



Heat Source for Field Applications

White Paper



Heat Source for Field Applications

1.0 BACKGROUND

THE NEED FOR A SAFE AND EFFECTIVE HEAT SOURCE IN THE FIELD

In 1991 the United States Armed Services discontinued the trioxane fuel bar (“heat tabs”) for heating field rations because of its inherent toxicity. Since then there has been no good alternative that allows forces in the field to effectively heat rations, boil water, and start fires for heat, hygiene and survival purposes.

The heat source in common use today, pre-packaged with military meals ready-to-eat (MRE)¹ is the flameless ration heater (FRH)². This system is difficult to use, inefficient in bringing the MRE entree to full heat, and limited in its potential use.

What’s more, because many soldiers become frustrated with its limitations, the FRH is often tossed aside (as often as 60% of the time). These discarded FRHs must be disposed of as hazmat waste, effectively doubling their cost to the military. Worse, because the FRH gives off hydrogen gas when activated, it is used by insurgents in combat zones for improvised explosive devices.



A Better Way To Cook

¹ There are three US firms which produce MRE: [SoPakCo](#); [AmeriQual](#); [Wornick](#)

² The manufacturer of FRH for US MRE is [InnoTech](#).

2.0 REQUIREMENT

A BETTER, SAFER HEAT SOURCE

The modern warfighter requires a heat source that can quickly and efficiently deliver a hot entree and beverage in the field without providing the enemy with a weapon.

With all that the modern soldier has to carry, their ration heater would be more valuable if it did more than just heat a single MRE entree to lukewarm. It should be able to easily start a fire for warmth or to dry a pair of wet socks, and; to burn smokeless and clear, leaving no charring and no trace that soldiers have been there.

That system is now available. The *Utility Flame™* system (formerly known under the *PyroPac™* and *MilPack™* brand names) fulfills all the heat source needs of the modern warfighter. It is a perfect fuel for cooking and as a fire starter. It is approved by the US Defense Logistics Agency¹, as well as by the armed forces of Canada and Norway.

It is so safe that it is approved for transport on commercial airlines by the United States Transportation Security Agency. (Not even the US Air Force will fly with the FRH unless it is double sealed). *Utility Flame™* is odorless, smokeless, economical, non-toxic and friendly to the environment. With an unlimited shelf life, it is the perfect fuel for troops who need 'fire in the field.'



No Transport Restrictions

¹Defense Logistics Agency, Andrew T. McNamara Building, 8725 John J. Kingman Road, Fort Belvoir, VA 22060-6221 USA. Attention: Distribution Chief of Staff. Tel: + 1 717 770 7325. References: National Stock Number: 9110-01-518-9201; Federal Supply Class: 9110; National Item Identification Number: 015189201; Description: Fuel, Gel, Diethylene Glycol.

3.0 RANGE OF USE

MORE USES IN THE FIELD MEANS MORE VALUE TO THE SOLDIER

Utility Flame™ is a heat source system developed by military experts with the needs of soldiers in mind. The system is based on a proprietary gel that burns hot and clean, with no smoke or fumes. *Utility Flame™* will not freeze or melt, and it burns well at high altitude. *Utility Flame™* is non-toxic and safe for the environment. Its only by-products are carbon dioxide, water and silica sand.

The *Utility Flame™* kit comes with an ultra light metal stove that, when easily unfolded creates a convection flow that funnels the heat where it's needed, while shielding the faint blue flame from enemy eyes.

When set up, the stove is the perfect size to fit a standard issue canteen cup. Alternately, a pot and its contents weighing up to 1.3kg can be set on top.

Unlike the FRH, *Utility Flame™* can be used to boil water, dry wet clothing, or start an open fire. And because the gel is smokeless and burns so clean, the flame is almost impossible to see — a clear advantage on the battlefield.



Foldable, Reusable Stove

3.1 HOW IT WORKS

SAFE, EASY, AND FAST

In the field, the soldier unfolds and forms the stove, keeping the small cutout as a surface for the gel. He opens the gel pack and empties its contents on the metal cutout. He places the cutout on level ground, lights the gel with a lighter or matches, and then sets the stove above the flame with its opening downwind.

The soldier then fills his canteen cup with water and places one or two MRE entrees inside. The water comes to a boil in 7-8 minutes. The entree is removed, piping hot, and the water is used to make a hot beverage. One single 37 ml pack of gel will burn hot for 15-20 minutes.

Once the gel has burned, all that is left at the site is fine silica sand that easily brushes away. There are virtually no signs that a fire has been made, and the stove folds back up to its original size for reuse. Because *Utility Flame™* gel is not a hazardous material, it requires no special clean up or handling.

Utility Flame™ also ships in a re-sealable 177 ml pouch that burns hot for over one hour. And while the stove was specifically designed with the U.S. Military Canteen Cup in mind, the gel is perfect for all other gel and solid fuel cookers, such as the *Crusader Cooker™* and the *Esbite™* stove. Of course, the gel can be set directly on the ground or any other surface as well.



Stable, Non Toxic Gel



Smokeless, Odorless Blue Flame



Burns on any surface at 737°C

3.2 PACKAGING OPTIONS

BUILT TO YOUR SPECIFICATIONS

Utility Flame™ can be custom packaged to meet your specifications and needs. The standard packs are the 177 ml multi-use and 37 ml single use packets.



177 ml Multi-Use



37 ml Single Use

For retail sale, it also comes in a 37 ml multi-pack with stove and a 20 count retail bucket for the 177 ml.



37 ml Retail Box with Stove



177 ml Retail Bucket

It can be packaged in bulk for central field dispensing, such as in a disaster relief or refugee operation.



IBC Tote on Pallet For Field Dispensing in Emergency Situations

We can also custom design the package graphics to incorporate your information in your language, including co-branding with your organization.

Instructions for Use	Instructions for Use
이용 안내	Instrukcja użytkowania
	მიოთოთებები გამოყენება
Gebrauchsanweisung	Инструкция по применению
	Bruksanvisning
Kullanma talimatları	使用説明書
İstifadəçi üçün təlimat	Istruzioni per l'uso
Mode d'emploi	Használati utasítás
Οδηγίες Χρήσης	Návod k použití
	Brugsanvisning
Instrucciones para el uso	Upute za uporabu
Instrucțiuni pentru utilizare	Käyttöohjeet
Udhëzime për përdorim	Инструкции за ползване
Instruções para uso	Maelekezo kwa ajili ya Matumizi
Ցուցումներ է օգտագործման համար	Kasutusjuhised



Co-Brand With Your Graphics and Information

3.3 USES & SPECIFICATIONS

FIELD HEAT SOURCE FOR MILITARY, NGO, RECREATION AND HOME USE APPLICATIONS

Utility Flame™ is light, inexpensive, safe to transport and use, and extremely versatile. It is an excellent addition to the kit for soldiers, relief agencies, hikers and campers and even home cooks.

USES

Heat entrees and cook indigenous foods	Provide heat for tents and other enclosed spaces
Boil water for hot beverages and hygiene	Cook anywhere for picnic or BBQ
Start a campfire with wet wood	Gives off high temperature flame for emergency sterilization

SPECIFICATIONS

[See Technical Data Sheets]

Does not evaporate	Burns hot with high BTU output (737°C)
Does not freeze	Burns at 5000+m elevation
Does not melt	Burns at -30°C
Smokeless	Not explosive (high ignition — flash point 151°C)
Odorless	Zero vapor pressure
Non-toxic	Unlimited shelf life; does not deteriorate after air exposure
Water soluble — washes off with water	Gel assumes any form
No transport restrictions	Easy to contain and/or package in any kind of container
Not a hazmat — no EPA restrictions	NSN number and available in COTS
“Green” product	Byproducts are carbon dioxide, water, silica sand



Hot Water For Field Hygiene



Safe For Indoor Use



For Campers

3.4 COLD WEATHER APPLICATIONS

WHEN A RELIABLE HEAT SOURCE REALLY COUNTS

If the outside temperature is below freezing, a soldier may do without warm food or a hot drink if using a FRH. The average altitude of Afghanistan, for example, is 1500m and it is often below freezing in the mountains.

However, *Utility Flame™* does not freeze. A single *Utility Flame™* packet has proved its usefulness in cold conditions by heating two cups of snow to boiling water, and then fully heating the MRE entree. In comparison, the FRH takes 10 to 15 minutes to raise the temperature of an entree only 37°C above ambient temperature. (The test was conducted at the [U.S. Army Mountain Warfare School](#)).

The Meal Cold Weather and Food Packet Long Range Patrol ([MCW/LRP](#)) are designed to meet the Joint Service requirements of the United States Marine Corps (USMC) and the Army Special Operations Forces (SOF). These rations are designed for extreme cold environments. They require boiling water to reconstitute the meal and beverage but have no FRH heaters.

A single *Utility Flame™* packet provides sufficient heat to boil the water requirement for the LRP, while the MCW requires multiple small packets (or a single large packet) for its full use.



Works at -30°C and 5000+m

4.0 TESTING & TRIALS

PROVEN IN THE LAB, PREFERRED IN THE FIELD

Utility Flame™ has been tested and approved by the U.S. Army Research, Development and Engineering Command [RDECOM]. They granted *Utility Flame™* National Stock Numbers (NSN) for supplying the Armed Forces.¹ Says their report:

“[Utility Flame™] is the only fuel which meets the following user requirements: it is tactical in that it burns with a steady blue flame which does not disclose the warfighters’ position; has negligible vapor pressure that allows it to be declared a non-flammable substance and therefore not subject to Department of Transportation hazardous material regulation, which allows ease of transport to overseas destinations; and has completed the safety and health data sheet required for immediate material fielding. Additionally, the heat to mass ratio allows the warfighter to carry lesser amounts of fuel to complete their mission.”²

In a field test, *Utility Flame™* was clearly favored over the standard FRH by 95% of the soldiers. Soldiers were randomly selected from the Combat Medics Course during field training at Camp Bullis, Texas in March 2010. They were divided into two groups: one was given the FRH system to heat their MRE entree, the other used *Utility Flame™*. Then each group got the opportunity to use the other heat system.

The results were clear. Both groups — the soldiers who used the FRH first and the soldiers who used *Utility Flame™* first — preferred *Utility Flame™* by a wide margin. And the soldiers who used *Utility Flame™* first preferred it by a significantly wider margin over the FRH (8.3 to 4.9 respectively, on a scale of 1 to 9).



¹ NSN 9110-01-518-9201 for the 1.25 oz packets; NSN 9110-01-518-9219 for the multiuse 6 oz pouch.

² U.S. Army Robert Morris Acquisition Center, ATTN: ASSB-CAN-S, Natick Contracting Division (R&D and Base OPS) Building 1, Kansas Street, Natick, MA 01760-5011

Utility Flame™ has been used in the field by the 10th Mountain Division and 101st Airborne Division to great success. Special attention was provided to one unit, Co “B”, 1st BN, 506th PIR, 101st Division at Fort Campbell, KY just prior to deployment. Every man received three units with a stove, and additional cases were provided to the S-4. Not one negative evaluation was received throughout an extensive deployment during which they ate MREs extensively. Writes Brigadier General Benjamin Freakly:

“101st Airborne Division (Air Assault) has an urgent operational need for [Utility Flame™] gel to enable our soldiers to heat items (consumables) in a safe and environmentally sound manner. This ability would greatly enhance the morale of our soldiers in support of contingency operations.”¹



Once they use it, soldiers request more *Utility Flame™*. Most suggest that it should be standard issue in the MRE. Evaluations submitted to the U.S. Army Training and Doctrine Command ([TRADOC](#)) System Manager indicated that 99% of troops who use it say the US Army should adapt it as the heater in the MRE.

The product has also been marketed to non-governmental organizations (NGOs), relief agencies, and civilian outdoors enthusiasts.



Utility Flame™ has been evaluated for safety and has on file a full Material Safety Data Sheet [[MSDS](#)] as required by the U.S. Occupational Safety and Health Administration. Highlights of the report include:

- “If this material becomes a waste, it would not be a hazardous waste by RCRA [Resource Conservation and Recovery Act] criteria (40CFR 261).”
- “This material is not subject to DOT [Department of Transportation] regulations under 49CFR parts 171–180.”

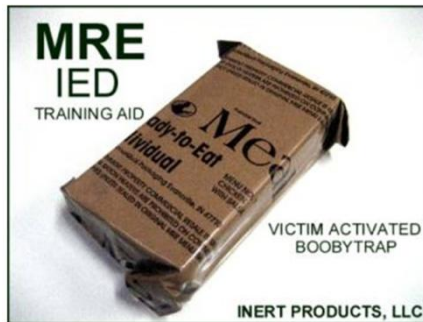


¹ Memorandum thru Commander, XVIII Airborne Corps. (ATTN: Chief of Staff), FT Bragg, NC 28310-5000; Commander, United States Army Special Forces Command (ATTN: Chief of Staff), FT McPherson, GA 30220, 4 March 2003.

5.0 PRODUCT COMPARISON

NOTHING WORKS LIKE UTILITY FLAME™

The Flameless Ration Heater (FRH) is presently included in all US military issue MREs that have a heat source. It is a pouch containing an iron oxide/manganese dioxide mixture, which when united with water produces heat (60°C) and hydrogen gas (6-8 liters), leaving a wet residue in the package. Its shortcomings include low temperature (it does not heat water sufficiently for a hot beverage), and it is a hazmat product. When deployed in a confined area, the FRH can be explosive, and unused FRHs are used by insurgents for improvised explosive devices. ([RDECOM](#) estimates more than 60% of FRH units are discarded unused).



FRH used as an insurgent's tool

The FRH cost includes extra packaging for safe transport, and disposal of both used and unused items. It cannot be transported by air outside of the MRE packaging due to its explosive nature. Common complaints among soldiers are:

- *"The FRH seldom works properly."; "Smells awful."; "Heats rations unevenly."; "Doesn't heat the coffee."; "Does not work in cold weather conditions."*

Utility Flame™ vs. FRH

	<i>Utility Flame™</i>		FRH
Entree temperature	98°C		60°C
Time to reach hottest entree temperature	8 min.		15 min.
Weight	35 g		92g
Shelf life	Unlimited		Limited
Can transport on commercial airline	✓		
Boils water	✓		
Thoroughly heats MRE	✓		
Has multiple uses	✓		
Can use frozen water	✓		
Soldier preferred	✓		
Can heat entree AND make hot drink	✓		
Hazmat			✓
Can be used as explosive			✓

6.0 CUSTOMER SERVICE & SUPPORT

AMERICAN MADE, AMERICAN OWNED

Utility Flame™ is manufactured by Milpack Ventures of Clearwater, FL and distributed internationally by the SIL Group of Tampa, FL. Both are USA owned and operated business enterprises.

Safety and quality control of the product are primary concerns of the manufacturer, and are examined in quarterly reports derived from user input, field reviews, and independent testing as necessary. We encourage you to visit our product website (UtilityFlame.us) to learn more.



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Technical Data Sheets

Material Safety Data Sheets

US Army Purchase Specs

Product Comparisons

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2 September 2011	UtilityFlame	1.00USA

1 - IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING


Product Identifier – UtilityFlame
Product Number – NR
Chemical Name – Mixture
Trade name – Milpack UtilityFlame
CAS No. – Mixture

Manufacturer/Supplier Information (USA)


Company Identification – Milpack Ventures, LLC D.B.A. UtilityFlame
USA Telephone – (813) 205-5604
USA Address – 8089 John's Road, Suite 7, Tampa, FL 33634
Emergency telephone number – Chemtrec
Emergency Phone No. – (800) 424-9300 (US/Canada), (703) 527-3887 (Intl.)

2 - HAZARDS IDENTIFICATION

OSHA HCS (29 CFR 1910.1200) – Hazardous under OSHA Hazard Communication Standard. HMIS (Hazardous Material Information System): Health (*Chronic) – 1*, Flammability – 1, Reactivity- 0. Target Organ Effect, Harmful by Ingestion. GHS Classification (USA) – 3.1/4, 3.2/3, 3.3/2B. Target organs: Kidney, Liver, Central Nervous System. WHMIS (WORKER HAZARDOUS MATERIALS INFORMATION SYSTEM) – Hazardous under WHMIS regulations in Canada. Class D2B - Irritant
GHS (USA/CANADA) – Hazardous under GHS regulations.

Hazard Pictogram(s)		Signal Word(s)	Warning
Hazard Statement(s)	H302-Harmful if swallowed. H316 Causes mild skin irritation. H320 Causes eye irritation. P301 + P330 + P331: IF SWALLOWED: rinse mouth. Do NOT induce vomiting.		
Precautionary Statement(s)	P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.		
Additional Information			
Potential Health Effects			
Inhalation	Possible irritation of respiratory tract.		
Skin Contact	Possible mild irritation.		
Eye Contact	Eye irritation.		
Ingestion	Harmful if swallowed, Irritating, significant exposure may result in unconsciousness and death. Repeated ingestion may cause kidney toxicity.		

3 - COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous Ingredient(s)	%W/W	CAS No.	EC No.	GHS Hazard Pictogram(s) and Hazard Statement(s)	
Diethylene Glycol	>90	111-46-6	203-872-2		3.1/4*, 3.2/3, 3.3/2B, H302, H316, H320
Siloxanes and Silicones di-Me, reaction products with silica	<10	67762-90-7	Not referenced	None	None

Additional Information - For full text of H phrases see section 16. Non-Hazardous ingredients are not listed and make up the balance of the product.

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4 - FIRST AID MEASURES

Inhalation	Remove patient from exposure. Keep patient at rest and give oxygen if breathing difficult. If symptoms develop, obtain medical attention.
Skin Contact	Remove contaminated clothing immediately and drench affected skin with plenty of water.
Eye Contact	Irrigate with eyewash solution or clean water, holding the eyelids apart, for at least 15 minutes. Obtain medical attention if ill effects occur.
Ingestion	Do not induce vomiting. If swallowed, seek medical advice immediately and show this container or label.
Further Medical Treatment Conditions Aggravated By Exposure to Product	Treat symptomatically. No specific measures should be required. None known.

5 - FIRE-FIGHTING MEASURES

Combustible. Flash Point 244°F / 117.78°C. T.C.C. NFPA (USA National Fire Protection Association); Health – 1, Flammability – 1, Reactivity- 0.

Extinguishing media	Water fog, Alcohol Foam, Dry Chemical, CO2
Unsuitable Extinguishing Media	None
Fire Fighting Protective Equipment	A self contained breathing apparatus and suitable protective clothing should be worn in fire conditions.
Special Hazards arising from Combustion	None known or anticipated

2

6 - ACCIDENTAL RELEASE MEASURES

Personal Precautions	Ensure full personal protection (including respiratory protection) during removal of spillages.
Environmental Exposure Controls	Cover with absorbent or contain. Collect and dispose.
Other	Permanent damage is unlikely. Product is non-hazardous to aquatic organisms.

7 - HANDLING AND STORAGE

HANDLING	Avoid contact with eyes. Avoid ingestion. Avoid inhalation of high concentrations of vapours.
STORAGE	Keep container tightly closed. Keep out of the reach of children. Avoid storage with water-reactive substances, strong acids, and strong bases.
Storage Temperature:	Ambient. Avoid contact with heat and ignition sources.
Storage Life:	Stable at ambient temperatures.
Specific use:	Not applicable.

8-EXPOSURE CONTROLS/PERSONAL PROTECTION

PERSONAL PROTECTIVE EQUIPMENT

Respirators	Not normally required.
Eye Protection	Wear protective eyewear (goggles, face shield, or safety glasses).
Gloves	Wear suitable gloves if prolonged skin contact is likely.
Body protection	Not normally required.
Engineering Controls	Not normally required.
Other	Contaminated clothing should be thoroughly cleaned.

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OCCUPATIONAL EXPOSURE LIMITS

SUBSTANCE.	ACGIH	OSHA	Note:
Diethylene Glycol	NE	10mg/m3	USA workplace environmental exposure levels (WEEL)
As Amorphous Silica Dust or particles NOS	10 mg/m3, inhalable 6mg/m3,respirable	6 mg/m3	USA

9 - PHYSICAL AND CHEMICAL PROPERTIES**Information on basic physical and chemical properties**

Appearance - Liquid.	Vapour Pressure (mm Hg) – 0.04hPa (0.03 mmHg)
Colour – No data	Vapour Density (Air=1) - 3.66
Odour - Slight	Density (g/ml) – ~ 1.118 g/ml at 25°C (77°F)
Odour Threshold (ppm) - Not available	Solubility (Water) - Miscible.
pH (Value) – 5.0-8.0 @ 500 g/l @20°C (68°F)	Solubility (Other) - Not established
Melting Point (°C) / Freezing Point (°C) - -10°C / 14°F	Partition Coefficient (n-Octanol/water) - Not available
Boiling point/boiling range (°C): - ~ 245°C / 473°F	Ignition Temperature (°C) - 228°C (442°F)
Flash Point (°C) – 118°C /244°F, T.C.C.	Decomposition Temperature (°C) - Not available
Evaporation rate - Not available	Viscosity (mPa.s) - Not available
Flammability (solid, gas) - Not available	Explosive properties - Not explosive
Explosive limit ranges – LEL 2%Vol., UEL 12.3%Vol.	Oxidising properties - Not oxidising
Other information – Not Available	

10 - STABILITY AND REACTIVITY

Reactivity	Slight
Chemical stability	Stable under normal conditions.
Possibility of hazardous reactions	Can react violently if in contact with - Water-Reactive Substances, Strong Acids, Strong Oxidizers, Zinc.
Conditions to avoid	Extreme Temperatures
Incompatible materials	Water-Reactive Chemicals, Strong Acids, Strong Bases.
Hazardous Decomposition Product(s)	Carbon monoxide, Carbon dioxide,

11 - TOXICOLOGICAL INFORMATION

Acute toxicity - Low oral toxicity, but ingestion may cause irritation of the gastrointestinal tract.

Irritation - May cause eye irritation under prolonged exposure.

Corrosivity - None expected.

Sensitization – None expected.

Repeated dose toxicity - No data available.

Carcinogenicity - None expected.

Mutagenicity - None expected.

Toxicity for reproduction - None expected.

Aspiration hazard - None expected.

Potential Health Effects

Inhalation - None anticipated.

Ingestion – Low acute oral toxicity. But drowsiness, dizziness, confusion, nausea, vomiting, and kidney injury may occur.

Skin – Mild skin irritation

Eyes - Mild eye irritation.

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SUBSTANCE.	LD ₅₀ (Oral, Rat)	LC ₅₀ (Inhalation, Rat)	LD50 (Dermal, Rat)
Diethylene Glycol	12,565 mg/kg	No data	LD50 Dermal - rabbit - 11,890 mg/kg

12 - ECOLOGICAL INFORMATION

Toxicity	Low ecotoxicity - not harmful to aquatic environments.
Persistence and degradability	Unlikely to persist.
Bioaccumulative potential	The product has low potential for bioaccumulation.
Mobility in soil	The product has high mobility in sediment.
Other adverse effects	None anticipated.

13- DISPOSAL CONSIDERATIONS

Waste treatment methods - Disposal should be in accordance with local, state or national legislation.
Product does not require any special disposal or handling.

14 - TRANSPORT INFORMATION

Land Transport (Within USA) (a)(c)

UN number	Not regulated
Proper Shipping Name	None
Transport hazard class(es)	None
Packing Group	None
Hazard label(s)	None
Environmental hazards	None
Special precautions for user	None

Sea Transport (IMDG) (c)

UN number	Not regulated
Proper Shipping Name	None
Transport hazard class(es)	None
Packing Group	None
Marine Pollutant	None
Special precautions for user	None

Land Transport (Within Canada) (b)(c)

UN number	Not regulated
Proper Shipping Name	None
Transport hazard class(es)	None
Packing Group	None
Hazard label(s)	None
Environmental hazards	None
Special precautions for user	None

Air Transport (ICAO/IATA) (c)

UN number	Not regulated
Proper Shipping Name	None
Transport hazard class(es)	None
Packing Group	None
Environmental hazards	None
Special precautions for user	None

(a)- ORM-D may be applicable within the USA for package sizes less than 30kg.

(b)- Shipments into Canada from the US may use USDOT rules per TDG SP 1.33.

(c)- Consult with transport provider. Check relevant regulations for Special Provisions.

15 - REGULATORY INFORMATION

USA

TSCA (Toxic Substance Control Act) - **All Components Listed.**

SARA 302 - Extremely Hazardous Substances - **Not applicable.**

SARA 313 - Toxic Chemicals - **None.**

SARA 311/312 - Hazard Categories - **Acute health hazard, Chronic Health Hazard**

CERCLA (Comprehensive Environmental Response Compensation and Liability Act) - **No RQ.**

CWA (Clean Water Act) - CWA 307 - Priority Pollutants - **None**

CAA (Clean Air Act 1990) - CAA 112 - Hazardous Air Pollutants (HAP) - **None**

Proposition 65 (California) - **No Listings.**

State Right to Know Lists - **CAS # 111-46-6 Diethylene glycol listed in NJ, PA.**

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Canada

WHMIS Classification (Canada) - **None**

CANADA INGREDIENT DISCLOSURE LIST - **None**

Canada (DSL/NDSL) - **All Components Listed on DSL or NDSL.**

16 - OTHER INFORMATION

The following sections contain revisions or new statements: 1-16.

LEGEND

ACGIH	American Conference of Governmental Industrial Hygienists	NA	not applicable, not available
AICS	Australian Inventory of Chemical Substances	NIOSH	National Institute for Occupational Safety and Health
ANSI	American National Standards Institute	ND	not determined
atm	atmosphere (pressure unit)	NFPA	National Fire Prevention Association
BOD	biological oxygen demand	NTP	National Toxicology Program
CAS	Chemical Abstracts Service	OC	open cup
CC	closed cup	OSHA	Occupational Safety and Health Administration
CDTA	Chemical Drug and Trafficking Act	Part	partition
COC	Cleveland Open Cup	PEL	permissible exposure limits
COD	chemical oxygen demand	ppb	parts per billion
coeff.	coefficient	PPE	personal protective equipment
CFR	Code of Federal Regulations	ppm	parts per million
CPR	cardio-pulmonary resuscitation	psi	pounds per square inch
DEA	Drug Enforcement Agency	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	RQ	Reportable quantity
DSCL	Dangerous Substances Classification and Labeling	RTK	Right to Know
EEC	European Economic Community	SARA	Superfund Amendments and Reauthorization Act
FDA	Food and Drug Administration	STEL	short-term exposure limit
HMIS	Hazardous Materials Information System	SUSDP	Standard for the Uniform Scheduling of Drugs and Poisons (Australia)
IARC	International Agency for Research on Cancer	TCC	Tagliabue Closed Cup
IDLH	immediate danger to life or health	TDG	Transportation of Dangerous Goods
kg	kilogram	TPQ	threshold planning quantity
L	liter	TQ	threshold quantity
LC50	median lethal concentration	TSCA	Toxic Substances Control Act
LD50	median lethal dose	TWA	time-weighted average
LEL	lower explosive limit	UEL	upper explosive limit
mg	milligram	WHMIS	Workplace Hazardous Material Information

References: RTECS, CAS Registry, EINECS/ESIS, *Casarett & Doull's Toxicology*, *Goldfrank's Toxicological Emergencies*, Manufacturer Information

GHS Hazard statement(s) And Precautionary statement(s)

H302-Harmful if swallowed.

H316 Causes mild skin irritation.

H320 Causes eye irritation

P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Additional Information – None.

Information contained in this publication or as otherwise supplied to Users is believed to be accurate and is given in good faith, but it is for the Users to satisfy themselves of the suitability of the product for their own particular purpose. ChemTel Inc. gives no warranty as to the fitness of the product for any particular purpose and any implied warranty or condition (statutory or otherwise) is excluded except to the extent that exclusion is prevented by law. ChemTel Inc. accepts no liability for loss or damage (other than that arising from death or personal injury caused by defective product, if proved), resulting from reliance on this information. Freedom under Patents, Copyright and Designs cannot be assumed.



Health	1
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Diethylene glycol MSDS

Section 1: Chemical Product and Company Identification

Product Name: Diethylene glycol	Contact Information:
Catalog Codes: SLD3151	Sciencelab.com, Inc.
CAS#: 111-46-6	14025 Smith Rd.
RTECS: ID5950000	Houston, Texas 77396
TSCA: TSCA 8(b) inventory: Diethylene glycol	US Sales: 1-800-901-7247
CI#: Not applicable.	International Sales: 1-281-441-4400
Synonym: Carbitol	Order Online: ScienceLab.com
Chemical Name: 2,2'-Oxydiethanol	CHEMTREC (24HR Emergency Telephone), call:
Chemical Formula: C ₄ H ₁₀ O ₃	1-800-424-9300
	International CHEMTREC, call: 1-703-527-3887
	For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Diethylene glycol	111-46-6	100

Toxicological Data on Ingredients: Diethylene glycol: ORAL (LD50): Acute: 12565 mg/kg [Hamster.]. DERMAL (LD50): Acute: 11890 mg/kg [Hamster.].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:

Hazardous in case of skin contact (irritant, permeator), of ingestion. Slightly hazardous in case of eye contact (irritant).
CARCINOGENIC EFFECTS: Not available. **MUTAGENIC EFFECTS:** Not available. **TERATOGENIC EFFECTS:** Not available.
DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to blood, kidneys, the nervous system, liver. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cold water may be used. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:

Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 227.78°C (442°F)

Flash Points: CLOSED CUP: 138°C (280.4°F). OPEN CUP: 143°C (289.4°F) (Cleveland).

Flammable Limits: LOWER: 2% UPPER: 12.3%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances: Slightly flammable to flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: When heated to decomposition, it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Absorb with an inert material and put the spilled material in an appropriate waste disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes.

Storage:

Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Clear viscous liquid.)

Odor: Odorless.

Taste: Sweet.

Molecular Weight: 106.12 g/mole

Color: Colorless.

pH (1% soln/water): 7 [Neutral.]

Boiling Point: 245.8°C (474.4°F)

Melting Point: -8°C (17.6°F)

Critical Temperature: Not available.

Specific Gravity: 1.12 (Water = 1)

Vapor Pressure: 0.01 mm of Hg (@ 20°C)

Vapor Density: 3.66 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether.

Solubility: Easily soluble in cold water, hot water, methanol, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Slightly reactive to reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity: Hygroscopic; keep container tightly closed.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

Acute oral toxicity (LD50): 12565 mg/kg [Hamster.]. Acute dermal toxicity (LD50): 11890 mg/kg [Hamster.].

Chronic Effects on Humans: The substance is toxic to blood, kidneys, the nervous system, liver.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Experimentally tumorigen by inhalation. Exposure can cause nausea, headache and vomiting.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

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Federal and State Regulations:

Pennsylvania RTK: Diethylene glycol TSCA 8(b) inventory: Diethylene glycol

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC): R36/38- Irritating to eyes and skin.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Splash goggles.

Section 16: Other Information

References:

-SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.

Other Special Considerations: Not available.

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REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
PROJECT MANAGER CLOTHING AND INDIVIDUAL EQUIPMENT
10170 BEACH ROAD
FORT BELVOIR, VA 22060-5800

SFAE-CSS-FP-F

MEMORANDUM FOR US Army Evaluation Command, ATTN: CSTE-ECS (SFC William LeonGuerrero), 4501 Ford Avenue, Alexandria, VA 22302-1458.

PURCHASE DESCRIPTION

For

ENHANCED FUEL BAR

03 March, 2004

Amended August 6, 2004

PM – CIE

PD – SEP 0103

03 March, 2004

PURCHASE DESCRIPTION

FUEL, GEL, DIETHYLENE GLYCOL, BEVERAGE HEATING

1. SCOPE AND CLASSIFICATION

1.1 Scope. This purchase description covers fuel gel heaters used for heating beverages.

1.2 Intended Use. The fuel gel is intended for use by individual soldiers to heat water and beverages in a field environment. The individual warfighter uses the fuel gel during dismounted missions spanning all areas of the world, all terrains and climates, low and medium density conflicts, and low to high technology conflicts.

1.3 Classification. The fuel gel heaters shall conform to the following types as specified (see 6.2 and 3.3).

Type I – Single use, 1.25 ounces of fuel.

Type II – Multi-use, recloseable pouch containing 6 ounces of fuel.

2. APPLICABLE DOCUMENTS. The following documents form a part of the description to the extent specified herein.

2.1 GENERAL. The documents listed in this section are specified in sections 3 and 4 of this purchase description. This section does not include documents cited in other sections of this purchase description or those recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirement documents, verifications and certifications cited in sections 3 and 4 of this purchase description.

2.2 GOVERNMENT DOCUMENTS.

2.2.1 SPECIFICATIONS AND STANDARDS. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto.

Section SF 1449 - CONTINUATION SHEET

ADDENDUM

ADDENDUM TO FAR 52.212-4 (Contract Terms and Conditions)

Contractor's proposal dated July 6, 2004 and final revised cost proposal dated August 10, 2004 are hereby incorporated into this contract.

STATEMENT OF WORK

Enhanced Fuel Bar

I. BACKGROUND:

Trioxane tablets have been used by all members of the Military Services to heat water and beverages in a canteen cup while in a field environment. The individual warfighter uses the fuel gel during dismounted missions spanning all areas of the world, all terrains and climates, low and medium density conflicts, and low to high technology conflicts. A replacement, non-hazardous fuel is desired to replace Trioxane.

2. GENERAL SCOPE:

The Enhanced Fuel Bar (EFB) is a gelled fuel developed as a non-hazardous replacement to the Trioxane tablets currently used by individual members of all Military Services.

3. GENERAL REQUIREMENTS:

3.1. First Article Testing CLINs 0001 and 0002. The contractor shall develop, produce and deliver 1620 units of EFB's Type I, single-use pouch containing 1.25 ounces of fuel, 5" x 3" x 0.33", and 280 units of EFB's Type II, multi use, recloseable pouch, containing 6 ounces of fuel 6-1/8" x 6" x 1", in accordance with paragraphs 4.2 and 6.3 of the Purchase Description (attached) and CDRL A001 and A002 (attached).

3.2. Production Quantity, CLINs 0003 and 0004. EFB Type I for a quantity of 1,500,000 and Type II for a quantity of 500,000, as further described in the attachments.

4. PACKAGING:

4.1 Item Identification. Each Type I and Type II size fuel gel packet shall be marked with identification markings in accordance with MIL-STD-130 and Section 3.5.1 of the Purchase Description dated August 6, 2004, (attached).

4.2 Military Packaging. For all items entering the military distribution system as defined in MIL-STD-2073-1, the EFB shall be packaged in accordance with the attached Special Packaging Instructions (SPIs). Unit packs, shipping containers and unitized loads (when applicable) shall be marked in accordance with MIL-STD-129. Refer to MIL-HDBK-774 for unitization guidance.

4.3 Packaging Acceptance. The contractor shall conduct packaging First Article Tests (FAT) on a minimum of five (5) shipping containers of each Type of the EFB, in the shipping container configuration, for military packaged items, in accordance with MIL-STD-2073-1. A FAT report shall be submitted in accordance with CDRL A002. The Government shall be notified of FAT tests 15 days prior to test.

A Government representative shall be notified of FAT tests 15 days prior to test. A Government representative may witness the tests.

4.4 Commercial Packaging. All items not entering the military distribution system, such as shipments to test sites or between contractor and sub-contractor, shall be packaged in accordance with ASTM D3951. All shipments shall arrive at their final destination undamaged and in useable and operable condition. Marking for commercial packaging shall be in accordance with MIL-STD-129.

4.5 Wood Packaging and Materials. The contractor shall use wood packaging comprised in whole or in part of non-manufactured wood of conifers, (except that of the Thuja), originating in Canada, China, Japan and the United States. Use similar packaging including pallets, boxes, crates, load boards and pallet collars, whether or not actually in use in the transport of objects of all kinds, that has been heat treated or kiln dried to a minimum core temperature of 56 degrees Centigrade or at least 30 minutes in a closed chamber or kiln. The chamber or kiln shall have been tested, evaluated and approved officially by the American Lumber Standard Committee (ALSC) for this purpose. Display on the wood an official ALSC approved heat-treated or kiln dried marking enabling the identification of where and by whom the above treatment has been completed. Use the box and pallet manufacturer and the manufacturer of wood used as inner packaging that is authorized as an inspection agency accredited by the Board of Review of the American Lumber Standard Committee, P.O. Box 210, Germantown, MD 20875 (Phone 301-972-1700). Place the quality mark on both ends of the outer packaging, between the cleats or end battens, on two sides of the pallet.

4.6 Transportability. The EFB shall be transportable for all modes of transportation for worldwide shipment. The EFB shall be deployable on standard pallet systems including 463L, and shall be transportable by all commercial and military transportation media, including the Landing Craft Air Cushion (LCAC) without restriction.

5. ACCEPTANCE:

5.1 First Article Tests (FAT). EFB's Type I, quantity of 1620, and EFB's Type II, quantity of 280. The testing will follow the procedures outlined in the Government approved First Article Test Plan as required in CDRL A001.

6. DELIVERY:

6.1 52.211-8 Time of Delivery (JUN 1997)

(a) The Government requires delivery to be made according to the following schedule:

(b) The Government will evaluate equally, as regards time of delivery, offers that propose delivery of each quantity within the applicable delivery period. Offers that propose delivery that will not clearly fall within the applicable required delivery period, will be considered nonresponsive and rejected. The Government reserves the right to award either the required delivery schedule or the proposed delivery schedule, when an offeror offers an earlier delivery schedule than required above. If the offeror proposes no other delivery schedule, the required delivery schedule will apply.

REQUIRED DELIVERY SCHEDULE

CLIN 0001	EFB, Type I, First Article Testing (FAT), Quantity 1620	100 days after award of contract
CLIN 0002	EFB, Type II, First Article Testing (FAT), Quantity 280	100 days after award of contract
CLIN 0003	EFB, Type I, Production Quantity, Maximum Quantity 1,686,609	60 days after approval of FAT
CLIN 0004	EFB, Type II, Production Quantity, Maximum Quantity 562,203	60 days after approval of FAT

Product Comparison							
2 Mar 23:10 Hours Lab 72° 1 Pt. of H ₂ O at 57°							
	Utility Flame 1.25 oz	Esbit (1) HEX 1 Stone Kit [\$8.95, 6 Units]	Esbit (2) HEX 2 Tablet Pack [\$5.40, 6 Units]	Charcook HEX 3 Tablet Pack [\$4.95, 8 Units]	Brit Tcooker HEX 4 [\$6.95, 8 Units]	Wet Fire Tablet Pack [\$4.95, 6 Units]	
	F°	F°	F°	F°	F°	F°	
30 Seconds	95	87	111	115	109	69	
100 Seconds	120	129	132	125	129	89	
180 Seconds	150	145	136	120	134	105	
240 Seconds	162	152	154	152	156	128	
5 Minutes	172	165	167	157	162	123	
6 Minutes	178	176	174	167	168	98	
7 Minutes	182	174	165	163	152	87	
8 Minutes	187	168	163	160	164	84	
9 Minutes	189	154	156	148	148	83	
10 Minutes	186	150	149	149	146	82	
11 Minutes	177	140	140	136	136	80	
13 Minutes	173	136	136	132	132	78	
Note: All figures in °F.							
www.utilityflame.us							

Product Comparison

2 Mar 23:10 Hours Lab 72° 1 Pt. of H₂O at 57°

