

**A FreshAWL® Solution for  
Open Water Oil Spill Cleanup**

**White Paper**

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**FreshAWL® FUEL-WASH™ OWOS  
A Solution for Open Water Oil Spill Cleanup**

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### Introduction

An **oil spill** is the release of petroleum into the environment and specifically in this discussion, marine oil spills, where oil is released into the ocean, coastal waters or freshwaters (<http://www.uppermichiganssource.com/news/content.aspx?id=124025>). Spills may take weeks, months or even years to clean up.

Chemicals, such as detergents and dispersants, break apart surface oil into smaller particles or droplets so that the oil is no longer in a layer on the water's surface.

### Problem Statement

Most dispersants themselves harm marine life and the dispersed oil can remain in the body of water where it is toxic to marine life while FreshAWL solutions are totally safe.

### Previous Options

- Corexit 9500, 9527, and 9580 have moderate = LC50 or EC50 – 1.6 to 100 ppm\*, while stated as having moderate toxicity, is toxic;
- A less toxic alternative is Dispersit but is still toxic at 7.9-8.2 ppm; and

- Best Option – FreshAWL® FUEL-WASH™: LC-50/96-rainbow trout **5,000 ppm** is the only truly non-toxic solution for safe and effective oil spill cleanup.

### FreshAWL Solution

FreshAWL FUEL-WASH™ Open Water Oil Spill (OWOS) blend, is an earth conscious (and cost effective) waste treatment solution for open water oil spills; prevents oil from clumping and/or clinging to marine life, equipment, shorelines and, will remove oil from the surface of the water and into the water column safely while aiding the oil digestion process.

#### Benefit 1

FUEL-WASH prevents oil molecules from sticking together and causes dispersion to happen.

#### Benefit 2

FUEL-WASH disperses hydrophobic molecules from the top and from the bottom of oil clumps, balls, and sheens.

#### Benefit 3

FUEL-WASH OWOS is biodegradable, non-toxic, and non-corrosive and GRAS Certified.

### Implementation

Delivered to oil spills using traditional applications via aircraft, watercraft and submersibles.

### Summary

There are a variety of dispersants available for use on OWOS. Among the many factors for considering which of these dispersants to use are Efficiency, Environmental Impact, Safety, Ease of Use, and of course, Cost Effectiveness.

FreshAWL FUEL-WASH combined with Z-FOG™ work together to make FUEL-WASH™ OWOS making it the best solution for treating any open water oil spill to eliminate the devastating effects.

## **Introduction**

An **oil spill** is the release of petroleum into the environment and specifically in this discussion, marine oil spills, where oil is released into the ocean or coastal waters due to equipment failure, human error or nature's course. The oil may be a variety of materials, including crude oil, refined petroleum products (such as gasoline or diesel fuel) or by-products, ships' bunkers, oily refuse or oil mixed in waste. Spills may take months or even years to clean up.

When oil leaks or spills into water it floats on the surface of both freshwater and saltwater. Oil floats because it is less dense than water. When these two liquids are mixed together, the denser seawater forms a layer underneath the less dense oil.

The oil penetrates up the structure of the plumage of sea birds, reducing its insulating ability, and so making the birds more vulnerable to temperature fluctuations and much less buoyant in the water. It also impairs birds' flight, abilities to forage, reproduce and escape from predators. Most birds affected by an oil spill die unless there is human intervention. Marine mammals exposed to oil spills are affected in similar ways as seabirds. Oil coats the fur of sea otters and seals, reducing its insulation abilities and leading to body temperature fluctuations and hypothermia. Ingestion of the oil causes dehydration and impaired digestions. Because oil floats on top of water, less sunlight penetrates into the water, limiting the photosynthesis of marine plants and phytoplankton. This, as well as decreasing the fauna populations, affects the food chain in the ecosystem.

Chemicals, such as detergents and dispersants, break apart floating oil into smaller particles or droplets so that the oil is no longer in a layer on the water's surface.

## **Problem Statement**

Most dispersants themselves harm marine life and the dispersed oil can remain in the body of water where it is toxic to marine life while FreshAWL solutions are biodegradable, non-toxic and totally safe.

Another problem of cleaning up an oil spill is that it often becomes more difficult the longer the oil is in the water. Over time, a number of things can happen to oil that has been spilled. The oil may evaporate, reach the shore and cover beaches, remain suspended in the water for long periods, or sink into ocean sediments and reefs.

## **Previous Options**

Laboratory experiments have shown that currently utilized dispersants increased toxic hydrocarbon levels in fish by a factor of up to 100 and may kill fish eggs. The disadvantages of currently available chemical dispersants are that they are toxic in certain ways. As an added precaution, chemical dispersants are not applied to shallow near-shore waters, mangrove areas, marshes, or waters over coral reefs and sea grass beds.

For instance, the currently utilized dispersant in the Gulf oil is widely known to be toxic. In a report written by Anita George-Ares and James R. Clark for Exxon Biomedical Sciences, Inc. entitled "Acute Aquatic Toxicity of Three

Corexit Products: An Overview” states that “Corexit 9500, Corexit 9527, and Corexit 9580 have moderate toxicity to early life stages of fish, crustaceans and mollusks (LC50 or EC50 – 1.6 to 100 ppm\*). It goes on to say that decreasing water temperatures in lab tests showed decreased toxicity, a lowered uptake of the dispersant. Unfortunately, we’re going to be seeing an increase in temperatures, not a decrease. Amongst the other caveats is that the study is species-specific, that other animals may be more severely affected, silver-sided fish amongst them.

The lesser of two evils seems to be a product called Dispersit, manufactured by Polychem, a division of U.S. Polychemical Corporation. In comparison, water-based Dispersit is toxic at 7.9-8.2 ppm; Dispersit holds about one third of the toxicity that Corexit 9500 presents. Dispersit is a much less harmful water-based product which is both EPA approved and on the U.S. Coast Guard’s NCP list.

In comparison, the Aquatic Toxicity for FreshAWL® FUEL-WASH™ OWOS: LC-50/96-rainbow trout **5,000 ppm** and is completely safe for plants, animals, and most importantly, humans. (Please refer to toxicity test in Appendix A)

Other dispersants are only effective at the start of the spill and for short time frames due to their susceptibility to evaporation and dehydration and solvent evaporation from an oil slick.

### **FreshAWL® Solution**

FUEL-WASH OWOS blend is an earth conscious (and cost effective) waste treatment solution for open water oil spills. This unique blend has been successfully developed to work as a dispersant to prevent oil from clumping and clinging to marine life, equipment, shorelines and, will remove the oil from the surface of the water and into the water column by enhancing the natural chemical and physical breakdown of oil.

Once in the water column, the dilution of oil is greatly facilitated and hence the toxicity level is reduced. Eventually, this dispersant and the resultant oil droplets become food sources for bacteria in the ocean. By removing the oil from the water surface, birds, marine mammals, turtles, and sensitive coasts are protected. It also prevents the oil from sinking where it remains in suspension within the water column.

The unique properties of FUEL-WASH OWOS allow it to manipulate mercaptans and breakdown oil in a way that does not harm good bacteria, plant and animal life; while actively seeking out and destroying harmful bacteria.

One of its components, FreshAWL Z-FOG™ referring to its ability to obtain **Z**ero **F**ats, **O**ils and **G**rease, will break down protein bonds, acting as an oil emulsifier and digester; rendering spilled oil non-adhesive. Tar balls and clumped oil are broken down to increasingly finer particles that are collected as liquid layers, or will be bio-organically degraded by enzymatic actions.

In addition to effectively and quickly breaking down oil, this is accomplished without harming the environment. Field and lab tests demonstrate that allowing this blend to stay with the oil, the oil molecules are destroyed with no negative impact on marine life.

### Benefit 1

Oil spill cleanup has always also depended on nature to degrade and break up the oil. FUEL-WASH OWOS prevents oil molecules from sticking together, eliminating sulfur bonds along with the hydrocarbon bonding, chemically splitting the oil fractions, while the Z-FOG component softens the viscous oil and allows dispersion to happen. This is a truly unique method of attacking a spill that can eliminate oil from water and surfaces.

### Benefit 2

FUEL-WASH OWOS floats on the top surface of the water, on the oil and grease layers, and on clumps. It is designed to break up hard water type adhesions between hydrophobic fatty acids and the organic layers.

Oceanic wave actions or rising and falling of water levels facilitates organic molecules affected by the FUEL-WASH OWOS chemistry to be partially emulsified, liquefied and dispersed. Tar balls and clumped oil breaks down to finer and finer particles that can be collected as liquid layers or bio-organically degraded by enzymatic actions. FUEL-WASH OWOS will assist in cleaning of soils, plants, animals and water systems, releasing oily and tar-like substances. FUEL-WASH OWOS disperses hydrophobic molecules from the top and from the bottom of oil clumps, balls, and sheens. FUEL-WASH OWOS will destroy oil and tarlike substances, eliminating the adhesive sticky oil properties and release it from surfaces to effectively mitigate oil spills and contaminations.

### Benefit 3

Additionally, FUEL-WASH OWOS is safe enough to effectively clean oil off of oil-soaked wildlife. The combined value of the FUEL-WASH OWOS application is that it is biodegradable, adheres to development standards of the EPA and DfE certification programs, is non-toxic or corrosive, works in fresh and salt water, removes oil from marine life, sea walls and rocks, is cost effective, and works amazingly fast.

FUEL-WASH OWOS is a GRAS (Generally Regarded as Safe) product made from food additives and non-toxic emulsification agents. It was designed for non-toxic, non-hazardous cleaning. Protein bonds and hard water adhesions are broken while the oil is emulsified and chemically digested, dispersed and rendered non-adhesive. It washes off, it frees any surfaces from contamination and it saves the environment from contamination, making containment or natural processes of degradation possible without damages.

## **Implementation**

Delivered to oil spills using traditional aircraft applications and underwater submersible vehicles.

FUEL-WASH OWOS has been shown as non-toxic to fish and harmless to humans, with little odor and very little negative response. Once introduced into the system FUEL-WASH exhibits these unique characteristics:

- FUEL-WASH OWOS behaves as a chemical digester in systems, cutting chemical bonds without being quickly consumed;
- FUEL-WASH OWOS cuts sulfur bonds and glue-like substances;
- FUEL-WASH OWOS digests oil, and acts to chemically degrade the oil into smaller molecules;
- FUEL-WASH OWOS has also been shown to increase the speed of digestion in composting;
- FUEL-WASH OWOS will chemically digest large sludge volumes that biological digestion is not able to achieve;
- FUEL-WASH OWOS turns sludgy liquids into clear solutions; and
- FUEL-WASH OWOS enhances good bacterial action on oil, aiding in quick digestion, and helping the system return to its natural state.

How does FUEL-WASH OWOS accomplish this?

Unique bonding sites and enzyme-like systems and unique chemistry and delivery systems allow the FUEL-WASH OWOS molecule to attack proteins, mercaptan-like sulfur bonds, and more importantly, oil to oil bonds at the oil–water interface.

The Z-FOG component complements the technology by softening the oil and decreasing the viscosity and pour point at the oil–water interface. Evaporation of solvents contained in the oil decreases its ability to be dispersed because of lipophilic adhesions and dehydration producing tar balls. Other dispersants are limited over time because of these phenomena and are not able to perform up to the standard of Z-FOG which is able to reduce the pour point of the oil keeping it liquefied and able to be dispersed.

FUEL-WASH OWOS can continue dispersing even old oil and tar substances for days or weeks, because it softens the oil, turns it from a peanut butter consistency to the consistency of cooking oil, and then breaks it up. Its oil soluble portions dissolve in the oil and begin decreasing the oils viscosity, and then goes on to break it up at the oil–water interface.

On shoreline applications, most dispersants are ineffective, because they must be scrubbed into the oil on hard surfaces such as rocks and sea walls before water can wash them away. FUEL-WASH OWOS promotes erosion by water to remove all adhesion in as short as two (2) hours without additional scrubbing.

How does FUEL-WASH OWOS make this possible?

Unique liquefying agents put the process in motion along with our proprietary chemistry developed from natural plant based extracts. Along with naturally occurring suspending agents and dispersants FUEL-WASH OWOS disassembles the oil molecules bonds from each other and apart from anything they were sticking to.

## **Solutions Application**

The application process for FreshAWL FUEL-WASH and Z-FOG is simple and impressive. These solutions should be dispersed using typical dispersing units such as t5hose mounted on watercraft and aircraft. The dilution rate is 1 part FreshAWL solution to 25 parts water. For OWOS applications, a blend of 10 gallons of solution with 250 gallons of water will cover one acre.

For small applications in water, wetlands, shorelines and similar areas, a one-gallon device such as a Hudson Sprayer will be effective by adding water to 6 ounces of solution and spray liberally. One gallon will cover 350-400 square feet.

For any application, immediate results occur when a contaminated area is first dispersed with FUEL-WASH and will be seen within 20-30 minutes for the Z-FOG application. That is all that is required, no additional booms, surface burns, skimming, vacuuming, or costly man-hours required for operation.

## **Summary**

There are a variety of dispersants available for cleaning open water oil spills. Among the many factors for considering which of these dispersants to use are Efficiency, Environmental Impact, Safety, Ease of Use and of course, Cost Effectiveness.

FreshAWL OWOS present a positive value impact for all of these considerations making it the best choice for oil cleaning after an open water oil spill and provide these great benefits:

- FUEL-WASH OWOS is biodegradable;
- The only residual by-products of FUEL-WASH OWOS are water, carbon dioxide and trace amounts of methane;
- FUEL-WASH OWOS adheres to development standards set forth in accordance with the guidelines of the EPA and the DfE certification programs;
- FUEL-WASH OWOS does not require special PPE, storage, agitators, mixers, or hoses;
- FUEL-WASH OWOS does not use bacteria, enzymes, or dangerous chemicals;
- FUEL-WASH OWOS is non-toxic and non-corrosive;
- FUEL-WASH OWOS works in both saltwater and freshwater;
- FUEL-WASH OWOS removes oil from hard surfaces like sea walls and rocks;
- FUEL-WASH OWOS is safe for plants and animals and works to safely and effectively remove oil from them. In fact setting up a boom area in the water containing FUEL-WASH OWOS will remove oil from birds and fish swimming through it;
- Aquatic Toxicity: LC-50/96-rainbow trout 5,000 ppm;
- FUEL-WASH OWOS is not regulated by OSHA or DOT; and
- FUEL-WASH OWOS typically provides positive results in less than one hour!

**Appendix A**

Toxicity Reports



## **Aquatic Toxicity Testing & Metals Analysis**

**Product ID: Z-FOG**

**Date of Report: August 6, 2010  
Total Number of Pages: 25**

Report Prepared For:  
FreshAWL, LLC  
1950 Olivera Rd., Suite D  
Concord, CA 94520  
888-400-3295

Report Prepared By:  
RespirTek, Inc.  
12450 Shortcut Rd.  
Bldg F  
Biloxi, MS 39532  
228-392-7977



**Project ID: FRE-2251**

**Sample ID: Z-FOG**

**Date of Sample Receipt: July 1, 2010**

**Date Final Report Issued: August 6, 2010**

## **Project Summary**

The Z-FOG sample was received at RespirTek, Inc. on July 1, 2010. Two bottles of the sample were received in good condition. One bottle of sample was sent to AquaTOX Research, Inc. (AquaTOX) located in Syracuse, NY for acute aquatic toxicity testing on July 6, 2010. The product generated a 96-hr LC<sub>50</sub> value of 102 mg/L using fathead minnow species (*Pimephales promelas*).

The second bottle of sample was delivered to Micro-Methods Laboratory located in Ocean Springs, MS for metals analysis on July 6, 2010. The results are as follows:

Arsenic	ND
Cadmium	ND
Copper	ND
Lead	0.295 mg/kg
Nickel	ND
Selenium	ND
Zinc	1.20 mg/kg
Mercury	ND

*ND: non-detect*

The Z-FOG sample is hereafter referred to as FRE-2251. The complete data reports as generated by RespirTek's aforementioned affiliates are enclosed.

**ACUTE CHEMICAL TOXICITY TEST REPORT FORM - FRE2251  
(FATHEAD MINNOW, PIMEPHALES PROMELAS)**

Facility: Respiritek, Inc. Laboratory  
12450 Shortcut Rd Bldg F  
Biloxi, MS 39532

Facility Contact: Jude Martin

Test Laboratory: AquaTox Research, Inc.  
1201 East Fayette Street  
Syracuse, NY 13210

Investigator(s): L. Tatum

Approved By: \_\_\_\_\_ July 27, 2010  
Francis G. Doherty, Ph.D. Date  
Aquatic Toxicologist

Chemical Toxicity Test Summary:

Test Organism: Pimephales promelas  
Test Starting Date: 7/19/10 Completion Date: 7/23/10  
ARI Test ID No. 07-19-10-01 ARI Notebook No. File  
Test Result: 96-hr LC<sub>50</sub> = 102 mg/L (89.6-115)

AquaTox Research, Inc., adheres to the current industry standards in the performance of its work as set out in published guidelines. If we err, omit, or otherwise do not perform in accordance with the terms of the original proposal, we will gladly re-do the work at no additional cost, or will, at the client's option, refund fees charged for the work. The client agrees that AquaTox Research shall not be liable for damages to anyone arising in contract or tort actions; nor for any civil penalties arising under state or federal regulation; nor any other liability of whatever kind or nature, except for the repeat of work performed or refund of fees charged. In no event shall AquaTox Research be liable for any incidental or consequential damages. The client hereby waives the WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.



Leaders in Life Science and Technology

**TOXIKON FINAL GLP REPORT: 09-3274-G1**

**AGAR DIFFUSION TEST – ISO**

Test Article

Author

Franck Grall, Pharm.D., Ph.D.

Final Report Date

August 14, 2009

COMPLIANCE

21 CFR, Part 58

Good Laboratory Practice for Non-Clinical Laboratory Studies

MANAGEMENT OF THE STUDY

Performing Laboratory

Toxikon Corporation  
15 Wiggins Avenue  
Bedford, MA 01730

Sponsor

FreshAWL, LLC  
506 Silver Drive  
Vacaville, CA. 95687

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Appendix I: Software Systems

## STUDY SUMMARY

Mild biological reactivity (Grade 2) was observed in the L929 mammalian cells at 48 hours post exposure to the test article. The observed cellular response obtained from the positive control article (Grade 3) and negative control article (Grade 0) confirmed the suitability of the test system. Based on the criteria of the protocol, the test article, FUEL-WASH™ is considered non-cytotoxic and meets the requirements of the Agar Diffusion Test defined in ISO 10993-5 guidelines.

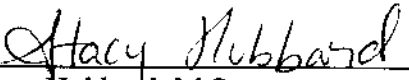
**QUALITY ASSURANCE STATEMENT**

This study was conducted in compliance with U.S. Food and Drug Administration regulations set forth in 21 CFR, Part 58.

The sections of the regulations not performed by or under the direction of Toxikon Corporation, exempt from this Good Laboratory Practice Statement, included characterization and stability of the test article and its mixture with carriers, 21 CFR, Parts 58.105 and 58.113.

The Quality Assurance Unit conducted inspections on the following dates. The findings were reported to the Study Director and to Toxikon's Management.

INSPECTIONS	DATE OF INSPECTION	DATE REPORTED STUDY DIRECTOR	DATE REPORTED MANAGEMENT
SCORING	08/06/09	08/06/09	08/06/09
RAW DATA	08/14/09	08/14/09	08/14/09
FINAL REPORT	08/14/09	08/14/09	08/14/09

  
\_\_\_\_\_  
Stacy Hubbard, M.S.  
Quality Assurance

08/14/09  
Date