

## Initial field assessment, Super Absorbent Polymers (SAP/s) - October 2009.

### Introduction

The State Aircraft Unit (SAU) has taken the opportunity to undertake a field assessment of SAP products, SAP/s are now being used as chemical fire fighting additives and are described commonly as "a water enhancers" or Gels.

The supervised field assessments were conducted during the annual SAU Air Attack Supervisor scenario based training program in eucalypt forested areas near Mangalore, Victoria. The SAU had access to two products, which were subject to an initial evaluation and field assessment for aerial application using fixed wing fire bombers. The two products reviewed were: Phos-Chek® AquaGel-K and Thermo-Gel®.

SAP/s are polymers that can absorb and retain extremely large amounts of a liquid relative to their own mass.

SAP/s are generally a dry granular crystalline product which, when mixed with water, form a gel-like mixture which have the ability to retain large quantities of water greater than the size of each of the individual particles. When mixed, the result can range between a slightly thicker than water appearance to a coagulated mass depending on the concentration and more importantly the water quality.

Generally SAP/s have the capability to provide an increased cooling and wetting time on the available fuels. SAP/s are generally applied as a guide with the mix ratios between 0.4% to 0.6% for aerial applications.

### Background

There have been a number of evaluations undertaken in other Australian states and anecdotal information has indicated positive results.

More recently New South Wales used operationally SAP products on wildfires and information received from personnel involved also indicated a level of success.

The SAU Evaluation involved a number of drops delivered using both an Air-Tractor AT-802F with longitudinal doors and a PZL M18 Dromader with a modified flop door.



The AT-802F releases 1400 litres of Phos-Chek® AquaGel-K, at 0.5% concentration.

Each drop from the AT-802F were split loads of approximately 1400 litres and drops from the PZL M18B Dromader were full loads, approximately 2200 litres.



The PZL M18B releases 2200 litres of Thermo-Gel®, at 38 seconds viscosity.

### Products

Two products were tested during the field assessment, "Phos-Chek® AquaGel-K, and Thermo-Gel®,. Both products used in the SAU Evaluation have been qualified by USDA Forest Service in accordance with Forest Service Specification 5100-306A (June 2007).

*Phos-Chek® AquaGel-K.* Is a hydrophilic compound, a dry powdered composition and can be kept for long periods without degradation provided it is kept in a clean, closed UV protected tank or vessel and away from intense heat, AquaGel-K is considered environmentally friendly and contains no oils or solvents.

*Thermo-Gel®.* Is a liquid concentrate which is a mineral oil based gel concentrate which contains a small proportion of surfactants and gelating agents. It can be kept for extended periods

without degradation if it is kept in a clean, closed UV protected tank or vessel and away from intense heat.

### Mixing

#### *Phos-Chek® AquaGel-K*

The dry powder is self dispersing in many applications or can be easily mixed by in-line induction or by simple circulation. For the SAU Evaluation the SAP was mixed in a mobile hydro-seeder. The Phos-Chek® AquaGel-K powder product is introduced by weight/volume measurement.



Phos-Chek® AquaGel-K powder.

#### *Thermo-Gel®*

The gel concentrate is mixed using an in line adjustable flow water driven proportioning control which operates subject to the water volume flow. For the SAU Evaluation the concentrate was mixed with a FireDos® water driven proportioner. The Thermo-Gel® liquid concentrate product is introduced by volume measurement and verified with a viscosity flow test.



The in-line Fire Dos®. proportioner.

### Evaluation method

The drops and distribution of the SAP/s pattern were visually observed and measured, coverage within the stand, including mid-storey and on the ground surface fuels were also noted and analysed.

Drop heights prescribed were 150 feet above the canopy, at normal drop speed for each aircraft.

### Observations

Initial loads were delivered using both products mixed at 0.3% which gave a uniform mix containing both gel particles and free water, it was noted that there was noticeable mist and a fine cloud of moisture presumably from the free water portion of the drop.

The drops with the 0.3% mix provided good general coverage, penetration through the eucalypt over-storey and coverage and penetration of the ground fuels.

The remaining drops were all made using the SAP/s mixed at 0.5% which indicated a uniform mixture with no apparent free water.

Generally it appeared that the drop pattern in canopy was good. It was also apparent that the mist/cloud portion was not present and the time the SAP/s was in the air was greatly reduced.

The ground distribution patterns were distinct with defined edges with the fringe areas reduced. The ground distribution patterns were acknowledged to have provided improved uniformity and more uniform coverage.

Critical observations indicated that there appeared to be a minimal amount of volume of free water and water run-off on the elevated and ground fuels within the drop zone and diminished water run-off from the drop zone.

A significant feature of the SAP/s was the ability to provide a high adherence to elevated and vertical fuel surfaces and providing an increased cooling and wetting time on the ground fuels.

The SAP/s appeared to provide an increased control of the drop evacuation indicating a reduced drift in the delivery process while providing a better control and less evaporation.

### Comments

Observations and assessment of the drop tests indicated a high degree of success with the drop characteristics of the SAP/s at the 0.5% mix ratio.

The products mixed at 0.3% visibly produced a greater misting that contributed to the amount of free water in the gel mix while still providing a satisfactory result.

Documentation of the water hardness of the premix water was not made therefore the depletion qualities of the SAP/s was not assessed and can not be qualified.

It would appear to protect the quality of the SAP/s a closed circuit mixing is required to avoid evaporation. In addition all of the mixing equipment and aircraft required immediate wash down/flush to prevent equipment blockages or malfunctions.



## Additional



Representative image "Phos-Chek® AquaGel-K, 0.3% concentration.



Representative image "Thermo-Gel®, 38 seconds viscosity.



Representative image "Phos-Chek® AquaGel-K, 0.5% concentration.



Representative image "Thermo-Gel®, 38 seconds viscosity.



Snapshot of video image from the AT-802F, "Phos-Chek® AquaGel-K, 0.5% concentration.



The AT-802F delivers "Thermo-Gel®, 38 seconds viscosity.

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- Jay Symonds Thermo Technologies, LLC

## Further Information

- Hayden Biggs, State Aircraft Unit, Victoria.
- The SAU Evaluation will also be subject to a report with further details included.