

AIRBASE AND MOBILE SERVICES GUIDE



Perimeter Solutions' Mobile Equipment fleet provides for fast aircraft turnarounds and significantly more effective firefighting. Perimeter Solutions can provide forward base support for all types of aerial operations including helicopter (both fixed tank and bucket), large airtanker, VLAT and SEAT operations. Our mobile LC Trailers provide portable retardant storage to support temporary or remote aerial operations across the nation.

PERIMETER SOLUTIONS PROVIDES A FULL RANGE OF FIXED AND MOBILE BASE SERVICES:

For accurate, 24 hour retardant operations, Perimeter Solutions can deploy specially designed ground application units. Perimeter Solutions Ground Applied Retardant Units (GARU) can be operated when airtankers are unavailable due to weather, availability or for night operations. Retardant application is accurate and effective for fire line construction, burnout support, community protection and fire prevention.

- **Helicopter Support (MRB-H)** for support of fixed-tank and bucket operations.
 - > Close in support to reduce aircraft turnaround time
 - > Retardant, foam or gel support
 - > High volume capability for support of multiple aircraft
- **Airtanker support (MRB-AT)** for support of fixed-wing airtankers operating at remote bases.
- **Very Large Airtanker Support (VLAT)** for support of fixed-wing very large airtankers (VLAT's) operating from airports without permanent retardant facilities or to supplement existing bases.
 - > High volume capacity
 - > Loading rates of 800-1000 gallons per minute

- **Single Engine Airtanker Support (MRB-SEAT)** for support of SEAT operations at remote or forward operating locations.
- **Retardant Support Trailers (MRB-TRAILER)** to provide remote/mobile retardant storage and support:
 - > Support SEAT operations where SEAT operator has mixing capability
 - > Supplemental supply for ongoing operations
- **Ground Application (MRB-GROUND)** for accurate 24 hour-per-day placement of retardant, gel or foam.
 - > Application by Perimeter Solutions specially designed spray equipment
 - > Night operations
 - > Application in windy/smoky conditions
 - > Support of Agency engines
- Water tenders to support any MRB operation.
- Mix master, crew and lead personnel to assist with agency base operations.
- Tanker base/equipment construction, maintenance, rehab and repair.
- Sales of equipment and parts for tanker base operations.
- All Perimeter Solutions personnel providing mobile services are NWCG Fireline Qualified.



Perimeter Solutions has a large fleet of multi-purpose mobile units ready to deploy.

- **Fast response times** – mobilization typically within 24 hours of order
- **Fast set up** – operational within 4 hours of arrival
- **Fast/reliable product supply and resupply**
- **Trained/experienced lead and crew personnel**
- **Unused product can be returned**
(small re-stock fee applied)

AVAILABLE EQUIPMENT

UNIT	MRB-AT	MRB-VLAT	MRB-H	MRB-SEAT	MRB-TRAILER	GROUND APPLIED
All Purpose Bases						
APB-1	✓		✓	✓		
ABP-2	✓	✓	✓	✓		
APB-3	✓	✓	✓	✓		
APB-4	✓	✓	✓	✓		
APB-5	✓		✓	✓		
APB-6	✓		✓	✓		
APB-7 thru APB-12	✓	✓	✓	✓		
Liquid Concentrate Trailers						
LCT-1 thru LCT-5				✓	✓	
Water Tenders						
HYDRO-1				✓		✓
WT-11 thru WT-18						✓



PRODUCTS FOR BASE AND MOBILE OPERATIONS

Perimeter Solutions offers a full range of products, all USDA Forest Service Qualified.

LONG-TERM RETARDANT FOR WILDLAND FIRE MANAGEMENT

Qualified by US Forest Service in Accordance with Forest Service Specification 5100-304d

These products are evaluated and qualified only at the specified mix ratio and only for use with the indicated application method. Consult individual agencies for specific policies relating to long-term retardant use.

CHEMICAL	MIX RATIO (Pounds concentrate per gallon water)	QUALIFIED APPLICATION ¹				
		Fixed Wing		Helicopter		Ground Engine
		Multi-Engine	SEATS	Fixed-Tank	Bucket	

DRY CONCENTRATE – Gum-thickened: Permanent or Temporary Base

PHOS-CHEK MPV-Fx	0.96 lb/gal	•	•	—	•	•
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DRY CONCENTRATE – Gum-thickened: Temporary Base

PHOS-CHEK 259-Fx	1.01 lb/gal	•	•	•	•	•
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WET CONCENTRATE – Gum-thickened: Permanent or Temporary Base

PHOS-CHEK LC95A-R	5.5:1	•	•	—	•	•
PHOS-CHEK LC95A-Fx	5.5:1	•	•	—	•	•

WET CONCENTRATE – Gum-thickened: Temporary Base

PHOS-CHEK LC95W	5.5:1	•	•	—	•	•
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¹Qualification Notes:

- Fully Qualified: Product complies with all requirements of a formal specification.
- Not qualified for this application.

PRODUCT DESCRIPTIONS

PRODUCT	TYPE	COLOR	YIELD/MIX RATIO
PHOS-CHEK LC95A-R	Liquid Concentrate	Red Iron Oxide	1054 Gallons/Ton
PHOS-CHEK LC95A-Fx	Liquid Concentrate	Fugitive	1053 Gallons/Ton
PHOS-CHEK LC95W	Liquid Concentrate	Uncolored	1050 Gallons/Ton
PHOS-CHEK MVP-Fx	Powder	High Visibility Fugitive	2209 Gallons/Ton
PHOS-CHEK 259-Fx	Powder	Fugitive	2105 Gallons/Ton
PHOS-CHEK WD881	Class A Foam	Uncolored	0.1–1.0%
PHOS-CHEK INSUL-8	Liquid Concentrate Gel	Uncolored	0.37% (air) 0.37–3.0% (ground)

RELATIVE EFFECTIVENESS OF COMMON FIRE CHEMICALS

APPLICATION	LONG-TERM RETARDANT	GEL	CLASS A FOAM	WATER
Indirect Attack	✓✓✓✓	✓✓	✓	
Direct/Parallel Attack	✓✓✓✓	✓✓✓	✓✓	✓
Interior Structure Attack		✓✓	✓✓✓✓	✓
Structure Protection-Indirect Application	✓✓✓✓	✓✓✓	✓✓	✓
Structure Protection-Direct Application		✓✓✓✓	✓✓✓	✓
Mop Up	✓✓	✓✓	✓✓✓✓	✓
Prescribed Burn Control	✓✓✓✓	✓✓✓	✓✓	✓
Burnout Operations	✓✓✓✓	✓✓✓	✓✓	✓

✓✓✓✓ = Superior Effectiveness

✓✓ = Good Effectiveness

✓✓✓ = Excellent Effectiveness

✓ = Baseline Effectiveness

PRODUCTS FOR BASE AND MOBILE OPERATIONS

BASE TYPE	PRODUCTS AVAILABLE	TYPICAL PRODUCTS USED
Fixed Tanker Base	LC95A, MVP-Fx	LC95A, MVP-Fx
MRB-H	259-Fx, WD881 (for fixed-tank), LC95A, MVP for buckets	259-Fx, WD881
MRB-AT	LC95A, MVP-Fx	LC95A, MVP-Fx
MRB-VLAT	LC95A, MVP-Fx	LC95A, MVP-Fx
MRB-SEAT	LC95A, MVP-Fx	LC95A
MRB-Ground	LC95A, LC95W, MVP-Fx, 259-Fx, WD881, INSUL-8	259-Fx, LC95A LC95W
MRB-Tanker	LC95A	LC95A

*LC95A includes both R and Fx product variants



PERIMETER SOLUTIONS' COMMITMENT TO SAFETY

Perimeter Solutions strives to design, develop, manufacture and market products in a manner that meets societal needs while posing no undue risk to human health or the environment, during all stages of the product's life cycle. In addition, Perimeter Solutions continuously works with customers to ensure that these principles are followed during the product's use and ultimate disposal.

These principles are of particular importance when dealing with wildland fire retardants which, during their normal use, come into contact with people, wildlife and the environment. Perimeter Solutions encourages the practice of good industrial hygiene when handling PHOS-CHEK fire retardant concentrates, and good common sense practices in their use as fire prevention and control tools.



WHAT IS IN PHOS-CHEK WILDLAND FIRE RETARDANTS?

Perimeter Solutions' PHOS-CHEK brand fire retardant concentrates, which are supplied for use on wildland fuels (vegetation), are offered as dry powders and liquid concentrates. These concentrates contain ammonium phosphates or ammonium polyphosphates which function as the active fire retarding component. In addition, PHOS-CHEK retardant concentrates contain small quantities (5–15%) of performance additives including one or more of the following: a gum thickener, a flow conditioner, a coloring agent, and/or corrosion inhibitor(s). The concentrate is mixed with water to form a 10–15% solution prior to use in fire prevention, prescribed burning or suppression.

HOW DO PHOS-CHEK FIRE RETARDANTS WORK?

Retardant solution is typically applied to vegetation in the form of a chemical fire break before the arrival of an approaching fire. This solution coats the fuel and, as the fire gets closer, and its contained water evaporates, the fire retardant component reacts with the cellulose in the woody material, grass, needles and other matter which normally provide fuel for the fire, changing the way it decomposes and rendering it nonflammable. The water in the retardant solution acts only as a carrier for the fire retardant.

As wildland fuel heats up, cellulosic material decomposes. Untreated, cellulose depolymerizes into flammable compounds. In the presence of PHOS-CHEK fire retardant, cellulose dehydrates into water vapor and nearly pure carbon. Energy in the form of heat from the advancing flame is consumed in the reaction between the retardant and the cellulose lowering the surrounding temperature and preventing further preheating of the fuels while the carbon, in the form of black char, is non flammable and insulates the fuel. When this occurs, the fuel starved fire combined with the lower surrounding temperature decreases the rate of spread and control is more easily achieved.

Any fire retardant not consumed in the fire will continue to be effective in preventing and controlling ignition and flame spread until removed from the fuel by heavy rain or wind. [generally 0.25" (6 mm) to 0.5" (13 mm)].

ARE PHOS-CHEK FIRE RETARDANTS HAZARDOUS?

No. PHOS-CHEK retardant concentrate and solutions are no more than moderately irritating to the eyes and minimally irritating to the skin. Proper protective equipment (PPE) should be worn. Please consult the SDS for detailed information.

WHAT HEALTH, SAFETY AND ENVIRONMENTAL TESTING HAS BEEN DONE ON PHOS-CHEK FIRE RETARDANTS?

Perimeter Solutions manufactures and sells products that are considered safe when used properly. Prior to offering any product for sale, Perimeter Solutions conducts a safety and environmental assessment. At this time, test data is generated to answer any questions raised during the assessment. The SDS is the primary means of communicating the results of that assessment, including a presentation of all known health, safety and environmental data.

In addition, the composition of all qualified PHOS-CHEK products is submitted to the USDA Forest Service prior to commercial use. The Forest Service reviews the composition and conducts extensive performance, health, safety and environmental testing using Agency protocols. Products must meet all of the requirements detailed in the Forest Service specification in order to be used for fire suppression.

ARE SAFETY DATA SHEETS (SDS) AVAILABLE FOR THE PHOS-CHEK PRODUCTS?

Yes. Safety Data Sheets are available on our website (www.phos-chek.com) or by calling +1 909-983-0772.

CAN PHOS-CHEK BE APPLIED AS A FERTILIZER?

The components in PHOS-CHEK are safe for land application when applied in the recommended manner as a fire retardant. Even though the products provide a source of nitrogen and phosphorus, their uncontrolled application for other than their intended purpose is not recommended.

IS PHOS-CHEK RESIDUE DANGEROUS TO ANIMALS?

There are no known adverse effects on domestic or farm animals which eat small amounts of foliage covered with PHOS-CHEK Fire Retardant. Reactions can vary, however, so a veterinarian should be contacted if an animal eats a significant amount of fire retardant coated vegetation.



All PHOS-CHEK products have been tested by Perimeter Solutions and the US government for possible acute toxicity effects on small terrestrial wildlife (birds, rodents, etc.). These studies indicate that PHOS-CHEK Fire Retardants exhibit a comparatively low order of acute toxicity.

PHOS-CHEK Fire Retardants have been tested for toxicity to fish and water dwelling invertebrates. The results, presented in the SDS, indicate a relatively low order of acute toxicity to these organisms. This indicates that runoff from the application of PHOS-CHEK is unlikely to pose a serious threat to aquatic life.

HOW ARE PHOS-CHEK FIRE RETARDANTS REMOVED?

Wildland retardants are completely water soluble and can be removed with little effort prior to drying. Once dry, the gum thickener can form a film that tends to hold the dried retardant rather tightly to whatever surface it is in contact with. This is desirable when it lands on wildland fuel, but not so desirable when trying to remove it from other areas. Retardant residues should be removed as soon as possible. Repeated wetting with copious amounts of normal hose pressure water and some light scrubbing with a soft bristle brush may be required. Additionally, use of a mild surfactant, such as dish soap may assist removal.

GROUND APPLIED

LONG-TERM RETARDANT IN GROUND APPLICATIONS

PHOS-CHEK Long-term Retardant is a valuable fire management tool for controlling and suppressing wildland fires. For over 50 years, PHOS-CHEK has been applied from the air by the world's largest fire management agencies. Now Fire Managers are getting great results by applying PHOS-CHEK from the ground. PHOS-CHEK ground applied products have the same superior performance, plus pinpoint, cost effective placement and the ability to apply retardant in all weather conditions, 24 hours a day.

PHOS-CHEK Long-term Retardant creates a fire break by making wildland fuels non-flammable. It works even when dry, so apply it once and it stays effective even after you've moved on. It can be applied by fire engine, water tender, or with Perimeter Solutions' custom Ground Applied equipment.

ADVANTAGES OF GROUND APPLICATION

- Uniform coverage ensures maximum effectiveness
- Can be applied hours, days, weeks and months in advance
- Application 24 hours per day, 7 days per week including night operations
- Can be applied when airtankers are not available due to weather conditions or areas of low accessibility
- Placement — pinpoint accuracy
- Mitigate business interruption including Public Safety Power Shutoffs (PSPS)

APPLICATIONS FOR GROUND APPLIED RETARDANT

- Pre-treatment of high risk fire areas
- Around critical infrastructure assets (communication towers, highway signage)
- Prescribed fire control
- Support for backburn operations
- Around and within communities, homes and businesses
- Protection for urban interface areas, campgrounds, rest areas and railway interface areas
- Protection for historical and national monuments and sensitive and endangered habitats
- Protection for fence posts, power poles, easements and rights-of-ways
- Extending roadway fire breaks



MIXING AND APPLICATION SERVICES

- Support for application by Agency Engines
- Perimeter Solutions' Application Systems through National and State agreements
- Hand lines, Ranch/Farm style ATV's with Poly Tanks, and Mark III Pump systems
- Backpack sprayers
- Perimeter Solutions tenders for pre-treatment with up to 4000 gallons of mixed solution.
- Mobile concentrate storage of 3000 gallons or larger for resupply
- Perimeter Solutions trained personnel including Qualified Mix Masters, Technical representatives and NWCG Fireline Qualified personnel for line operations

PRODUCTS

- PHOS-CHEK LC95W Uncolored LC for areas where retardant does not need to be visible
- PHOS-CHEK LC95A-Fx Fugitive Colored LC when firefighters need to see where the retardant has been applied. Color will fade after several weeks exposure to sunlight. LC95A-R permanent red colored retardant for applications where visibility is crucial.
- PHOS-CHEK 259-Fx Fugitive colored powder for ground operations in conjunction with portable helicopter operations



RECOMMENDED RETARDANT COVERAGE LEVELS

NFDRS FM	BEHAVIOR FM	COVERAGE LEVEL	FUEL DESCRIPTION
A, L, S	1	1	Annual & Perennial Western Grasses, Tundra
C	2	2	Conifer w/Grass
H, R	8	2	Shortneedle Closed Conifer, Spring Hardwood
E, P, U	9	2	Longneedle Conifer, Fall Hardwood
T	2	3	Sagebrush with Grass
N	3	3	Sawgrass
F	5	3	Intermediate Brush (Green)
K	11	3	Light Slash
G	10	4	Shortneedle Conifer (heavy, dead litter)
O	4	4	Southern Rough
F, Q	6	4	Intermediate Brush (cured; Alaska Black Spruce)
B, O	4	> 6	California Mixed Chaparral; High Pocosin
J	12	> 6	Medium and Heavy Slash
I	13	> 6	Medium and Heavy Slash

Adjust Coverage Level based on fire behavior, i.e., for smoldering fires decrease by 1.

Each fire chemical is a unique tool, best suited for specific application. To be successful, firefighters must know what each tool does, where to use it, and crucially how it works. Unfortunately, misinformation in the field often leads to confusion and misapplication, and can result in firefighter risk. The following will “clear up” the most common myths regarding fire chemicals.

THE BASICS

Long-term Retardants are “chemical retardants” that do not require water to be effective. They chemically alter the fuel to render it non-combustible. Retardants are among the most effective tools for building fire line and creating fire breaks in advance of approaching fire.

Class A Foam and Gels are “fire suppressants” that function by making water more effective. Suppressants (or water enhancers, as they are called) rely on the presence of water to be effective. Once the water is gone, there is NO effectiveness. Suppressants are effective for direct attack and structure protection.



MYTHS VERSUS REALITIES

- Terms like “retardant foam” “and retardant gel” are MISLEADING. Long-term retardant alters fuel decomposition making it non-flammable. Retardants do not need water to be effective and are effective until physically removed. Water, Foam and Gel are SUPPRESSANTS, not retardants. The latter enhance water, making the water more effective. Once the water is gone, there is NO EFFECTIVENESS.
- Long-term Retardants do NOT need to be re-wetted once applied (and shouldn't be). Long-term retardant is effective wet and dry. Re-wetting a retardant line is unnecessary, wastes resources, and could physically wash away the retardant, eliminating effectiveness.
- Gel effectiveness may last from a few minutes to a few hours. Don't count on 8 hours or more of protection. Gel longevity depends on temperature, wind, RH, exposure to sunlight, coverage and fuel conditions.

Coverage level 4 (CL4) provides less than 1/16 inch of gel. Experience in California with aurally applied gel in indirect attack, under actual fire conditions indicates gel effectiveness of 20-30 minutes.

Gel should be targeted for direct suppression or structure protection.



Magnesium exposed to an approved fixed-tank helicopter product.



Magnesium exposed to a non-approved product.

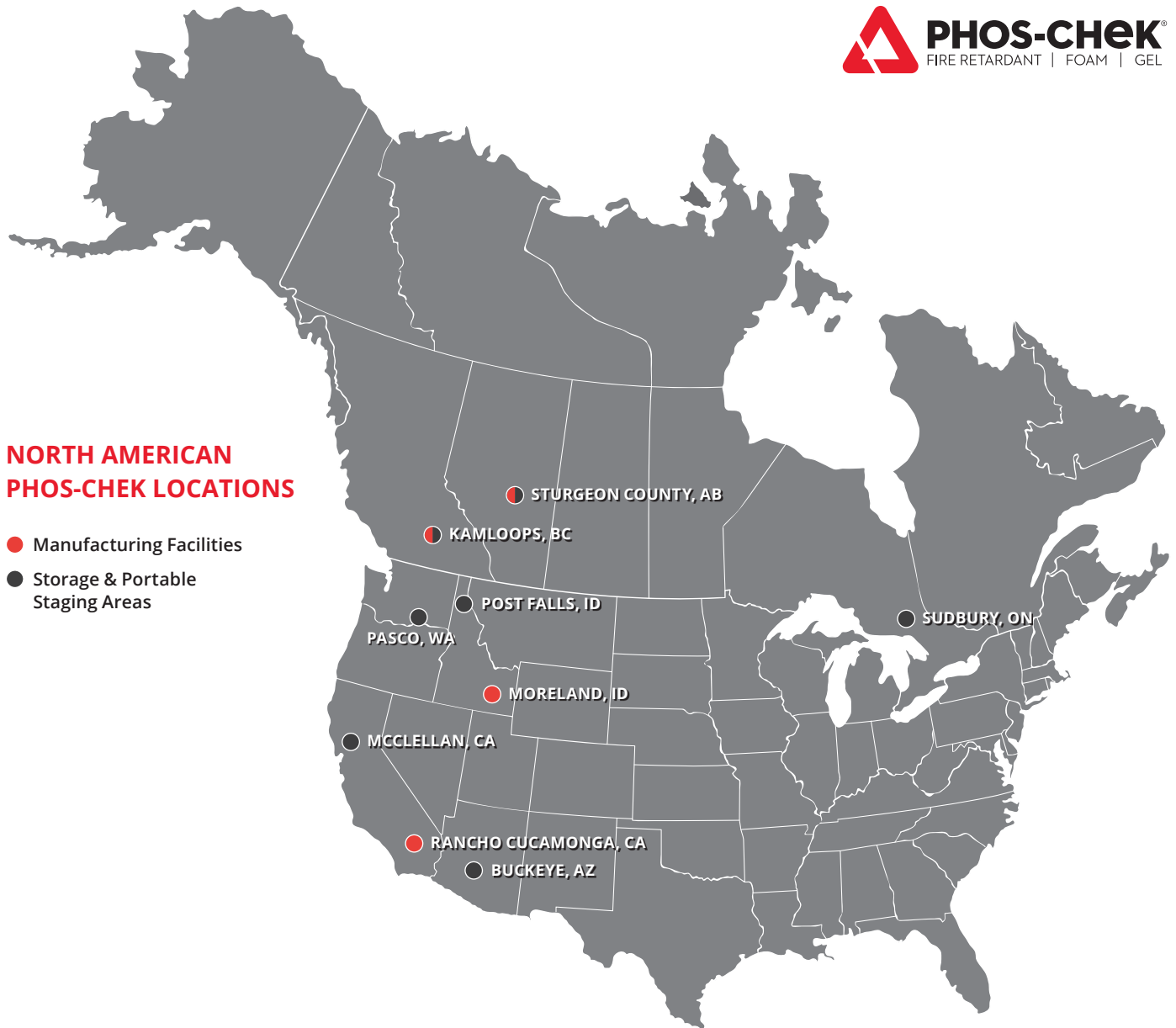
- **Gel cannot be effectively re-hydrated in the field.** Technically, under controlled conditions, gel may be re-hydrated using a gentle water mist. Aerially applied gel, contains very little gel polymer per square foot. Aerial re-hydration would require an aircraft to hit the same spot as the original application and water to drop in a mist to prevent washing away the gel. It is not realistic and should not be attempted.
- **Gel is NOT half the price of retardant.** Gel cost vary significantly depending on water quality and coverage level. A gallon of gel can cost from 50% to 120% of the cost of a gallon of retardant. In addition, retardant coverage levels are well understood. How much gel is enough?
- **Not all products are approved for use in fixed tank helicopters.** Only a few products meet the USDA Forest Service requirements for use in fixed tank helicopters. Products that are not qualified for this use could do **severe damage** to the helicopter. Don't believe ... ask for proof.
- **Not all Class A Foams perform the same.** USDA Forest Service Testing and QPL Listings ensure that a Class A foam is safe and non-corrosive. It says nothing about suppression effectiveness. USFS Qualified foams vary widely in foam generation, foam stability, and the concentration needed to generate foam. Also, different foams perform differently depending on delivery system, water temperature and salinity.

HANDLING PRECAUTIONS

- For detailed safety information, please refer to the SDS.

NORTH AMERICAN PHOS-CHEK LOCATIONS

- Manufacturing Facilities
- Storage & Portable Staging Areas



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