Safe Handling of Bitumen
A PRACTICAL GUIDE
Nynas Policy for Health Safety Security Environment & Quality (HSSE&Q)

- We want to be the preferred long term supplier of high performance specialty oil products and services, meeting and, where possible, exceeding the expectations of our customers.
- We assess the health, safety and environmental impact of our products and do our utmost to minimise it. We provide guidance for safe use of our products.
- We comply with both applicable regulatory and internal requirements as documented in our management system. We constantly strive to improve the HSSE&Q performance by minimising the risk of major and minor accidents, the risk to people's health and the environment as well as optimising the efficiency of our activities and use of resources.
- We promote a strong and positive HSSE&Q culture, where the line management are responsible. All employees are individually aware and responsible for their working activities.
- We operate a fully integrated and certified management system which meets the requirements of ISO 9001 and for our technical and operational sites also meets the requirements of ISO 14001 and OHSAS 18001. Our system provides a framework for establishing and reviewing HSSE&Q objectives and targets and to continuously evaluate and improve the effectiveness of the management system.

The aim of the Policy is to support Nynas vision and deliver a performance we all can be proud of, so that confidence can be earned of customers, employees, shareholders, suppliers, authorities, neighbours and society at large.

Staffan Lennström
President Nynas AB
Nynas is a different kind of oil company. We use oil to create value and more sustainable options. Within our field of specialisation we are a world leader.

With over eighty years’ experience, we are one of Europe’s leading suppliers of bitumen. We continue to develop bitumen and its functional performance in a wide variety of applications. Our long standing focus on bitumen has earned us the reputation of being the ‘bitumen specialist’ - and that is something we are very proud of.

We are recognised as a reliable supplier of specific quality bitumen to meet our customers’ changing needs and performance requirements.

We have refineries and a network of terminals across Europe. Operating as a coordinated European company we are geared to meet each customer’s local or regional needs as well as pan European requirements.

By controlling each step of the supply chain - shipping crude oil, refining and final product dispatch - we are able to provide consistent products with assured performance. Our customers often require deliveries on very short notice at any time of the day or night, at remote locations. Our customer driven logistics system and non stop, year round operations consistently meet these demanding requirements. This is verified by our certified ISO 9001 quality management systems. In addition all Nynas refineries are certified for ISO 14001 and OHSAS 18001 (environmental and safety & health management systems respectively).

Nynas provides CE marked bitumen for paving applications in accordance with the applicable EN specifications. CE marking is an EU official confirmation that our products fulfil the product specifications and the essential requirements of the Construction Products Directive.
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Bitumen in its solid phase is not hazardous but due to high temperatures for storage, handling and transportation there are risks when working with the material. The main aim of this book therefore is to provide the reader with a clear, useful understanding of bitumen from a product health and safety perspective so that bitumen can be handled safely within the supply chain. This creates a good knowledge base and an appreciation of the product and its potential risks.

Nynas’ HSSE&Q ‘Observe, think and act’ initiative encourages people to be observant of any risks, think what should be done to mitigate them and then actually do something about the situation.

The information in this ‘Safe Handling of Bitumen’ guide is primarily intended for those who work operationally with bitumen: road tanker drivers, operating personnel in asphalt works and bitumen depots, surfacing gangs and other production personnel. Other groups that we hope will use this publication include safety managers, human resource managers of the above groups, training coordinators and technicians of all kinds.

The advice given in this publication reflects the current knowledge of the hazards and risks associated with the handling of bitumen products. If the product is mixed with other materials, the users shall take these into account when identifying any additional hazards and risks which might arise.

At the time of printing this safety booklet, the full report of ‘IARC monographs on the evaluation of occupational exposures to bitumen and bitumen emissions, volume 103’ had not been published. For the latest update on the bitumen industry position, which Nynas is actively following, please check the Eurobitume website on www.eurobitume.eu/hse. If there are future industry requirements to make changes in safety recommendations these will be highlighted in our Nynas Safety Data Sheets, latest versions of which can be found on www.nynas.com.

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This booklet and Nynas Safety Data Sheets are available on the Nynas website www.nynas.com
Product information
Bitumen is a non volatile, adhesive and waterproofing material derived from residue from selected asphaltene rich crude oil which is completely or nearly completely soluble in toluene. It is a viscous and elastic thermoplastic material, brown to black in colour and very viscous or nearly solid at ambient temperatures.

There are many different bitumens and bitumen products with many different fields of application in both road construction and industrial manufacturing. Bitumen is defined as a construction material according to the Construction Products Directive (CPD).

Bitumens are, from a regulatory standpoint, regarded as substances although they contain a complex mixture of high molecular weight hydrocarbons.

Bitumen should not be confused with coal tar which is produced from black coal by destructive distillation at high temperatures. Coal tar is completely different in chemical composition and physical properties and is classified as carcinogenic while bitumens are non classified.

Bitumen should not be confused with natural asphalts which are unrefined products.
Bitumens are very complex mixtures of high molecular weight hydrocarbons which also contain small amounts of sulphur, oxygen and nitrogen. Carbon numbers are predominantly greater than C25, with molecular weights varying from 350 up to about 1500 daltons*. They may also contain small amounts of various metals such as nickel, iron and vanadium. The hydrocarbon skeleton consists of four basic elements: straight chain alkanes, branched alkanes, saturated rings (naphthenes) and fused aromatic rings which are combined in different size and proportions to make the large variety of molecules in bitumen.

The several hundred thousand different molecules in bitumen are continuous with respect to size and other chemical properties like for example polarity. All current knowledge about bitumen chemistry is based on averages from chemical characterisation. It has just recently been possible to identify single bitumen molecules and determine their basic structure in terms of size and number of rings but still not the exact structure.

* dalton (Da) is a unit used to indicate the mass on an atomic or molecular scale.
There are three main types of bitumens.

**Paving bitumens** are usually produced from the atmospheric distillation of petroleum crude oil followed by further processing such as vacuum distillation, thermal conversion, air-rectification or solvent precipitation. A combination of these processes can be used for production of different bitumen grades. Road paving as the name indicates is the principal use.

**Hard bitumens** are manufactured in similar processes to paving bitumens but are harder and more brittle (with lower penetrations and higher softening points). The principal use is in the manufacture of flooring, bitumen paints, preservation of fibreboard etc.

**Oxidised bitumens** (air-blown) are produced by passing air through a bitumen feedstock. This gives a product with higher softening point relative to penetration, with reduced temperature susceptibility. The properties of the final bitumen product depend on the degree of blowing and the process conditions.

A mild degree of air-blowing, known as air-rectification, is commonly used to adjust the physical properties in order to manufacture substances used in paving. The penetration index for air-rectified bitumens is \( \leq 2 \).

An intense degree of blowing (oxidation) is commonly used to adjust the physical properties in order to manufacture substances used in industrial applications. The oxidation process may use flux oil to soften the feed. A catalyst (phosphoric acid, ferric chloride etc) may also be used to increase the speed of the reaction. The main uses for oxidised bitumen include roofing material, waterproofing, electrical insulation and many other building and construction materials.

The penetration index for severely oxidised bitumens is \( >2 \).
Modified bitumens usually contain polymers or waxes which change their rheological properties and are used in road paving, roofing and waterproofing.

In the case of polymer modified bitumens the desired end performance of the product influences the selection of the polymer type. Typical polymers used in the bitumen industry are elastomeric polymers eg SBS (Styrene Butadiene Styrene co-polymer).

Wax modified binders exhibit lower viscosities at elevated temperatures than unmodified bitumen. This reduced viscosity allows end users to either:

- reduce mixing temperatures typically by 20°C or
- maintain conventional mixing temperatures and improve the workability and time available for effective compaction when compared to standard paving grade bitumen.

In addition wax modified binders are designed to enhance the performance characteristics of asphalt at specific phases within construction and in service lives.

Bitumen emulsions are fine dispersions of bitumens or modified bitumen in water where the bitumen commonly is the dispersed phase and water is the continuous phase.

Bitumen emulsions are normally produced using a high shear rate mill which disperses the bitumen in the water. Some bitumen emulsions may also contain a fluxing agent and/or a solvent and the bitumen phase may be a modified bitumen (eg containing polymer).

The bitumen content of an emulsion typically varies between 40%-80% and the application temperature ranges from ambient to about 90°C. A higher content of bitumen usually leads to a higher application temperature.

Bitumen emulsions are identified by the type of electrical charge of the emulsifier. Three types of emulsifiers are used: anionic (alkaline), cationic (acidic) and non ionic.
In Europe the cationic emulsions are most frequently used for bitumen applications.

**Cutback bitumens** are mixtures of bitumen with volatile petroleum diluents (kerosene, white spirit etc) to render them more fluid for ease of handling and application at ambient temperature. Depending on the type of diluent the original properties of the bitumen may be partly or completely recovered as the solvent evaporates. Cutbacks are mainly used in road surface dressings and tack coating.

**Fluxed bitumens** are mixtures of bitumen with relatively non volatile flux oils to make the product softer for ease of application. The flux oils are commonly high boiling distillates or process oils which tend to remain in the binder after application. Fluxed bitumens are mainly used for very flexible road pavements in areas with a cold climate.

For all of the above types of bitumen an adhesion agent is sometimes added to improve the adhesive performance of the asphalt mix.

Although there may be other bitumen mixtures available on the market Nynas only offers the bitumen and bitumen mixtures described in this chapter.
The quality and performance of bitumen can be compromised if it is contaminated by light oil products during transportation or laying. If there is any doubt the product should be retested to check the quality.

Even small amounts of solvent, petrol, fuel oil or diesel can considerably alter the properties of bitumen films and lead to deterioration of their adhesive properties which in turn may lead to failure of the asphalt.

It is essential that bitumen is handled and stored at the correct temperature.

If the temperature is too low, coating of aggregate will be uneven; whereas if the temperature is too high, the properties of the bitumen will deteriorate and it may drain from the aggregate leading to run off.

The temperature at which bitumen can be pumped and mixed depends on the grade. These temperatures are calculated on the basis of viscosity measurements and are supported by operational experience.

More information can be found in ‘Recommended bitumen storage and handling temperatures’, Appendix 6.
Nynas offers a wide range of bitumen products.

Safety Data Sheets, Product Data Sheets and CE Data Sheets can be found on the Nynas website www.nynas.com or will be sent upon request.

For additional information please contact one of the Nynas regional sales offices.

Contact information is given in Appendix 7.
REACH is the European regulation on chemicals and their safe use. It stands for Registration, Evaluation, Authorisation and Restriction of Chemicals. REACH requires manufacturers and importers of chemicals to register the substance(s) to the European Chemical Agency (ECHA). Depending on annual tonnage and hazards of the substance there are different deadlines for when the registration has to be completed.

As from 30 November 2010 all substances manufactured or imported above 1000 tonnes/year need to be fully registered.

One major part of the registration dossier is the Chemical Safety Assessment (CSA) which must include:

- hazard assessment; classification and labelling of human health, environmental and physiochemical hazards; Derived No Effect Levels (DNELs)\(^1\); Predicted No Effect Concentrations (PNECs)\(^2\)

- Persistent, Bioaccumulative and Toxic (PBT) and very Persistent and very Bioaccumulative (vPvB) assessment.

If the substance meets the criteria for classification as dangerous or meets the PBT/vPvB criteria, the CSA shall also include:

- an exposure assessment for all identified and relevant uses of the substance including the generation of exposure scenario(s)

- a risk characterisation which identifies if the risks arising from manufacture/import and uses of a substance are adequately controlled.

The risk characterisation consists of a comparison of DNELs and PNECs with calculated exposure concentrations respectively to humans and to the environment. If the calculated exposure exceeds the DNEL/PNEC there is a need to implement risk management measures (protective clothing, ventilation etc).

European bitumen manufacturers have recently completed a review of the health and environmental impacts of bitumen, required as part of the REACH registration process. Based on the published data at that time bitumen is considered unlikely to present a hazard that requires classification for human health, safety or the environment.

Animal studies on severely oxidised bitumen (penetration index \(>2\)) indicate that repeated exposure to fumes may present a weak carcinogenic hazard. The classification criteria are not fulfilled but additional risk management measures are communicated in the Safety Data Sheets for these products.

Since bitumen is not classified as hazardous under REACH there is no legal requirement to make an exposure assessment or a risk characterisation.

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1. Derived No Effect Level: the level of exposure above which humans should not be exposed.
2. Predicted No Effect Concentration: the concentration of the substance below which adverse effects in the environmental sphere of concern are not expected to occur.
REACH also sets up the obligations for Safety Data Sheets (SDS). Suppliers are required to provide their customers with SDS for all classified substances/mixtures.

The SDS is supposed to be the main channel for communication down the supply chain on REACH related information. As a consequence the information requirements in the SDS have become more extensive compared to the previous Safety Data Sheet Directive.

Examples of new information to be included:

- identified uses for the substance uses which have been identified by supplier and/or customer and for which use is regarded as safe
- REACH registration number - company specific number that confirms the substance has been registered
- exposure scenarios for classified substances should be in an annex to the SDS covering identified uses
- DNEL/PNEC - both DNEL and PNEC are derived from toxicological and ecotoxicological studies.

Under REACH, bitumen is not classified as hazardous and there is currently no legal requirement to provide SDSs for bitumen. However SDSs do contain very important information regarding safe handling of bitumen and therefore it is industry practice, which is followed by Nynas, to provide them.
Classification Labelling and Packaging (CLP) is the European version of the UN based system for classification and labelling Globally Harmonised System (GHS). CLP introduces a new system including new criteria for classifications, new types of indications of danger, pictograms, hazard statements and precautionary statements.

As from 1 December 2010 all substances have to be classified according to the regulation on CLP, EC 1272/2008.

For mixtures there is a transition period for classification according to CLP until 2015.

Bitumen is not classified as hazardous according to the CLP regulation.

Bitumen mixtures that contain solvents, flux, emulsifiers and other additives may be classified as dangerous to health and/or to the environment. The classification of these mixtures is specific since they depend on the classifications and amount of the different ingredients. Therefore it is important to check the SDS.
Bitumen burns

Bitumen is normally manufactured, stored, transported and handled hot. Hence the most significant hazard is the potential to cause severe burns.

There are several cases where there is a risk of personnel being covered with hot bitumen for example:

- if a hose bursts
- boil-over of a truck or storage tank
- if a valve has been blocked and the plug is released
- sampling without correct Personal Protective Equipment (PPE) or experience of how to open the valve.

To minimise the risk of burns it is essential to always wear PPE and to follow proper working procedures. The required PPE is shown in Appendix 1. It is recommended to have a safety shower in the vicinity (20m radius) of the loading/unloading areas.

For first aid in case of burns

After an accident has occurred the affected area of the body should be cooled as soon as possible to prevent the heat from causing further damage to the skin. The burn should be drenched in cold water for at least ten minutes for skin burns and at least five minutes for eye burns. However body hypothermia must be avoided.

Never attempt to remove bitumen from burned areas!

The bitumen layer will be firmly attached to the skin and removal should not be attempted unless carried out at a medical facility under the supervision of a doctor.

The cold bitumen will form a waterproof sterile layer over the burn which will prevent the burn from drying out. If the bitumen is removed from the wound there is the possibility that the skin will be damaged further, bringing with it the possibility of complications.

Furthermore, by exposing a second degree burn in order to treat it, there is the possibility that infection or drying out will make the wound deeper.

Eurobitume has published a recommendations card about burns that is easy to read and suitable to hang up at the work site. The ‘Bitumen Burns Card’ is available in several languages and can be ordered from Eurobitume or via Nynas. A copy of this is illustrated in Appendix 5 (showing the version available at time of print).
If water comes into contact with hot bitumen there is a risk of a violent reaction. In contact with hot bitumen the water evaporates and expands in volume which leads to splattering. In a storage tank or truck the pressure can increase and result in a violent eruption of hot bitumen. If closed, the truck or tank could explode or rupture.

As a consequence it is of utmost importance to ensure that tanks and trucks are free from water. See 3.2, 3.5 and 4.1 for more information.

Examples of risks of boil-over:
- previous load of bitumen emulsion or any product with high water content
- cold truck (water condensation/mist)
- trapped water in storage tank.

The most common reason for boiling over is hot bitumen being loaded in a tank that has previously contained bitumen emulsion. The water in the emulsion vaporises and expands. The pressure will increase and eventually become so high that the steam will push the bitumen through the manhole. If the tank is closed the increase of pressure can cause an explosion.
Exposure to bitumen fumes

Heated bitumen emits fume consisting of a gas phase and an aerosol phase. The gas phase is often called the semi volatile phase while the aerosol phase is called “blue smoke”. Bitumen fumes are not considered harmful to the public. Exposure to high concentrations when handling hot bitumen can cause irritation of the eyes and nose and/or respiratory tract.

Working at the correct temperature and using the correct bitumen products for each specific application can reduce the fuming of bitumen during normal handling.

It is recommended to strive for a good working environment where all unnecessary exposure is avoided. In certain applications, for example indoor mastic asphalt works (in tunnels, buildings or multi storey car parks), the exposure level can be high.

In these cases adequate ventilation must be provided (eg tunnel fans) and it is essential to use the recommended protective equipment. Due to the presence of solvent, cutbacks may cause dizziness or nausea when used in confined spaces. Again in these circumstances adequate ventilation is always recommended.

There is no EU occupational exposure limit (OEL) set for bitumen fumes but several European countries have established their own threshold value and/or short term exposure limit. Please note that these values are country specific. For more detailed information please refer to section 8 of the Safety Data Sheets.

The Derived No Effect Level (DNEL) which has been derived in the REACH process is 2.9mg/m³ (Total Hydrocarbon Concentration, TWA* 8h) for bitumen based on irritative effects.

For more information on workplace exposure measurement protocol see www.eurobitume.eu

Exposure measurements at paving works have shown that the light oil molecules which are present in inhaled air largely come from solvents such as diesel oil which was historically used as a release and cleaning agent when applying the bitumen.

Bitumen contains a small amount of Polycyclic Aromatic Hydrocarbons (PAHs) of which some are classified as carcinogenic. As a consequence there have been many studies to evaluate if there is an increased risk of cancer among asphalt workers. The International Agency on Research on Cancer (IARC) has done an epidemiological study on asphalt workers in several European countries. This study showed a small increase of lung cancer among asphalt workers in some countries but it was not possible to see if the cancer was related to bitumen or other factors (eg tobacco smoking). As a follow up IARC conducted a study where the reasons behind the cancers were evaluated. The outcome of this study showed that there was no direct link between bitumen and lung cancer. The increase was probably more linked to tobacco smoking.

At the time of printing this safety booklet the full report of ‘IARC monographs on the evaluation of occupational exposures to bitumen and bitumen emissions, volume 103’, had not been published.

*Time Weighted Average
Bitumen fuming as a function of handling temperature

Soft grade bitumen
Hard grade bitumen

For further details on the monograph conclusions and latest bitumen industry updates please check Eurobitume’s website: www.eurobitume.eu/hse or Nynas website www.nynas.com

Although there is no currently available study showing that even long term exposure to bitumen fumes is harmful, it is nevertheless recommended to avoid all unnecessary exposure.

The following should be noted:
• control temperature to reduce fuming
• do not use diesel fuel as a release and cleaning agent.
The principal symptoms of exposure to H₂S are irritation of the eyes, nausea, vomiting, dizziness and headaches. Prolonged exposure to concentrations above 50ppm produces irritation of eyes, nose, throat and lungs. Any exposure to concentrations above 500ppm can be fatal. Levels above 700ppm cause unconsciousness and a person can collapse within seconds.

In open working areas hydrogen sulphide is unlikely to pose a risk to health. However hydrogen sulphide can accumulate in closed spaces and in the headspace of storage tanks containing bitumen and can reach potentially hazardous concentrations (lethal concentrations may occur).

There is also a risk of potential hazardous concentrations in headspace of trucks and in storage tanks further down the supply chain (asphalt plants etc).

Hydrogen sulphide (H₂S)

The release of H₂S from both crude oil and certain types of oil products such as heated bitumen is and has been a common occurrence in the petroleum industry.

Hydrogen sulphide (CAS # 7783-064, EINECS # 231-977-3) is a toxic and flammable gas which is heavier than air and may accumulate in low areas and confined spaces. It is characterised by a strong odour of "rotten eggs" at low concentrations. But this odour cannot be relied upon to warn of the presence of dangerous concentrations because the gas rapidly deadens the sense of smell even at concentrations below hazardous levels. When handled hot, bitumen odour will also camouflage the rotten egg odour of H₂S.

At many loading sites the driver has to stand here during loading

\[ 1.5 \text{m} \leq 1\text{ppm} \]
\[ 1.0 \text{m} \leq 3\text{ppm} \]
\[ 0.5 \text{m} \leq 5\text{ppm} \]

Inside tanker manlid < 50ppm

Truck tank headspace < 500ppm

Note: figures obtained from Nynas H₂S monitoring measurements 2010/11
Areas around manlids and ventilation pipes are risk areas for exposure especially during filling operations.

Access to vents should be restricted with warning signs for H₂S and access prohibited while the tanks are being filled.

When access is necessary, as for manual tank measurements, a full gas mask should be worn.

At loading sites there should be signs that warn the loader of possible H₂S. Personal Dose Monitors (PDM) are recommended for those performing the loading.

Before entering confined vapour spaces in bitumen tanks always check for hydrogen sulphide.

There are national Occupational Exposure Limits (OEL) for hydrogen sulphide. The values can be found in the Safety Data Sheets for bitumen.

First aid in case of hydrogen sulphide intoxication or excessive fume exposure

Under safe conditions, remove the person from the contaminated atmosphere into fresh air. Rescuers must wear breathing apparatus, belt and safety rope and follow rescue procedures. If trained to do so immediately begin artificial respiration if breathing has ceased. Provision of oxygen may help. Obtain medical advice for further treatment. If the gas has affected the eyes, wash with water for at least five minutes and seek medical attention.

Note: figures obtained from Nynas H₂S monitoring measurements 2010/11
Cutbacks contain a solvent (eg naphtha, kerosene, white spirit or flux oil) which depending on the type of solvent may cause skin irritation at repeated exposure.

Where contact with the skin is repeated over a long time there is a risk - although a small one - of permanent skin damage.

Bitumen contains very low concentrations of Polycyclic Aromatic Hydrocarbons (PAHs) of which some are known to be carcinogenic. The concentration of PAHs is lower in bitumen than in the crude oil itself since the production process includes a vacuum distillation step where practically all the PAHs are lifted out.

In undiluted bitumen the PAHs are not considered to be bioavailable. However if the bitumen is mixed with diluents it is believed that such materials may become bioavailable if the product has low viscosity at ambient temperatures.

Bitumen emulsions contain low concentrations of emulsifiers which can cause irritation to the skin and eyes. Some of the emulsions can also contain small amounts of solvents.

It is therefore essential to wash carefully the parts of the body that have come into contact with a bituminous mixture with soap and water or a vegetable oil. It is recommended to use an appropriate skin cream afterwards.

Always check the appropriate Safety Data Sheet for more information.
Danger of fire and explosion

In order to prevent fire in storage tanks the product should be stored sufficiently below its ignition temperature. This provides a safe margin for deviations of any measuring devices. Bitumen should be stored at least 30°C under its flash point. The auto ignition temperature for pure bitumen is over 300°C.

There is a risk of self ignition if bitumen has leaked into tank insulation. Heating that leads to self ignition on the surface of porous or fibrous material that has been impregnated with bitumen or by condensed bitumen fume can occur at temperatures below 100°C.

Carbon deposits that can be pyrophoric may develop on walls and roofs of bitumen storage tanks. In the presence of oxygen, these might develop a risk of self ignition.

Actions to prevent fire and explosions

Clean and repair any damaged insulation. Replace the insulation where it has been contaminated. If there has been a storage tank overfill it is very likely that this will lead to a fire in the insulation unless correct actions are taken. If contaminated, insulation cannot be immediately replaced the risk of fire could be decreased by injecting steam through the use of steam lances.

Bitumen road tankers and storage tanks that have contained cutbacks may contain concentrations of flammable vapours in the headspace. Therefore no open flame such as that of a bottled gas burner, blow torch or similar should be in the immediate vicinity during or soon after unloading. However road tankers and railway wagons can be equipped with heating tubes for heating bitumen with bottled gas. It is essential that heating tubes in a tank are well covered by bitumen (between 10cm and 20cm) during the heating process. This especially applies to cutbacks that contain solvent with a low flash point. The heating tubes should have a double skin to avoid local overheating. Flames must never directly heat the tank surface. If this happens there will be a risk of ignition. Ensure that protective tubing is in good condition. A common cause of bitumen ignition is localised overheating during the heating process, for instance during unloading.
Extinguishing bitumen fires

NEVER USE A WATER JET!

Bitumen fires must be extinguished by smothering so that the continued supply of oxygen can be prevented.

Small fires can be put out with a blanket of foam, dry powder or carbon dioxide extinguishers.

Large fires are extinguished preferably by using foam or dry powder extinguishers but there is a danger of fires flaring up again. Foam and powder do not provide a lasting oxygen free atmosphere in bitumen fires.

Fires in tank insulation can be put out using steam from a spray unit or a dry powder extinguisher. It is essential to always replace contaminated insulation. If it is not replaced the fire could ignite again when oxygen is reintroduced unless the temperature is well below 100°C. Ensure that workplaces and road tankers are equipped with extinguishers of the correct size and type.

If a bitumen fire arises, always call the local emergency fire services and tell them what is on fire.
Bitumen as such is not classified as dangerous to the environment.

REACH requires assessment of the Persistent Bioaccumulative Toxic (PBT) and Very Persistent Very Bioaccumulative (vPvB) properties of a substance. Bitumens are neither classified as PBT or vPvB.

Bitumen is a hydrocarbon UVCB (substances of Unknown or Variable composition, Complex reaction products or Biological materials) that does not pose a chronic hazard to water, soil or sediment. Derivation of PNEC (Predicted No Effect Concentration) for bitumen is not scientifically justified due to limitations on water solubility.

Some components used in bitumen mixtures are classified as environmentally hazardous. For example bitumen cutbacks normally contain solvents that are classified as dangerous to the environment. Depending on the type of ingredients used, some of the bitumen emulsions are also classified as harmful or toxic to aquatic organisms. The severeness of the classification depends on the classifications and amounts of the ingredients. Always check the Safety Data Sheet.
Spill

Bitumen

Spillage of bitumen to ground is relatively harmless. Leaks and spillages will initially consist of molten hot material and there may be a risk of severe burns. The bitumen will cool down and become solid. The affected area can be cleaned up using ordinary equipment such as spades, rakes, wheel mounted loaders and similar.

In water, bitumen will normally sink into the sediment at the bottom although in some circumstances it may float.

The main effect of a spill of bitumen in water or on soil is adsorption to sediment causing physical contamination. The water solubility of bitumen is so low that it could be considered to be negligible. Bitumens are not thought to present any significant hazard to the aquatic environment.

Bitumen constituents are potentially bioaccumulative but the low water solubility and high molecular weight make the bioavailability to aquatic organisms limited. Bioaccumulation is unlikely. The use of bitumen in road and roofing construction shows that bitumen is a persistent material (ie it is not and should not be biodegradable).

Cutbacks

Cutback spillage to ground can be more complicated since it has a lower viscosity and can consequently penetrate the soil and/or affect nearby watercourses before hardening. In time the solvent will evaporate from the product.

If spilled in water the product will form a film on the surface and spread. The product will adhere to soil and the solvent will evaporate from the product. The bitumen itself is immobile and will remain on the soil surface where it can be removed mechanically.

Bitumen emulsions

In contact with soil the emulsion will break and the bitumen particulates are adsorbed in the upper layer and are therefore easy to clean up.

In contact with water, the emulsion will spread out on the surface of water and blend with the water. The emulsion will finally collapse on dilution. The emulsifier will partly dissolve in water and the bitumen phase will disperse.
Atmospheric emissions

Bitumen at ambient temperature does not cause any atmospheric emissions. However, storage and application at elevated temperatures cause diffuse emissions of mainly hydrocarbons. These emissions increase with the handling and storage temperature.

When bitumen is heated, hydrogen sulphide is given off as well as hydrocarbons. For more information regarding hydrogen sulphide please see 2.6.

Actions and advice in case of a spill

Even though most bitumen products are not hazardous to the environment they can cause physical contamination.

A major bitumen spill can for example block sewers and drains when hardening. For this reason any spill should be controlled as soon as possible without endangering people's health in the process.

Prevent product from entering sewers, rivers or other bodies of water since the solidified product may clog drains and sewers.

Guidance on spillage:

- small spill - allow the bitumen to cool and solidify. Remove mechanically into containers for disposal or reclamation in accordance with local regulations
- large spill - prevent from spreading by making a trench or barrier with sand, earth or other material. Otherwise treat as a small spillage.

Contact the local authorities and/or emergency services. Always act according to the local legislation.

Waste disposal

For the disposal of bitumen products, refer to section 13 of the Nynas Safety Data Sheets. Bitumen itself is not regarded as a hazardous waste.
Distribution, transport, loading and unloading
The majority of bitumen products are transported in bulk by road tankers or vessels. In some countries rail transport is also used. Smaller volumes can also be supplied in drums or mini containers for example intermediate bulk containers. This is common practice for emulsions and bituminous solutions but less common for road bitumen. Oxidised bitumen and polymer modified bitumen can also be distributed in pellets or in blocks, stacked on pallets.

Transporting hot bitumen is subject to the international UN regulation regarding the transportation of hazardous goods which applies to:

- road transport (ADR)
- rail transport (RID)
- inland waterways transport (ADN)
- sea transport (IMDG).

Road transportation of dangerous goods in Europe is regulated by the international agreement 'Accord Européen relatif au transport international des marchandises Dangereuses par Route' (ADR). This regulation implies specific requirements regarding for example:

- the vehicle
- labelling of the vehicle (with respect to the goods being transported)
- checking documentation and emergency information relative to the product
- the driver (and co-driver).

For details of ADR refer to Appendix 2.

For the transport of bitumen products refer to section 14 of the Nynas Safety Data Sheets.
Preventing accidents during handling and transportation

All equipment and its maintenance should always follow local, national and international regulations and codes of good practice.

During loading of Bitumen

It is important that the tanker does not contain residues from previous loads, for example emulsion or a product with a low boiling point. Bitumen loaded onto water or emulsion can lead to a violent eruption or boil-over. It must therefore be avoided at all times.

Tanks that have carried emulsions have to be steam cleaned and dried before they can be used for bitumen products. Procedure loading must be considered.

If a dead man’s handle is to be used during loading, it is strictly forbidden to override the operation of the safety handle.

There is a risk of splashing especially when loading commences. Always use the correct Personal Protective Equipment (see Appendix 1).

In the event of an accident the depot or refinery personnel should always be contacted and the local site instructions followed.

Safe bitumen delivery in brief

- Use all round Safety Awareness - Observe, think and act.
- Be aware of the vehicle’s emergency locations (fire extinguishers, emergency stop buttons, main closure valve).
- Ensure all personnel are kept at least 6m away from the delivery operation (exclusion zone).
- Driver must stay in attendance at the main closure valve at all times during delivery.
- Check and secure any valves, caps, covers and padlocks.
- Leave the delivery point in a clean condition.
- Sign and complete delivery documentation.
- Report all defects or any problems firstly to the customer, secondly to your Nynas contact.
The supplier’s responsibilities

The supplier/consignor is responsible for:

• classification of the products under ADR, RID, ADN and IMDG
• using approved packaging for packaged products ensuring correct marking and labelling
• declaring products in accordance with local regulations
• issuing the correct transportation documents to accompany the delivery.

Information regarding the classification of each product is given in the Safety Data Sheets provided by the supplier.

Nynas can provide on request ‘Additional Information for ADR 5.4.3 Instructions in Writing’. Please see an example in Appendix 2.

The haulier’s responsibilities

In order to guarantee the correct delivery it must be ensured that the right product and quantity at the right temperature is loaded on the premises of the bitumen supplier. This should be verified throughout the entire process.

The temperature of the load can fall quickly if the vehicle’s tanks are cold. Recommended handling temperatures are given in Appendix 6.

The haulier guarantees that vehicle tanks are approved for transport according to the Nynas instructions. The driver must inform the supplier about the previous load. The supplier is entitled to verify this information at any time.

It is the haulier’s responsibility to:

• make sure that vehicles are fully equipped according to the ADR legislation and that they are properly marked and labelled
• provide their driver/s with ‘ADR Instructions in Writing 5.4.3’.

Drivers who transport ADR classified goods require a special training certificate. The haulier is responsible for the training and certification of its drivers.

Accredited bitumen suppliers normally have equipment and checking procedures so that the driver can easily monitor the loading process. If anything goes wrong the driver should always immediately stop loading and contact the bitumen supplier’s personnel.

The haulier/driver should use the supplier’s accident/incident reporting system as well as the one used in his own organisation in order to take preventive and corrective actions as soon as possible.
The delivery hose/flex is a vital piece of equipment for the safe delivery of elevated temperature products. It is therefore very important to use the correct hose/flex for the intended use.

It is recommended that the hose should have a minimum length of four metres. Importantly for elevated temperature products the hose/flex must have temperature rating and a pressure rating.

Testing of the hose/flex should be carried out according to local legislation and codes of good practice. It is recommended to test them at least annually. This will include equipment certification. Records of the testing should be kept by the owner. Hoses that have not been tested should not be used.

Drivers should carry out checks on their hose/flex, connection packings and gaskets before use on a daily basis. If any faults are found defective equipment should not be used and corrective actions should be taken.
To minimise the risk of accidents and to ensure a high quality standard of delivered products, it is very important that a vehicle's tank does not contain residue from previous loads. Special attention should be paid to emulsions (containing water) and products with a low flash point. In case of doubt the bitumen supplier/depot manager should always be consulted.

Due to the dangers of mixing bitumen emulsion and bitumen it is recommended that inspection of the loading vehicle is instigated and site specific procedure loading is followed. Always consult with the bitumen loading facility.

More information regarding safe loading is described under ‘Preventing accidents during handling and transportation’, 3.2. Loading and unloading checklists are added as Appendices 3 and 4.


**Sampling bitumen products**

Hot bitumen sampling is particularly hazardous due to the risk of splashes and spills that can cause burns. It is therefore essential to wear the appropriate Personal Protective Equipment (PPE) as indicated in Appendix 1.

The sampling area should have safe ingress and egress with adequate lighting.

Local site specific instructions must always be followed. If in doubt, ask the site representative.

**In line sampling valves**

In this case sampling valves are placed in the pipe and are used to take a sample directly from the bitumen flow.

**Dip sampling**

Dip sampling is used for small samples using a weighted receptacle attached to a rope or rod. Sample taking from road vehicles should be avoided. There is a risk of exposure to potentially hazardous concentrations of H₂S during dip sampling (please see section 2.6). Dip sampling of cutbacks should be avoided due to the flammable atmosphere in the tanker’s vapour space.

**Labelling of samples**

Always fill in the label on the sample container with the following information:

- date of sampling
- delivery depot/place of sampling
- delivery note number
- receiving tank
- sampler’s signature.
Storage of bitumen

All bitumen products should to a certain extent be regarded as perishable goods as their characteristics change when stored for long periods at varying temperatures. This applies especially for packaged liquid bitumen products which therefore can only be stored for a limited period.

Correct storage temperature of bitumen products will guarantee product quality in the final application. From a quality perspective it is therefore essential that the product is handled correctly. Bitumen is a construction material and should be handled accordingly.

Bitumen should be stored in well insulated tanks. This will reduce the need for extra heating which in turn will reduce heating costs. The temperature of the heating source can also be kept lower so that the bitumen will not be unnecessarily exposed to excessive contact temperatures. Please note that bitumen at the bottom of a storage tank can have a considerably higher temperature than in other parts of the tank unless it is properly agitated.

If the bitumen is overheated locally, deposits may be produced. These deposits appear on heating coils and other inner parts of storage tanks. After a while such deposits may fall off and interfere with pumping or mixing actions.

For the selection of a product’s storage temperature please refer to the bitumen handling temperature recommendations given in Appendix 6. In the case of specialty products please refer to manufacturers’ recommendations.

Care should be exercised to ensure that the temperature at the bottom of an empty tank does not become so low so as to allow water to condensate.

An empty cold tank should initially be filled up gradually. This will give any remaining moisture time to evaporate. For tanks containing cold bitumen, heating should be carried out at a low level until the bitumen temperature has reached 120°C. This enables moisture to evaporate before hot bitumen is added to the tank. It is important that bitumen covers the heating tubes when heated.

It is recommended to fill tanks in three stages allowing the temperature in the tank to equilibrate each time one third has been loaded.

Packaged bitumen for example in drums is not as likely to be affected by oil or contaminants as is bitumen in bulk. Nevertheless packaged bitumen should be stored carefully. The warmth of the sun can cause the light components in the product to vaporise and form bubbles when the packaging is damaged. These bubbles can contain flammable vapours.

4.1
The characteristics of bitumen products can change when stored for prolonged periods at high temperatures. Bitumen will gradually harden. The penetration, a measure of the bitumen’s hardness, may decrease. The hardening process will increase when higher storage temperatures are used and will be worse in partly full tanks where more air is present.

There is a possibility that flammable atmospheres can be generated. Pyrophoric deposits can also be formed. For this reason controlled oxygen depletion is recommended. Continuous purging of the tank vapour space is not recommended because it can promote the formation of pyrophoric deposits. Oxygen concentrations between 4% and 6% are normally sufficient to prevent the build up of deposits.

If the tank has been operated under controlled oxygen depletion then any potentially flammable vapours should be displaced for example with nitrogen before air is allowed to enter the tank (ie cooling before maintenance).
In some cases it is necessary to blend different grades of bitumen. Such blends seldom become homogeneous if they are not stirred mechanically or blended through an in line blender. Mixing by means of air is not advisable for bitumen products since this will result in an oxidation process. The mixers should be activated occasionally in order to maintain the proper temperature and quality of a tank’s contents.
Construction, equipment and inspection of storage tanks for oil products in general should follow the API standards 650 and 653 regarding ‘Welded steel tanks for oil storage’ and ‘Tank inspection, repair, alteration and reconstruction’ and/or any additional local standards such as the latest ‘Bitumen Safety Code (model code of safety practice)’ provided by the Energy Institute.

For bitumen product tankage inspection by an independent inspection company is not necessary. Inspection can be handled locally in a self administered programme.

It is recommended that new tanks are inspected after 20 years. Tanks older than 20 years should be inspected every 12 years.

Inspection can be more frequent if any reasons are seen for this, for instance if tank corrosion is begun to be noticed and the tank needs to be monitored more closely. This evaluation can be done by expertise at the location or in cooperation with Nynas.

A bitumen tank should also be provided with an inert gas blanketing system to prevent tank breath (moisture and oxygen getting into the tank). API 2023 gives recommendation on when bitumen tanks shall be inerted.

It is recommended to have a safety shower in the vicinity of storage tanks in which bitumen is being unloaded.

In respect of tank entry please refer to 4.7.
Venting pipes and other attachments

Pipework should comply with local regulations and standards and should be as vertical, as short and with as few bends as possible. If the pipework is required to be longer than necessary or is in exposed locations then insulation and heating of the pipework will be required. The inlet should be between 0.5m and one metre from ground level and be fitted with a specialist flange fitting.

If the line is full and the inlet line is lower than the bitumen level then syphoning will take place.

It is recommended to have independent low, high and ultra high level alarms installed on bitumen storage tanks.

Ventilation from the headspace of tanks should be placed to minimise personal exposure of hydrocarbon and H₂S to the tank headspace.

Bitumen and bituminous solutions are stable substances that do not tend to corrode metal surfaces they contact. However vapours from the tank’s vapour space constantly move in and out through the vent pipes at storage depending for instance on weather conditions. The tank breathes which causes a continual mixing of air, moisture and hydrocarbons. This mixture is corrosive.

Coke deposit can also be formed in vent pipes and cause a harmful over - or under - pressure inside the tank. This applies especially to tanks containing oxidised bitumen. Storage tanks for bitumen emulsions are normally not affected by the product.

Damage to tanks’ pipework and equipment can be prevented through regular inspection and an adequate preventive maintenance programme.

Special attention should be paid to the inlets through the insulation because pitting may occur there. Bitumen leakage and condensation of oil mist between the tank plate and insulation is a frequent cause of fire. It is important to replace contaminated insulation as soon as possible!
**Bitumen storage tank requirements**

- **Ladder**
- **Vent**
- **Measuring electronics**
  - High level alarm
  - Level gauge
  - Temperature gauge
- **Handrail and stairs**
- **Choose the right construction steel**
  Must be easy to replace
- **Heating coils**
  Must be easily accessible for maintenance
- **Manlid**
  Consider the placing for ease of tank maintenance
- **Shells plates Wind girder**
  Strong winds can tear down the shell plates
- **OverFLOW pipe**
- **Stirrer**
  Consider power requirement and mechanical stability
- **Insulation**
  - Suitable for temperatures up to 230°C
  - Good insulation limits temperature variations in the tank
  - Limits deposits
- **Cleaning hatch**
- **Decontamination**
  Gravel or smooth concrete base on the area around the storage tank - for easier waste handling
- **Sloping bottom plate**
  Easier to empty the tank
- **Valves**
  - Draining
  - Inlet
  - Outlet
  - Sampling
Cleaning and emptying of tanks EU Directive – UK Confined Space Entry Regulations

Bitumen deposits created by the oxidation process can often be found in storage tanks with a high storage temperature or uneven temperature distribution. Therefore tank cleaning should be part of a regular maintenance programme taking into account the tank’s history and the applicable local legislation.

When emptying a storage tank it is essential to be familiar with the layout of the bottom of the bitumen tank; the way in which the heating coils are constructed; and how conduits are connected.

The tank is normally heated to the highest temperature the product allows for storage before the content is pumped out. Draining of the final section should be done slowly to allow the bitumen sufficient time to flow and prevent tank implosion.

When a tank is taken out of service always ensure that the tank’s temperature is below 40°C before opening the manhole for ventilation. When the tank has more than one manhole, the lower one should be opened first.

Before personnel can enter the tank, the tank should be ventilated and gas tests should be performed in order to guarantee a safe work environment (with safety permit system/checklist for work in confined spaces in place).

Bitumen residue that cannot be pumped out or washed out with oil while it is warm is usually allowed to solidify and must be chiselled away. Product remnants should be disposed of in compliance with local and national regulations. Recycling is always recommended.

Tanks for soft bitumen, bituminous solutions and bitumen emulsions can normally be cleaned through successive mixing of the residue with solvent. However care must be taken to ensure that the temperature is always kept below the flash point of the mixture.

Whenever products are changed in large installations the pipework must be emptied. This can be done by flushing in several stages which will ensure that only traces of the previous product will remain in the piping system.
Appendix 1 - Personal Protective Equipment (PPE)

For all tasks involving bitumen handling, a task Risk Assessment should be performed detailing the required PPE for the associated task.

PPE should be used when working with bitumen and should cover all parts of exposed skin to avoid direct contact.

1. Loading and unloading

Always use:

- a safety helmet 1 and visor 2.
  Eye goggles do not give full face protection
- a neck apron to protect the back of the neck 3
- a coverall with additional high visibility 4
- heat resistant gauntlets/gloves 5.
  Ensure that no bitumen can run into the gloves (see latest Eurobitume documentation)
- a one piece protective coverall 6 with 7 long sleeves and legs worn over boots
- safety footwear, calf length 8.
  No shoes, sandals, clogs or trainers.

NOTES:
During loading and discharging it is recommended to wear well fitting long sleeved gauntlets (see picture). If close fitting wristlet gloves are used the cuffs should always be worn inside coverall sleeves.

In general there may be additional PPE requirements from local sites eg Personal Dose Monitor (PDM) for H₂S during loading operations.
2. Product handling and sampling

Always use:

- safety glasses \(^1\)
- gloves \(^2\)
- overall \(^3\).

NOTES:
If close fitting wristlet gloves are used, the cuffs should always be worn inside overall sleeves. If taking bitumen samples, full face protection must be used.

Always follow any site specific requirements.
Transport containers (tankers)

Trucks used for bitumen transport should fulfil the technical specifications in the countries where they are to be used. Furthermore vehicles and tanks must fulfil the demands of the ADR/RID/ADN/IMDG* legislation.

It is essential that tankers are constructed in such a way that they can be completely emptied. (In the UK this is done by means of dump valves. Air is released from the trailer air suspension and this in turn lowers the rear air suspension). It is also the reason why road/railway tanks used for bitumen transportation nowadays are built with a completely smooth interior.

ADR legislative requirements should be followed for tank manufacture with regard to metal type in order for them to endure high temperatures and large temperature changes. The tanks should be well insulated to maintain the temperature of the product for as long as possible. Some tankers are equipped with heating. Equipment is chosen according to the geographical area of transportation and the type of product handled.

Bitumen tanks should be constructed and should function in such a way that the risk of injuries is reduced to a minimum and the product retains its quality, homogeneity and temperature during transit.

Labelling of vehicles according to ADR regulations

This relates to UK, Nordic and Continental marking requirements.

Dangerous goods have been divided into nine different classes.

Within this classification each product is assigned a UN number, packaging group and a safety label code.

Bitumen is classified as dangerous due to its high transport temperature (>100˚C, below its flashpoint). Also the low flash points of cutbacks may imply classification as dangerous goods.

Bitumen is classified as follows:
- UN 3257, ELEVATED TEMPERATURE LIQUID, N.O.S. at or above 100˚C and below its flash point (bitumen)
- Class 9
- Packaging group III
- Classification code M9.

* see section 14 of Safety Data Sheets (SDS)
For UK domestic journeys the marking and labelling for bitumen

For Nordic and Continental journeys the marking and labelling for bitumen
Additional Information for ADR 5.4.3. Instructions in Writing

**UN number:** 3257  
**ADR/RID Class:** 9  
**Hazard identification number:** 99  
**Packing group:** III

**LOAD**  
**Proper shipping name:** Elevated temperature liquid, N.O.S. at or above 100°C and below its flashpoint. (Bitumen) (D)  
**Name of product or products:** Bitumen 
**Physical state:** Liquid at normal handling temperature. 
**Colour:** Brown to black 
**Odour:** Characteristic. 
**Solubility:** Insoluble in water.

**NATURE OF DANGER**  
- Contact of hot liquid with skin causes severe burns. 
- Overheating of product may result in fire or explosion. 
- Contact with water will result in a violent expansion and a danger of boil-over. 
- Respiratory problems or nausea may be induced by high concentration of fumes / vapours.

**PERSONAL PROTECTION**  
- Safety helmet with integrated full face visor and neck protection 
- One-piece protective coverall 
- Safety footwear covering ankle 
- Heat resistant gloves with long sleeves 
- During loading/unloading there should be no areas of exposed skin and the face visor must be down!  
  
**GENERAL ACTIONS TO BE TAKEN BY DRIVER**  
- Stop the engine. 
- No naked lights. No smoking. 
- Mark roads and warn other road users or persons passing by. 
- Inform the public about the hazard and give advice to keep up wind. 
- Notify police and fire brigades as soon as possible.

**ADDITIONAL AND/OR SPECIAL ACTIONS TO BE TAKEN BY THE DRIVER**  
- Only take action if without personal risk. 
- Avoid direct contact with the product. 
- Stop leaks if possible without risk. 
- Contain or absorb leaking liquid with sand / earth or suitable material. 
- If practicable: use shovel, broom, small collecting container. 
- Prevent liquids from entering water courses, sewers, basements and workpits. 
- If product has entered a watercourse or sewer or been spilt on soil or vegetation, advise Police.

**FIRE**  
**Information for the driver in case of fire:**  
- Do not attempt to deal with any fire involving the load. 
- Extinguish fire with water fog or fine spray, dry powder, foam, inert gas, carbon dioxide, sand. 
- Do not use water jet. 
- Cool closed containers exposed to fire with water.

**FIRST AID**  
**In case of burns:**  
- Drench burn in cold water for a minimum of 10 minutes. 
- Do not attempt to remove the bitumen unless blocking an airway. 
- Bitumen acts as a sterile layer and should only be removed by specialist medical care. 
- Send person for medical attention immediately. 
- If product gets into the eyes, immediately wash out with plenty of water and get medical attention.

**IN CASE OF CIRCUMFERENTIAL BURNS:**  
- Where hot bitumen completely encircles a limb or other body part, the bitumen must be softened and/or split to prevent restriction of blood flow during cooling (tourniquet effect).

**IN CASE OF RESPIRATORY PROBLEMS:**  
- Under safe conditions remove person from contaminated atmosphere into fresh air. 
- Seek medical assistance if breathing remains difficult.

**ADDITONAL INFORMATION**  
**Date of issue:** 2010-01-07  
**Version:** 2  
**Emergency phone:** +44 (0)208 762 8322

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**APPLIES ONLY DURING ROAD TRANSPORT**

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**Nynas provides additional information sheets on ADR 5.4.3**
Appendix 3 - Bitumen loading checklist

This is not an extensive list but can be used as an example to formulate questions on site and address specific requirements for loading bitumen vehicles.

### BEFORE LOADING

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Vehicle owner</td>
</tr>
<tr>
<td>2.</td>
<td>Vehicle number</td>
</tr>
<tr>
<td>3.</td>
<td>Load order number</td>
</tr>
<tr>
<td>4.</td>
<td>Product required</td>
</tr>
<tr>
<td>5.</td>
<td>Last load</td>
</tr>
<tr>
<td>6.</td>
<td>Same product (compatible)? yes - go to number 9/no - cleaning is required</td>
</tr>
<tr>
<td>7.</td>
<td>Other product (non compatible)? yes/no</td>
</tr>
<tr>
<td>8.</td>
<td>Is cleaning required? yes/no</td>
</tr>
<tr>
<td>9.</td>
<td>Is tank dry, empty and clean? yes/no</td>
</tr>
<tr>
<td>10.</td>
<td>Is procedure loading required? yes/no</td>
</tr>
<tr>
<td>11.</td>
<td>Tank/barrel capacity</td>
</tr>
<tr>
<td>12.</td>
<td>Number of compartments</td>
</tr>
<tr>
<td>13.</td>
<td>Can tank/barrel carry requested amount? yes/no</td>
</tr>
<tr>
<td>14.</td>
<td>Are all tank/barrel valves closed shut? yes/no</td>
</tr>
<tr>
<td>15.</td>
<td>Vehicle correctly labelled? yes/no</td>
</tr>
<tr>
<td>16.</td>
<td>Correct product temperature? yes/no</td>
</tr>
</tbody>
</table>

### AFTER LOADING BUT BEFORE LEAVING

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery note</td>
<td></td>
</tr>
<tr>
<td>Instructions in writing (ADR 4 Page requirement) (Hauliers responsibility)</td>
<td></td>
</tr>
<tr>
<td>Additional information to the ADR 5.4.3 Instructions in Writing</td>
<td>Nynas can provide additional information sheets to the ADR 5.4.3 Instructions in Writing (see Appendix 2).</td>
</tr>
<tr>
<td>Special directions / instructions (if applicable)</td>
<td></td>
</tr>
<tr>
<td>Necessary transport documentation on board</td>
<td>yes/no</td>
</tr>
</tbody>
</table>
## Appendix 4 - Bitumen unloading checklist

### BEFORE UNLOADING

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact with customer’s representative?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Check that the load corresponds to order</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Is the receiving tank number and labelling correct?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Is there enough space in the receiving tank?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Customer signature for ullage</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Correct connection for unloading?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Is all emergency equipment working?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Are high level alarms and tank gauges working properly?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Is a safe exit route available?</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>
Appendix 5 - Eurobitume Bitumen Burns Card

Please check for updates of this card at www.eurobitume.eu

BITUMEN BURNS

NOTES FOR GUIDANCE OF FIRST AID AND MEDICAL PERSONNEL

All persons working with hot bitumen should be familiar with these recommendations in order to administer first aid to burn victims. This document should accompany the patient and be placed in a prominent position before transport to Doctor or Hospital.

NO ATTEMPT SHOULD BE MADE TO REMOVE THE BITUMEN AT THE WORKSITE

FIRST AID

When an accident has occurred the affected area should be cooled immediately to prevent the heat causing further damage. The burn should be drenched in cold water for at least ten minutes for skin and at least five minutes for eyes. However, body hypothermia must be avoided. No attempt should be made to remove the bitumen from the burned area.

FURTHER TREATMENT, FIRST AID AND MEDICAL CARE

The bitumen layer will be firmly attached to the skin and removal should not be attempted unless carried out at a medical facility under the supervision of a doctor. The cold bitumen will form a waterproof, sterile layer over the burn which will prevent the burn from drying out. If the bitumen is removed from the wound there is the possibility that the skin will be damaged further, bringing with it the possibility of complications. Furthermore, by exposing a second degree burn in order to treat it, there is the possibility that infection or drying out will make the wound deeper.
>> SECOND DEGREE BURNS
The bitumen should be left in place and covered with a Tulle dressing containing paraffin or a burn ointment containing paraffin, e.g. Flammazine (silver sulphadiazine). Such treatment will have the effect of softening the bitumen enabling it to be gently removed over a period of days. As a result of the natural re-epithelialisation of the wound any remaining bitumen will peel off in time.

>> THIRD DEGREE BURNS
Active removal of the bitumen should be avoided unless primary surgical treatment is being considered due to the location and depth of the wound. In such cases removal of the bitumen is best carried out in the operating theatre between the second and fifth day after the burn occurred. By the second day the capillary circulation has usually recovered and the bed of the wound is such that a specialist can assess the depth to which the burn has penetrated. There are normally no secondary problems such as infections to contend with before the sixth day. However, it is essential to commence treatment using paraffin based substances from the day of the accident to facilitate removal during surgery.

>> CIRCUMFERENTIAL BURNS
Where hot bitumen completely encircles a limb or other body part the cooled and hardened bitumen may cause a tourniquet effect. In the event of this occurring the adhering bitumen must be softened and/or split to prevent restriction of blood flow.

>> EYE BURNS
No attempt should be made to remove the bitumen by unqualified personnel. The patient should be referred urgently for specialist medical assessment and appropriate treatment.

Considerable effort has been made to assure the accuracy and reliability of the information contained in this publication. However, neither Eurobitume nor any company participating in Eurobitume can accept liability for any loss, damage or injury whatsoever resulting from the use of this information. Eurobitume would like to acknowledge the contribution of Drs M.J. Hoekstra and M.H.E. Hermans of the Burns Unit, Red Cross Hospital, Beverwijk, The Netherlands, in compiling this guide.

eurobitume
E-mail: info@eurobitume.eu
## Appendix 6 - Bitumen storage and handling temperatures (as recommended by Eurobitume)

The table gives an overview of best practice for handling each grade:

### PAVING GRADE BITUMEN

<table>
<thead>
<tr>
<th>Grade</th>
<th>Minimum Pumping Temperature</th>
<th>Typical Storage Temperature</th>
<th>Maximum Handling/Storage Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/20</td>
<td>150°C</td>
<td>175°C - 190°C</td>
<td>200°C</td>
</tr>
<tr>
<td>15/25</td>
<td>145°C</td>
<td>175°C - 190°C</td>
<td>200°C</td>
</tr>
<tr>
<td>20/30</td>
<td>140°C</td>
<td>165°C - 185°C</td>
<td>200°C</td>
</tr>
<tr>
<td>30/45</td>
<td>130°C</td>
<td>160°C - 180°C</td>
<td>200°C</td>
</tr>
<tr>
<td>35/50</td>
<td>130°C</td>
<td>155°C - 175°C</td>
<td>200°C</td>
</tr>
</tbody>
</table>

### PAVING GRADE BITUMEN

<table>
<thead>
<tr>
<th>Grade</th>
<th>Minimum Pumping Temperature</th>
<th>Typical Storage Temperature</th>
<th>Maximum Handling/Storage Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>40/60</td>
<td>125°C</td>
<td>150°C - 170°C</td>
<td>200°C</td>
</tr>
<tr>
<td>50/70</td>
<td>125°C</td>
<td>145°C - 165°C</td>
<td>200°C</td>
</tr>
<tr>
<td>70/100</td>
<td>120°C</td>
<td>140°C - 160°C</td>
<td>190°C</td>
</tr>
<tr>
<td>100/150</td>
<td>115°C</td>
<td>135°C - 155°C</td>
<td>190°C</td>
</tr>
<tr>
<td>160/220</td>
<td>110°C</td>
<td>130°C - 150°C</td>
<td>190°C</td>
</tr>
</tbody>
</table>

### PAVING GRADE BITUMEN

<table>
<thead>
<tr>
<th>Grade</th>
<th>Minimum Pumping Temperature</th>
<th>Typical Storage Temperature</th>
<th>Maximum Handling/Storage Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>250/330</td>
<td>100°C</td>
<td>125°C - 145°C</td>
<td>190°C</td>
</tr>
<tr>
<td>330/430</td>
<td>95°C</td>
<td>120°C - 140°C</td>
<td>180°C</td>
</tr>
<tr>
<td>500/650</td>
<td>90°C</td>
<td>115°C - 135°C</td>
<td>170°C</td>
</tr>
<tr>
<td>650/900</td>
<td>85°C</td>
<td>110°C - 130°C</td>
<td>160°C</td>
</tr>
</tbody>
</table>

### OXIDISED BITUMEN

<table>
<thead>
<tr>
<th>Grade</th>
<th>Minimum Pumping Temperature</th>
<th>Typical Storage Temperature</th>
<th>Maximum Handling/Storage Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;B &lt;100°C</td>
<td>r&amp;b + 80°C</td>
<td>200°C - 220°C</td>
<td>230°C</td>
</tr>
<tr>
<td>R&amp;B &gt;100°C</td>
<td>r&amp;b + 90°C</td>
<td>210°C - 230°C</td>
<td></td>
</tr>
</tbody>
</table>

### SOFT BITUMEN

<table>
<thead>
<tr>
<th>Grade</th>
<th>Minimum Pumping Temperature</th>
<th>Typical Storage Temperature</th>
<th>Maximum Handling/Storage Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1500</td>
<td>60°C</td>
<td>80°C - 130°C</td>
<td>130°C</td>
</tr>
<tr>
<td>V3000</td>
<td>65°C</td>
<td>85°C - 135°C</td>
<td>140°C</td>
</tr>
<tr>
<td>V6000</td>
<td>70°C</td>
<td>90°C - 140°C</td>
<td>150°C</td>
</tr>
<tr>
<td>V12000</td>
<td>80°C</td>
<td>100°C - 150°C</td>
<td>150°C</td>
</tr>
</tbody>
</table>
Minimum pumping temperature
This indicates the minimum temperature at which the bitumen reaches a suitable viscosity for pumping, typically related to 2000 mPa.s.
For normal operations, temperatures 10°C to 50°C in excess of these may be selected to facilitate transfer or blending operations but the maximum safe handling temperature must not be exceeded.

Typical storage temperature
A range is given for each grade. These cover the typical temperatures used for storage of the bitumen and are consistent with achieving realistic loading rates and delivery to customer storage tanks. The period during which bitumen is stored and circulated at elevated temperature should be minimised to prevent hardening. If the bitumen is to be stored for an extended period without addition of fresh material, the temperature should be reduced to approximately 20°C to 25°C above the softening point with circulation stopped. When reheating the process must be carried out carefully to prevent localised overheating and operating problems.

Maximum handling/storage temperature
The recommended maximum storage and handling temperatures are based on generally satisfactory experience for storage in contact with air subject to avoidance of flammable atmospheres in the vapour space of the tank.
The maximum handling and storage temperatures vary according to bitumen grade but the current recommended maximum for paving grade bitumen is 200°C. For other grades please refer to the appropriate Safety Data Sheets.
<table>
<thead>
<tr>
<th>Appendix 7 - Nynas bitumen sales offices</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Belgium</strong></td>
</tr>
<tr>
<td>Nynas NV</td>
</tr>
<tr>
<td>Excelsiorlaan 87</td>
</tr>
<tr>
<td>BE-1930 Zaventem</td>
</tr>
<tr>
<td>Tel: +32-2-725 18 18</td>
</tr>
<tr>
<td><strong>Denmark</strong></td>
</tr>
<tr>
<td>Nynas A/S</td>
</tr>
<tr>
<td>Lyngbyvej 20</td>
</tr>
<tr>
<td>DK-2100 Copenhagen</td>
</tr>
<tr>
<td>Tel: +45-39-15 80 80</td>
</tr>
<tr>
<td><strong>Estonia</strong></td>
</tr>
<tr>
<td>AS Nynas</td>
</tr>
<tr>
<td>Öli 5</td>
</tr>
<tr>
<td>EE-74115 Maardu</td>
</tr>
<tr>
<td>Tel: +372-631 94 22</td>
</tr>
<tr>
<td><strong>Finland</strong></td>
</tr>
<tr>
<td>Nynas OY</td>
</tr>
<tr>
<td>Ayritie 128</td>
</tr>
<tr>
<td>FIN-01510 Vantaa</td>
</tr>
<tr>
<td>Tel: +358-20-743 33 10</td>
</tr>
<tr>
<td><strong>France</strong></td>
</tr>
<tr>
<td>Nynas NV</td>
</tr>
<tr>
<td>Excelsiorlaan 87</td>
</tr>
<tr>
<td>BE-1930 Zaventem</td>
</tr>
<tr>
<td>Tel: +32-2-725 18 18</td>
</tr>
<tr>
<td><strong>Germany</strong></td>
</tr>
<tr>
<td>Nynas NV</td>
</tr>
<tr>
<td>Excelsiorlaan 87</td>
</tr>
<tr>
<td>BE-1930 Zaventem</td>
</tr>
<tr>
<td>Tel: +32-2-725 18 18</td>
</tr>
</tbody>
</table>
# Appendix 7 - Nynas bitumen sales offices

<table>
<thead>
<tr>
<th>Sweden</th>
<th>United Kingdom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nynas AB</td>
<td>Nynas UK AB</td>
</tr>
<tr>
<td>PO Box 10700</td>
<td>North Road</td>
</tr>
<tr>
<td>121 29 Stockholm</td>
<td>Ellesmere Port CH65 1AJ</td>
</tr>
<tr>
<td>Tel: +46-8-602 12 00</td>
<td>Tel: +44-151-327 31 71</td>
</tr>
</tbody>
</table>

Nynas UK AB
East Camperdown Street
Dundee DD1 3LG
Tel: +44-1382-462 211
## Appendix 7 - Nynas bitumen depots

### Denmark

Nynas A/S  
Kuwaitvej 3  
DK-8000 Århus C  
Tel: +45-861 273 44  
Fax: +45-861 374 46

Nynas A/S  
Sdr. Molevej 13-15  
DK-4600 Køge  
Tel: +45-566 550 50  
Fax: +45-56-655014

### Estonia

AS Nynas  
Öli 5  
EE-74115 Maardu  
Tel: +372-631 94 22

### France

Nynas NV  
c/o LBC  
Dépôt de Bayonne  
ZI  
Route de la Barre  
FR-40220 Tarnos  
Tel: +32-2-7252238  
Fax: +32-2-7251091

Nynas NV  
c/o LBC  
Dépôt de Nantes  
103, Quai E. Cormerais  
BP 53  
FR-44801 St-Herblain  
Tel: +32-2-7252238  
Fax: +32-2-7251091

### Poland

Nynas Sp. z o.o.  
ul. Gornoslaska 17/18  
PL-70-664 Szczecin  
Tel: +48-914-623 121  
Fax: +48-914-623 188

### Sweden

Nynas AB  
Oljevägen 55  
SE-418 78 Göteborg  
Tel: +46 31 755 12 00  
Fax: +46 31 755 12 01

Nynas AB  
Tjärhovet  
SE-392 31 Kalmar  
Tel: +46 480 40 36 90  
Fax: +46 480 40 36 91

Nynas AB  
Oljehamnsvägen  
SE-149 82 Nynäshamn  
Tel: +46 8 520 652 48  
Fax: +46 8 520 165 10

Nynas AB  
Box 18  
SE-820 22 Sandarne  
Tel: +46 270 42 84 05  
Fax: +46 270 42 84 06

Nynas AB  
Umeå Uthamn  
SE-913 32 Holmsund  
Tel: +46 90 14 91 80  
Fax: +46 90 14 96 09
Appendix 7 - Nynas bitumen depots

Sweden

Nynas AB
Oljevägen 18
SE-211 24 Malmö
Tel: +46 40 93 66 50
Fax: +46 40 18 39 63

Nynas AB
c/o Vopac Logistics AB
Oljevägen 55
SE-418 78 Göteborg
Tel: +46 31 755 12 00
Fax: +46 31 755 12 01

Nynas AB
c/o Vopac Logistics AB
Björkuddsvägen 1
SE-151 38 Södertälje
Tel: +46 8 550 115 38
Fax: +46 8 550 105 14

Estonia

AS Nynas
Öli 5
EE-74115 Maardu
Tel: +372-631 94 22

AS Nynas
Kärkna küla
EE-60503 Tartu
Tel: +372-736 61 44

Appendix 7 - Emulsion plants

Sweden

Nynas AB
Oljevägen 5
SE-418 78 Göteborg
Tel: +46 31 755 12 00
Fax: +46 31 755 12 01

Nynas AB
Kritvägen 1
SE-941 00 Piteå
Tel: +46 911 633 20
Fax: +46 911 633 20

Nynas AB
Cisterngatan 3
SE-721 32 Västerås
Tel: +46 73 029 70 89
Fax: +46 70 662 24 78
## Appendix 8 - Glossary

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>API</td>
<td>American Petroleum Institute</td>
</tr>
<tr>
<td>CLP</td>
<td>EU regulation 1272/2008 on Classification Labelling and Packaging of substances and mixtures</td>
</tr>
<tr>
<td>Concawe</td>
<td>CONservation of Clean Air and Water in Europe. The oil companies’ European association for environment, health and safety in refining and distribution</td>
</tr>
<tr>
<td>CSA</td>
<td>Chemical Safety Assessment</td>
</tr>
<tr>
<td>DNEL</td>
<td>Derived No Effect Level</td>
</tr>
<tr>
<td>ECHA</td>
<td>European Chemical Agency</td>
</tr>
<tr>
<td>Eurobitume</td>
<td>The European Bitumen Association</td>
</tr>
<tr>
<td>FPC</td>
<td>Factory Production Control</td>
</tr>
<tr>
<td>GHS</td>
<td>Globally Harmonised System of Classification and Labelling of Chemicals</td>
</tr>
<tr>
<td>Hazard</td>
<td>The potential to cause harm</td>
</tr>
<tr>
<td>IARC</td>
<td>International Agency on Research on Cancer</td>
</tr>
<tr>
<td>OEL</td>
<td>Occupational Exposure Limit</td>
</tr>
<tr>
<td>PAHs</td>
<td>Polycyclic Aromatic Hydrocarbons</td>
</tr>
<tr>
<td>PBT</td>
<td>Persiant Bioaccumulative and Toxic</td>
</tr>
<tr>
<td>PDM</td>
<td>Personal Dose Monitor (H₂S)</td>
</tr>
<tr>
<td>PNEC</td>
<td>Predicted No Effect Concentration</td>
</tr>
<tr>
<td>ppm</td>
<td>parts per million</td>
</tr>
<tr>
<td>vPvB</td>
<td>Very Persistant and Very Bioaccumulative</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
</tr>
<tr>
<td>REACH</td>
<td>EU regulation 1907/2006 on Registration Evaluation Authorisation and Restriction of Chemicals</td>
</tr>
<tr>
<td>Risk</td>
<td>The likelihood of harm</td>
</tr>
<tr>
<td>SDS</td>
<td>Safety Data Sheet</td>
</tr>
<tr>
<td>TWA</td>
<td>Time Weighted Average</td>
</tr>
<tr>
<td>THC</td>
<td>Total Hydrocarbon Concentration</td>
</tr>
<tr>
<td>UVVCB</td>
<td>Unknown or Variable Composition Complex reaction products or Biological Materials</td>
</tr>
</tbody>
</table>
## Management system standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 9001</td>
<td>A global quality management standard. ISO 9001 applies to all types of organisations. It can help both product and service organisations achieve standards of quality that are recognised and respected throughout the world.</td>
</tr>
<tr>
<td>ISO 14001</td>
<td>An environmental management standard. It specifies a set of environmental management requirements for environmental management systems. The purpose of this standard is to help all types of organisations to protect the environment, to prevent pollution and to improve their environmental performance.</td>
</tr>
<tr>
<td>OHSAS 18001</td>
<td>An occupational health and safety management standard. It defines a set of occupational health and safety (OH&amp;S) management requirements for occupational health and safety management systems (OHSMS).</td>
</tr>
<tr>
<td>CE Marking</td>
<td>CE Marking is a legal requirement to place bitumen - for use in paving applications - on the EU market, except in those countries where CE Marking is optional to date. CE Marking on a product is a manufacturer’s declaration that the product complies with the essential requirements of the Construction Products Directive of the European Union and indicates that the product complies with the relevant national standards transposing the harmonised European standards and that all the tasks linked to attestation of conformity have been completed. CE Marking is not a mark of origin. CE Marking is the evidence of conformity to the requirements described in the harmonised product standards. CE Marking is only possible for those products for which a harmonised European product standard is available. The manufacturer must have a system of Factory Production Control (FPC) in place. FPC has a set of procedures, inspections and tests to control and ensure the quality and properties of the finished product. The FPC system covers all manufacturing sites for which CE Marking is required. External auditing is performed by a certified body whose task is to check that the quality systems and documentation comply with the requirements of Annex ZA in the product standard, by visiting the location and examining the relevant processes, records etc.</td>
</tr>
</tbody>
</table>
### Appendix 8 - Glossary

<table>
<thead>
<tr>
<th>Other</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-rectified bitumen</td>
<td>Bitumen that has undergone a mild degree of air-blowing for adjustment of the physical properties. Penetration index ≤2.0.</td>
</tr>
<tr>
<td>Severely oxidised bitumen</td>
<td>Bitumen products that have undergone intensive air-blowing, in some cases with the presence of a flux. Penetration index &gt;2.0.</td>
</tr>
<tr>
<td>Hazardous substances</td>
<td>Substances that, following exposure, can have an adverse effect on health. Examples of hazardous substances include poisons, substances that cause burns or skin and eye irritation and substances that may cause cancer.</td>
</tr>
<tr>
<td>Dangerous goods</td>
<td>Substances or articles that, because of their physical, chemical (physicochemical) or acute toxicity properties, present an immediate hazard to people, property or the environment. Types of substances classified as dangerous goods include explosives, flammable liquids and gases, corrosives, chemically reactive or acutely (highly) toxic substances.</td>
</tr>
</tbody>
</table>
Appendix 9 - References

Concawe publications: www.concawe.be

Echa publications: www.echa.europa.eu

Eurobitume publications: www.eurobitume.eu

Nynas publications: www.nynas.com

Information relating to ADR/RID/ADN legislation is available on the UNECE Transport Division website page www.unece.org/trans/danger/danger

Information relating to IMDG legislation is available on the website page http://gisis.imo.org/pub or www.imo.org/publications