



Department of Energy, Mines,  
Industry Regulation and Safety  
Dangerous Goods Safety



## CODE OF PRACTICE

# Minimising the risk of tyre fires when transporting ammonium nitrate explosion risk goods







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**WorkSafe**  
Western Australia

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Further details of safety publications can be obtained by contacting:

Department of Energy, Mines, Industry Regulation and Safety  
WorkSafe  
303 Sevenoaks Street  
Whadjuk Noongar Country  
CANNINGTON WA 6107

**Telephone:** 1300 307 877

**NRS:** 13 36 77

**Email:** [safetycomms@demirs.wa.gov.au](mailto:safetycomms@demirs.wa.gov.au)

# Foreword

## The DGS Act

A key focus of the *Dangerous Goods Safety Act 2004* (the DGS Act) is the duty to minimise risk from dangerous goods. This duty not only applies to employers and employees, but to all persons, including members of the public. Public safety is one of the most important aims of the DGS Act.

The DGS Act is supported by several sets of regulations. The Dangerous Goods Safety (Road and Rail Transport of Non-explosives) Regulations 2007 (DGS Transport Regulations) deliver safety outcomes related to the transport of ammonium nitrate explosion risk goods. The security of security sensitive ammonium nitrate explosion risk goods is captured within the Dangerous Goods Safety (Security Sensitive Ammonium Nitrate) Regulations 2007.

## Background

On 24 October 2022, on the Great Central Road approximately 150 kilometres east of Laverton in Western Australia (WA), a tanker trailer carrying ammonium nitrate emulsion (ANE) exploded because of a tyre fire on the trailer. The explosion caused considerable damage, including the destruction of the trailer, formation of a crater, and the scattering of shrapnel up to 800 metres away from the centre of the blast.

The *Ammonium nitrate emulsion tanker trailer explosion: Incident investigation report* was released on 19 September 2023 and included 16 recommendations to improve safety in the transport of ANE. This Code has been developed because of the recommendations from the investigation report and provides for the enhancement of fire detection, fire fighting capacity and training for drivers.

## Codes of practice

Approved codes of practice provide safety information to assist people in meeting their obligations under the DGS Act and related regulations. The codes are approved and gazetted by the Minister under section 20 of the DGS Act and compliance with them may be used as a defence in law (as per section 62 of the DGS Act).

Although compliance with an approved code is not mandatory, it is expected that deviations from recommended practice will be justified and it can be demonstrated that the use of alternative risk control measures provides an equivalent or higher level of safety.

This Code of practice does not prevent the use of designs, materials, methods of assembly, procedures and similar that are above the minimum requirements of this Code or are not mentioned in it (for example nitrogen tyres), provided the Code is complied with or an equivalent or higher level of safety can be demonstrated.

## Scope and application

This Code applies to the transport of ammonium nitrate explosion risk goods on public roads within WA.

The Code is intended to be read by prime contractors, owners and drivers of vehicles that transport the following placard loads of dangerous goods:

- ammonium nitrate – UN 1942 and UN 2067
- ammonium nitrate emulsion or suspension or gel – UN 3375
- ammonium nitrate, liquid (hot concentrated solution) – UN 2426.

Mobile processing units (MPUs) are exempt from the requirements of this Code. However, if the MPU is towing trailers of ammonium nitrate explosion risk goods, the trailers are covered by the Code.

Dangerous Goods Safety regulations are actively enforced by inspectors which include Dangerous Goods Officers, WA Police and Main Roads Transport Inspectors. Breaches are likely to result in remediation notices or infringements to improve safety requirements, and in serious cases can lead to prosecution or the suspension of licences.

This Code should be read in conjunction with the DGS Transport Regulations and the Australian Dangerous Goods Code (ADG Code).

## Acknowledgement

The Department of Energy, Mines, Industry Regulation and Safety recognises the contributions received during public consultation and thanks respondents for their feedback. This feedback has been considered when finalising the structure and content of this Code.

<b>Foreword</b> .....	III
<b>1</b> Introduction.....	2
1.1 What are ammonium nitrate explosion risk goods? .....	2
1.2 Duties under the Dangerous Goods Safety Act.....	2
1.3 General duties as to dangerous goods .....	2
1.4 Duty on owners, prime contractors and drivers .....	3
<b>2</b> Vehicle fire fighting equipment.....	4
2.1 Fire fighting system options .....	4
<b>3</b> Driver training.....	6
3.1 Requirements for drivers .....	6
<b>4</b> Temperature monitoring tyre assemblies.....	7
4.1 Manual monitoring.....	7
4.2 Automatic monitoring .....	8
<b>Appendix 1</b> Glossary and definitions.....	9
<b>Appendix 2</b> Relevant legislation and guidance.....	10
<b>Appendix 3</b> Examples of vehicle fire fighting equipment .....	11

# 1 Introduction

This Code of practice provides guidance on managing the hazard of tyre fires on vehicles transporting placard loads of ammonium nitrate explosion risk goods.

The most significant risk associated with ammonium nitrate explosion risk goods is the risk of an explosion. The event of a fire on a vehicle transporting ammonium nitrate explosion risk goods has the potential, under particular circumstances, to result in an explosion.

This Code provides guidance on minimising the potential for tyre fires on vehicles transporting ammonium nitrate explosion risk goods and mitigating the severity of such fires.

## 1.1 What are ammonium nitrate explosion risk goods?

Ammonium nitrate explosion risk goods are used extensively within the mining industry to manufacture explosives. These goods refer to the following products:

- (a) ammonium nitrate emulsion or suspension or gel conforming to UN 3375 - these materials are collectively referred to as ANE in this Code
- (b) solid ammonium nitrate prill of UN 1942 and UN 2067
- (c) ammonium nitrate liquid (hot concentrated solution) (ANSOL) UN 2426.

This group of dangerous goods all contain ammonium nitrate, which in a fire scenario may decompose and potentially explode.

## 1.2 Duties under the Dangerous Goods Safety Act

The DGS Act places a duty of care on people involved in the transport of dangerous goods, which includes ammonium nitrate explosion risk goods.

## 1.3 General duties as to dangerous goods

### DGS Act s. 8

Duty to minimise risk from dangerous goods

A person who is directly or indirectly involved in transporting dangerous goods, such as the prime contractor, owner, driver and consignor, has a duty to minimise the risk of harm to people, property and the environment from dangerous goods.

The DGS Transport Regulations further detail specific requirements for duty holders to minimise the risks of ammonium nitrate explosion risk goods during transport.



## 1.4 Duty on owners, prime contractors and drivers

A person is an owner of a vehicle if the person is the sole owner, a joint owner or a part owner of the vehicle; or has possession or use of the vehicle under a credit, hire-purchase, lease or other agreement, except an agreement requiring the vehicle to be registered in the name of someone else.

A prime contractor is a person, in conducting a business for or involving the transport of dangerous goods by road, who undertakes to be responsible, or is responsible, for the transport of the dangerous goods by road.

An owner, prime contractor, or driver must not use a road vehicle, allow the use of a road vehicle, or drive a road vehicle to transport a placard load if the road vehicle is not equipped with:

- (a) fire extinguishers and portable warning devices that comply with *Part 12: Safety equipment for road vehicles* of the ADG Code
- (b) any other equipment required under that Part
- (c) an additional fire fighting system when transporting ammonium nitrate explosion risk goods, and
- (d) equipment that monitors the temperature of the tyre assemblies.

Section 2 of this Code provides details on the fire fighting system required when transporting ammonium nitrate explosion risk goods.

Section 4 of this Code provides details on the temperature monitoring equipment for tyre assemblies required when transporting ammonium nitrate explosion risk goods.

## 2 Vehicle fire fighting equipment

Prime contractors are required to provide a suitable fire fighting system, in addition to the fire extinguishers required by the ADG Code, on vehicles transporting a placard load of ammonium nitrate explosion risk goods on public roads.

There are many variables that contribute to the intensity and size of a fire. The location and capacity of fire fighting systems is required to be considered as part of a risk assessment to determine the most suitable arrangement for a company's vehicle fleet.

### DGS Transport Regulations r. 163

Duty on owners

### DGS Transport Regulations r. 164

Duty on prime contractors

### DGS Transport Regulations r. 165

Duty on drivers

### 2.1 Fire fighting system options

There are three options to consider when choosing a suitable fire fighting system to comply with this Code. A prime contractor can use one of these options in addition to fire extinguishers required by the ADG Code.

#### 2.1.1 Option A: Fixed fire fighting system

A suitable fixed fire fighting system that meets the following criteria:

- (i) a foam, water or encapsulating agent fire fighting system designed for the load using compressed air, electric pumps or other means, which must still be operational even when the engine of the vehicle is turned off. The system must be suitable for the types of tyre fire scenarios likely to be encountered, with the aim of preventing the spread of fire to the load
- (ii) minimum capacity of 60 litres - the capacity should be based on the risk assessment and the location of the fire fighting system should be positioned away from high risk areas
- (iii) minimum of at least one system for the entire combination vehicle
- (iv) the system(s) must be capable of reaching all parts of the vehicle
- (v) the system should be filled with a suitable medium, such as a foam, water or an encapsulating agent
- (vi) the fire fighting system is required to be maintained in accordance with manufacturer requirements.

### 2.1.2 Option B: Portable fire extinguishers – Water

At least six 9-litre water fire extinguishers on the combination vehicle in addition to fire extinguishers required by the ADG Code. The following requirements apply:

- (i) the fire extinguishers must comply to AS/NZS 1841 series, AS/NZS 1850 and AS 1851
- (ii) each fire extinguisher must be mounted securely by means of a quick release attachment
- (iii) each fire extinguisher must be located so as to be readily accessible for use
- (iv) the locations and spacing of fire extinguishers should be risk assessed.

### 2.1.3 Option C: Portable fire extinguishers – Encapsulating agent

At least three 9-litre encapsulating agent fire extinguishers on the combination vehicle in addition to the fire extinguishers required by the ADG Code. The following requirements apply:

- (i) the fire extinguishers must comply to AS/NZS 1841 series, AS/NZS 1850 and AS 1851
- (ii) each fire extinguisher must be mounted securely by means of a quick release attachment
- (iii) each fire extinguisher must be located so as to be readily accessible for use
- (iv) the locations, spacing and type of encapsulating agent fire extinguishers should be risk assessed.

## 3 Driver training

### 3.1 Requirements for drivers

#### DGS Transport Regulations r. 14A

Transport of ammonium nitrate explosion risk goods – instruction and training

There are a number of requirements for drivers detailed within the Regulations relating to appropriate instruction and training. To transport ammonium nitrate explosion risk goods by road, drivers are to receive regular practical training in the use of the vehicle's onboard fire fighting equipment and the tyre pressure monitoring system. The training must also provide an understanding of the chemical properties of the dangerous goods being transported and suitable emergency response actions.

#### 3.1.1 Theoretical training

- (i) Training must provide details on the fire fighting media and delivery systems fitted to the vehicle, as well as their applicability and use in different fire scenarios relevant to the vehicle.
- (ii) Drivers must be provided with suitable training in the chemical hazards, safety implications and explosion risk of ammonium nitrate explosion risk goods when subjected to fire, for example, theory around decomposition process and timeframes.
- (iii) Training on the characteristics of a tyre and wheel fire versus a fire involving the load should be included. The importance and methodology of fighting a fire, if safe to do so, should be emphasised as well emergency evacuation distances as per the National Transport Commission's *Australian and New Zealand Emergency Response Guide Book*.

#### 3.1.2 Practical training

- (i) Practical training in the fighting of fires must be conducted, at a minimum, every two years. Credible fire scenarios are considered extremely beneficial to simulate anticipated conditions and enable individuals to accurately assess a fire situation and choose an appropriate response.
- (ii) Training for all drivers and subcontractors must include how to discharge and operate different types of fire extinguishers and fire fighting systems on a company's vehicle fleet. Training should also emphasise the ability to distinguish between the different types of vehicle fires, for example, tyre fires and a cargo fire (i.e. a fire where the ammonium nitrate explosion risk goods is involved).
- (iii) The procedures which detail the operation of any fire fighting systems are required to be documented. This information should be readily available to drivers in the event of an emergency.
- (iv) Training is required to be documented and drivers are required to undergo a practical and written competency assessment that is witnessed and signed off by a trainer.
- (v) Training records for individuals are required to be kept for a period of at least two years and may be audited by inspectors.

In addition, companies must incorporate fire fighting systems into their pre-start checks before commencing transport of ammonium nitrate explosion risk goods. Drivers should familiarise themselves with how to initiate the fire fighting system on board for each journey, as these systems may differ for different vehicle combinations.

## 4 Temperature monitoring tyre assemblies

The primary cause of a tyre fire is the application of heat to the tyre or the development of heat within the tyre structure. **Manual or automatic** monitoring of tyre temperatures may prevent the occurrence of a fire on a vehicle. A risk assessment should be conducted to determine if a manual or automatic monitoring system is used.

**DGS Transport Regulations r. 170A**

**Temperature monitoring – ammonium nitrate explosion risk goods**

### 4.1 Manual monitoring

Regular monitoring of tyre or wheel hub temperatures with a calibrated thermal imaging camera (TIC) or thermometer can provide an indication of temperatures that are outside normal operating temperatures.

It is recommended that temperatures are manually checked frequently. This includes reasonably prior to loading and reasonably prior to unloading product and each time a vehicle parks, for example, at fatigue breaks. It is important to conduct temperature checks early enough so that an overheating tyre assembly can be identified and managed before entering a place to commence loading or unloading.

Temperature checks must be performed on all readily accessible tyres or wheel hubs and recorded. This must be incorporated into the journey management plan.

When using manual monitoring:

- (i) companies are required to determine a policy on 'normal operating temperatures' and an action plan should these temperatures be exceeded, for example, 'ground' a vehicle for repair or plan to undertake maintenance – the policy should make clear how frequently temperature checks are expected to be recorded by a driver
- (ii) accessible tyres should be monitored with an accurate and maintained TIC or thermometer
- (iii) a record of temperature checks must be kept for three months and provided to inspectors when requested.

## 4.2 Automatic monitoring

Automatic monitoring of tyre and wheel hub temperatures may provide an early indication and alert the driver of an issue with the heating or loss of pressure to the vehicle's tyres.

Where implemented, the direct tyre pressure monitoring systems (TPMS) must include temperature monitoring.

There are number of TPMS available and transport companies need to consider the suitability of the systems available for their operations.

The automated system must:

- (i) have thresholds for temperature that, if exceeded, alerts the driver
- (ii) be suitable for the weather, road and environmental conditions likely to be encountered
- (iii) be suitable for the type of vehicle used
- (iv) be installed as per manufacturer specifications
- (v) have a real time monitoring system; a post journey data collection when the vehicle returns to the depot is not sufficient
- (vi) record and store temperature data for analysis
- (vii) monitor individual tyre or wheel hub temperatures
- (viii) be inspected, maintained and calibrated in accordance with manufacturer specifications.

# Appendix 1 Glossary and definitions

Term	Description
ADG Code	Australian Code for the Transport of Dangerous Goods by Road and Rail (also called the Australian Dangerous Goods Code)
AS/NZS 1841 series	<i>Portable fire extinguishers</i>
AS/NZS 1850	<i>Portable fire extinguishers – classification, rating and performance testing</i>
AS 1851	<i>Routine service of fire protection systems and equipment</i>
Combination	Means a road vehicle consisting of a motor vehicle and one or more trailers
DGS Act	<i>Dangerous Goods Safety Act 2004</i>
DGS Transport Regulations	Dangerous Goods Safety (Road and Rail Transport of Non-explosives) Regulations 2007
Encapsulating agents	Additives mixed with water in fire suppression systems used to control and suppress fires as approved in National Fire Protection Association NFPA 18A <i>Standard on water additives for fire control and vapor mitigation</i>
Inspector	Dangerous Goods Officer, or WA Police Officer or Main Roads Transport Inspector with the power to enforce the DGS Transport Regulations
Mobile processing unit (MPU)	A vehicle or a moveable piece of equipment (also called a mobile mixing unit or MMU) designed to transport the constituents of a bulk AN-based explosive to the place where the explosive will be manufactured and used
Owner	<p>Person who is either:</p> <ul style="list-style-type: none"> <li>• sole, joint or part owner of the vehicle, or</li> <li>• has possession or use of the vehicle under a credit, hire-purchase, lease or other agreement.</li> </ul> <p>DGS Transport Regulation 39</p>
Prime contractor	<p>Person, in conducting a business for or involving the transport of dangerous goods by road, undertakes to be responsible, or is responsible, for the transport of the dangerous goods by road.</p> <p>DGS Transport Regulation 43</p>
TIC	Thermal imaging camera
TPMS	Tyre pressure monitoring systems

# Appendix 2 Relevant legislation and guidance

## Legislative provisions

*Dangerous Goods Safety Act 2004*

*Dangerous Goods Safety (Road and Rail Transport of Non-explosives) Regulations 2007*

*Dangerous Goods Safety (Security Sensitive Ammonium Nitrate) Regulations 2007*

*Australian Code for the Transport of Dangerous Goods by Road and Rail*

## Standards Australia

*AS/NZS 1841 series Portable fire extinguishers*

*AS/NZS 1850 Portable fire extinguishers – Classification, rating and performance testing*

*AS 1851 Routine service of fire protection systems and equipment*

## National Transport Commission

*Australian and New Zealand Emergency Response Guide Book*

## Department of Energy, Mines, Industry Regulation and Safety

*Safety equipment for road vehicles transporting dangerous goods*

*Tyre safety for earth-moving machinery on Western Australian mining operations*



## Appendix 3 Examples of vehicle fire fighting equipment

The following are worked examples of the fire fighting equipment required when transporting a placard load of ammonium nitrate explosion risk goods.

The location of the fire fighting equipment is to be based on a risk assessment. The fire fighting equipment is to be kept away from places where a fire may likely occur. Where additional fire extinguishers are employed rather than a fixed fire fighting system, they can be distributed over the entire vehicle combination to enhance access to most or all the fire extinguishers in the event of a fire.

Where a fixed fire fighting system is used (which is generally located close to the centre of the combination vehicle to access all parts of the vehicle), should a fire start near the fixed system it may be necessary to use a fire extinguisher to temporarily knock down the fire to access the fixed system.

### Worked examples of complying fire fighting equipment for various vehicle configurations

Vehicle type	Prime mover	Trailer 1	Trailer 2	Trailer 3	Trailer 4	For entire vehicle combination	Total (for entire vehicle combination)
Semi-trailer	One 10B DP*	One 60B DP*	N/A	N/A	N/A	Additional fire protection #	Two fire extinguishers plus additional fire protection #
Block truck	One 10B DP*	One 60B DP*	N/A	N/A	N/A	Additional fire protection #	Two fire extinguishers plus additional fire protection #
Double road train	One 10B DP*	One 60B DP*	One 60B DP*	N/A	N/A	Additional fire protection #	Three fire extinguishers plus additional fire protection #
B-double	One 10B DP*	One 60B DP*	One 60B DP*	N/A	N/A	Additional fire protection #	Three fire extinguishers plus additional fire protection #
Triple road train	One 10B DP*	One 60B DP*	One 60B DP*	One 60B DP*	N/A	Additional fire protection #	Four fire extinguishers plus additional fire protection #
Quad road train	One 10B DP*	One 60B DP*	One 60B DP*	One 60B DP*	One 60B DP*	Additional fire protection #	Five fire extinguishers plus additional fire protection #

\* DP means a dry powder fire extinguisher. Refer to the ADG Code Table 12.1 for alternative equivalents.

# The additional fire protection required is either one of the three options given in Section 2 of the Code. It can be either a fixed fire fighting system or six 9-litre water fire extinguishers or three 9-litre encapsulating agent fire extinguishers. The additional fire protection can be spread throughout the combination vehicle.

Using the examples on the previous page, for a double road train transporting placard loads of ammonium nitrate explosion risk goods, the required fire protection will be either:

- three DP fire extinguishers plus a fixed fire fighting system
- nine fire extinguishers when using water extinguishers (three DP and six 9-litre water fire extinguishers), or
- six fire extinguishers when encapsulating agent fire extinguishers are used in conjunction with DP extinguishers (three DP and three 9-litre encapsulating agent fire extinguishers).

For a 'block vehicle' towing a trailer carrying a placard load of ammonium nitrate explosion risk goods, the vehicle combination requires a dry powder fire extinguisher for both the prime mover and the trailer and either:

- a fixed fire fighting system
- six 9-litre water fire extinguishers, or
- three 9-litre encapsulating agent fire extinguishers.

The location where the additional fire fighting equipment is fitted can be decided following a risk assessment. If the 'block truck' does regular runs to a Road Train Assembly Area (RTAA) to make a longer vehicle combination, it is prudent for the equipment to be fitted on the prime mover.

For a triple road train transporting placard loads of ammonium nitrate explosion risk goods, the fire protection will be either:

- four DP fire extinguishers plus a fixed fire fighting system
- ten fire extinguishers being a combination of DP and water extinguishers, or
- seven fire extinguishers being a combination of DP and encapsulating agent fire extinguishers.

The location where the fire fighting equipment is fitted can be determined following a risk assessment.



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## Department of Energy, Mines, Industry Regulation and Safety

Dangerous Goods Safety  
1 Adelaide Terrace  
Whadjuk Noongar Country  
EAST PERTH WA 6004

**Telephone:** 1300 307 877

**NRS:** 13 36 77

**Email:** [dgsb@demirs.wa.gov.au](mailto:dgsb@demirs.wa.gov.au)

**Website:** [www.demirs.wa.gov.au](http://www.demirs.wa.gov.au)