ADDENDUM TO
SOIL REMEDIAL ACTION PLAN
DEFENSE FUEL SUPPORT POINT NORWALK
15306 Norwalk Boulevard
Norwalk, California

(F4 BIOREMEDIATION TECHNICAL DESCRIPTION)

04-NDLA-007

Prepared For:

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For Submittal To:

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Prepared By:

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December 10, 2014

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Technical Description
F4 Remediation - Bioreclaim™
Prepared December 5, 2014

Introduction

F4 Remediation's ex-situ bioremediation technology combines a proprietary blend of non-pathogenic microbes and a safe surfactant to degrade petroleum hydrocarbons and other organic compounds into carbon dioxide and water. The microbe and surfactant liquid solution, or "Bioreclaim™", is applied to contaminated soil as the soil is processed through F4 Remediation's custom-designed Earth Cleaning Machine (ECM). The ECM can process approximately 2,500 tons of soil per day (volume can vary depending on soil and site conditions). The ECM soil processing and Bioreclaim™ application mechanics are engineered so that a one-time application permanently treats the soil to established cleanup requirements.

F4 Remediation's Bioreclaim™ solution contains a proprietary mixture of microbes and surfactant. The microbes consist of the naturally occurring *Pseudomonas* bacteria. The particular strain of *Pseudomonas* has been selected for their affinity to utilize petroleum hydrocarbons as a carbon (food) source. The surfactant "Bio-Surf" consists of a non-ionic alcohol ethoxelate surfactant solution (note that "Bio-Surf" is a rebranded product sold originally under the trade name "QX-9", manufactured by Win Manuco Ltd of Ontario, Canada; see attached MSDS for QX-9). As described in more detail below, alcohol ethoxelates have been determined by the US EPA to be a safe and preferable surfactant to be used in numerous applications.

When combined, the liquid mixture of the *Pseudomonas* bacteria and diluted Bio-Surf solution is referred to as Bioreclaim™. Bioreclaim™ has been approved for use by the United States Environmental Protection Agency (see attached US EPA Technical Product Bulletin B-69 for Bioreclaim™ Sump Safe: Bioreclaim™ Sump Safe contains the same bacteria and surfactant as the Bioreclaim™, but is marketed for use a green alternative to traditional parts cleaners).

Microbiology of *Pseudomonas putida*

The F4 technology was developed to employ the ability of *Pseudomonas putida to* degrade hydrocarbons through oxidative reactions. *Pseudomonas putida* is a rod-shaped, flagellated, gram-negative bacterium that is found in most soil and water habitats where there is oxygen. It grows optimally at 25-30 C and can be easily isolated. *Pseudomonas putida* has several strains including the KT2440, a strain that colonizes the plant roots in which there is a mutual relationship between the plant and bacteria. The surface of the root, rhizosphere, allows the bacteria to thrive from the root nutrients. In turn, the *Pseudomonas putida* induces plant growth and protects the plants from pathogens. Because *Pseudomonas putida* assist in promoting plant development, researchers use it in bioengineering research to develop biopesticides and to the improve plant health. [1]

Pseudomonas putida has a very diverse aerobic metabolism that is able to degrade organic solvents such as toluene and also to convert styrene oil to biodegradable plastic Polyhydroxyalkanoates (PHA). This helps degrade the polystyrene foam which was thought to be non-biodegradable. Due to the bacteria's strong appetite for organic pollutants, researchers are attracted to using *Pseudomonas putida* as the "laboratory 'workhorse' for research on bacteria-remediated soil processes". [2] This bacteria is unique because it has the most genes involved in breaking down aromatic or aliphatic hydrocarbons which are hazardous chemicals caused by burning fuel, coal, tobacco, and other organic matter. There is great interest in sequencing the genome of *Pseudomonas putida* due to its strong effect in bioremediation. [3]

Cell structure and metabolism

Pseudomonas putida is a rod-shaped, non-spore-forming, gram-negative bacteria that utilizes aerobic metabolism. This bacterium also has multiple polar flagella for motility. The flagella have a waveform that is usually 2 to 3 wavelengths long. *Pseudomonas putida* is sensitive to the environment and suppresses the changes in the direction of flagella rotation upon sensing chemo-attractants. This

is very helpful in guiding the *Pseudomonas putida* to propel towards the seeds of the plants which provides nutrients to the bacterial cells. [4]

Pseudomonas putida is able to tolerate environmental stresses due to its diverse control of proteins including protein and peptide secretion and trafficking, protein modification and repair, protein folding and stabilization, and degradation of proteins, peptides, and glycopeptides. Some important proteins include the global regulatory proteins which link the pathway genes to the cell status. *Pseudomonas putida* exercises a very complex metabolism, the proteins control a particular pathway that not only depends on the signal received, but also the specific promoters and regulators in the pathway. And in turn, once the signals are received, it informs the cell of the oxygen and nutrient availability. Another important protein is the Crc protein which is part of the signal transduction pathway moderating the carbon metabolism. It also functions in biofilm production. [6]

In addition, *Pseudomonas putida* has important lipids that are developed as an adaptation mechanism to respond to physical and chemical stresses. The bacteria is able to change its degree of fatty acid saturation, the cyclopropane fatty acids formation, and the cis-trans isomerization. In different phases, the cell changes its characteristics to better respond to the environment. During the transition from growth to stationary phase, there is a higher degree of saturation of fatty acid and a higher membrane fluidity which improves substrate uptake, thus regulating the cell. [7] All these characteristics allow *Pseudomonas putida* to survive deadly toxins in the soil and allow it to thrive in contaminated areas. Its metabolism allows these bacteria to convert harmful organic solvents to nontoxic composites which are so essential to bioremediation.

Ecology

Pseudomonas putida are significant to the environment due to its complex metabolism and ability to control pollution. There is a high versatility of bacterial communities towards contaminations which is further increased by certain catabolic sequences on the TOL plasmids in the cell. [7] Even the plasmids are important in sensing the environmental stress. Some of the environmental stresses are caused by benzene, xylene, and toluene, the main components of gasoline and are major sources of water contamination. *Pseudomonas putida* can degrade the hydrocarbons of these organic solvents through oxidative reactions therefore placing *Pseudomonas putida* as one of the most important microbes in bioremediation.

Pathology

In 1982, the US National Institutes of Health designated Pseudomonas putida a safety strain which meant it could be used to clone genes from other soil-inhabiting bacteria.[8] Certain strains of *Pseudomonas putida* are not pathogenic due to lack of certain genes including those for enzymes that digest cell membranes and walls of humans and plants. *Pseudomonas putida* is saprophytic and deemed a safe bacteria.

Chemistry of the Surfactant

Surfactants, a functional class of chemicals that provide increased surface activity and reduce the surface tension of water, allowing easier spreading, wetting, and better mixing of liquids. The F4 Remediation Bioreclaim™ solution uses an alchohol-based class of surfactants broadly known as ethoxylates. Alcohol ethoxylates (AEs) are part of the alcohol alkoxylates class that also includes alcohol propoxylates and butoxylates. Alcohol ethoxylates are a class of nonionic surfactants that contain a hydrophobic alkyl chain attached via an ether linkage to a hydrophilic ethylene oxide (EO) chain and have the general structure $R(OCH_2CH_2)nOH$.

The hundreds of different possible AEs each have slightly different chemical and physical properties, however, the presence of a strong hydrophilic (ethoxylate chain) and strong hydrophobic (alkyl chain) moiety linked together gives them their characteristic surfactant properties. AEs concentrate at

surfaces and interfaces in aqueous solutions and create a surface film that reduces the surface tension of water and alters the wetting properties between water and solids. The solubility of AEs in water results from the presence of the hydrophilic group.

As part of its efforts to enhance public understanding and the safety of chemicals in commerce, the USEPA has taken steps to identify chemicals that may pose human and environmental health concerns and, in response, develop plans that consider potential regulatory and voluntary risk management actions. In August 2010, EPA released the Nonylphenol (NP) and Nonylphenol Ethoxylates (NPE) Action Plan to address concerns over potential ecological and other effects from the manufacturing, processing, distribution in commerce, and uses of NP and NPEs. [9] To implement part of the NP/NPE Action Plan, EPA's Design for the Environment (DfE) Program has prepared this Alternatives Assessment: Alternatives for Nonylphenol Ethoxylates. The report includes criteria that define safer NPE - alternative surfactants and lists a sampling of surfactants that meet the criteria. As a result of that study, the EPA found that alcohol ethoxylates are a safe alternative to NPEs. The results of the EPA's analysis found that alcohol ethoxylates meet their safe use criteria as summarized here:

C_{9-11} Alcohols, ethoxylated (6EO) 68439-46-3	
Persistence	VERY LOW: Based on experimental data indicating that this compound passes standard ready biodegradation tests. C_{9-11}EO8 consumed 80% ThOD in 28 days in a closed bottle test, and C_{10-12} EO6 released 83% $ThCO_2$ in the OECD 301B assay. Persistent biodegradation products are not formed. C_{9-11}EO6 is also reported to pass several OECD 301-series tests, consistently meeting the 10-day window criterion. (HERA, 2009, pp. 28; Talmage, 1994, pp. 47-50, CleanGredients, 2011).
Acute Toxicity	HIGH: Based on experimental LC_{50} values ranging from 1.6-2 mg/L for C_{11}EO5 to 8-9 mg/L for C_{9-11}EO5 in fish; 5.4-14 mg/L for C_{9-11}EO6 in invertebrates; and 2.9-3.5 mg/L for C_{11}EO5 in algae (HERA, 2009, pp. 70, 76, 84, 86; Talmage, 1994, pp. 66, 71, 77).
Chronic Toxicity	HIGH: Based on an measured NOECs in juvenile fish of 1.0-4.4 mg/L (survival), 0.73 mg/L (reproduction) and 1.0 mg/L (growth) for C_{9-11} EO6; and a LOEC of > 2.0 mg/L in algae, measured in a 7-day reproduction study with C_{9-11}EO6 (Talmage, 1994, pp. 80, 95).
Degradate Toxicity	NOT EVALUATED: No persistent degradates are formed.
DfE Criteria for Surfactants	**PASS:** Based on a classification of "High" for acute toxicity and "Low" for persistence, with no formation of biodegradation products of concern.

The surfactant "Bio-Surf" used in the F4 process has the following positive features:

- All components are readily biodegradable per Organization for Economic Co-operation and Development (OECD) methods.
- The product is nonionic in character and is compatible with anionic, cationic, nonionic and amphoteric surfactants.
- The aquatic toxicity profile is excellent with LC50 values of 39.8 and 37.9 mg/L respectively for rainbow trout and daphnia magna, and
- The vapor pressure of the product as supplied is less than 0.1 mm Hg at 25C.

Furthermore, Bio-Surf contains no salts, nitrogen compounds, sulfates, and thus will not affect soil chemistry or add to soil loading of these compounds.

F4 Remediation Bioreclaim™ Preparation and Application

The bacteria are produced in an off-site laboratory and then freeze dried to place the bacteria into an inactive, yet vital state. By freeze drying the bacteria, they can be preserved until needed. The bacteria are shipped to the project site in a solid powdered state, within a vacuum sealed container, and kept frozen.

The preparation and of the F4 Remediation Bioreclaim™ is completed via a process mobile trailer and the ECM. Prior to treating soil, F4 Remediation will mobilize a mixing trailer to the site. The mixing trailer has been designed and is configured for the storage, mixing, and supply of the BioReclaim™ solution. On the upper half of the trailer are four 275-gallon storage totes constructed of high-density polyethylene (HDPE). On the lower half of the trailer are two 1,250-gallon HDPE tanks.

In the top storage totes 8 kilograms of the freeze-dried, powdered bacteria will be constituted with 250 gallons of potable water. In the bottom tanks, 7 gallons of Bio-Surf surfactant are combined with 1,000 gallons of potable water resulting in a 0.7% solution..

Within 24 to 48 hours, the 250 gallons inoculated bacteria will be combined with the 0.7% surfactant solution. The combined "BioReclaim™" surfactant and bacteria solution will be conveyed via flexible hoses to spray nozzles within the Earth Cleaning Machine (ECM) and applied to the soil at the approximate rate of 4 gallons per ton of soil (resulting in a modest, approximate 5% increase in the moisture content of a sandy loam soil containing 25% of the field capacity of water).

Quality Assurance and Quality Control

F4 Remediation will be responsible for internal QA/QC of the production of both the powdered bacteria and the Bio-Surf surfactant. The configuration of the mixing trailer will facilitate quality control of the mixing process. The following describes the additional QA/QC to be done on site for mixing and application of solution as well as progress performance of the amended soil.

The bacterial component once received may be stored in refrigerated storage for up to two weeks. For Quality Control, bacterial component "lots" received will be logged with date and time and placed in refrigeration. When a lot is retrieved for use, it will be logged out and the time retained in storage will be verified to ensure that the two-week period has not been exceeded. For Quality Assurance the project manager or delegated staff will inspect storage of lots on a weekly basis to ensure storage times are not being exceeded.

The date and time the bacteria/water mixture is created will be maintained on a log sheet. The date and time a given lot of the inoculated bacterial mixture has been exhausted will also be logged. The objective is to ensure all lots are consumed within 48 hours of initial constitution. Teams of two people will conduct measurement and mixing. A technician will measure the constituent to be mixed (powdered bacteria and surfactant) and for Quality Assurance a second technician will verify quantities measured.

As previously indicated, the bacteria/surfactant solution will be applied at a rate of approximately 4 gallons per ton. ***In terms of surfactant loading, this equates to approximately 3.5 ounces per ton of soil treated.*** This is F4 Remediation's recommended average application rate and is not an absolute requirement. However for consistency of treatment time once soil has been placed in treatment pile it is important to maintain reasonable consistent control of solution application. Contaminated soil in queue for treatment will be weighed. It is initially assumed that soil amendment with solution will be on the order of 1,000 tons per day and in turn will consume 4,000 gallons of the Bioreclaim™ solution. The Bioreclaim™ application rates will be field adjusted to ensure application is occurring at the recommend rate of 4-gallons per ton of soil.

Ultimately, Quality Assurance will be accomplished by means of performance measurement of decreasing contamination concentration over time. Upon review of the data field determinations will

be made as to whether soil treatment is proceeding adequately. Successful confirmation sampling, as also specified in the SMP, is required prior to reuse of soil. Depending performance monitoring results, it will be determined if soil requires additional time to remain in a treatment pile, requires reprocessing or if necessary requires off-site disposal.

Pre-Treatment Sampling

To assess initial contaminant concentrations prior to initiation of the treatment, soil samples should be collected from soil treatment stockpile to serve as a baseline of soil conditions. A minimum of one sample every 500 CY of treated soil is recommended. Where petroleum hydrocarbons are the principal chemical of concern, soil samples should be analyzed for TPH (C6-C44 hydrocarbon range) using EPA Method 8015 and for VOCs, including fuel oxygenates, using EPA Method 8260B.

Post Treatment Progress and Confirmation Sampling

Progress samples should be collected at approximately 3-4 week intervals following initiation of treatment to evaluate the effectiveness and progress of the biotreatment process. Soil samples should be collected at randomly selected locations at a rate of one sample for every 250 CY of soil from within the soil stockpile during each sampling event. Sampling should be accomplished by retrieving samples from depths ranging from several inches to several feet in treated soil pile and collecting an undisturbed sample using a brass sampling ring, or transfer into a laboratory-supplied glass sampling jar. Progress samples should be analyzed for TPH (C6-C44 hydrocarbon range) using EPA Method 8015 and VOCs, including fuel oxygenates, using EPA Method 8260B.

A minimum of three sets of progress samples will be collected analyzed every three to four weeks to provide a defensible record that the soil has been effectively treated. The results of the progress samples, and the last set of samples, which will be considered the confirmation data set, should be retained and submitted to the regulatory oversight agency to document the effects of the treatment process, if required.

Use of the Technology in Non-Attainment Air Districts

The use of Bioreclaim™ technology in itself is an excellent vapor suppressant. However, in non-attainment air districts additional engineering control measures may be required to meet requirements for the storage of VOC-containing soil. Although not needed for Bioreclaim™ technology to be effective, these measures may be required by the local air board to control the release of volatile organic vapors from the hydrocarbon-containing soils. These control measures may entail simply covering the treated soil piles with secured plastic sheeting. As added benefit, the plastic sheeting will minimize the dispersal of dust from the soil treatment piles and will serve to minimize the evaporative loss of moisture (or the addition of excess moisture in rainy climates). Further enhancements may be dictated by the local air district, and may include the application of a negative atmosphere within the treatment pile through the use of vapor extraction piping. The vapor extraction piping can be connected to a vapor extraction blower with the extracted vapors treated via carbon or another suitability technology prior to release to the atmosphere.

Attachments:

QX-9 (Bio-Surf) Material Safety Data Sheet

Sump Safe Bio-Reclaim – U.S.EPA Technical Product Bulletin B-69

References

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2. Kowalski, H. "U.S. – German Research Consortium Sequences Genome of Versatile Soil Microbe". J.Craig Venter Archive. December 2002.

3. Marcus, A. "Versatile soil-dwelling microbe is mapped". Genome News Network. January 2003.

4. Harwood, C.S., Fosnaugh K., Dispensa M. "Flagellation of Pseudomonas putida and analysis of its motile behavior". Journal of Bacteriology. July 1989. Volume 171. p. 4063-4066.

5. Ballerstedt, H., et al. "Genomotyping of Pseudomonas putida strains using P. putida KT2440-based high-density DNA microarrays: implications for transcriptomics studies". Applied Microbiology and Biotechnology. July 2007. Volume 75. p,1133-1142

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7. Härtig, C., Loffhagen, N., Harms, H. "Formation of trans Fatty Acids Is Not Involved in Growth-Linked Membrane Adaptation of Pseudomonas putida". Applied and Enbironmental Microbiology. April 2005. Volume 71. p.1915-1922.

8. Federal Register, Appendix E, Certified host-vector systems. 47, 17197, 2008.

9. U.S. EPA, DfE Alternatives Assessment for Nonylphenol ethoxylates, May 2012

BIO-SURF (QX-9) SURFACTANT

MATERIAL SAFETY DATA SHEET

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SECTION 1 – CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

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Product Name: **QX-9**

Chemical Family: Surfactant

Product Use: Multi-Purpose

Supplier: **WIN MANUCO LTD**
Address: 3465 Mainway
Unit # 1
Burlington, ON
L7M 1A9
Telephone: 888-203-6333
Emergency: IN CANADA: **CANUTEC: 613-996-6666**
IN U.S.A.: **CHEMTREC: 800-424-9300**

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SECTION 2 – COMPOSITION, INFORMATION ON INGREDIENTS

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Ingredients	CAS #	Percent	ACGIH-TLV	Ld_{50}-LC_{50}
Alcohol ethoxylate	68991-48-0	30-60	Not applicable	>2000 mg/KG (oral, rat)
Alcohol ethoxylate	68438-46-3	5-15	Not applicable	

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SECTION 3 – HAZARDS IDENTIFICATION

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Emergency Overview: This product is an amber liquid. It may cause irritation to the eyes and skin. If ingested, it may cause vomiting, headache, and medical problems.

Potential Health Effects:
Eye: Contact with liquid may cause severe irritation.
Skin: Prolonged or repeated contact can cause irritation.
Ingestion: Causes diarrhea, nausea, vomiting, cramps, and gastrointestinal irritation.

Chronic Effects:
Skin: Prolonged or repeated exposure can cause drying, defatting, and dermatitis.

Carcinogenicity: Non-hazardous by WHMIS/OSHA criteria. Not listed by IARC, NTP, or ACGIH.

Teratogenicity, Mutagenicity, Reproductive Effects: No data available

Synergistic Materials: Not available

Potential Environmental Effects: No data available

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SECTION 4 - FIRST AID MEASURES

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Eye: Immediately flush with warm running water for at least 15 minutes, holding eyelids open during flushing. If irritation persists, repeat flushing and obtain medical attention immediately.
Skin: Immediately flush exposed area with soap and water for at least 10 minutes. If irritation persists, or if contact has been prolonged, obtain medical attention. Remove contaminated clothing and launder before reuse.
Inhalation: Immediately remove the affected victim to fresh air. If symptoms persist, obtain medical attention.
Ingestion: Do Not Induce Vomiting. If patient is fully conscious, rinse mouth with water and drink 1 glass of water. Obtain medical attention immediately. Never give anything by mouth if victim is unconscious, is rapidly losing consciousness, or is convulsing.

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SECTION 5 - FIRE FIGHTING MEASURES

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Flammability: Not Flammable
Flash Point (°F, °C, PMCC): > 200, > 93.3
Autoignition Temperature (°F, °C): Not available
Flame Propagation or Burning Rate of Solid Materials: Not applicable
Sensitivity to Static Discharge: Not sensitive
Sensitivity to Mechanical Impact: Not sensitive
Extinguishing Media: Water fog, alcohol foam, and dry chemical.
Special Fire Fighting Procedures: Directing a solid stream of water into a hot burning liquid can cause frothing and spread the fire. Use self-contained breathing apparatus and body-covering protective clothing.
Unusual Fire and Explosion Hazards:
Hazardous Decomposition Products: Oxides of carbon, oxides of nitrogen, hydrogen chloride, and methyl chloride.

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SECTION 6 – ACCIDENTAL RELEASE MEASURES

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Leak and Spill Procedure: Evacuate area. Ventilate area. Collect for disposal. Clean up remaining materials from spill with suitable absorbent. For large spills provide diking or other appropriate containment to keep material from spreading. If diked material can be pumped, store recovered material in compatible drums for recovery or disposal. Clean area as appropriate since some material, even in small quantities, may present a slip hazard. Final cleaning may require steam, solvents, or detergents. Observe all personal protection equipment recommendations.

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SECTION 7 – HANDLING AND STORAGE

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Storage Requirements: Keep Out Of Reach Of Children. Store in a cool, dry place away from incompatible materials..

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SECTION 8 – EXPOSURE CONTROLS, PERSONAL PROTECTION

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Engineering Controls: General ventilation usually adequate.
Respiratory protection: Not normally required if good ventilation is maintained.
Eye protection: use chemical safety glasses or full face shield.
Skin protection: use impervious (rubber, nitrile) gloves.
Other protective clothing or equipment: Eye Bath, Safety Shower, Full Protective Clothing.
Work Hygienic Practices: The usual precaution for the handling of chemicals must be observed.

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SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

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Appearance: Amber liquid
Specific Gravity @ 20 °C: 0.99 +/- 0.02 (8.2 lbs/gallon)
Vapor Pressure: < 0.1 mm Hg @ 20°C
Physical State: Liquid
Evaporation Rate: N/A
Cloud Point (1% distilled water): 78°C - 86°C
Surface Tension (0.1% static)**:** 26.7 dynes/cm

Freezing/Melting Point: N/A
% Volatile (Wt %): N/A
Solubility In Water: Soluble
pH (as is): 6.0 – 9.0
Vapor Density: N/A
Pour Point: < -7.0°C
Activity, %: 88.0 – 92.0

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SECTION 10 – STABILITY AND REACTIVITY

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Stability: Stable
Incompatible Materials: Strong oxidizing agents
Hazardous Decomposition Products: Oxides of carbon, hydrogen chloride, oxides of nitrogen, methyl chloride when heated.
Reactivity, and Under What Conditions: Not available.

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SECTION 11 - TOXICOLOGICAL INFORMATION

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There is no test data on this product. Based on the information on the ingredients (see section 2) this product may cause irritation to the eyes and skin upon contact.

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SECTION 12 – ECOLOGICAL INFORMATION

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Ecotoxicity: There is no test data on this product
Environmental Fate: There is no test data on this product

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SECTION 13 – DISPOSAL CONSIDERATIONS

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Review federal, provincial or state and local government requirements prior to disposal.

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SECTION 14 - TRANSPORT INFORMATION

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U.S. Department of Transportation: Not Regulated
Canadian T.D.G.: Not Regulated
Water Transportation (IMO): Not Regulated
Air Transportation (IATA): Not Regulated

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SECTION 15 - REGULATORY INFORMATION

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Occupational Health & Safety Regulations:

WHMIS Classification: Class D - Division 2B
OSHA & WHMIS: MSDS prepared pursuant to the Hazard Communication Standard (CFR29 1910.1200) and Canadian WHMIS regulations (Controlled Products Regulations under the Hazardous Products Act).

Environmental Regulatory Lists:
SARA: Section 313 (Toxic Chemical Release Reporting) 40 CFR 372 – None of the ingredients are listed.
Toxic Substances Control Act (TSCA): All the ingredients are listed on the Chemical Substance Inventory
Canadian Domestic Substance List (DSL): All ingredients are listed.

INTERNATIONAL INVENTORY LISTINGS:
Components in this product are listed on the:

- U.S. TSCA Inventory
- Canadian Domestic Substances List (DSL)
- European EINECS Listing
- Australian AICS
- Korea – Existing Chemical Substances Directory
- Japan – Handbook of Existing and New Chemical Substances
- China – National Environmental Protection Directory

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SECTION 16 - OTHER INFORMATION

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WIN MANUCO LTD **Telephone:** 888-203-6333 **Date: December 19, 2011**
Previous Revision: March 30, 2009

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"The technical source for innovative solutions"

U.S. EPA – TECHNICAL PRODUCT BULLETION – B-69

SUMP SAFE- BIO-RECLAIM

Menu

SUMP SAFE BIO-RECLAIM

TECHNICAL PRODUCT BULLETIN: B-69
USEPA, OIL PROGRAM CENTER
LISTING DATE: OCTOBER 13, 2011
"SUMP SAFE BIO-RECLAIM"
EPA HAS NOT RECEIVED UPDATED CONTACT INFORMATION FOR THIS PRODUCT: 10/01/12

I. NAME, BRAND, OR TRADEMARK

SUMP SAFE BIO-RECLAIM
Type of Product: Bioremediation Agent (Biological Additive/Microbiological Culture)

II. NAME, ADDRESS, AND TELEPHONE NUMBER OF MANUFACTURER/CONTACT

Teamwork Distributing
P.O. BOX 2506
Stony Plain, Alberta
T7Z 1X1
Phone: (780) 968-5367 (Plant)
Mobile: (780) 238-2741
Fax: (780) 958-9070
E-mail: marlin@xplornet.com
E-mail: marlin@teamwrk.ca
(Mr. Marlin Rudolph)

III. NAME, ADDRESS, AND TELEPHONE NUMBER OF PRIMARY DISTRIBUTORS

PNE Corporation
55 International Way
Longview, WA 98632
Phone: (360) 423-2245
Fax: (360) 423-2272
E-mail: garyh@pnecorp.com
Website: www.pnecorp.com
(Mr. Gary Healea)

IV. SPECIAL HANDLING AND WORKER PRECAUTIONS FOR STORAGE AND FIELD APPLICATION

1. Flammability: Non-flammable (DOT: Non-hazardous)
2. Ventilation: No special requirements
3. Skin and eye contact; protective clothing; treatment in case of contact: No special equipment or clothing required, however goggles are recommended. If eye or skin irritation occurs, flush with plenty of fresh water.
4.a. Maximum storage temperature: 110°F maximum, must be used within 24 hours from constitution
4.b. Minimum storage temperature: 45°F
4.c. Optimum storage temperature range: 60°F to 90°F
4.d. Temperatures of phase separation and chemical changes: Stable

V. SHELF LIFE

The material must be used within 24-48 hours of constitution of the powdered bacteria portion in water. The dry material must be kept at -20°C and is stable for two years at this temperature. Once sent to the field, the material may be stored on ice for up to two weeks prior to constitution.

VI. RECOMMENDED APPLICATION PROCEDURE

1. Application Method: Product may be applied by the usual methods. For smaller spills a drum pump with sprayer may be used, mixing with fresh water typically. The concentrate is used at 25:1 dilution rate with water and is typically applied at a rate of 6 gallons per cubic meter of soil. It is important that the soil be broken up into small clumps (rototilling is acceptable) to ensure effective application. The soil is left and biodegradation is expected to complete in approximately 12 weeks. Analysis using approved sampling procedures is performed to confirm biodegradation.

For larger volume projects, any auger based soil homogenizer is employed to break up large clumps of soil, which are dug out from the contaminated area using a standard hoe. The broken up soil is taken up a conveyor and has the diluted concentrate (25:1) at a rate of 6 gallons per cubic meter of soil. Piles up to 20 feet high may be formed. The soil is left and biodegradation is expected to be complete in approximately 12-18 weeks. Analysis using approved sampling procedures is performed to confirm biodegradation. Proper safety rules must be employed to ensure that any holes dug out are not accessible to employees or unauthorized personnel.

For oil spills on open water, it is recommended that a 25:1 dilution of the product be applied via spraying. In this way, the bacteria can contact the floating oil and immediately begin to form a bio-film. The spray would also be applied on any soil contaminated on banks, etc. It is important to ensure complete coverage of the water/oily surface and soil during spray application. Degradation will be visible visually and can be confirmed by Fats, Oil and Grease (FOG) analysis.

For smaller, contained volumes of oily water (typically emulsified, white water), it is recommended that sufficient concentrate be added to the contaminated water such that it results in a 2.5% concentration of the concentrate in the contaminated water. Preferably, aeration can be performed, using even a small, fish tank aeration unit. Visual evidence of biodegradation should be apparent within one week or less and can be confirmed by FOG analysis.

2. Concentration/Application Rate: The concentrate is used at 25:1 dilution rate with water and is typically applied at a rate of 6 gallons per cubic meter of soil.

3. Conditions for Use: The product can be used in fresh or salt water and may be applied at temperatures between 40°F and 120°F. However, the product is most effective when applied at water temperatures between 70°F-90°F. Further, the product is effective on fresh spills or aged hydrocarbons. Note for preparation of the product to be applied while in the field: all components listed in the product are packaged as a complete unit and are applied as such. The microbial portion of the product is supplied in bags which are either drum (55 gallon) or pail (5 gallon) sizes. Fresh water, if available, is added to fill the bag (bags are placed in pails or open headed drums) to 55 gallon of 5 gallons respectively. Depending upon which of these are being constituted with water, a high-density polyethylene (HDPE) bottle with the appropriate quantity of surfactant is added into the container (bottles are labeled Bio-Reclaim Surfactant – Drum Size (or Pail Size)). In the same way, HDPE containers with appropriate amounts of sodium nitrite are added and are labeled Bio-Reclaim Salt – Drum Size (or Pail Size)).

VII. TOXICITY AND EFFECTIVENESS

a. Effectiveness:
Bioremediation Agent Effectiveness Test (40 CFR 300.900), Federal Register September 15, 1994:

Summary Data Table:

DAYS	PRODUCT 3 REPS/PROD	TOTAL MEAN ALKANES (ppm)	RED% 28 DAYS	TOTAL MEAN AROMATICS (ppm)	RED% 28 DAYS
	CONTROL	40,770	0	5,229	0
0	NUTRIENT	41,329	0	5,326	0
	PRODUCT	40,609	0	5,384	0
	CONTROL	37,530	0	4,824	0
7	NUTRIENT	21,788	0	4,634	0
	PRODUCT	38,354	0	5,298	0
	CONTROL	31,456	22.8	3,692	24.2
28	NUTRIENT	502	98.8	3,052	42.7
	PRODUCT	21,356	47.4	3,742	49.0

Results of Gravimetric Analysis:
Percentage (%) Decrease in Weight of Oil on Day 28
Control: 6.36%
Nutrient: 33.00%
Product: 3.00%

VIII. MICROBIOLOGICAL ANALYSIS

1. Listing of each component of the total formulation, other than microorganisms, by chemical name and percentage by weight: CONFIDENTIAL
2. Listing of all microorganisms by species and percentages of each species in the composition of the additive: CONFIDENTIAL
3. Optimum pH, temperature, and salinity ranges for use of the additive:
pH: 6-8
Temperature: 90°F
Salinity: Not applicable
3. Minimum and maximum pH, temperature, and salinity levels below or above which the effectiveness of the additive is reduced to half its optimum capacity:
pH: 4.8 – 9
Temperature: 59°F – 104°F
Salinity: Not applicable
4. Special nutrient requirements: A combination of 70 percent live active yeast mixed with 30 percent fine ground corn cob is used as a nutrient. In a 55 gallon drum of concentrate, approximately 1.1 kg of this mix will be found (relative to the 1.1 kg, the actual bacteria represent the negligible mass of several grams). There are no storage requirements for the nutrient portion of the formula; however, as they are in a homogenous mixture with the bacteria, they must be stored as described in Part V of this bulletin.
5. Test results regarding the determination of the presence of the following:
Salmonella: Negative
Fecal coliform: Negative
Shigella: Negative
Staphylococcus Coagulase positive: Negative
Beta hemolytic Streptococci: Negative

IX. PHYSICAL PROPERTIES

NA

X. ANALYSIS OF HEAVY METALS, CYANIDE, AND CHLORINATED HYDROCARBONS

NA

Last updated on August 26, 2014