

PHOS-CHEK®

Fire Retardants, Class A Foam & Gels

Fire Retardant in Prescribed Burning: Application Guide

by



ICL Performance
Products LP

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Quality Products, Exceptional Response.

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Objectives of Guide

A. Explain to the Project Leader / Prescribed Burn Manager the use of Phos-Chek retardant in prescribed burning applications.

B. Familiarize the Project Leader/ Prescribed Burn Manager with the use of some equipment most commonly available for mixing and applying Phos-Chek retardant in prescribed burning applications

PHOS-CHEK

G-75 Fire Retardants are qualified for use with ground equipment and helicopter buckets. These PHOS-CHEK brand retardants are packaged, shipped and handled as dry powders, but are easily and quickly mixed with water to prepare them for use. PHOS-CHEK G-75 fire retardants are fully qualified by the United States Forest Service under specification 5100-304a.

PHOS-CHEK retardants suitable for ground and helicopter bucket application are available in two formulations:

G-75F - Produces a fugitive red-colored and slightly thickened solution (*The color returns to earth-tones after application*)

G-75W - Uncolored and slightly thickened solution.

PHOS-CHEK retardants are packaged in 50-pound (22.7 Kilograms) buckets, which are particularly suitable for prescribed burning applications.

How PHOS-CHEK Retardants Work

The active fire retardant in PHOS-CHEK G-75 is a mixture of ammonium phosphate and ammonium sulfate. These fire retardants change the flammability of plants and other fuels by altering their rate of decomposition when exposed to fire. Without PHOS-CHEK Retardants, a fire spread by preheating fuels as it advances, releasing combustible gases which then ignite. With PHOS-CHEK Retardants, the heating changes the fuel into carbon and releases water. The water boils off, absorbing heat and cooling the fire. The remaining graphite-like carbon is almost impossible to burn at ambient conditions, but rather, insulates subsurface fuels, depriving the fire of additional fuel. PHOS-CHEK Fire Retardants do not depend on contained water for their effectiveness. They retain their retardant properties until they are washed, blown or rubbed off the fuel to which they have been applied.

PHOS-CHEK Retardants are formulated for easy safe mixing, storage and application. They contain corrosion inhibitors to minimize damage to aluminum, brass and steel. Small, carefully controlled amounts of a gum thickener are added to PHOS-CHEK retardant to give the right consistency for clinging to fuels. The use of fine powder allows high-mixing and easy handling in large and small application.

Uses of PHOS-CHEK Retardants in Prescribed Burning

In general, PHOS-CHEK retardants can be used in prescribed burns to reduce the flammability of fuels, either in association with fuel removal, clearing mineral soil lines or as a substitute for fuel removal. PHOS-CHEK retardants serve several purposes in prescribed burning, for example:

Reinforcing conventional Control Lines.

Application can increase the effectiveness of roads, mineral soil lines and other man-made or natural features, which may be utilized for containment of a prescribed burn.

Establishing a control line

PHOS-CHEK retardants provide a line from which to burn. The burn buffer and retardant line, together, provide a control line for a prescribed burn, without the necessity of clearing a line to mineral soil.

Limiting spotting

Application outside the control line, at a lower application rate, can minimize the possibility of spot fires.

Controlling a fire within the burn

Application at low concentrations inside the burn can help to reduce intensity and flame height. Application around fire sensitive trees can help protect them from damage in understory burns. Application along fences, around power and telephone poles and structures can help protect them from burning or scorching.

Using PHOS-CHEK fire retardants in these applications is discussed in detail on page 6.

Retardant mixing barrel ready for use*

*Available at phos-chek.com

This Application Guide is another tool available to assist you in formulating your prescribed burn plan.

Mixing PHOS-CHEK Retardants

In general, mixing PHOS-CHEK retardants is a simple process, which can be done in amounts suitable for prescribed burns, utilizing readily available fire suppression equipment. Dry powdered PHOS-CHEK retardant in buckets can be easily moved and loaded into a mixer by one person without special equipment. The powder is highly soluble and can be mixed in bucket amounts, with running water providing the necessary agitation.

► **Table 1** Mixing Ratios for PHOS-CHEK G-75 Retardant

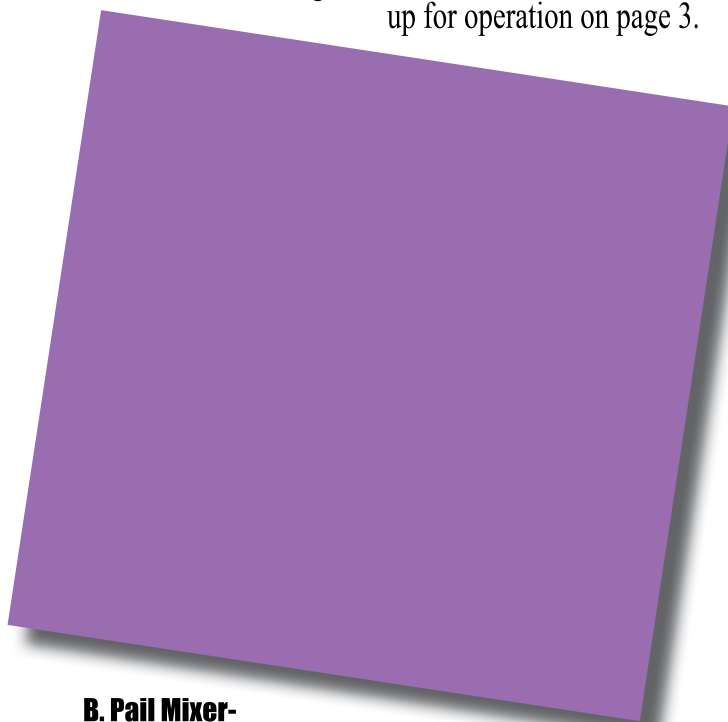
Tank Capacity		Volume of Water ⁽¹⁾		Weight of Retardant ⁽²⁾		Number of Pails	Volume of Solution	
Gals.	Liter	Gals.	Liter	Lbs.	Kg.		Gals.	Liter
50	189	44	167	50	23	1	47	178
100	378	88	333	100	45	2	94	356
125	473	110	416	125	57	2.5	117	443
150	568	132	500	150	68	3	141	534
175	662	154	583	175	80	4	164	621
200	757	176	666	200	91	4.5	188	712
250	946	220	833	250	114	5	235	889
300	1136	264	999	300	136	6	282	1067
400	1514	352	1332	400	182	8	375	1419
500	1893	440	1665	500	227	10	469	1775
750	2839	660	2498	750	340	15	704	2665
1000	3785	880	3331	1000	454	20	939	3554

(1) Quantity of water was selected for nominal 88 percent of tank capacity to allow for 7 percent volume increase plus 5 percent splash room.

(2) Amount of retardant is calculated at 1.12 lbs/gal or 0.134 kilos/liter of water then rounded to the nearest one-half (½) pail for ease of field mixing.

Mixing Equipment

A. Mixing Barrel - The mixing barrel is a very simple way to mix PHOS-CHEK retardant in small quantities for ground application. The mixing barrel is a collapsible 20-gallon container equipped with an ejector, nozzle and valve which mix retardant and water into a ground engine or other storage tank. The barrel is shown set up for operation on page 3.



B. Pail Mixer-

The pail mixer will readily combine water with powder retardant directly from the plastic 50-pound (22.7-kilograms) shipping pails. This is a convenient method for mixing small amounts of retardant. The unit can be easily carried along with a supply of retardant on most vehicles. The pail mixer can be used to supply

retardant for delivery to ground engines, helicopters or other applications methods.

C. Agitation Tank / Spray Unit - PHOS-CHEK Retardants can be mixed with water using equipment frequently available on ranches and farms. As long as the unit has the capability to agitate or recirculate the dry powder with water, it will work very well in mixing and applying retardant solution.

Concentration of PHOS-CHEK Retardants

Table 1 shows the amount of PHOS-CHEK fire retardant to mix with various amounts of water and tank sized to make the standard concentration of 1.12 pounds per gallon (0.134 kilograms per liter) of water.

Storage

PHOS-CHEK retardant can be stored indefinitely. However, the powder can become hard and difficult to dissolve when allowed to become wet and then dry. Any partially used container should be closed when not in use.

You can store mixed PHOS-CHEK retardant solution and need not discard it if you are unable to use it immediately. Storage of retardant solution poses no problems other than those associated with routine maintenance of mixing and application equipment. The retardant solution may settle out and should be recirculated prior to reusing.

Applying PHOS-CHEK Retardants

PHOS-CHEK retardants can be applied with readily available equipment, most or all of which you may already have on hand.

Equipment

Nozzles. - Since reach is not important in preparing for a prescribed burn, and a heavy stream of retardant will

only produce wasteful runoff, nozzles should be used that are capable of producing a spray.

Since PHOS-CHEK G-75 retardant is slightly thickened, it is desirable to use a special fan tip, which can be attached directly to a hose nozzle (such as the twin tip nozzle*) or, alternately, to a mop-up wand on the nozzle. If one experiences difficulty with flow, double check mix ratio. If mix ratio is correct, increase nozzle tip size. Nozzles require no special maintenance when used with PHOS-CHEK retardants. Simply flush the nozzle with clear water after each use.

Other Equipment. - In general, PHOS-CHEK retardants can be used with all commonly available hoses, valves, pumps and tanks.

Storing solution of PHOS-CHEK retardants in a ground engine for an extended period of time is not recommended.

Corrosion inhibitors in PHOS-CHEK retardants help prevent damage to all metals. PHOS-CHEK retardants minimize damage to other materials; nevertheless, equipment should be flushed with clear water after each use. Good housekeeping is recommended.

Backpack Pumps. - Backpack pumps are useful in applying PHOS-CHEK retardants. In particular, backpack pumps can be used to protect fire-sensitive trees in understory burns. Detail of this application are discussed on page 6.

Since they are slightly thickened, PHOS-



▲ **Line Widths** are determined by wind speed, direction and fuel height, with the head of the fire burning into the widest line and the flanks protected by narrower lines

CHEK G-75 retardants should be sprayed with straight-stream tip, perhaps using the finger to produce a fan-shaped pattern on the vegetation. If you use backpack pumps to apply PHOS-CHEK G-75F or G75W retardants, stainless steel, aluminum, fiberglass and coated fabric tanks are all suitable. You should flush all backpack pumps with clear water after each use.

Application Rates and Techniques

The amount of PHOS-CHEK retardant solution, and the application parameters, should be selected for your burn on the basis of fuel, weather and terrain. Application rates and methods will vary according to such factors as:

- ▶ Fuel type, loading and moisture content
- ▶ Wind velocity and humidity
- ▶ Slope of area to be burned
- ▶ Purpose of retardant use

PHOS-CHEK retardants can be used for reinforcing a conventional control line, preparing a control line with out clearing to mineral soil, preventing spotting, controlling the rate and intensity of the burn and protecting fire-sensitive trees, structures and other objects inside the burn perimeter. In general, the application instructions that follow apply to preparation of a control line, but suggestions are included for other applications.

Most or all of the fuel that will burn rapidly should be coated with PHOS-CHEK retardant. This application will stop the fire if the retardant

▼ **Table 2** Suggested Application Rates for Control with PHOS-CHEK G-75*

Fuel Type	Typical Fuel Loading		Fuel Height		Retardant Line Width		Retardant Required	
	Tons / Acre ⁽¹⁾	Metric tons / Hectare ⁽²⁾	Feet	Meters	Feet	Meters	Gallons / 100 sq. ft.	Liters / sq. m.
Shortgrass	0.75	2.0	1.0	0.3	2.0	0.7	0.75	0.3
Timber Litter	5.00	13.6	0.2	0.1	2.0	0.7	1.50	0.6
Brush	3.50	9.5	2.0	0.7	4.0	1.3	1.75	0.7
Tall Grass	3.00	8.2	2.5	0.8	5.0	1.7	2.50	0.9
Timber, Grass and Understory	4.00	10.9	1.5	0.5	3.0	1.0	2.50	0.9
Light Logging Slash	7.60	20.7	1.0	0.3	2.0	0.7	2.50	0.9
Hardwood Litter	3.5	9.5	0.2	0.1	2.0	0.7	2.75	1.0
Timber Litter and Understory	12.00	32.7	1.0	0.3	2.0	0.7	4.75	1.8
Medium Logging Slash	34.50	94.0	2.3	0.8	4.5	1.5	7.25	2.7
Chaparral	16.00	43.6	6.0	2.0	12.0	4.0	9.5	3.6
Heavy Logging Slash	58.00	158.00	3.0	1.0	6.0	2.0	12.50	4.7

(1) Short ton equals to 2000 pounds
 (2) Metric ton equals to 2205 pounds

*Available at phoschek.com

line is wide enough to prevent heat radiation or spotting across it. Line widths are determined by wind speed, direction and fuel height, with the head of the fire burning into the widest part of the line and the flanks protected by narrower lines.

Avoid leaving untreated fuel which can allow the fire to escape. Make sure to apply PHOS-CHEK retardants to sensitive areas such as the lee side of stumps and downed logs, large slash piles and areas of thick duff.

While PHOS-CHEK retardants can be applied in advance of the burn, 1/8 to 1/4 inch of rain (or repeated heavy fog) can wash it off. Be careful, therefore, not to apply PHOS-CHEK retardants when they are likely to be lost before the burn.

Application rates, in gallons of retardant per 100 square feet, are suggested in Table 2. The fuel loading shown in Table 2 is typical. Heavier loading will require you to increase the suggested application rates. The table assumes that the perimeter of a burn is fired out before the center of the burn. The table is based on burning conditions favorable to containment. Burning conditions less favorable will require you to increase the suggested application rates or line widths.

Reinforcing an Existing Perimeter Control Line. - The retardant line does not have to be as wide when you are using it to reinforce a road or other man-made or natural control line. In this case, the total line width should equal or exceed the line widths suggested in Table 2.

Controlling Spotting. - PHOS-CHEK fire retardant solution can be applied to areas subject to spotting. Application rates to prevent spotting can be lower than those showing in Table 2. You will have to determine the application rates experimentally for controlling spotting under your specific prescription. A suggested starting rate is one-third (1/3) to one-half (1/2) the rate shown in Table 2.

The width of the areas to be protected against spotting depends upon:

- ▶ Fuel type, density and moisture
- ▶ Wind conditions
- ▶ Slope and aspect of area in which spotting could occur

The project leader / prescribed burn manager should determine the areas in which spotting may be a problem and PHOS-CHEK retardant should be applied initially to those areas.



▲ **Protect natural and man-made objects** inside the burn by applying retardant solution to the fuel immediately around them.



▲ **Areas subject to spotting** can be controlled by applying PHOS-CHEK fire retardant.

It may be possible to apply heavier retardant solution closer to the burn, where the risk of spotting is greatest, and less retardant away from the fire, where brands are fewer and heating by radiation much lower.

Controlling Burn Rate and Intensity. - It is desirable to keep the burn from moving too fast and getting too hot. This will minimize the chances of escape and prevent soil sterilization and damage to trees and other objects inside the burn. You should pay particular attention to dense concentrations of hot-burning fuels and to terrain features such as draws which, by creating drafts, may also produce hot spots.

Applications of retardant to these areas should be at a lower rate than for comparable fuel types shown in Table 2. Again, you will have to determine experimentally the application rates for your situation. A suggested starting rate is one-fourth (1/4) the rate shown in Table 2.

Protecting Objects Inside the Burn. - Certain species such as white fir and hemlock, are easily damaged by fire. Retardant can also be used to protect natural features, as well as man-made objects such as power and telephone poles, fences and structures.

Natural and man-made objects can be protected inside the burn by applying retardant solution to the fuel immediately around them. You should protect outward from the base of the object being protected a distance of approximately 2 times the height of the fuel you are burning.

Adjusting to Local Conditions. - Regardless of the use you make of PHOS-CHEK fire retardants in prescribed burns, you should adjust the application rate and area to meet local fuel, water and topography conditions.

Estimating Your Application Rate

Applying PHOS-CHEK retardants effectively requires controlling the application rate. Methods of controlling the application rate depend on whether the terrain and access conditions require building line by application of retardant from a hand-held nozzle or if they will allow direct application from a fixed nozzle mounted on a moving engine. PHOS-CHEK retardant flows through a nozzle at about the same rate as water, whether application is by hand or from an engine.

Hand Applications. - First, estimate the required rate of application in gallons per 100 square feet (liters per square meter) of line width and length for the particular area to be burned. Table 2 is useful for this purpose. Then determine the flow rates for the nozzle and pump pressure to be used. Convert the amount of retardant to be applied to each 100 square feet (square meter) into application times in minutes. This time can then serve as a rough guide to help avoid too light or too heavy coverage. Then, convert tank capacity into line-building capability for the selected application rate.

The most difficult problem in hand application is applying the retardant evenly. The calculated time is only a rough guide. It may be difficult to apply retardant evenly if you have not had experience applying a set amount of chemical solution to a fixed area. You may want to set up a 100 square-foot training area to practice applying a measured amount of water, simulating the application of retardant.

Also, you may want to mark your progress with flags, stakes or other markers to assist identifying your test area.

Vehicle Application. - After application rate and line width have been determined, convert the information into terms of pump output and vehicle speed. Pump output and pressure can be corrected to vehicle speed by using the vehicle speedometer or tachometer, but should be kept under 10 mph. The tachometer setting to use for less than 10 miles per hour will have to be determined on a measured course.

Precautions in Using PHOS-CHEK Retardants

Safety and environmental considerations require that a few simple precautions be used when mixing and applying retardants.

Safety

Dust can be irritating to the respiratory system and to the eyes. Goggles and dust mask should be worn by the mixing crew when working with retardant powder.

When hands and arms are in contact with mixed retardants for long periods, they may become dry and chapped. A hand lotion should be available to minimize chapping. If a person's clothes are soaked with mixed retardant, they

should be rinsed thoroughly or washed before they are worn again.

Handle retardant powder and solution in accordance with good industrial hygiene and safety practices. These practices include:

EYE PROTECTION: Wear safety goggles to prevent eye contact.

SKIN PROTECTION: Wear protective gloves to minimize skin contact.

RESPIRATORY PROTECTION: Wear dust mask if dusty conditions exist.

IF IN EYES: Flush with plenty of water.

Environmental Considerations

Fish and Aquatic Organisms. - All retardants contain ammonia. Materials containing ammonia are potentially toxic to marine life.

The fire retardant salts in PHOS-CHEK retardants are plant nutrients and therefore, can cause excessive growth of aquatic plants.

The following guidelines should be followed to help minimize the entry of retardant into bodies of water.

1. Locate mixing and loading points where natural water contact is minimal.
2. Exercise care in prevention of spills, especially near rivers, ponds and lakes. Be especially careful when using retardants near fish hatcheries.
3. Avoid direct application of PHOS-CHEK fire retardant into, or on the banks of rivers, streams, ponds and lakes.

Plants. - If applied at high concentrations, all plant nutrients (including fire retardant salts) will cause leaf burn and drop. This is a temporary effect as new growth will soon reappear.

Domestic Water Supplies. - When retardants are used near water supplies, the same precautions should be exercised as described for fish and aquatic organisms. Leave at least a 50-foot buffer zone from the high water line. Plants and soil normally absorb a majority of chemicals before they wash or leach to the body of water.



▲ **Vehicle speeds** should be less than 10 miles per hour.



▲ **Water supplies** can be protected by leaving at least a 50 foot buffer zone from the high water line.



PHOS-CHEK®

Fire Retardant, Class A Foam & Gel



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