

Bitumen Health & Safety Portal



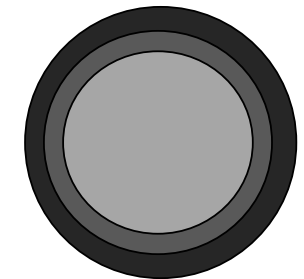
- Back pressure is the developed pressure pushing back against the flow of bitumen
- It can show itself as residual pressure in the line after a delivery

Cause

Back pressure can result from:

- Cold spots in the bitumen delivery line
- Poor design of pipework (too many bends)
- Inadequate venting capacity
- Blocked or partially blocked lines and vents

Cooling bitumen gradually restricts the internal pipe diameters meaning the pressure inwards becomes higher than the pressure out and so back pressure builds



Solutions

There can be a range of actions to take as both preventative actions and leading indicators

- Apply trace heating to the offloading pipes
- Reduce the number of severe bends in the pipework
- Set up a Planned Preventative Maintenance system to regularly check the vent line is clear
- Monitor the time for offloading and watch for time increasing



Bitumen Discharge Permit (BDP)



What is it?

- A Permit to Work document
- Critical document to ensure there is adequate ullage to receive the delivery – avoid tank overfills
- Ensures all necessary pre-delivery checks are completed
- Designed to encourage good communication between plant operator and driver

Who Completes it?

- Tank details are completed by the plant operative and load details by the driver
- Each party checks each others' figures
- Document is signed by both parties so it must be diligently completed

This section to be completed by both the Plant Operator and the Driver

Tank number	A	
Flange number/description	B	
Grade	C	
Theoretical design capacity, tonnes	D	◀ Customer representative to complete
Safe working capacity, tonnes	E	◀ E = 90% of D
Current contents, tonnes	F	◀ From tank contents gauge
ULLAGE: useable capacity, tonnes	G	◀ G = E minus F
Quantity to be delivered, tonnes	H	
Is the bitumen temp. within the acceptable range for this grade ?	I	
Delivery ticket number	J	
Date	K	

- Sections A – C checks that we are going into the correct tank
- Sections D – G highlights the safe ullage of the tank
- Section H highlights the quantity to be delivered
- **The number in H must be less than the number in G**
- Sections I-K provides the details of the load delivered

Bitumen Discharge Permit (BDP)



This section to be completed by the Plant Operator

PLANT OPERATOR / SUPERVISOR (Person issuing this BDP) Please confirm the following prior to commencement of delivery/offloading	✓ or X
All boxes A-K completed with correct values and details	
Verification that HLA, HHLA and tank gauge are functioning via test button or weekly test	
Emergency shower tested and is functional on delivery day	
Figure in box G is GREATER than the amount to be delivered (box H)	
Is there the need to discharge part of the load into another tank? (Yes or No)	
If 'yes' to above question, complete the table opposite. Note - a 2 nd BDP must be completed	
Have any modifications or repairs been made to the plant since the last delivery? (Yes or No)	
Has the driver's passport been checked and verified that it is valid? (Yes or No)	
Is the site induction in date for this driver? (Yes or No)	
If 'X' is in any box (above or below) do not proceed with delivery. Seek advice from site management and driver's supervisor.	

- Double check that all parts of the initial section have been completed
- Validate that pre-use checks on layers of protection have been completed, (alarms and shower) just in case things go wrong
- If there is a need to split the load as a result of calculations from the first table, then an explanation must be given and a further form completed
- Check that the driver's training is up-to-date

This section to be completed by the Driver

DELIVERY DRIVER (Person receiving this BDP) Please confirm the following prior to commencement of delivery/offloading	✓ or X
Key (identification) issued matches tank/flange details in boxes A and/or B	
Tank flange and transporter's equipment visually OK for safe connection and delivery	
Grade to be discharged matches the grade in box C	
Figure in box H equates to the delivery ticket amount	
Figure in box F is the same as the contents gauge reading on the receiving tank Place 'X' if there is no gauge or it is unreadable	
Received confirmation that the emergency shower has been checked and is working	
Driver confirms the packing is clean and the flange connection is correct prior to discharge	
Plant Operator/Supervisor Name: _____ Signature: _____	
Delivery Driver's Name: _____ Signature: _____	

- Double check that critical parts of the initial section have been completed correctly
- Check that all connections are sound prior to discharge
- Further confirmation that the shower is working
- Signatures provide traceability
- Requires engagement by all and not a tick box approach

Bitumen Discharge Permit (BDP)



If the delivery is stopped complete the table below:					
Reason for stopping the delivery (Driver to tick as required)					
Spillage		High Level Alarm		Split Load	
Seen	Informed	Visual	Noise	On Arrival	During Delivery
Driver's comments:					
Action Taken (Customer to tick only one box)					
Wait for ullage		Split load		Return product	
Customer's comments:					

This section to be completed by the Driver in partnership with Plant Operative

- If the load has to be split; it is important to understand and record the reason why
- The split delivery is treated as a new delivery and so a new Bitumen Discharge Permit must be completed
- If an alarm has activated, this shows a loss of control. **DO NOT** continue discharging into the same storage tank without a full investigation and remedial action
- A Permit to Work document
- Completed jointly by Plant Operative and Driver
- Checks the ullage vs load size
- Ensures checks on layers of protection are working in case of incident
- Checks the competency of the driver
- Encourages good communication
- Must not be a tick box exercise

Key
Points

Bitumen Safe Delivery



SAFE HANDLING OF BITUMEN

The purpose of this safe handling card is to give brief general advice on best practice on safely handling of bitumen. Any controls and means of protection must be based on local site specific risk assessments, e.g. laboratory activities, operations etc.

- Paving bitumens (including polymer modified bitumen) are supplied and stored as hot liquids at temperatures up to 200°C.
- Industrial bitumens are supplied and stored at temperatures up to 230°C.

PRINCIPAL HAZARDS AND RISKS

- Severe thermal burns (up to third degree) and shock.
- Fire and explosion. If bitumen is over-heated flammable decomposition products may be formed resulting in a fire or explosion hazard.
- Boil-over of tanks due to the presence of water.
- Fumes. Respiratory problems or nausea may be induced by high concentrations of fumes from hot bitumen.
- Hydrogen Sulphide. In confined spaces hydrogen sulphide may accumulate and may reach hazardous levels.
- Pyrophoric deposits may develop in bitumen tanks which may self-ignite.

GENERAL SAFETY ADVICE

- Storage temperatures should not exceed 200°C for paving bitumens and 230°C for industrial bitumens. Bitumens should be kept at least 30°C below flash point, or national limits whichever is the lower.
- Heat-resistant hoses free from twists, kinks, damage and supported along their length should be used. They should be clean, dry and free from plugs of solid bitumen.
- Do not use steam to empty pipelines or hoses, to avoid water in the system. Use suction pumps, compressed dry air or blanket gas.

PERSONAL SAFETY MEASURES

Protective clothing to be considered includes:



- Head protection: helmet, preferably fitted with chin strap, neck apron, full visor to protect the face.
- Note: Goggles only protect eyes



- Heat-resistant gloves with long sleeves.



- Coverall, legs to be worn over boots, 100% cotton fire retardant (Proban® or similarly treated), preferably with high visibility markings.



- Safety boots that can be removed easily.

Note: Additional site specific equipment may be required: safety spectacles / goggles, ear defenders, rigger style boots or similar, anti-static clothing etc.

FIRST AID



- Bitumen burns should be cooled for at least 15 minutes, first with cool water to reduce pain, then with warm water to prevent hypothermia if the burned surface is larger than the size of a hand.
- Burns to the eyes should be irrigated for at least 5 minutes.

• **NO ATTEMPT SHOULD BE MADE TO REMOVE THE BITUMEN AT THE WORKSITE.**



- Measures to remove the Bitumen layer from the skin should be taken as soon as possible under the supervision of a doctor, or at a hospital.
- Careless removal of the bitumen may result in the skin being damaged further, bringing with it the risk of infection and the possibility of complications.
- Respiratory problems due to excess fume exposure: Under safe conditions remove person from contaminated atmosphere into fresh air. Seek medical assistance if breathing remains difficult. Apply emergency first aid measures.

BITUMEN FIRE



- Call the fire brigade immediately.
- Switch off all electrical power to heaters, circulation pumps, etc.
- Close valves if safe to do so in order to limit the spread of fire.
- Attempt to extinguish fire by using dry chemical powder, foam, inert gas, or water spray (fog).

Never use water jets.

TELEPHONE NUMBERS:

FIRE DEPARTMENT

AMBULANCE

PRODUCT EXPERT

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Bitumen Safe Delivery Card

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- 1 • Safety helmet
- 2 • Full face visor
- 3 • Safety glasses
- 4 • Neck Apron
- 5 • Heat-resistant gloves with long sleeves
- 6 • High visibility coverall, 100% cotton and fire retardant
- 7 • Coverall legs worn over the boots
- 8 • Safety boots (Rigger style)

- Bitumen is delivered at **temperatures up to 180°C**
- The **main hazard** is the risk of contact burns
- The following **controls** are designed to minimise the risk of making contact with hot bitumen:
 - 6-metre exclusion zone
 - Bitumen Discharge Permit
 - Tank level gauges and alarms
 - Flange guards
 - PPE will protect you as a final layer of protection, provided it is used and worn correctly
 - Emergency shower
- If bitumen discharge is supervised by your site, and your supervisor will be in the 6m zone during discharge, then your employees must be provided with PPE compliant to Appendix 2 of the Eurobitume: Guide to the Safe Delivery of Bitumen

Emergency Shower Specification



The following should be considered when installing a new emergency shower. Refer to the attached document for the full specification

- Must be capable of supplying a sustained volume of clean water for a minimum of 15 minutes
- Flow rate and spray pattern must be sufficient to drench the whole body to cool the bitumen
- If an eye wash is in place, the flow rate should be sufficient to wash the eye but not to cause pressure damage to the eye
- The shower must be operational throughout the bitumen delivery
- Trace heating should be considered to ensure
 - The shower is operational during all weather conditions
 - To reduce the risk of hypothermia from excessively cold water
- A risk assessment and testing should be in place to avoid bacterial contamination. e.g. Legionella
- It should be a simple operation e.g. footplate



**Click icon to download the full
Emergency Shower Specification Guide**

Emergency Shutdown Procedure



Key Points

- Do not put yourself at risk in order to shut down the vehicle
- When any emergency stop button is pressed, the air operated secondary outlet valve shuts immediately
- If there is a spray or leak of hot bitumen, this will subside very quickly
- There is no need to close the manual Homir valve
- If entering 6m zone, ensure full PPE worn and driver made safe
- **DO NOT** move the delivery vehicle or disconnect the flexible delivery hose
- Immediately contact TotalEnergies for further instruction

Location of Emergency Stops

- Bitumen delivery vehicles are typically fitted with 4 emergency stop buttons – 1 on each corner front and rear, near and offside. Some vehicles have additional stops in the middle

Introduction and Scope

- Employers should carry out a fire safety risk assessment, and based on the findings ensure that suitable measures are in place to minimise the risks from fire
- The risk assessment should identify what could cause a fire to start, i.e. sources of ignition, the substances that could burn, the people who may be at risk
- At least one (6kg) dry powder extinguisher must be available in the area of the delivery point



Reducing Risks

- Keep sources of ignition and flammable substances apart
- Ensure that the correct fire fighting equipment is available
- Identify suitable escape routes, ensure that they are clearly marked and unobstructed at all times
- Ensure that personnel have been appropriately trained
- Ensure that facilities and equipment are inspected and maintained
- Check how effective fire safety arrangements are by regularly carrying out regular drills, reviewing and updating the risk assessment

Bitumen

- Call the Fire Brigade **IMMEDIATELY**
- If it is safe to do so switch off power to all heaters, circulation pumps etc. and close valves in order to limit the spread of the fire
- If it is safe to do so attempt to extinguish the fire using a dry powder fire extinguisher, **NEVER USE WATER JETS**

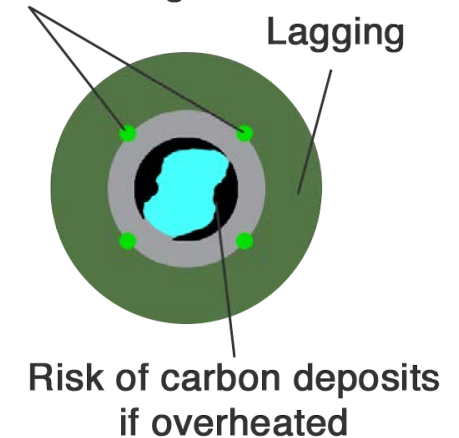
The issue

- Blockages or restrictions in pipelines can often create issues during off-loading
- Increased pressure in these pipes can be dangerous
- Blockages can be a result of thermal shock or rapid cooling of bitumen during offloading
- Blockages can also be the result of over heating of the pipelines causing carbon build up
- Application and control of trace heating is critical

Solution

- Trace heating will ensure the pipelines are warm prior to receiving the bitumen and stop the rapid “shock cooling”
- Control the temperature to around the minimum pumping temperature of the bitumen
- Only set the heating to come on an hour or two prior to the delivery being received
- Set the heating to be turned off an hour or so post delivery
- Constant heat (even at low temperatures) can cause thin layers of bitumen to carbonise – so avoid leaving the trace heating on for prolonged periods

Trace Heating



The issue

- Bitumen storage tanks can be taken out of service for a period of time for a number of reasons including
 - Cleaning
 - Maintenance
 - Engineering works
 - Mothballing of a plant
 - Transfer of a tank from one plant to another
 - Grade change
- Bringing the tank back into service must be carefully controlled to ensure all engineering works have been signed off and tank integrity is checked
- Be aware that water can enter the tank due to condensation occurring internally



Returning Tanks To Service



Actions

- Prior to receiving the first load of bitumen ensure that any and all work permits are properly signed off
- Double check tank integrity and status
 - All manholes are in place and sealed
 - All flanges are properly made up and tightened
 - All valves are working and sealed
 - The integrity of the tank and associated pipework is good
 - The vent pipe has been checked to ensure that it is fully cleared
 - All spades and blanks have been removed
 - Tank heating systems are working and there are no leaks
 - Tank levels gauge is operational and calibrated
 - Tank High and High / High level alarms are working and calibrated
 - Tank Safe working capacity is understood and shown on the tank
 - Tank contents grade is clearly shown on tank and off-loading flange
 - Tank is certified as clear of water

Bitumen delivery

- When ordering the first delivery of bitumen into the storage tank, make the supplier aware that the tank is being brought back into service
- TotalEnergies will require a form to be completed to ensure that relevant risks have been addressed
- The first delivery will be staged i.e. transferred in small amounts
- Rapid expansion of any residual water (water expands X1600 at these temperatures) and expansion of air in the vapour space as it increases in temperature can compromise venting capacity
- During this staged delivery it is important to recheck flange / joint integrity to ensure expansion of metal has not created leaks

First Aid Advice (Bitumen Burns)



BITUMEN BURNS

INFORMATION NOTE FOR 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 a Doctor or Hospital.

FIRST AID

Bitumen burns should be cooled for at least 20 minutes, first with tepid water to reduce pain, then with warm water to prevent hypothermia if the burned surface is larger than the size of a hand. Burns to the eyes should be irrigated for at least 5 minutes.

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

MEDICAL CARE

(if in doubt do not hesitate to contact a burns centre)

Measures to remove the bitumen layer from the skin should be taken as soon as possible under the supervision of a doctor, or at a hospital. However, this treatment should be carried out with caution because careless removal of the bitumen may result in the skin being damaged further, bringing with it the risk of infection and the possibility of complications.

Initially it is not important to know whether the burn is superficial or deep. The priority should be to remove the bitumen without causing further damage.



BITUMEN BURNS

BY MEDICAL PERSONNEL ONLY: REMOVAL OF BITUMEN ADHERING TO THE BURNED AREAS

Different methods can be recommended:

- The bitumen layer should be left in place and covered with thick gauze containing paraffin or a paraffin-based antibiotic cream, e.g. Flammazine (silver sulphadiazine). Such treatment will have the effect of softening the bitumen, enabling it to be gently removed after a few days.
- Alternatively, olive oil (new bottle) should be applied and left to soak the affected areas for a few hours. Thereafter the bitumen can be removed by rubbing gently with some gauze. Any remaining bitumen can be removed by wrapping the affected areas with gauze soaked in olive oil. The dressing should be changed every 4 hours. After 24 hours any remaining bitumen can be removed and the burn may be disinfected and treated conventionally.

CIRCUMFERENTIAL BURNS WITH TOURNIQUET EFFECT

When bitumen completely encircles a limb, or other body part, the cooled and hardened bitumen may cause a tourniquet effect due to oedema (swelling) in the burn. In the event of this occurring the bitumen must be softened as soon as possible 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 to an ophthalmologist or hospital with an ophthalmology unit for diagnosis and appropriate treatment.

Eurobitume has made considerable efforts to compile this publication on the basis of reliable sources. More specifically this publication was established with the assistance of Professor Stan Monstrey, Head of Burns Unit of the Academy Hospital of Ghent (Belgium) and Jean-Pierre Arnould, Chief Executive officer of the Belgian Burns Foundation and reflects the prevailing opinions in medicine on Eurobitume would like to thank Professor Stan Monstrey and Jean-Pierre Arnould for their contribution in compiling this guide.

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Action Plan

Who	What	When	How

Introduction

- Ensure all appropriate risk assessments are complete and relevant site-specific procedures are adhered to
- This exercise should be carried out on all plants and processes
- Consideration must be given to the frequency and nature of the intervention

Planned Preventative Maintenance

- Planned Preventative Maintenance (PPM) has many benefits
- Equipment downtime is decreased, and the number of major repairs are reduced
- Better conservation of assets and increased life expectancy of assets, thereby eliminating premature replacement of machinery and equipment
- Reduced overtime costs and more economical use of maintenance workers due to working on a scheduled basis instead of a crash basis to repair breakdowns
- Improved safety and quality conditions for everyone

Bitumen Storage Tanks

- Are not pressure vessels. It is critically important to ensure venting capacity is adequate for the input pressure and the output suction
- Check pipework for corrosion and leaks
- Check storage tank and line wall thickness
- Storage tanks should be cleaned regularly
- Ground based pumps must be maintained to ensure the correct operation of valves and that they shut down in an emergency

Hydrogen Sulphide



What is it?

- Hydrogen Sulphide (H₂S) is a gas naturally occurring in bitumen
- H₂S is toxic acting on the nervous system
- H₂S can deaden the sense of smell and taste (smell is not a reliable indicator of H₂S presence)
- H₂S is highly flammable and can become explosive in high concentrations
- In the presence of rust it can produce pyrophoric iron sulphide

Risks

- In enclosed areas risk of intoxication, unconsciousness and in extreme cases, fatality
- Fire or explosion in tank vapour spaces
- Ignition sources on tank walls and roofs through formation of iron sulphide

Exposure potentials

- Opening of manlids on tankers and tanks
- Releasing pressure from tanks, vents or valves
- Entering tanks for cleaning or maintenance

Exposure Limits

- Short Term Occupational Exposure Limit (STEL)
Time weighted average over 15 mins = 10ppm
- Long Term Occupational Exposure Limit (LTEL)
Time weighted average over 15 mins = 5ppm

Managing the risk

- Keep storage temps as low as possible
- Never expose heating elements to vapour
- Identify exposure zones and sign accordingly
- Always ensure adequate ventilation
- Always provide monitoring or detection equipment in risk areas
- Provide education / training about H₂S
- Use of work permits for access to enclosed areas
- Carry out DSEAR regulation assessments
- Provide a Preventative Maintenance Program for tank maintenance

Spillage Guidance



General Information

- In the event of a spill, inform the relevant authorities if the situation cannot be brought under control rapidly and efficiently
- When the presence of dangerous amounts of H₂S around the spilled product is suspected or proved, additional or special actions may be warranted to determine controls appropriate to local circumstances
- Evacuate non-essential personnel
- Stop or contain leaks at the source, if safe to do so
- Avoid contact with skin, eyes and inhalation of vapours
- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area)
- Ensure adequate ventilation, especially in confined areas.

Advice for responders

> Small spillages: normal antistatic working clothes are usually adequate

> Large spillages:

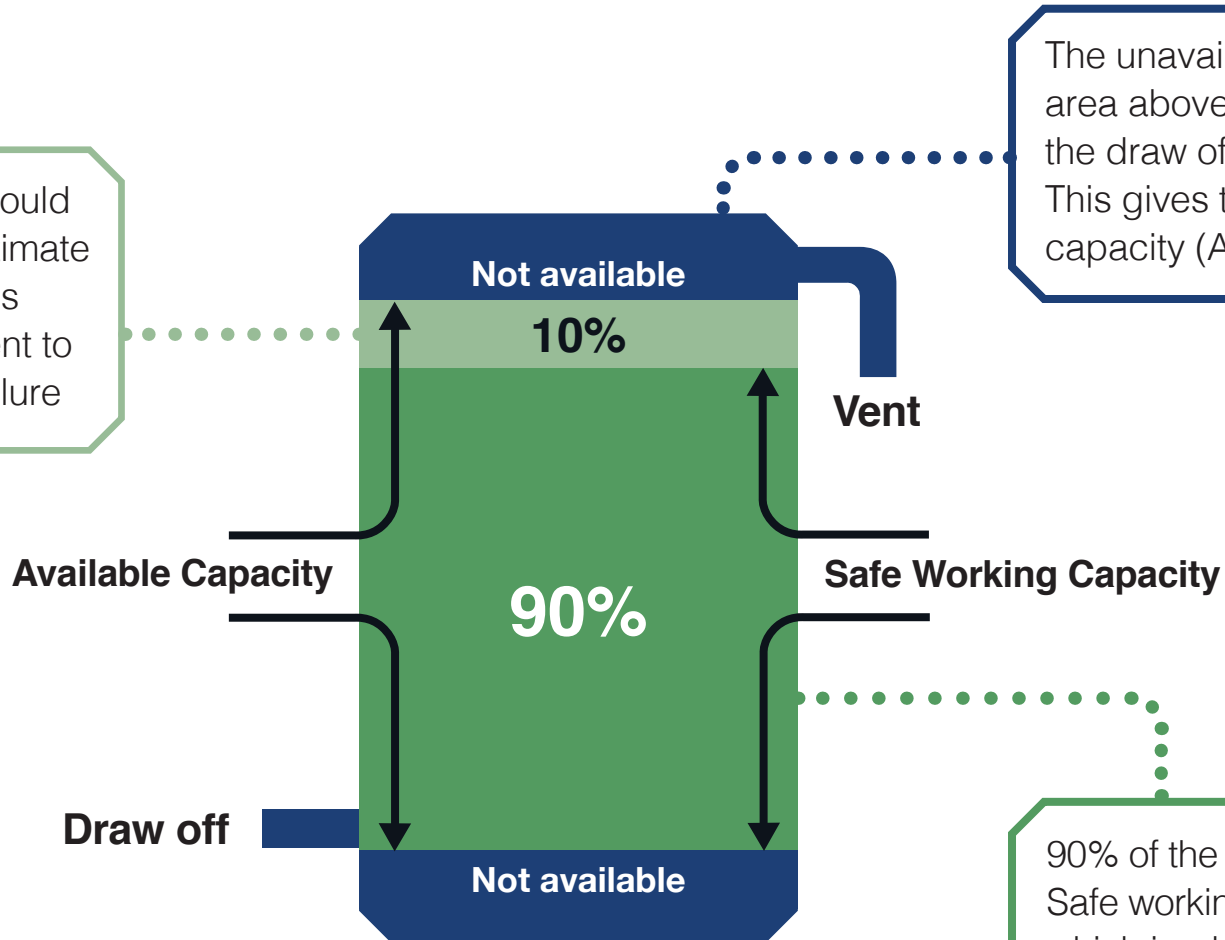
- Full body suit of chemically resistant and thermal resistant material should be used
- Work gloves (preferably gauntlets) providing adequate chemical resistance.
Note: Gloves made of PVA are not water-resistant, and are not suitable for emergency use
- If contact with hot product is possible or anticipated, gloves should be heat-resistant and thermally insulated
work helmet with peak and neck cloth (full head protection).
- Antistatic non-skid safety shoes or boots
- A half or full-face respirator with filter(s) for organic vapours (and when applicable: for H₂S)
- If the situation cannot be completely assessed, or if an oxygen deficiency is possible, only SCBA's should be used

Environmental precautions

- The product should not be allowed to enter drains, water courses or the soil
- Solidified product may clog drains and sewers
- Stop the spread of bitumen using dry earth, sand or similar non-combustible materials to bund the area
- Recover the product in solid form, if possible
- If necessary, cautiously use water fog to help the cooling
- In case of spillage in the water, the solid product is denser than water and will slowly sink to the bottom, and usually no intervention will be feasible
- If possible, collect the product and contaminated materials with mechanical means, and store/dispose of according to relevant regulations

Safe Working Capacity

92.5% of the AWC should be used to set the Ultimate High Level Alarm. This should be independent to the HLA in case of failure

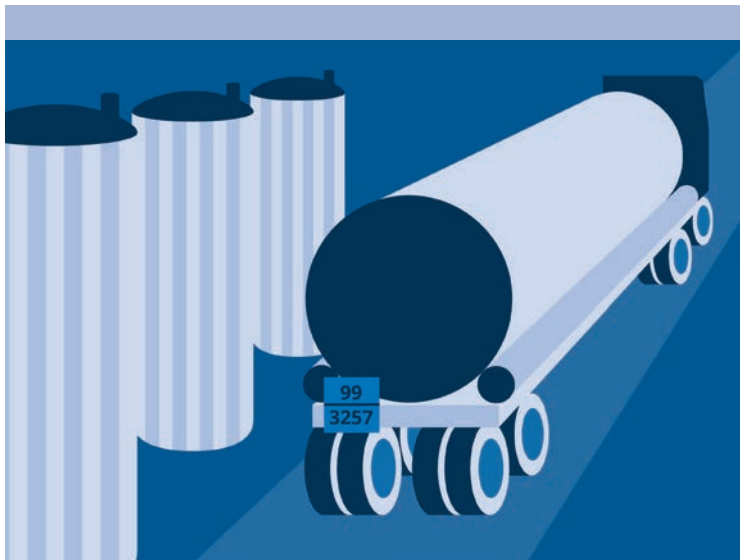


The unavailable space is the area above the vent and below the draw off pipe and heaters. This gives the available working capacity (AWC)

90% of the AWC gives you the Safe working capacity (SWC) which is what the High Level Alarm (HLA) should be set at and the maximum contents of the tank



Guide to the Safe Delivery of Bitumen UK Version



 **Click icon to view or download the Site Inspection Booklet.**

Introduction and Scope

- This guide is to assist suppliers of bitumen to ensure that bitumen delivery points are safe for their delivery drivers and other personnel involved in the delivery process
- To be compliant with current UK law, it is recommended that the individual site compiles its own risk assessment to cover all areas of operation
- It should be remembered that this inspection must be carried out as a joint exercise between the supplier's representative, the site manager or their appointed representative

Site Inspection

- The inspection must be carried out with both parties present & the inspection record form should be used to record conditions on the day of the inspection, giving as much detail as possible
- All non-conformances, observations and suggested improvements must be discussed as they arise and noted
- The site management must sign the site inspection document. A copy should be kept on record by both the supplier and the site
- The site should be re-visited after the target completion date, to ensure that the agreed actions have been completed to the satisfaction of both parties

Ground Based Pumps (GBP)



Background

- Ground Based Pumps (GBP) deliver bitumen at much lower pressure than pressure discharge
- Design, installation and maintenance of this equipment is critical to safety
- Examples of poor design has resulted in dangerous bitumen spills, with unexpected high back pressures involved

Process Safety Definitions

- Process safety is of paramount importance when installing and running this type of system
- HAZID – Hazard Identification Study. A systematic approach to identifying potential hazards for use in associated studies
- HAZOP – Hazard and Operability Study. Formal method of assessment performed by committee to document hazard and risk
- Functional Safety – The area of safety that depends on a system or equipment operating correctly in response to it's inputs
- FSA – Functional Safety Assessment. An assessment of the functional safety and safety integrity that has been achieved after installation
- Independent Protection Layer. Independent mechanism to stop the progression of an unsafe scenario developing.
- SIF - Safety Instrumented Function. Single set of actions and equipment needed to identify a single hazard and act to bring the system to a safe state.
- SIS - Safety Instrumented System. The instrumented system used to implement one or more SIFs. i.e. a means of
 - Detecting the hazardous condition
 - Determining what needs to be done
 - Taking effective action to control the hazard

Ground Based Pumps (GBP)



Risk Assessment

- At design stage complete a HAZID and HAZOP study utilising the following:-
 - Up-to-date process flow diagram (PFD)
 - Process and instrumentation diagram (P&ID)
 - Detailed equipment specifications
 - Construction materials
 - Mass and energy balance
- Carry out a FSA in accordance with BS EN 61511
- Check potential safety instrumented functions that are required by BS EN 61511
- Check potential requirements under the Dangerous Substances and Explosive Atmosphere Regulations 2002

System Design

- The ground-based pump system should comprise of a storage vessel with associated pipework, a pump, in-line valves, a tank gauging system with a High Level Alarm (HLA) and an independent High High Level Alarm (HHLA)
- The system must be designed to fail-safe
 - Upon activation of either alarm or any system failure; the system will simultaneously and automatically stop the pump, close any in-line valves and stop any ancillary equipment
 - If any of these components fail, the system must stop, e.g. if an in-line valve closes, the pump, additional valves and any ancillary equipment will stop

Ground Based Pumps (GBP)



System Design

- When the HHLA is activated, the stopping of the ground-based pump must be sequenced to simultaneously shut off both the pump and any in-line valves, and initiate an audible and visible alarm
 - This SIS must be independent of any other system
- Consideration must be given to the rating of the installed pump, i.e. flow rate (litres per minute). This needs to be measured against the vent line capacity of the bitumen delivery vehicle to prevent under pressure, and of the bitumen storage system to prevent overpressure
- The ground-based pump should be situated at a level lower than and as close as is reasonably possible to the delivery flange, to minimise the amount of bitumen in the pipework
- The design should allow for the suction of the pump to be below the outlet flange of the bitumen delivery vehicle, to allow total clearance of the delivery line before the pump loses suction
- It is recommended that the pump and delivery lines are heat traced and lagged

System Design valves

- A pump pressure relief valve (PRV) must be fitted to avoid overpressure situations upstream if there are blockages (should be identified in HAZOP)
- It is strongly recommended that an upstream pressure transmitter is fitted interlocked with the ground based pump, to stop the pump in case of overpressure
 - This must also be designed to fail to safe
- An automated fail-safe valve must be fitted in the line before the pump. This must be fully integrated into the system and self-closing in the event of any system failure or alarm activation
- All automated valves must be self-closing in the event of a failure (fail-safe)
- A non-return valve must be fitted as close to the pump outlet as practicably possible or as an integral part of the pump

Ground Based Pumps (GBP)



Maintenance

- Consideration must be given to maintenance requirements including:-
 - Schedule/frequency of proof testing in accordance with the requirements for each SIS
 - Preventative and corrective maintenance activities looking at:-
 - Tank and pipework integrity
 - Valve integrity
 - Trace heating
 - Other areas identified by the HAZOP

Alarm activations

- In the event of alarm activation, there must be an e-stop readily available for the driver (fail to safe)
- Activation of the HLA must only be reset by competent and authorised plant staff. All HLA activations should be treated as an incident and investigated accordingly
- Activation of the HHLA must only be reset by a competent designated person, usually the site manager or maintenance personnel. A thorough investigation to identify the cause of the HHLA activation and fault rectification must be completed before the system is reset