

FIRE RETARDANT CHEMICALS FOR USE IN THE PROTECTION OF ROAD AND BRIDGE ASSETS FROM BUSHFIRES

INTRODUCTION

Fire retardant chemicals have been used extensively in the United States for the suppression and control of bushfires for well over forty years. Over this period of time significant improvements have taken place to make fire retardants more effective, and minimise any adverse effects on health, safety and the environment. Different grades of fire retardants are available within the same range of proprietary products, which are supplied for application from fire hoses, helicopters equipped with either buckets or fixed tanks and from fixed wing aircraft. In order to accommodate the different methods of application, different grades of retardant vary in the ratio of individual ingredients which alter basic product characteristics, such as viscosity, consistency, colour and so on. In the United States fire retardants undergo an extensive testing regime and are approved by the US Forest Service. In Victoria the Department of Sustainability and Environment (DSE) and the Country Fire Authority (CFA) only accept fire retardant chemicals which comply with the requirements of the US Forest Service. Fire retardant coatings used for domestic, industrial and chemical structures are beyond the scope of this technical note.

COMPOSITION OF FIRE RETARDANT CHEMICALS

Fire retardant chemicals contain ammonium phosphates, ammonium polyphosphates, ammonium sulphates, or their combinations, which are chemicals commonly used as agricultural fertilisers. These retardant salts coat the fuels and alter the way fire burns, thereby decreasing the fire intensity and flammability and slowing the advance of the fire, even after the water they originally contained has evaporated. Fire retardants mixed for delivery to the fire contain about 80-85% water, 10-15% fertilizer type salts and 5-10% minor ingredients such as corrosion inhibitors, colouring agent, gum thickeners, stabilisers and bactericides. The water they contain serves primarily as the carrier to aid in the uniform dispersal of the chemicals over the target area. It evaporates before the arrival of the fire and consequently contributes little in terms of fire retardancy.

Retardant chemicals can be supplied as dry powders or as concentrated liquids. The dry powder concentrates are mixed with water to form relatively dilute (10-15%) solutions prior to use in fire prevention or control. Fluid

concentrate type retardants are essentially identical to dry powder, except that a portion of the water used to prepare the retardant solution is incorporated at the time of manufacture to produce a low viscosity liquid which can be further diluted. Mixed retardants can be diluted to low, medium or high viscosity and gum thickened when mixed with water for use. It should be noted that there are some retardant formulations available in the United States which still contain sodium ferrocyanide. The US Forest service plans to discontinue the approval of any sodium ferrocyanide products in 2005 due to their toxicity.

HOW DO FIRE RETARDANT CHEMICALS WORK

A fire spreads by preheating fuels (i.e. fallen leaves, grass, downed logs, twigs, tree branches etc) as it advances, releasing combustible gases which then ignite. When a retardant is applied to threatened vegetation, the fertiliser salts coat and cling to the grass or woody materials, which normally provide fuel for the fire. When these retardant salts are heated by the approaching fire they react with the cellulose material to form a graphite-like non-flammable carbon coating which does not burn and insulates any residual fuels. This starves the fire of any additional fuels and makes control easier. The water itself boils off, absorbing some heat and providing some cooling effect on the fire. Any fertiliser salts not consumed in retarding the fire can later provide plant fertilisation when they are diluted by rain.

HEALTH & SAFETY

Dust generated from the handling and mixing of retardant powders can irritate the respiratory system, the eyes and skin. Prolonged use can cause dryness and chapping of the skin. As such, safety precautions must be used when mixing and applying retardants, including eye, skin and respiratory protection (i.e. safety goggles, gloves and dust mask if dusty conditions exist). In general the material manufacturer's OH&S recommendations should be followed. It should be noted that the fire retardant chemical available for use in Australia is classified as hazardous according to the criteria of Worksafe Australia.

ASSET SELECTION

When fire threatens, valuable assets such as heritage timber bridges or key structural links to local area, should

be given consideration for treatment with a chemical fire retardant. Fire retardants continue to work effectively until they are washed off by rain or removed by erosion, rubbing or flexing.

Fire retardant chemicals should not be applied to any structure without full coordination with the relevant fire authorities or without undertaking a prior risk assessment. In addition, fire retardant chemicals can make bridge deck surfaces slippery when wet and therefore "Slippery" (T3-3) signs should be erected to warn traffic while the fire retardant chemical remains on bridge decks.

ENVIRONMENTAL CONSIDERATIONS

The ammonia salts which form the basis of fire retardants, are plant nutrients and application at excessive concentrations may cause leaf burn and in some cases even kill plants. However this is a temporary effect, as new growth will reappear. Retardants may contain levels of fertiliser higher than what is often sold at garden shops. As such, caution should be exercised when used commercially or aesthetically valuable vegetation. These fertiliser salts are also potentially toxic to fish and aquatic organisms, and may also cause excessive growth of aquatic plants. General precautions should be taken to ensure that retardants are not applied directly into rivers, ponds, lakes or domestic water supplies. Plants and soil normally absorb a majority of the chemicals before they wash or leach into any nearby water.

EFFECT ON STRUCTURES, REMOVAL AND CLEAN-UP

The retardant fertiliser salts can leave a residue on surfaces when they dry. They can also attract water and can cause wood to swell and contract. Although this may not be a problem with sound wood it can be very damaging to old fragile wood where salts may exist. As many retardants contain corrosion inhibitors some building materials such as metallic surfaces will turn blue or black if not cleaned as soon as possible. In addition, although colouring agents may fade after a few days of exposure to direct sunlight, some colour may still be detected. When the fire risk has passed, retardants may be washed off structures, houses or vegetation. Some scrubbing with water and detergent or power washing may be required.

PROPRIETARY PRODUCTS

The Department of Sustainability and Environment (DSE) only accepts fire retardants which have been tested and approved for fire fighting by the US Forest Service. The product, is currently available here in Australia, is Phos-Chek fire retardant Grade G-75F in dry powder form. Another product currently approved by the US Forest Service, but which is not available in Australia, is the Fire-Trol product. Special arrangements could be made

in advance with the Australian distributor of Phos-Chek to purchase mixed product ready for use by specialised maintenance crews. The Australian distributor of Phos-Chek G-75F is Phoz-Chem Pty Ltd (Tel: 03 9848 1111).

It should be noted that permanent fire retardant coatings are available, which can be used to provide fire rating for domestic, industrial and chemical assets. These are available in various generic forms such as epoxy, acrylic and water based. However, they are not discussed further as they are outside the scope of this technical note.

USE OF PHOS-CHEK ON VICROADS ASSETS

Two timber bridges sprayed with Phos-Chek two days prior to the firestorm passing the area during the Omeo fires of January 2003 were not damaged by the fire. A third bridge, which was not sprayed with the fire retardant chemical, was fire damaged. The attached picture shows the traces of the Phos-Chek and its effectiveness in saving a timber bridge.

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Bingo Munjie Creek Bridge - showing traces of the "Phos-Chek" fire retardant

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