

PHOS-CHEK[®]

FOAM CONCENTRATE BY Astaris

**Foam: Making
Water a Better
Firefighter**



Since 1963, Astaris LLC (formerly the chemical business of Monsanto Company) has continued to develop and supply products, services and equipment which increase the firefighting efficiency of water. Phos-Chek® brand fire retardants and foam suppressants are widely used by government agencies around the world who are responsible for wildland fire management.

Because of its proven value, Astaris has expanded its commitment to the fire service beyond traditional wildland fire management and is offering Phos-Chek foam concentrate to municipal, rural, industrial and military firefighters.

Water: Not as efficient as it can be

Water, alone, can be inefficient for fighting fires depending on fuel type, fuel loading and fire conditions. Water, as it is converted into steam, has tremendous capacity to absorb and carry away heat. Unfortunately, water's strong surface tension causes it to bead up and roll off most fuels and away from heat too fast to be able to absorb its full heat capacity. This effect reportedly makes water only 5% to 10% efficient, thus requiring larger volumes to extinguish a given fire.

Phos-Chek Class A Foam: Making water work better

Phos-Chek foam concentrate is specifically formulated to make water more efficient. A unique combination of surfactants significantly reduces water's surface tension. As a result, water, containing low concentrations (0.1% to 1.0%) of Phos-Chek foam concentrate, spreads out over the surface and penetrates deep into porous Class A fuels. Getting water deep into the fuel helps put the fire out quicker and protects areas around the fire.

Foam's Real Benefits:

Surrounds fuel with a thick layer of water Phos-Chek foam's white blanket coats and surrounds fuel with a thick layer of water, where water alone simply beads up and rolls off. With foam, more water is now available, for a significantly longer period of time, to let water absorb its full heat capacity making water more efficient. A blanket of Phos-Chek foam is especially valuable to reduce mop-up and overhaul time, improve exposure protection and combat wildland fires. Reported to be at least three times more effective at fire suppression than water, foam is valuable in fighting fires where water supplies are limited.

Creates a vapor barrier between the fuel and the fire Phos-Chek foam's white blanket reflects oncoming radiant heat, insulates fuel by dispersing heat laterally, continuously releases water from the bubble structure, helps smother the fuel and creates a vapor barrier between the fuel and the fire. The foam blanket gives fuels like wood, hay, fabrics and insulation more time to absorb more water for increased heat resistance.

Allows firefighters to see application areas With foam, firefighters can easily see where water has been applied, which is especially valuable in wildland fire management, mop-up and overhaul, and in low light environments such as coal mining operations and attic fires.

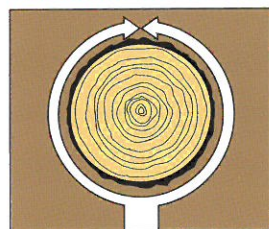
Knocks down fire faster than water alone Two sets of experimental burns conducted in identical motel rooms demonstrated that Phos-Chek foam knocked down the fire 29% to 52% faster than water alone, and took 47% to 77% less water to extinguish and overhaul the fire. Faster fire knock-down means less firefighter stress, improved safety and reduced water damage.

Easily disperses in water Phos-Chek foam concentrate easily disperses in cold water, hard water and sea water - and still makes high quality foam. This feature is especially valuable to wildland, rural, and to some industry firefighters where they may have to draft water from remote supplies such as ponds, lakes, bays or estuaries.

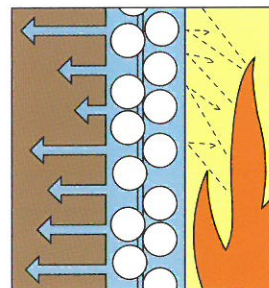


▲ Foam knocked down fire faster than water alone in experimental burns. Identical rooms in a one-story motel were instrumented to measure heat history. Rooms were allowed to burn about 60 seconds beyond flashover before extinguishing. The results from four burns, when compared to water alone, showed Phos-Chek foam cooled the rooms 36% to 46% faster, knocked down fire 29% to 52% faster, and required 47% to 77% less water.

▼ Phos-Chek surrounds fuel with a thick layer of water.



▼ The foam blanket offers numerous benefits. Foam's clinging nature effectively puts a thick layer of water on fuels, even on vertical surfaces. The more water available, the more heat can be removed from the fire. Phos-Chek foam reduces water's surface tension, allowing it to penetrate deep into the fuel. The foam blanket helps reflect heat and insulates fuel for enhanced exposure protection.



Fuel Phos-Chek foam:
Water ○ Air

Definitions— Class A Foam:

A foam specially designed for use on Class A fuels. The National Fire Protection Agency (NFPA) defines Class A fires as fires in ordinary combustible materials, such as wood, cloth, paper, rubber and many plastics. Class A foam terminology is also used to differentiate these foam concentrates from those foams such as AFFF and fluoroproteins which are specifically designed for Class B fires in flammable or combustible liquids and in gases or greases.

Concentrate: The foaming agent that is added to water, i.e. Phos-Chek foam concentrate.

Solution: The mixture of water and concentrate at the desired mix ratio. A 0.5% solution, for example, means adding only 1 gallon of Phos-Chek foam concentrate to 200 gallons of water.

Foam: The product formed when solution is mixed with air. Phos-Chek foam can be tailor-made to match your firefighting problem — ranging in character from frothy solutions to lathers as stiff as shaving cream.

Passes health and safety requirements Phos-Chek foam concentrate and 1% solutions meet or exceed U. S. government standards and requirements by similar agencies around the world for health and safety and for corrosion protection against aluminum, brass and steel. In addition, test data show that Phos-Chek foam concentrate and solutions should readily biodegrade in the environment and meet all technical requirements of the National Fire Protection Association (NFPA) #1150.

Making Foam is Easy

Making foam requires two decisions: how best to mix Phos-Chek foam concentrate with water and how to make foam from the resulting solution. Answers to these two questions depend on your equipment and firefighting challenges.

How to Add Phos-Chek Concentrate to Water:

Batch mixing means adding foam concentrate to your water supply tank by hand or by an automatic injection system. Batch mixing is ideal for wildland operations which use fixed wing airplanes or helicopters equipped with fixed tanks, or helicopters equipped with slung buckets.

Eductors are the most common form of proportioning equipment. They are used "in-line" in the hose lay or "hard piped" behind the pump panel for dedicated foam discharge. Eductors continually meter small amounts of concentrate into the hose line.

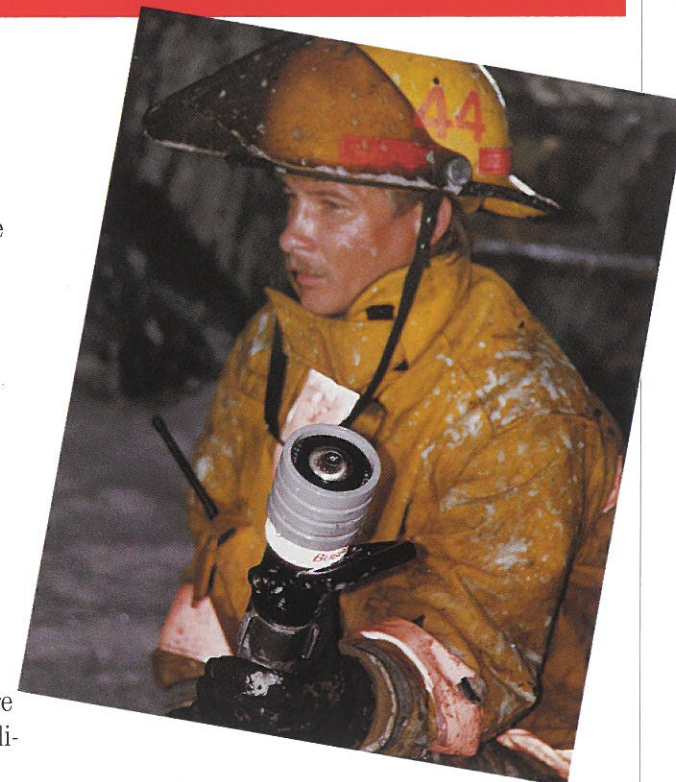
Around-the-pump metering systems are an inexpensive, dependable alternative for proportioning foam concentrate. These devices are connected across the pump and use a siphon injector to move concentrate into the water supply. A metering device in the pick-up tube is used to control the amount of concentrate.

Discharge side proportioning systems use a small pump to move Phos-Chek concentrate from a storage tank into the hose line on the discharge side of the pump. No concentrate ever enters the engine water tank or pump. Pressure losses are minimal. Since these systems, and the around-the-pump metering systems, are based on water flow rate, their performance is unaffected by nozzle selection, changes in length of hose lays, changes in engine pump pressure, and relative elevation of nozzle with respect to proportioner.

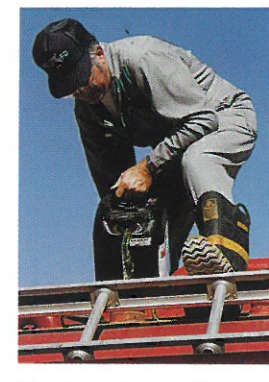
How to Make Foam:

A real advantage of foam is that its character can be altered to match the firefighting needs of the situation. For example, wet, runny foam with a minimal foam blanket may be best used for fires in hay. On the other hand, foam as stiff as lather may be best used for vertical exposure and structure protection. The type of foam generated greatly depends on nozzle selection.

Standard nozzles have enough aeration to generate a frothy, wet foam. This foam will coat and surround fuels with a layer of water, increase fire knock down, and reduce mop-up and overhaul effort. Higher expansion ratios will be achieved by using fog pattern settings. Air-aspirated nozzles and foam tubes produce even higher expansion ratios and result in excellent quality foam. Foam tubes have holes at the base which draw in air. Foam solution and air travel up the tube and expanding foam exits the nozzle. Air-aspirated nozzles use a special tooth pattern to draw in air at the nozzle tip where air turbulence results in a foam with a higher expansion ratio.



▲ Proper nozzle selection will significantly enhance the versatility of foam. Air-aspirated nozzles can be used both for interior structure attacks as well as outdoors for wildland fire management.



▲ Batch mixing Phos-Chek foam concentrate into your tank is a quick and inexpensive method of creating a foam solution.

Compressed Air Foam System (CAFS) is a complete system consisting of a foam concentrate proportioner, water pump, and air compressor.

Compressed air is injected into the hose line just past the point where foam concentrate is added — both are injected on the discharge side of the pump. Often, one cubic foot of air per minute (1CFM) is mixed with each gallon per minute (GPM) of water flow.

CAFS's make foam in the hose line rather than at the nozzle. Therefore, only ball valves or smooth bore tips are required. Compared to standard engines, CAFS's throw foam farther, have higher expansion ratios, require less foam concentrate and result in much lighter hose lines.

This combination of benefits may be valuable to wildland firefighters for structure protection in advance of wildland fires, and industrial, mining and military applications where reach is critical. The increased reach and fire knockdown power of Phos-Chek foam may make CAFS a valuable tool for municipal firefighters for fires in high-rise structures and warehouses.

Several nozzle attachments are available which further increase the expansion ratio. These devices use various screen designs to enhance mixing of the foam solution and air. Some reach is sacrificed due to the screen restricting flow. Expansion ratios can also be affected by nozzle pressure, degree of water hardness and the amount of foam concentrate used.

Phos-Chek Foam: Versatile and effective for many applications

Once you understand how best to create foam solution and generate foam, you generally can do a faster, safer, more efficient job in many firefighting situations.

Wildland Fire Management

Wildland fires are a threat in many areas of the world. Effectively controlling and containing these fires is essential to the preservation of national parks, forests and private property. Phos-Chek foam gives wildland firefighters a cost effective tool to increase their firefighting effectiveness.

Air applications: Phos-Chek foam has been proven to be a valuable tool to suppress wildland fires when applied from fixed wing airplanes and helicopters equipped with fixed tanks or from helicopters equipped with slung buckets. Phos-Chek concentrate is metered into and easily disperses in the water tank. Foam is generated by air turbulence when the solution is dropped. By varying the concentration, foams of different character can be generated. For example, lower concentrations (0.1% to 0.3%) result in wetter foams that better penetrate tree canopies and reach ground fuels. Higher concentrations (0.6% to 0.8%) result in drier foams that hang better in tree canopies or cling to the tops of grasses and brushes. Field reports suggest foam at least **DOUBLES** the firefighting productivity of these expensive aircraft.

Ground applications: Phos-Chek foam can be applied from standard fire engines and rapid attack brush trucks to combat a variety of wildland fire problems. Since foam stretches water's firefighting power, it is especially



▲ **Ground application** of foam significantly saves time and conserves resources - both of which are critical in mop-up operations. Foam will stretch your water supply by several times.



▲ **Fixed wing airplanes and helicopters** have become cost effective weapons in combatting wildland-type fires when they use foam. Dropping water which contains Phos-Chek foam concentrate onto these fires has been reported to double the effectiveness of these firefighting aircraft.

valuable where water availability is critically short. Firefighters, for example, can put a few ounces of Phos-Chek foam concentrate in their standard 5-gallon backpack and have several times the firefighting power of plain water. Foam has been shown to reduce the amount of resources and time necessary for mop-up. This benefit saves money and improves firefighter safety.

Foam can be used from the ground to reinforce a mineral soil fire line or natural fire barrier. Wildland firefighters can use foam to lay a wet line from which to back fire. Foam can be used to penetrate and stop fire in litter, sawdust piles, punkie logs or similar fuels. Ground vehicles equipped with Compressed Air Foam Systems have proven valuable to some wildland firefighters for protecting structures in advance of wildland fires.

Private Forestry

Phos-Chek foam is ideal for protecting the private forest industry from many fire hazards. Phos-Chek foam's penetrating power, combined with the coating and clinging action of the foam blanket, are especially valuable properties for fighting fires in sawdust piles, in wood chip piles and in log and lumber storage areas. Foam-based fire protection systems are invaluable to logging companies, sawmills, plywood, particle board, shake and shingle manufacturers, pulp-chip conversion facilities, and post and pole processors. Phos-Chek foam is considerably more effective than water alone for fighting fires in downstream industries such as pulp and paper plants, cardboard manufacturers, carton mills, box shops and paper recycling plants.

Prescribed Burning

The intentional burning of specified plots of land has many benefits. After harvest, fields which grew cane, rice, wheat, oats and straw, for example, are often burned to clear stubble and debris and for pest control. Grass seed farms routinely use this technique. Logging slash often is burned intentionally to clear land for reforestation. In order to reduce fire hazards, areas of extensive weed growth are reduced by the combination of herbicides and prescribed burning. This "brown and burn" practice can also be effective in clearing vegetative overgrowth from irrigation canals and drainage ditches.

Phos-Chek foam is an especially cost effective tool to help manage prescribed burns and reduce smoke generation. Foam's ability to cling and coat grasses, brush, and trees with thick layers of water is useful to build wet lines from which to start a fire; to reinforce control lines; to protect valuable trees bordering the burn site; to protect structures, fences and other resources within the burn; to protect seed trees within the burn; to reduce flame height and rate of spread as fire approaches control lines; to help prevent and control spot fires outside the burn. As in wildland fires, Phos-Chek foam can significantly reduce mop-up time and resources, thus saving money.



▲ **Foam penetrates deep-seated fires** in brush, timber, sawdust piles and landfills. Phos-Chek foam's blanket coats brush and grass with thick layers of water and causes water to cling to these fuels for extended periods of time. Both aspects are valuable for fighting and controlling fires associated with the timber industry, its related downstream industries, and prescribed burning operations.

▼ **Foam can double the effectiveness of helicopters.** More water can be applied faster than with hand-lines, especially in remote, rugged terrain. Longer and more effective fire lines can be built using foam instead of plain water. Foam's visibility allows pilots to see where water has been applied and gauge its coverage.



Wildland/Urban Interface

As families move further out of the city and into forested areas, special firefighting problems are created. Municipal and sometimes rural fire departments are not traditionally equipped to protect growing population centers in such remote areas from devastating wildland fires. On the other hand, wildland firefighters have not been traditionally equipped or trained for structure attack once fires encroach into these populated areas.

Phos-Chek foam, however, is a single tool available to all types of firefighters, that can significantly enhance firefighting effectiveness. The clinging and coating action can be valuable for structure protection. The rapid fire knock-down power of Phos-Chek foam allows wildland firefighters to make important progress on structure fires without entering the structure. Phos-Chek foam enhances water's firefighting ability — a valuable property in remote locations where water supplies are critically short. Since foam can be used to build fire lines, municipal firefighters, who usually do not have the same "pump and roll" capabilities as wildland firefighters, can effectively build barriers in front of advancing fires.

Municipal Fire Departments

Phos-Chek foam benefits fire departments in several respects. Foam helps achieve faster fire knock-down. This benefit reduces firefighter fatigue and cuts down water damage. Phos-Chek foam can help complete overhaul up to three times faster than plain water because it holds water on the fuel longer and penetrates more effectively. Field tests have shown that foam is especially effective in attic, ceiling, and chimney fires where the foam can keep moisture on the fuel more effectively than plain water. Using less water reduces the chance of ceiling collapse.

Protection of structures adjacent to the fire is another case where Phos-Chek foam's blanket is valuable. For vertical exposures, Phos-Chek foam used at 0.5% to 1.0% will create a thick foam blanket which will reflect radiant heat, allow the exposure to absorb water for prolonged protection and help insulate the surface. Neighboring structures with wooden roofs, roofs that have accumulated leaves or other debris, and wood sided homes present excellent opportunities to use Phos-Chek foam.

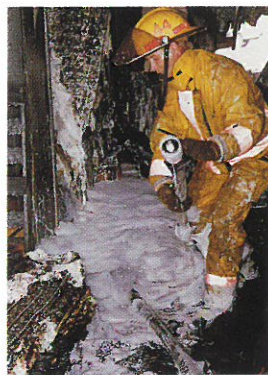


◀ **Foam for exposure protection** is valuable for protecting neighboring structures with minimal manpower and equipment. Phos-Chek foam has been successfully used to protect wood shingle roofs, structures with wood siding or log homes, and roofs with an excessive build-up of leaves, needles, and twigs.

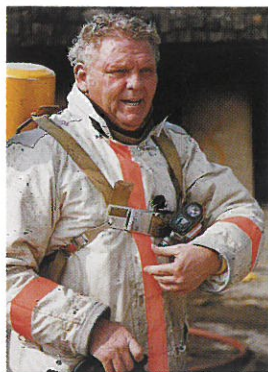


▲ **Foam stretches your water supply** by 3 to 5 times because it increases water's firefighting efficiency. Therefore, fewer shuttle trips are needed, resulting in less damage to vehicles in rough terrain. This benefit is especially valuable in remote locations where water supply is a critical issue.

▼ **Overhaul time and effort are greatly reduced** with Phos-Chek foam. The penetrating power is valuable for extinguishing fires in furniture, under insulation, and in carpet. The foam blanket causes thick layers of water to coat and cling to walls, ceilings, and in the roof instead of running off as does plain water.



▼ **Your job is easier and safer** with Phos-Chek foam. By knocking down fire faster and significantly reducing mop-up and overhaul time, foam reduces the amount of time and effort necessary for total extinguishment. This benefit is especially valuable during extreme outdoor weather conditions of the summer and winter.



Phos-Chek foam is also valuable in fighting vehicle fires. Foam coats and smothers fires in the engine compartment. The penetrating power effectively helps to extinguish fires in the interior compartment where fabric and carpet are involved.

The same coating and penetrating power of Phos-Chek foam is useful to fight fires in garbage dumps, dumpsters and trash piles. These fires often require expensive heavy equipment and take considerable time to pull apart and overhaul when using water alone.

Rural Fire Departments

Rural firefighters, who must carry their own water, especially benefit from the enhanced effectiveness of water containing Phos-Chek concentrate. Field and laboratory tests suggest that water mixed with only 0.1% to 1.0% foam concentrate is often 3 to 5 times as effective as plain water. Therefore, fewer water shuttle trips may be required. Fewer trips save money and reduce equipment maintenance.

Phos-Chek foam helps put out difficult fires faster and more effectively, such as fires in hay, barns, stables, grass, peat bogs, tundra, tire dumps, vehicles and mobile homes. Foam's ability to coat, cling, and penetrate these fuels with water significantly reduces rekindle. Improving firefighting efficiency with foam means volunteer firefighters can return to their paid jobs quicker.

Tire Fires

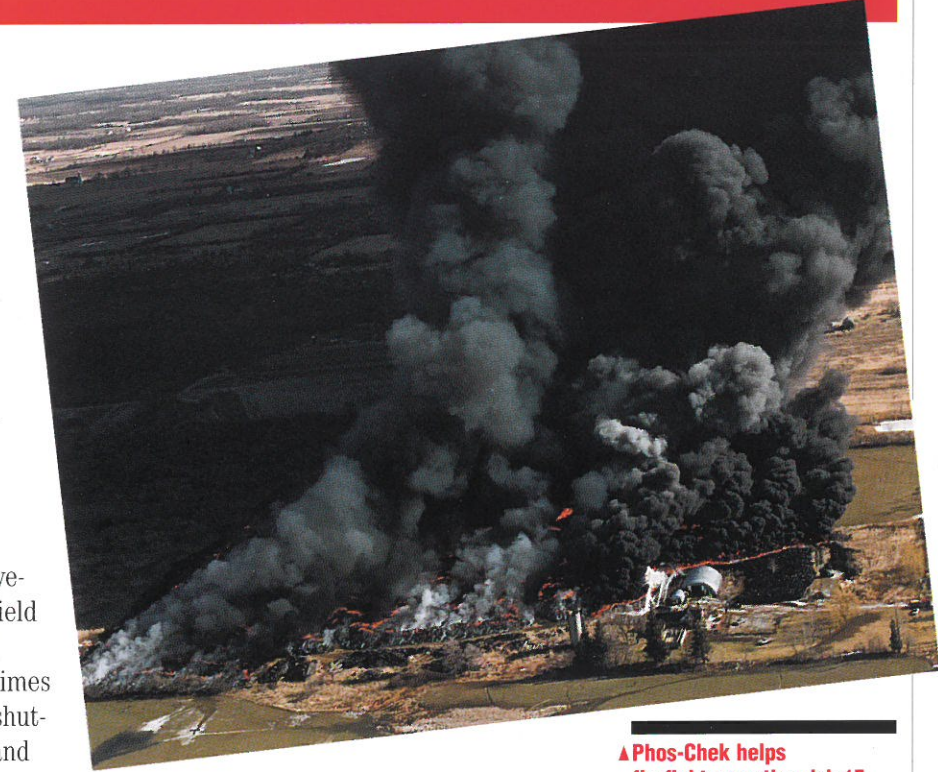
Tire fires are among the toughest fires to extinguish. Water alone on tires simply beads up and rapidly rolls off. The reduced surface tension of Phos-Chek foam allows water to sheet out and cover the tire surface and to penetrate deeper into the piles. Phos-Chek foam's blanket, created with 0.1% to 1.0% foam concentrate, builds up a thick layer of water on the tire surface. The more water available, the more heat it can remove from the fire. The longer water remains on the surface, the more time is available for water to absorb its full heat capacity, thus making it more efficient. The foam blanket also penetrates deeper into the pile of tires, creating a more efficient barrier than does water alone.

Coal Mining

Phos-Chek foam can be used to extinguish fires in and around coal mining operations. Foam effectively puts out fires in conveyor belts, gear boxes, coal bunkers and tailing piles. Phos-Chek foam has also been used on coal seam fires. A foam blanket will keep a thick layer of water on top of the coal which will continue to drip water deep into the pile and help to smother the fire.

Industrial

Phos-Chek foam concentrate is an excellent firefighting tool for many industrial applications. Industries which have considerable challenges protecting large quantities of classic Class A fuels include cotton gins and cottonseed oil mills, textile mills, grain elevators and countless other companies that use paper, fabric, and wood to produce their final products. Phos-Chek foam is ideal for wharf and warehouse fires, especially when they contain paper, cotton, or wood products.



▲ **Phos-Chek helps firefighters extinguish 15 acre tire fire in Canada.**

When 14 million tires in a fifteen acre pile caught fire in Hagersville, Ontario, Canada, it burned for 12 days while firefighters used water alone and water that contained other agents with minimal success. Then, they began to apply Phos-Chek foam. Within 5 days, the fire was extinguished! Firefighters claimed Phos-Chek foam knocked down the fire faster and significantly reduced smoke better than water alone or other agents when used under the same conditions.



▲ **Difficult fires**, such as fire in trash dumps, peat bogs, and coal mines can be fought more effectively with foam. Foam penetrates deep into the pile, reducing mop-up time and cost. A blanket of Phos-Chek foam significantly reduces smoke from the fire as well as from heavy equipment activities.