:

F.O.G. (Fats, Oils & Grease) deposits in both grease traps and lift stations accumulate within a short period of time. Their removal requires high-pressure Vac-Trucks and hazardous chemicals to break down and remove the unwanted build-up.

PROBLEM:

Several problems occurring because of grease accumulation are:

1.) **Clogged sewer lines**
2.) **Sanitary sewer overflows (SSO's)**
3.) **Raised hydrogen sulfide levels (H_2S)**
4.) **Breeding ground for pathogenic microorganisms**
5.) **A variety of ensuing issues when these untreated FOG deposits reach the head Works at the Main Plant**
6.) **Foul odors from associated Mercaptans/other organics**

SOLUTION:

Installation of the Patented DO2E Digester

What is the Little John Digester?

DO2E has designed and patented the "Little John Digester" for complete removal of FOG deposits and H_2S in waste water.

The Little John Digester is a device which operates on low-pressure, high-volume air flow, has NO moving parts, can be installed in five minutes, and can be equipped to provide various levels of Concentrated Oxygen which we have deemed Advanced Oxidation Processing or "A.O.P." for the complete removal of all F.O.G. (fat, oil, and grease) deposits and H_2S.

How does it work?

This digester is a state-of-the-art system that enables the injection of air through a specially-designed manifold system constructed of heavy-duty, non-corrodible material. Atop this specialized manifold are housed stationary ridges and/or blades. As the air travels up and through the digester cylinder, a void is created. By means of this vacuum (Venturi) effect created, solids are pulled in through openings at the bottom of the digester and impacted upon the stationary blades or ridges at the top of the unit. At a velocity up to 65 feet/second, the solids are immediately liquefied and liquid fractions are emulsified when they come into contact with blades and/or ridges; the result is a high degree of breakdown of the solids to smaller particulates which greatly increases the digestion process. Oxygen is also injected in this cylinder, which further facilitates the digestion process of raw sewage before it enters the wastewater treatment plant.

THE LITTLE JOHN DIGESTER UTILIZES THREE MEANS OF DIGESTION:

MECHANICAL, CHEMICAL, AND BIOLOGICAL.

1) MECHANICAL DIGESTION:

The mechanical process works as described above by continuously moving the solids at velocities of up to 65

feet/second. This accounts for approximately 70% of the digestion process, largely as the consequence of so dramatically increasing the surface area of the particulates.

2) CHEMICAL DIGESTION:

While we do not add any additional chemicals to our process, we do recycle the existing household and commercial chemicals such as soaps, detergents, degreasers, stain-removal solvents, drain cleaners, fabric softeners, and all of the other household and commercial solvents and cleaners that are continuously discarded down the drain. Once discarded, these household chemicals become stratified or separated in the water column within the grease trap or lift station and have little to no affect in the digestion process. The Little John Digester patented process has a unique method of blending all these existing chemicals/components together to further degrade the grease and other matting deposits which occur naturally in lift stations. This is a key component of our "GREEN" technology (recycling) and reduces chemical cost by up to 90%. It is estimated that this chemical digestion accounts for 20 to 25% of the digestion process that will be occurring in the lift station after the Little John Digester is installed.

3) BIOLOGICAL DIGESTION:

The digestion of these FOG deposits is enhanced by reduction of the biological oxygen demand (BOD) and the chemical oxygen demand (COD) through the continuous injection of 45 to 50 cfm (ft^3/minute) of warm, fresh air into the water column. By this means, we are able to enhance the activity of the various microorganisms that are decomposing the waste stream, both biologically and chemically. This enhancement of the aerobic environment results in more efficient breakdown by the bactors. It is estimated that this portion of the digestion process accounts for as much as 10 to 15% of the total digestion process.

TESTS & RESULTS:

A recent series of tests were conducted using the Little John Digester for FOG and H_2S removal in conjunction with Advanced Oxidation Processing. These tests were conducted in accordance with Standard Procedures and Methods (for Treatment of QA/QC of Wastewater). The tests results were conducted by a registered independent laboratory following ASTM protocols.

Facility:

Analytical Industrial Research Laboratories, Inc.
Cleveland, Tennessee

Personnel involved:

***Roy Patterson*; Licensed Class A Wastewater Operator, Director**

***Sean Glaser*; Senior Analytic Chemist**

Laboratory Licensing: State of Tennessee (ID # 02034)
Alabama Department of Environmental Management (ID # 40780)
U.S. EPA (ID # TN 00046)
A2LA ISO/IEC 17025:2005 Certification (# 3009.01)

Scope of Accreditation:

Waste Water, Surface Water, Ground Water, Drinking Water, Solids, Soils, Hazardous Wastes, Sediments, and Sludges.

Laboratory Report #251880

RECENT TESTS CONDUCTED EXCEEDED ALL PRIOR EXPECTATIONS FOR COMPLETE FOG & H_2S REMOVAL.

Several tests were conducted by:

Dr. J.H. Wakefield
Consulting Chemical & Environmental Engineer/Analytic Chemist
Pensacola, FL. 32514
Contact Number: (850) 316-7656

TEST RESULTS CONFIRMED BY INDEPENDENT LABORATORY:

The Little John Digester has proven to remove 99.95% of FOG deposits and H_2S found in grease traps and lift stations.

This removal results from contact interaction. These FOG and related deposits are converted into a stable suspension that can be easily pumped through the collection lines without resolidification (settling out) and without any negative impact on the receiving wastewater treatment plant. In short, the basic principle is to break down FOG deposits and other associated deposits found in both grease traps and lift stations into suspended solids of various stable forms that remain in suspension and do not reform in the distribution lines. The Little John Digester has been proven to remove 99.95% of FOG deposits and H_2S found in Grease Traps and Lift Stations. This removal is a direct result of; "*contact interaction combined with enhanced Oxygen concentration with in the fluid stream*". These FOG and related deposits are converted into a stable suspension that can be easily pumped through the collection lines without resolidification (settle out) and without any negative impact on the receiving waste water treatment plant. In short, the basic principle is to break down FOG and associated deposits found in

both Grease Traps and Lift Stations into suspended solids of various stable forms that remain in suspension and do not reform in the distribution lines.

Increasing the dissolved oxygen level or supersaturating the fluid stream using the patented Little John Digester in the wastewater column is the major contributing factor in the stabilization of the suspended particulates resulting in the pre-digestion by activated sludge organisms prior to delivery to the processing wastewater facility.

It was also determined, that the remaining processed solids found in the grease traps and lift stations are estimated to be up to 65% pretreated prior to being pumped out, thereby turning the collection basins into pretreatment basins and substantially reducing waste water plant loading.

The resulting degradation of the FOG includes saline, silicon dioxide (sand), CO_2, and various other non-treatable or degraded composites. The various inorganics have the desirable effect of keeping the distribution lines clear by means of acting as gentle abrasives as they are pumped through the collection lines.

X Dr. J.H. Wakefield

Dr. J.H. WAKEFIELD
Consulting Chemical & Environmental Engineer / Analytic Chemist

Please feel free to contact Dr. Wakefield at; (850) 316-7656.

ANALYTICAL INDUSTRIAL RESEARCH LABORATORIES, INC.

State of Tennessee (ID #02034)

Alabama Dept. of Environmental Management (ID #40780)

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CLEVELAND, TENNESSEE 37312
(423) 476 - 7766 Fax: (423) 476-7714

Scope of Accreditation:
Wastewater, Surface Water, Ground Water, Drinking Water, Solids, Hazardous Waste, Soils, Sediments, and Sludges.

Lab Report 251880

8104
DO2E
Attention: Randy McGuffin
1165 West Detroit Boulevard
Pensacola, FL 32534

Date Received 1 /16/2012
Date Sampled None Given
Date Requested 1 /31/2012
Rush Status Normal
Phone (850) 332-7799
Extension
☐ *Fax*
☐ *eMail:*
PO#

Sample Information

FOG's With & Without Areation

Lab Report: **251880**	*Result*	*LCL*	*Method*	*SDL*	*Date*	*Time*	*Analyst*
Research Standards							
Research/Standards	*	NA	STM	0	1/20/2012	11:10	SLW

** See Attached*

Lowest Calibration Level [LCL] - reporting limit; Sample Detection Level [SDL] - Sample Specific

QA/QC Procedures required by the Method(s) were followed unless otherwise noted. Performance and acceptance standards for required QA/QC procedures were achieved unless otherwise noted. No significant modifications have been made to the Method(s). I attest that, based upon my inquiry of those individuals immediately responsible for reviewing the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

Report approved by:

Analytical Industrial Research Laboratories Inc.
1550 37th Street, NE, Cleveland, TN 37312
Phone: (423) 476-7766 or Fax: (423) 476-7714
Reference Laboratory ID: 251880

Customer: ***DO2E Waste Water Treatment (Little John Digester)***

Case Narrative: ***The samples (FOG with and without aeration) were allowed to settle for 48 hours prior to testing (20 to 25C). The non-settleable solids Portion of each sample were classified as long-term solids Suspension.***

TDS = Total Dissolved Solids / **TS** = Total Solids / **TSS** = Total Suspended Solids
SS = Settleable Solids
FOG without aeration: Turbidity —26 NTU's, TDS - 124 ppm, TSS —37 ppm, TS - 148 ppm, SS-1.54%.
FOG with aeration: Turbidity - 268 NTU's, TDS - 288 ppm, TSS - 130 ppm, TS - 374 ppm, SS -0.56%.
Total solids of settleable matter in the FOG without aeration: 2.31%.
Total solids settleable matter in the FOG with aeration: 0.69%.
FOG without aeration: Oil and Grease (all polar - fatty acids/esters or fatty material from animal and vegetable sources) —**41 ppm.**
FOG with aeration: Oil and Grease (all polar - fatty acids/esters or fatty material from animal and vegetable sources) - **379 ppm.**
Foam: Oil and Grease (all polar - fatty acids/esters or fatty material from animal and vegetable sources) — 11.5%.
Foam: Detergents - 10 to 12 ppm (0.0012% as received).

The difference between the two samples is that the long-term suspension solids (relative description - 48 hours) are comparatively increased in the FOG sample with aeration. The turbidity increased by X 10, TDS by X 2.3, TSS by X 3.5, TS by X 2.5 and Oil & Grease by X 9.2. Settleable solids in the FOG with aeration comparatively decreased by X 2.75.
Neither sample had 100% solids Suspension based on the settleable solids. Less was found in the FOG with aeration (0.56%) as compared to without aeration (1.54%). The total solids of the settleable solids was also less in the aerated sample (0.69% of 0.56% versus 2.31% of 1.54% where 0.56 and 1.54 = 100%).

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The foam is an oil (11.5%) and water (87%) emulsified matrix. When dried down, the foam is approximately 90% animal or vegetable fatty matter. Additionally, the matrix of the foam and any oils, greases, fats or waxes in both samples is almost entirely polar in nature. The samples were solvent extracted to determine total hydrocarbons (polar and nonpolar) before eluting the nonpolar from the polar using hexane and silica gel. Little if any nonpolar materials were detected.

TSS / Method 2540D / Analyst - SLW / Date - 12512 / Time – 0830
TDS / Method 2540C / Analyst - SLW / Date - 12612 / Time - 0855
TS / Method 2540B / Analyst - SLW / Date - 12512 / Time - 1110
O&G / Method 1664A / Analyst - SLW / Date - 012512 / Time – 0910
SS / Method 2540F / Analyst - SLW / Date - 012412 / Time - 1040

QA/QC Procedures required by the Method(s) were followed unless otherwise noted. Performance and acceptance standards for required QAJQC procedures were achieved unless otherwise noted. No significant modifications have been made to the Method(s). 1 attest that, based upon my inquiry of those individuals immediately responsible for reviewing the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.