

**GUIDELINE FOR ENVIRONMENTAL MANAGEMENT**

**SPRAYING BITUMINOUS MATERIALS**

Publication 88o

November 2002

**Developed in partnership with the Australian Asphalt Pavement Association**

**1. INTRODUCTION**

Primers and primerbinders are used in road construction to prevent surface water seeping through to the permeable pavement materials and the underlying natural soils. They also provide a bond between the granular materials that form the road base and the surfacing which may be either asphalt or sprayed seal. When applied to a road surface they are in liquid form but 'set-up'<sup>1</sup> soon after, remaining soft for some time, before becoming fully cured. During this curing<sup>2</sup> stage, there is a risk of the primers and primerbinders being washed off the pavement into adjacent drains and open watercourses causing pollution and harming aquatic flora and fauna in these ecosystems.

Washoff is not only harmful to the environment, it can delay the completion of a project. Repairing the road surface, respraying the bitumen and cleaning up polluted waterways will increase costs not only for the contractor but also the client. Add to these the labour needed to carry out these tasks and the

possible damage to a company's or client's reputation and it is easy to see why preventing this type of wash-off not only protects the environment but makes good business sense.

Parties found to be liable of pollution may face prosecution and penalties of up to \$240,000. In addition directors and managers of companies may be personally liable and also subject to prosecution. While contractors causing pollution or an environmental hazard face enforcement action it is important to note that parties hiring a contractor may also be liable. When engaging a contractor to conduct bitumen spraying, you must ensure that the contractor has the necessary skills and experience, and systems and precautions in place, to prevent wash-off of primer or primerbinder. If you direct a contractor to conduct spraying operations at a time or in a manner that causes pollution of waters or an environmental hazard you may be guilty of an offence under the *Environment Protection Act 1970*.

**2. PURPOSE**

This guideline provides advice on avoiding pollution by minimising the risk of environmental damage arising from the wash-off of bituminous materials from road construction works during wet weather. The guideline does not address other environmental impacts from road construction sites. The

---

<sup>1</sup> 'Set-up' is a term used to describe an initial stiffening of the prime or primerbinder after spraying. In the case of cutback binders it occurs as the binder cools from the spraying temperature while for emulsions it occurs as a result of the initial separation of the emulsion into its component phases of water and bitumen.

<sup>2</sup> 'Curing' is the term used to describe the process of the binder achieving its full strength. For cutbacks it involves the evaporation of volatile solvents (cutter) from the binder while for emulsions it involves the complete separation of the water and bitumen.

# GUIDELINE FOR ENVIRONMENTAL MANAGEMENT SPRAYING BITUMINOUS MATERIALS

---

effectiveness of this guideline will depend on the judgement of the person using it. While this should help operators to reduce the environmental risks associated with priming in road construction, it will not exempt any of the parties from liability should primer or primerbinder wash-off occur causing pollution.

### 3. BACKGROUND

Cutbacks are a mixture of bitumen and a cutter oil (that is, a volatile hydrocarbon) such as kerosene. The amount of cutter used depends on the porosity of the surface of the granular pavement and the weather conditions at the time of spraying. Primers contain higher levels of cutter than primerbinders because they have to achieve greater penetration into the granular material. Primerbinders have a moderate level of cutter to provide some penetration and to retain the applied aggregate. The Australian Standard AS2157 provides further information on the appropriate classifications for cutback primers and primerbinders.

Bitumen emulsion is a mixture of bitumen and water, treated with an emulsifying agent and other stabilising agents. The bitumen is broken into very fine droplets that are suspended in water. These droplets usually have a positive (cationic emulsions)

or negative (anionic emulsions) charge depending on the emulsifying agent used. Further information on bitumen emulsion is available in Australian Standard AS1160.

Primerbinders are generally cationic emulsions because the bitumen droplets are attracted to the surface of the sealing aggregate, which often has a negative surface charge. Primers on the other hand tend to be emulsions with no electrical charge (non-ionic inverted emulsions).

All primers and primerbinders are applied to the pavement surface as liquids using purpose-built calibrated sprayers typically at the temperatures shown in Table 1.

Primers and primerbinders may not be totally cured for up to 72 hours (and in rare cases even longer). The curing time depends on a number of factors including:

- Type of binder used (emulsion or cutback);
- Season (winter, summer);
- Prevailing weather conditions (dry or wet);
- Temperature (hot or cold);
- Type of surface applied to (how porous the granular material is); and
- Dampness of the base material.

**Table 1: Typical Spraying Temperatures for Primers and Primerbinders**

Bituminous Material	Primer	Primerbinder
Cutback Bitumen	At or close to ambient	100°C – 130°C
Emulsion Bitumen		70°C – 80°C

## GUIDELINE FOR ENVIRONMENTAL MANAGEMENT SPRAYING BITUMINOUS MATERIALS

---

For cutback bitumens, the curing period depends on how fast the binder cools, how much solvent is in the binder and the rate of evaporation. This may range from a few hours on a porous surface in bright sunny weather to a few days on a tight relatively impenetrable surface in dull, overcast and cool weather.

For emulsions, the curing time depends on the rate at which water evaporates from the suspension and, for primer binders, the strength of the electrical attractive forces between the bitumen and the aggregate particles. The period for this curing process is similar to cutback bitumens in hot sunny conditions, but is much shorter in cool and overcast conditions.

#### 4. SELECTION OF PRIMER OR PRIMERBINDER

The selection of an appropriate primer/primerbinder is a balance between the technical requirements of the work and the environmental risks associated with different binders in the prevailing weather conditions. The Austroads '*Guide to the Selection of Surfacing*' and the Austroads/AAPA Work Tip No.18 '*Sprayed Seal Selection of Initial Treatments*' provide general information on the selection of primers and primerbinders.

The risk of primer or primerbinder wash-off should be assessed before application as part of the development of a risk management plan. The higher the risk and the more immediate the consequences, the more comprehensive the risk management plan should be. A risk management plan should consider how likely wash-off is to occur and how severe the

impact may be on the environment and the construction of the road. For example, using a cutback primerbinder may be a low risk option if used in conditions when rain is not anticipated for 24 hours. However, if a consequence of rain was to be a surface with poor skid resistance as a result of aggregate stripping, and hence a threat to the safety of road users, then it would be prudent to adopt a higher risk category. Equally where the construction site is in close proximity to a watercourse where there is little or no opportunity for the contractor to intervene to prevent any wash-off entering the watercourse, a higher risk category should be adopted.

Risks of wash-off increases in cooler damper weather because the primer or primerbinder remains in a partly cured state for longer and is exposed to wash-off if it rains during that time. The exposure period is slightly reduced by using an emulsion.

For primerseals, the risk of wash-off is also greater on roads carrying heavier traffic because the action of the traffic causes the aggregate to strip and the bitumen to emulsify, making it easier to flow off the pavement.

The environmental risks associated with primers or primerbinders are detailed in Table 2. The risk of a wash off associated with priming is typically greater than for primersealing due to the presence of the aggregate in the primerseal. The timing of spray operations and/or the selection of binder type should be aimed at achieving a low risk category. Table 2 should be used before spraying to ensure that appropriate measures are in place to prevent any washoff should rain occur.

**GUIDELINE FOR ENVIRONMENTAL MANAGEMENT  
SPRAYING BITUMINOUS MATERIALS**

**Table 2: Priming/Primersealing Risk Assessment**

**Cutback Bitumen**

	<b>Risk<sup>(1)</sup> of wash-off in the event of rain within the stipulated periods after spraying</b>			
<b>Weather Conditions<sup>(2)</sup></b>	<b>0 – 12 hours</b>	<b>12 – 24 hours</b>	<b>24 – 48 hours</b>	<b>Over 48 hours</b>
Fine, sunny, warm/hot,	Moderate	Moderate	Low	Low
Fine, overcast, cool/warm	High	Moderate	Low	Low
Damp, overcast, warm	High	High	Moderate	Moderate
Damp, overcast, cool	Unacceptable	High	High	Moderate
Wet, overcast, warm	Unacceptable	Unacceptable	High	High
Wet, overcast, cool	Unacceptable	Unacceptable	Unacceptable	Unacceptable

**Bitumen Emulsions**

	<b>Risk<sup>(1)</sup> of wash-off in the event of rain within the stipulated periods after spraying</b>			
<b>Weather Conditions<sup>(2)</sup></b>	<b>0 – 12 hours</b>	<b>12 – 24 hours</b>	<b>24 – 48 hours</b>	<b>Over 48 hours</b>
Fine, sunny, warm/hot,	Moderate	Low	Low	Low
Fine, overcast, cool/warm	Moderate	Low	Low	Low
Damp, overcast, warm	High	Moderate	Low	Low
Damp, overcast, cool	High	Moderate	Moderate	Moderate
Wet, overcast, warm	Unacceptable	High	High	Moderate
Wet, overcast, cool	Unacceptable	Unacceptable	Unacceptable	High

- (1) The risk levels reflect the likelihood of a wash-off from granular pavements on moderate grades with typical crossfalls. For roads on steep grades or with abnormal crossfalls or with a low porosity base course, the risk of wash-off is higher than those shown.
- (2) Typical temperatures associated with different weather conditions are: Hot = 25°C, Warm 15°C - 25°C; Cool = 15°C

# GUIDELINE FOR ENVIRONMENTAL MANAGEMENT SPRAYING BITUMINOUS MATERIALS

---

## **Unacceptable risk**

Where the risk is unacceptable, the likelihood of wash-off is so high that regardless of the type of primer or primerbinder being used, application should be delayed until conditions improve.

## **High risk**

Where the risk is high, application should be delayed or the application and curing supervised continuously until dry. Precautionary measures such as blocking stormwater entry points must be put in place to prevent wash-off in the event of rain. The weather should be checked regularly and inspections should be frequent enough to ensure that wash-off does not occur. Spill response equipment should be in place as a precautionary measure.

## **Moderate risk**

Where there is a moderate risk of wash-off occurring, inspections should be frequent enough to ensure that they are able to cater for rain events. Precautionary measures such as blocking stormwater entry points should be put in place to reduce the risk of wash-off. Spill response equipment should also be available on site.

## **Low risk**

Where there is a low risk of wash-off inspections may be less frequent than the above categories however the weather should be monitored to ensure that rain events can be planned for and prevention measures taken accordingly. The location of storm water entry points and water courses should be identified and noted so they can be blocked quickly

where work results in wash-off or weather conditions change suddenly. Spill response equipment should also be available.

Despite the best forecast, it is possible for weather conditions to change unexpectedly in which case the contractor should have a process for ensuring that all sprayed work completed in the preceding 24 hours is checked for evidence of damage and wash-off and action taken as necessary. In the event of rain, inspection frequency should be increased as a precautionary measure.

## **5. WORK PRACTICES**

It is important when spraying bituminous material to ensure that the work practices are consistent with minimising the risk of the material entering the drainage system and causing an environmental hazard or pollution. This should include:

- Ensuring that the surface to be sprayed is adequately compacted and swept and at the appropriate moisture content prior to spraying. For cutback primers, the surface should be dry but for cutback primerbinders and emulsions the surface should be damp. The retention of windrows of material swept from the pavement along the edges of the pavement can assist in minimising wash-off.
- Positioning of the sprayer to avoid spraying beyond the area to be primed or primersealed, where the bituminous material could be more readily washed into drainage systems.
- Ensuring that the sprayer is well-maintained, operated by a trained crew and that spray nozzles are operating correctly so that the

## GUIDELINE FOR ENVIRONMENTAL MANAGEMENT SPRAYING BITUMINOUS MATERIALS

---

bituminous material is applied at the design rate of application uniformly across the surface (two light applications may provide a lower risk than a single heavy application).

- Avoiding windy conditions when there is the potential for spray drift into areas adjacent to the pavement.
- Establishing appropriate traffic control measures in the event of damage due to wet weather – for primerseals reducing the speed and intensity of traffic can reduce the severity of wash-off.
- Clean all equipment in areas that will not impact on the environment or result in wash-off into the stormwater or open waterways.
- Site supervisors, senior staff and foreman on site should be trained in areas such as inspection procedures, spill prevention and response, correct handling, storage and cleaning procedures, management of waste materials and environmental impacts of primer or primerbinder wash off. Site supervisors and senior staff must ensure all staff follow proper procedures to prevent primer and primer binder wash-off and all staff should be aware of the environmental impacts that may occur.

In road construction work all drains represent an environmental risk. While good practice should minimise the risk of a wash-off, other precautionary measures such as the protection of drainage inlet pits or open watercourses should be put in place. Suitable devices for this purpose are sediment and litter traps described in EPA Publication 275 '*Construction Techniques for Sediment Pollution Control*'. These are also described in the EPA

Publication 480 '*Guidelines for Major Construction Sites*' and should be implemented if there is any doubt as to the possible risk of wash-off.

### 6. INCIDENT RESPONSE

Despite the level of risk associated with a possible primer/primerbinder wash-off, a risk management plan should contain emergency response procedures. A typical response procedure is shown in the accompanying flowchart (See Figure 1). Contact numbers for assistance should be current and available so the appropriate help may be sought in the event of a spill. Spill kits should be easily accessible and fully equipped with a container and stock of material which would allow any primer or primerbinder that is washed off to be safely and effectively cleaned up.

The waste material recovered should be placed in a container that will not leak or allow the material to escape. This waste is classified as prescribed waste and must be transported by EPA permitted vehicle to a facility with the appropriate EPA licence for recycling or disposal.

### 7. RESOURCES

For further information and advice contact:

Australian Asphalt Pavement Association

(03) 9853 3595

EPA Victoria

(03) 9695 2722

# GUIDELINE FOR ENVIRONMENTAL MANAGEMENT SPRAYING BITUMINOUS MATERIALS

**Figure 1. Incident Response Plan**

