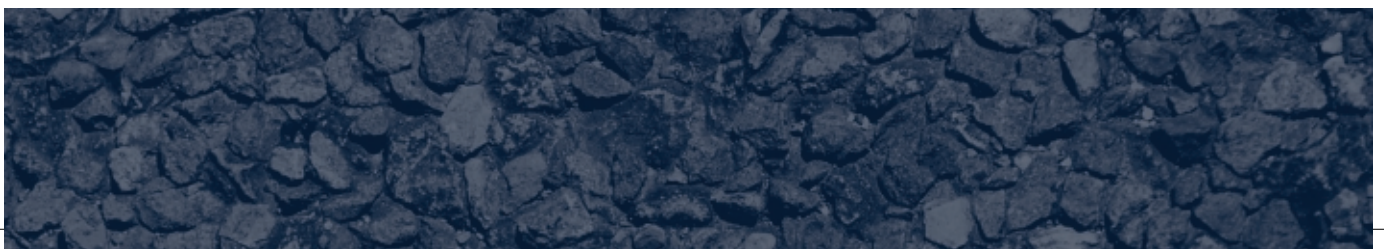


CHAPTER
TWO

Safety in the Chipsealing Industry



Chapter 2 Safety in the Chipsealing Industry

2.1	General	25
2.2	Legal Requirements	26
2.3	Hazards to Health from Chipsealing Materials	26
2.3.1	Fire	27
2.3.2	Explosions	27
2.4	Hazards to Health from Chipsealing Operations	28
2.4.1	Operational Hazards	28
2.4.2	Burn Hazards	30
2.4.3	Traffic Hazards	33
2.4.4	Chip Spreading Hazards	33
2.5	Hazards to the Environment from Chipsealing	34
2.6	References	35

Previous page: Chip-spreading trucks are operated in reverse, so for safety the driver and the chip-spreading operator should be visible to each other at all times.

Photo courtesy of Julien van Dyk, The Isaac Construction Co. Ltd

Chapter 2 Safety in the Chipsealing Industry

2.1 General

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Working in the chipsealing industry can be hazardous and all people involved need to familiarise themselves with the safety requirements demanded by the hazards encountered when handling sealing materials and carrying out sealing operations. Hazards include burns, steam scalds, explosions and fire, fire fighting, toxic fumes, asphyxiation, handling flammable and corrosive materials, transportation of dangerous goods, as well as traffic in the work area.

This Chapter contains only a brief summary of the main safety points, and more detail is provided in Appendix 1 of the Roding New Zealand¹ Code of Practice (COP) BCA 9904 (NZ PBCA 2000), and First Aid Manuals available from New Zealand Red Cross Society, and St John (1999).

The entire Code of Practice BCA 9904 details the hazards and safety requirements, but its Chapters 4, 5, 6 and Appendices 2 to 11 are especially relevant. Many of the hazards are industry-specific and, over the years, specialised safety measures have been developed through expertise and experience. Legal requirements are given in the Preamble of BCA 9904. Procedures and safety measures relating to traffic are to be in accordance with Transit New Zealand's Code of Practice for Temporary Traffic Management (COPTTM 2004).

Hazards to the environment caused by chipsealing are also of concern to the roading industry. The procedures in BCA 9904 follow a very responsible approach to managing environmental factors and to minimise the effects of chipsealing on the environment.

Employers have a duty to ensure that their employees are either sufficiently trained and experienced to do their work safely or supervised by a trained and experienced person. In addition employees must be adequately trained in the safe use of equipment in their place of work, including use of protective clothing and personal protective equipment (or PPE). Inexperienced individuals, regardless of position, must take advice from trained and experienced operators until they have received the appropriate level of training. Employers should arrange such training including courses on safety and first aid.

¹ NZ PBCA (NZ Pavement & Bitumen Contractors' Association) is now Roding New Zealand as from 26/06/2004. However, as COP BCA 9904 was published in 2000 by the then PBCA, it keeps its original publication number.

2.2 Legal Requirements

The NZ Government Acts that are relevant to chipsealing carried out by the New Zealand roading industry include:

Health and Safety in Employment Act 1992 (HSE), the principal object of which is to prevent harm to employees at work.

Hazardous Substances and New Organisms Act 1996 (HSNO), and **HSNO Regulations**, which are to ensure correct and safe use of hazardous substances in the work place and environment.

Resource Management Act 1991 (RMA), which is to protect the environment.

Dangerous Goods Act 1974, and **Dangerous Goods Regulations**, which cover the carriage and use of dangerous goods.

Surfacing engineers, consultants, practitioners and roading asset managers must ensure that their designs and specifications are compatible with safe practices in the chipsealing work place and operations.

2.3 Hazards to Health from Chipsealing Materials

Some of the materials used in chipsealing can present hazards to health if they are handled incorrectly. Detailed information on health and safety, environmental hazards, chemical and physical properties for bitumen binders and associated materials used in chipsealing are given in Appendix 10 of BCA 9904. Material Safety Data Sheets are supplied in that appendix for:

Bitumen, Bitumen cutback, Kerosene, Turpentine, and Diesel.

The temperatures at which heated bituminous binders will catch fire are useful to know and they are:

Flash Point – the lowest temperature at which a flammable liquid gives off enough vapour to flash momentarily when a small flame is applied. For bitumen it is 240°C–320°C, and for kerosene 43°C–48°C.

Ignition Point – the temperature at which a solid, liquid or gas will take fire and continue to burn. The ignition points for bitumen are 500°C, and for kerosene 255°C.

2.3.1 Fire

The normal spraying temperature of a binder is in the range of 140°C–170°C, depending on the type of bitumen and amount of diluents in it. Straight-run bitumen at these normal spraying temperatures is below its flash point (i.e. 240°C–320°C) and is relatively safe. However, binders containing kerosene or AGO (automotive gas oil or diesel) have spraying temperatures above the flash points of these diluents and are therefore hazardous.

2.3.2 Explosions

Explosions associated with chipsealing cause injury and significant damage. The industry, through its BCA 9904, has set procedures to avoid situations that will cause explosions.

Explosions caused by Vapour in Confined Spaces

Cutback binders give off vapours at temperatures lower than their flash points. These vapours build up in confined spaces such as the bitumen distributor. All sources of ignition, including obvious sources such as matches and lighters, and less obvious sources such as torches, transistor radios, steel boot caps and hobnails, must be kept at least 1.5 m away from such areas to prevent explosions. Many areas of chipseal operations must therefore be no-smoking zones for safety reasons, and ideally should be 'smoke-free'.

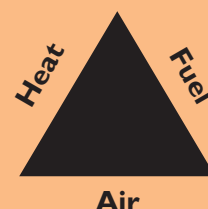
The nature of the materials and the high temperatures used in sprayed binders means the risk of fire and/or explosion is significant.

Explosions caused by Water in Binder

Other potentially explosive situations can occur by the introduction of water to a hot binder. Because water expands approximately 1500 times in volume when converted to steam, even a small amount of water introduced into a binder that is hotter than 100°C can result in a dangerously violent foaming eruption. BCA 9904 (Appendices 6 and 11) details the problem and precautions needed.

The Fire Triangle

The three ingredients needed for a fire or explosion to occur are fuel vapour, source of heat or ignition, and air (oxygen). This is called the Fire Triangle. If all three are present, as can occur in a bitumen distributor, the potential for a fire, or an explosion if the space is confined, becomes very real.



2.4 Hazards to Health from Chipsealing Operations

Chipsealing work can be hazardous and, according to the HSE Act, employers must take steps wherever practicable to eliminate the hazard, or if that is not practicable to isolate the hazard, or if both these actions are impracticable to minimise the hazard to employees. The following stages of chipsealing present the most hazards:

- Filling tanks with cutback binders (i.e. binder containing kerosene);
- Emptying tanks of binders;
- Blending binders;
- Venting tanks, working around tank vents and hatches;
- Using spraybars;
- Heating binders using flame tubes, electric elements, with potential for spot heating;
- Accidental mixing of water with binders.

The BCA 9904 provides details on these hazards.

2.4.1 Operational Hazards

Full PPE and clothing (Figure 2-1) must be worn at all times when working with hot bitumen, even on the hottest days, for protection against operational hazards.

As with other types of road construction plant, sealing plant is heavy, moving backward and forward at varying speeds, and therefore is potentially dangerous. Good practice is essential in accordance with BCA 9904, especially operations that need to be carried out within the confined width of the carriageway. Use high visibility garments in accordance with Transit NZ's COPTTM (2004) to ensure high visibility on site at all hours of the day and night.

Site workers often work in very hot operating conditions while wearing full cover protective clothing, and supervisors should consider how this affects their staff. Appropriate rest periods and refreshments, especially water, should be provided.



Figure 2-1 Chipsealing workers must wear appropriate clothing and gear (Personal Protective Equipment) so that they are protected when dealing with hot binder containing bitumen, cutter, and additives. This clothing is also used when working with emulsion and polymer modified binders.

Photo courtesy of Philip Muir, Works Infrastructure Ltd

2.4.2 Burn Hazards

In the roading industry burns can be caused by hot bitumen, flame, electricity, radiation (e.g. as sunburn), extreme cold (e.g. from liquid gases), and chemicals. Burns can also be caused when bare skin or flammable clothing come in contact with the hot surfaces of spraying equipment. Scalds (burns from moist heat) can be caused by steam or foam flashing off if water comes into contact with hot bitumen.

Treat these burns and scalds by pouring cold water over the burnt or scalded area immediately. Continue for at least 10-15 minutes or longer until pain subsides, and get the victim to medical treatment.

As binder is usually sprayed at temperatures between 150°C and 200°C, contact with it at these temperatures causes very severe burns that are possibly fatal or disabling. Binder sticks to the skin and the heat continues to burn the victim, but the binder must be left in place because removing it will cause far greater damage. Because it traps heat, keep cooling the binder by pouring cold water all over the area for at least 10-15 minutes. Treat as for other burns and for shock.

Because bitumen does stick to the skin, special first aid procedures are required that are not usually covered in basic first aid courses. Also because they do not occur often, the appropriate treatment procedures are often not understood by doctors and other medical staff. Therefore the industry has, in conjunction with specialist Burns Units, developed procedures for treatment. It has published, in its *Bitumen Safety Book* (NZ PBCA 2001), the yellow *Bitumen Burns Card* (Figure 2-2) on which is outlined the correct treatment of bitumen burns. All individuals working in the industry must make themselves aware of these treatment procedures for bitumen burns.

In the unfortunate instance of a burn, the card is attached to the victim with string through the eyelets on the card to make sure that doctors are aware of these procedures when they receive the burn patient for treatment.

Past experience has shown that attaching the card to the patient and relying on the doctor to read it, as well as to treat the patient, may not be enough. Therefore a person must accompany the patient to ensure that the treating doctor is aware of the card, and that he/she reads it before beginning treatment.

First aid courses specific to chipsealing requirements can be provided on request by recognised first aid organisations (e.g. NZ Red Cross, St John) and are the best way of training staff to increase their safety in the work place.

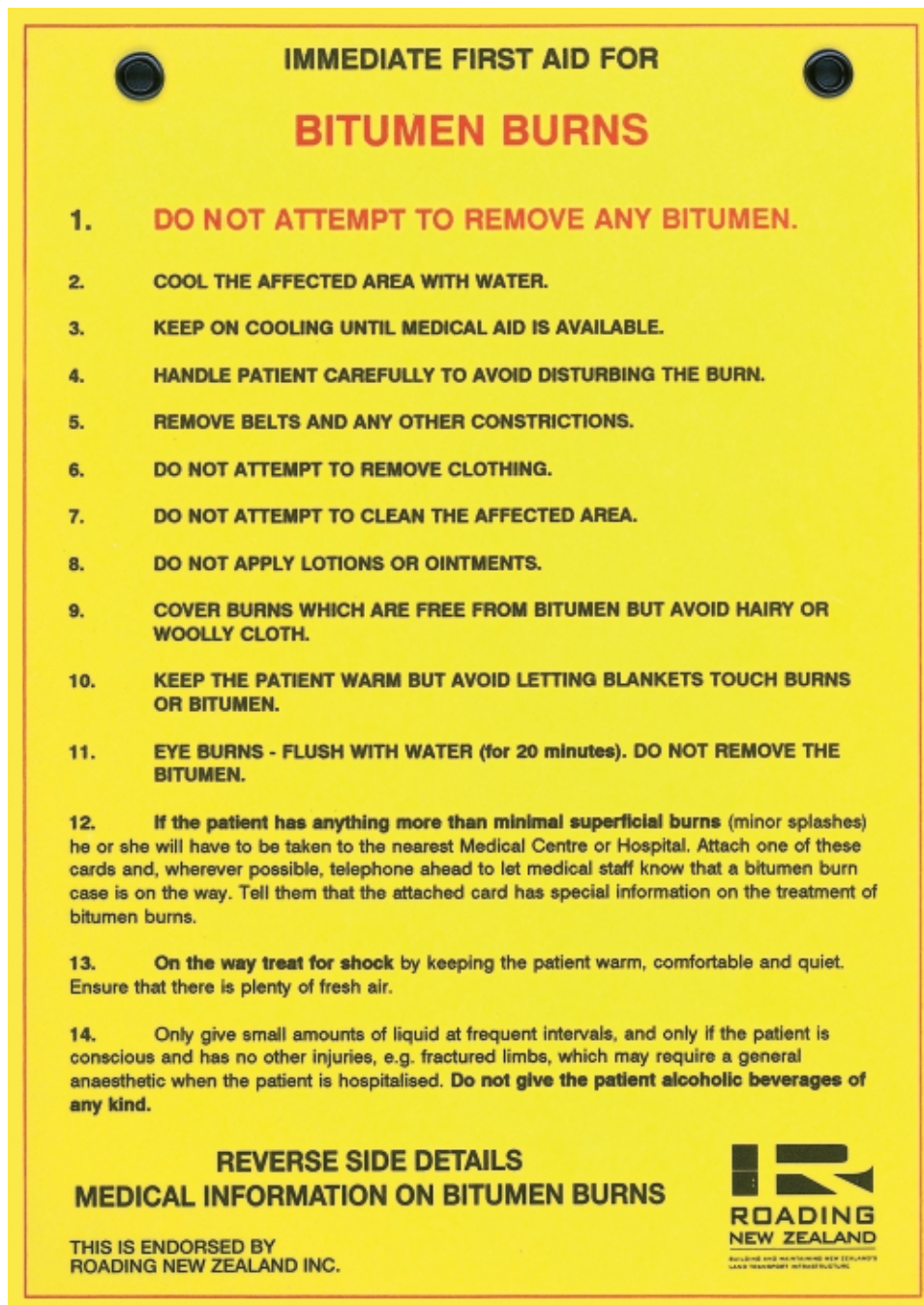


Figure 2-2 The yellow **Bitumen Burns Card** must accompany the burns victim to a doctor or hospital. Remember to dial 111 for the Ambulance and to alert A&E at the hospital of the specialised nature of the accident. A person must also accompany the victim.

Reproduced from NZ PBCA (now Roving NZ) 2000, 2001

BURNS CAUSED BY BITUMEN REQUIRE SPECIAL MEDICAL TREATMENT.

1. SKIN BURNS.

1.1 In the event of hot bitumen contacting the skin, no immediate attempt should be made to remove the bitumen.

(Except after admission to hospital and only at the direction of a burns specialist.)

1.2 The burn area should be drenched in cold running water or, preferably, placed in a basin of cold water to which ice cubes have been added.

1.3 In the case of burns to the head and neck, shoulder, chest, abdomen or back, cold wet towels, which are kept in a bucket of cold water (preferably iced), should be applied to the burned area.

1.4 The ice water treatment should be continued until pain no longer occurs when the burn area is removed from water. The time required is seldom less than 30 minutes.

1.5 Where possible the burned area should be continually wet until advanced medical aid is reached.

1.6 Remove any constricting rings, belts etc., and handle the patient gently to prevent further injury.

1.7 Cover any exposed burns, i.e. areas not covered by a protective layer of bitumen or clothing, with sterile dry dressings and lightly bandage to exclude the air. Keep the patient warm but avoid letting blankets touch burns or bitumen.

1.8 If there are burns to the face or head ensure that the airways for breathing are kept clear.

1.9 Do not apply lotions or ointments.

1.10 Do not prick blisters.

2. BURNS ENCIRCLING ANY PART OF THE BODY.

2.1 When a hot hard grade of bitumen completely encircles a limb it is theoretically possible for there to be a tourniquet effect as the bitumen cools. This will diminish blood circulation to the limb - a **potentially serious medical emergency**.

2.2 In such a case, elevating the limb will normally reduce the swelling enough to allow satisfactory circulation. If it does not and advanced medical care is more than 20 minutes away it could become essential to attempt to release the tightening effects of the cooling bitumen by carefully splitting the bitumen from the top to the bottom using a heavy pair of scissors. **Extreme caution must be taken** during this procedure to ensure that no damage is caused to the underlying skin. Toes and fingers require individual attention.

3. EYE BURNS.

3.1 The eye must be immediately flushed with cold water. This should be continued for 20 minutes by pouring water or, if available, sterile saline or eye irrigation solution, eg. "Eyestream" gently over the open eye and away from the unaffected eye.

3.2 The cooling process will be most beneficial if it can be done at the same time as the casualty is being transported to hospital.

3.3 No attempt should be made by untrained personnel to remove the bitumen.

3.4 If the eye needs to be covered with a dressing, apply a sterile eye pad. Stay close, reassure and support the casualty while travelling to seek medical care.

4. FURTHER TREATMENT.

4.1 **No attempt should be made to remove the bitumen which, in itself, supplies a sterile dressing to the underlying burned area of skin.**

4.2 The bitumen is covered with tulle gras dressings and left for two days after which time any bitumen that can easily be removed (that is bitumen which is detached from live dermis), is removed. The remaining burned area to which bitumen adheres is re-covered with sterile tulle gras dressings and left for a further week.

4.3 The appearance of the burns when the dressings are first taken off, together with the body surface area involved and the general condition of the patient will dictate when removal to a specialised Burns Unit is indicated. Certainly any forced removal of bitumen should only be undertaken in a specially equipped Burns Unit.

5. BITUMEN REMOVAL.

5.1 If for special reasons it becomes essential to remove bitumen, use peanut oil (arachis oil).

6. SPECIALIST BURNS UNITS.

Auckland - Middlemore Hospital (09) 276 0214 Hamilton - Waikato (07) 839 8899,
Wellington - Hutt Hospital (04) 566 6999 Christchurch Hospital (03) 364 0640.
(There are no other specialist units in the South Island.)

Figure 2-2 Continued.

2.4.3 Traffic Hazards

Any roadworks on trafficked roads have the potential to be hazardous to both workers and the travelling public. Sealing operations present significant traffic problems because they affect long lengths of road at the time of sealing, and they progress at a slow speed.

Close liaison between the contractor, the Road Controlling Authority (RCA), road user groups, affected neighbours, the wider community and general public is important. This is to minimise and manage any impacts or disruption to sealing, and to traffic flows, as well as to avoid conflict with other events.

These aspects of chipsealing are discussed in more detail in Chapters 6 and 11. Always carry out temporary traffic control associated with roadworks in accordance with Transit NZ's COPTTM (2004).

As explained earlier in this Section 2.4, according to the HSE Act, hazards are to be eliminated preferably, or isolated, or at least minimised. As it is difficult to totally eliminate traffic hazards, safe temporary traffic management practice focuses on isolating and minimising hazards.

Temporary traffic management is described in COPTTM (Transit NZ 2004), or in client-specific or site-specific requirements as appropriate. If using COPTTM, traffic management plans (TMPs) must be approved by the client before work commences.

TMPs aim to alert all drivers, whether in the sealing crew or of the public, to vehicle and worker movements and to minimise placing themselves or their vehicles in danger. The usual rules apply when driving operational plant, such as wearing seat belts, checking that tyre treads are not clogged with bitumen and chip, and keeping speed down when driving on the open road.

Conversely, workers on foot should also be alert to all vehicle movements, and avoid placing themselves in dangerous situations. So they can be seen, workers must wear high visibility garments at all times.

2.4.4 Chip Spreading Hazards

Most modern roller spreaders mounted on the rear of chip-spreading trucks are equipped with operating controls on the driver's side of the vehicle (as described in Chapter 10, and shown on the Chapter 2 frontispiece). These trucks are operated in reverse, and the driver and the chip-spreading operator should be visible to each other at all times.

Truck drivers should check for tray clearance from overhead wires, protruding objects and the like before commencing work. Consult BCA 9904 for further details in its Chapters 4, 5, 6.

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2.5 Hazards to the Environment from Chipsealing

Sealing activities have the potential to cause both good and bad effects on the natural environment and on neighbouring communities. As briefly referred to in Section 2.1, the industry's BCA 9904 provides ways which will help minimise the effects of chipsealing on the environment. To avoid costly remedial work and unwanted negative publicity, such effects should be considered early when planning chipsealing works (Chapter 11).

The objectives of RCAs reflect a commitment to, and a duty of responsible management of effects on, the environment and community. When operating under the RMA, the objectives should incorporate the duty to "avoid, remedy, or mitigate any adverse effect on the environment". They also have a duty under the NES for Air Pollutants (NES 2004) to reduce production of air pollutants (see Chapter 7 for details).

Some of the key environmental and community concerns to be considered that are relevant to sealing, and described in more detail in Chapters 6 and 11 of this book, are:

- Waste reduction;
- Energy efficiency, e.g. in use of fuel;
- Water use reduction and management;
- Pollution control, e.g. CO₂ emissions, leaks to stormwater, fumes;
- Spillage containment (see BCA 9904 Chapters 3.12, 5.11 for procedures);
- Noise mitigation;
- Community liaison.

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St John. 1999. *New Zealand First Aid Manual*. The Order of St John New Zealand. Penguin Books (NZ) Ltd.

NZ PBCA (NZ Pavement & Bitumen Contractors' Association Inc.). 2000. The safe handling of bituminous materials used in roading. *Code of Practice BCA 9904*. NZ PBCA (now Roding New Zealand), PO Box 12-412, Wellington, New Zealand.

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Transit New Zealand. 2004. Code of Practice for Temporary Traffic Management (COPTTM). *Transit NZ SP/M/010*. 3rd edition and amendments.

NZ Government Acts and Regulations

The Health and Safety in Employment Act 1992 (HSE).

The Hazardous Substances and New Organisms Act 1999 (HSNO).

HSNO Regulations.

The Resource Management Act 1991 (RMA).

The Dangerous Goods Act 1974.

Dangerous Goods Regulations.

Resource Management (National Environmental Standards relating to certain air pollutants, dioxins, and other toxics) Regulations. 2004 (NES).

