Appendix F

Bentonite slurry management plan

NORTH YORKSHIRE POLYHALITE PROJECT

Slurry Management Plan (Bentonite)

Document Number: 40-AMC-WS-10-EN-PL-0002

1. Contractor Document Submittal History:

Revision:	Date:	Prepared by:	Checked by:	Approved by:	Reason for Issue:
A	May 18, 2017	Bauer	SW/SF		AMC UK Review
B	May 25, 2017	Bauer	SF/Sirius		AMC UK / Sirius Review
0	May 26, 2017	Bauer			Issued for Use

2a. External Peer Review Required? YES ☐ NO ☒

Stakeholder submission required: ☐ ☐ ☐ ☐ ☐ Other: _____

Purpose of submission: For approval ☐ For information ☐

This document has been reviewed by the following individual for coordination, compliance, integration and acceptance and is acceptable for transmission to the above stakeholder for the above stated purpose.

Sign: _____ Role: _____ Name: _____ Date: _____

Sign: _____ Role: _____ Name: _____ Date: _____

2b. Review by External Peer (if required):

Stakeholder Organisation	Job Title	Name	Signature	Date	Acceptance
					☐

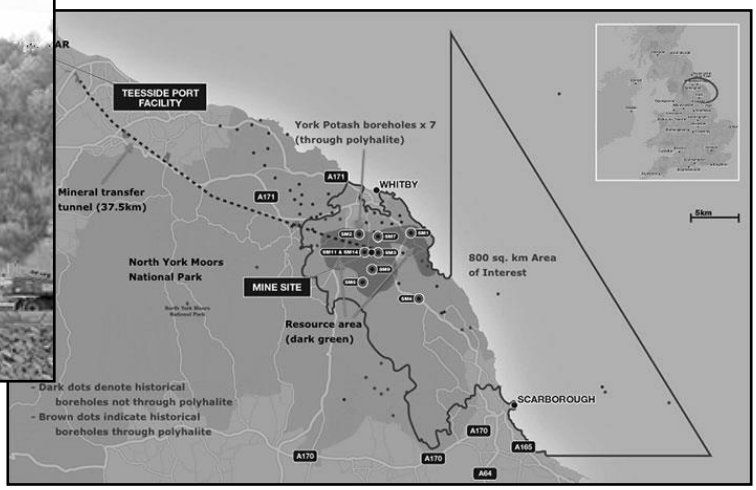
3. Acceptance by *Sirius Minerals*:

Sirius Minerals Review and Acceptance Decal				
This decal is to be used for submitted documents requiring acceptance by *Sirius Minerals*.				
☐	Code 1.	Accepted. Work May Proceed		
☐	Code 2.	Not Accepted. Revise and resubmit. Work may proceed subject to incorporation of changes indicated		
☐	Code 3.	Not Accepted. Revise and resubmit. Work may not proceed		
☐	Code 4.	Received for information only. Receipt is confirmed		
Reviewed/Accepted by:(signature)		Print Name:	Position:	Date:
Acceptance by *Sirius Minerals* does not relieve the designer/supplier from full compliance with their contractual obligations and does not constitute *Sirius Minerals* approval of design, details, calculations, analyses, test methods or materials developed or selected by the designer/supplier.				

REVISION SHEET

Report title	Slurry Management Plan (Bentonite)
Document number	**40-AMC- S-10-EN-PL-0002**

Rev.	Revision description	Prepared by	Checked by	Approved by	Rev. Date
A	Internal Review – Edits to whole document	Bauer	SW/SF		May 18, 2017
B	Internal Review – Edits to whole document	Bauer	SF/Sirius		May 25, 2017
0	Issued for Use	Bauer	SF		May 26, 2017



NORTH YORKSHIRE POLYHALITE PROJECT – WOODSMITH MINE

SLURRY MANAGEMENT PLAN (BENTONITE)

Bauer: YPM-BAU-SMP-BEN

AMC: AMC UK Document No. 40-AMC-WS-10-EN-PL-0002

Revision	Date	Description	Made by	Checked	Signed
A	18.05.17	Original Issue	G. Jahnert	N. Thomas	
B	25.05.17	Including AMC comments (24.05.17)	G. Jahnert	N. Thomas	
0	26.05.17	Final AMC UK and Sirius comments incorporated	G. Jahnert	N. Thomas	

Table of Contents

1. INTRODUCTION

Excavation of deep diaphragm walls and bored piles under a support fluid is a standard foundation engineering technique. It has been in regular use across the world for over 50 years. This report summarises the properties of support slurry, describes its stabilising effect on the ground and addresses queries associated to the potential environmental impact at the Woodsmith Mine site.

2. OPERATIONAL CONTEXT

The support slurry for the Woodsmith Mine diaphragm wall installation is required to stabilise the up to 60m deep trenches during panel excavation and construction. The slurry further minimises slurry loss in the surrounding ground and provides a transport medium for rock/soil particles which are produced at the cutter rotary wheels and conveyed to the desanding units through a pipe system.

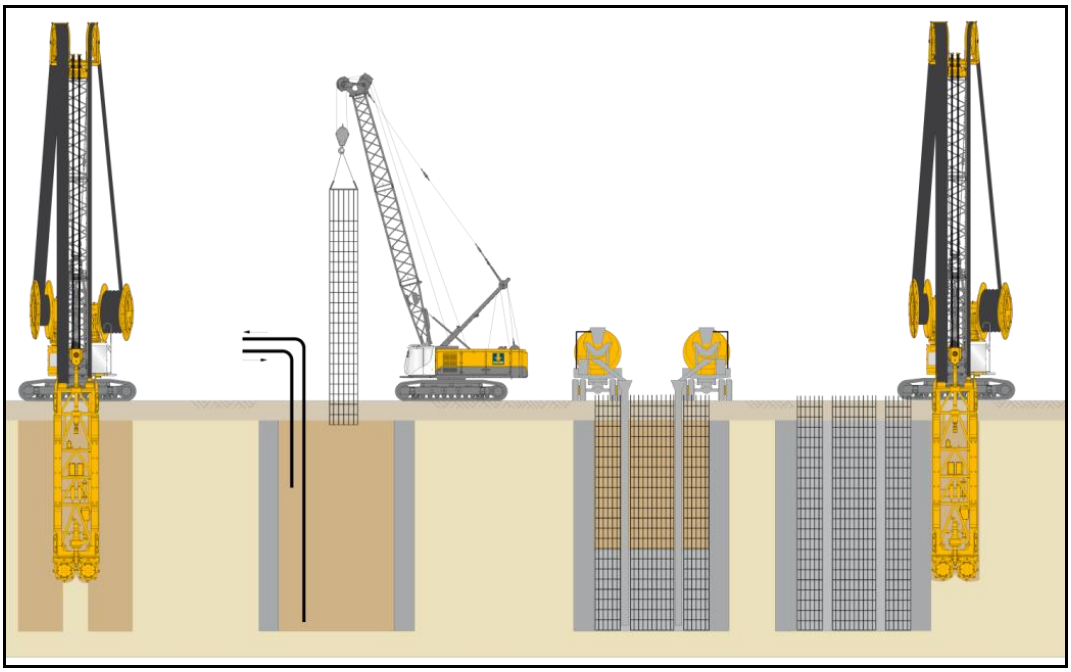


Figure 1: Sequence of diaphragm wall construction

In advance of panel construction, slurry is mixed in the slurry plant and stored in large tanks. The tanks together with all other slurry processing equipment will be positioned on a bunded, reinforced concrete slab.

Figure 2: Photograph of typical storage tank

During panel excavation, fresh / clean support slurry will be continuously pumped from the storage tanks to the panel location. The cutter operator will regulate the feed flow using a remote controlled feed pump. A flow chart representing the slurry management system can be found in Appendix A.

At the same time, the cutter internal mud pump will pump support slurry and rock/soil cuttings from the cutter wheels back to the slurry plant desanding units. The cutter operator will regulate the return flow to prevent overflow of the desanding units. The desander will segregate muck from the slurry and send cleaned slurry back to the storage tanks or directly back to the trench.

After completion of the excavation, the entire panel volume will be desanded (circulated through the desander) until the slurry parameters for concreting are fulfilled. If the slurry is too heavily loaded with solid particles, the entire panel volume can be exchanged (replaced with fresh / clean slurry). This process reduces waiting time for the start of reinforcement installation. In this instance, the excavation slurry will be cleaned later on by circulation between storage tanks and desanding unit or, if its life cycle is exhausted be stored and disposed of as waste slurry. Depending on the amount of suspended solids, the desanding/exchange takes between 2h and 12h. Once the panel has been desanded and the reinforcement cage has been installed, concrete is poured through a tremie pipe and slurry is pumped back to the storage tanks as the concrete in the panel rises.

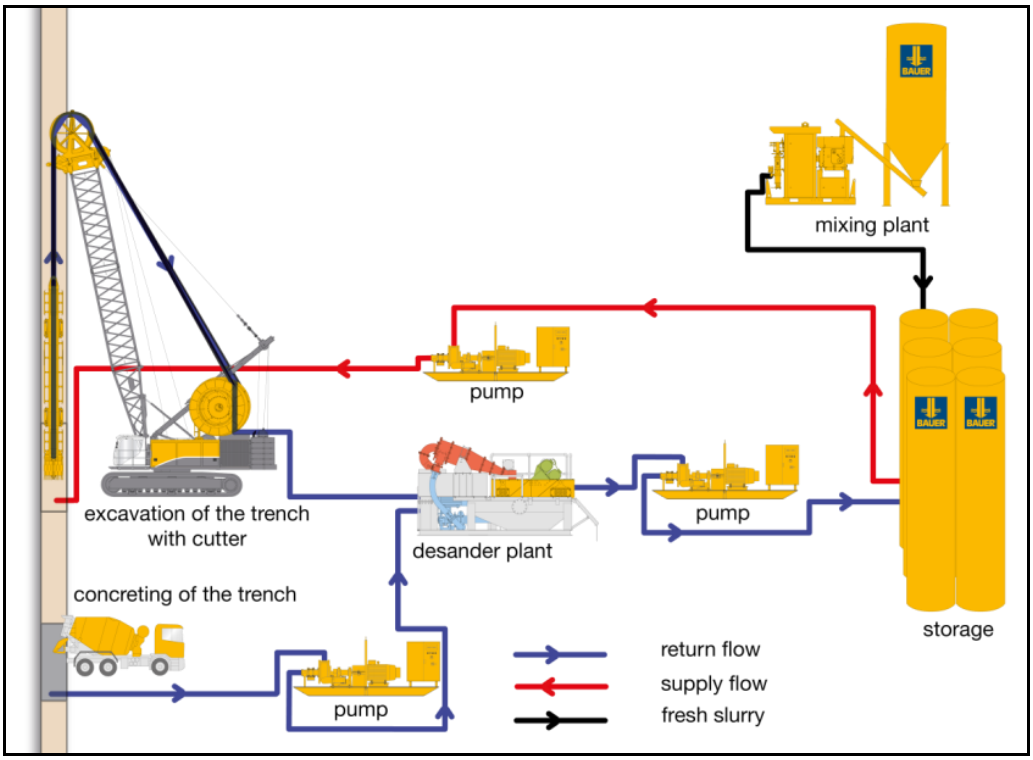


Figure 3: Schematic support fluid cycle for cutter d-wall

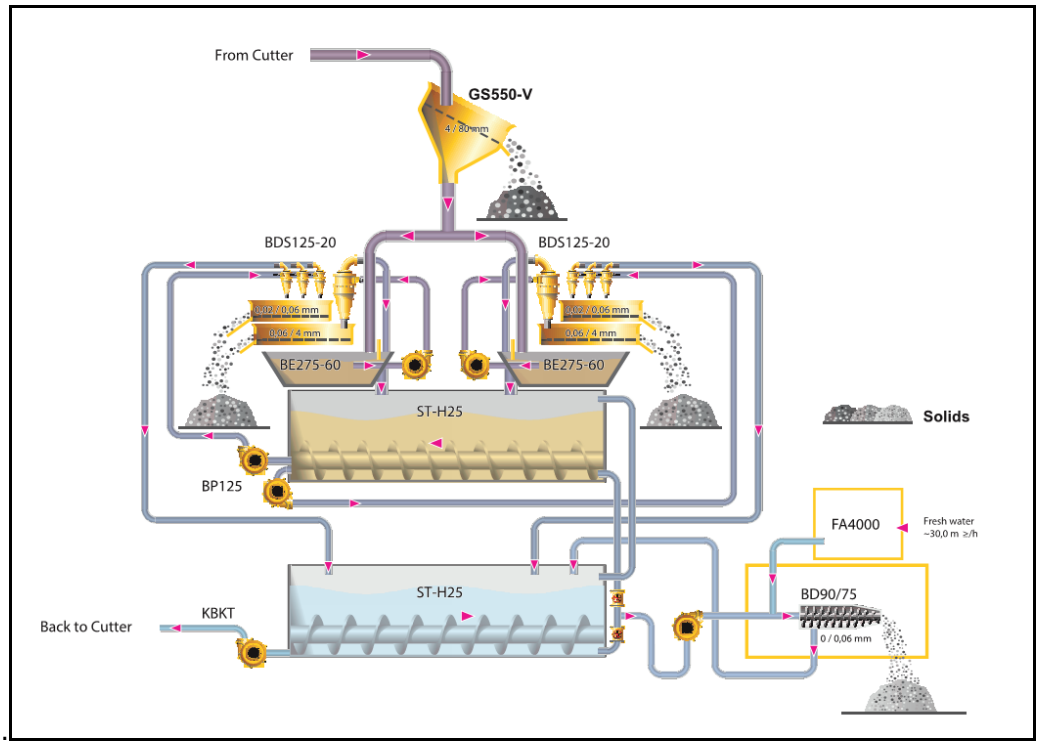


Figure 4: Typical desander flow chart

3. SUPPORTING PRINCIPLE OF SLURRY

Support slurry's main function is to prevent the excavation from collapse during panel construction. The slurry not only prevents ingress of areas of the local geology into the trench by acting as counter balance to earth- and hydrostatic pressures from outside the trench, but also stabilises individual soil particles within the excavation faces and prevents their immigration into the excavation.

The support slurry for the Woodsmith Mine site is a mixture of water combined with bentonite powder and additives. The mixture is designed to stabilise the ground and optimise the slurry life cycle, which can be detrimentally affected by the soil conditions (e.g. mudstone with high fines content) and cutting of concrete in secondary panels (pH level changes). The stabilising effect is achieved by adjusting the density and viscosity of the slurry according to the trench stability calculation.

In addition to the stabilising function, the support slurry is designed to close pores and fissures in the walls of the trench during the panel excavation which minimises fluid loss (e.g. support slurry or water segregated from the slurry) into the surrounding ground. The fines in the slurry (bentonite and soil particles) migrate into the pores and fissures and form a filter cake which seals the surface of the excavation walls. The filter cake prevents continuous slurry loss (refer to section 5. for further details) and allows the slurry to build up pressure on the face of the excavation. For solid and impermeable rock surfaces, a filter cake development is not expected. A filter cake only develops if there are open voids or pores accessible for water, but which do not allow suspended solids to flow through.

4. SLURRY PROPERTIES

The ingredients for support slurry are stored in dry silos, palletised bags, canisters and water tanks on site. The support slurry is mixed in the slurry plant and stored in the respective fluid tanks. The slurry mixing and slurry storage activities are located within the confines of the concrete containment pad for the slurry plant so as to prevent contamination of the surrounding environment. Slurry will be pumped to and from the panel location through a system of rigid pipes and flexible hoses. The slurry properties are defined in the inspection and test plan. The slurry properties will be tested by the slurry technician in the slurry testing laboratory which forms part of the slurry plant setup.

Figure 5: Typical slurry mixing setup

The slurry mix design depends on the derived earth and hydrostatic pressures as well as the risk of slurry loss. The mix design will be further optimised as per experiences gained during construction of the first panels, in line with the geological conditions encountered as well as the measured impact of overcut concrete on the slurry properties. The bentonite slurry pH level is generally kept between 7 and 10 but may increase to 12 through contact with concrete. Should this be the case and depending on the pH level impact on the slurry viscosity, the pH level will be lowered as required by addition of sodium bicarbonate (baking powder). Fresh support slurries will have the pH of the used mixing water, which may also increase through contact with concrete. The viscosity and density of the slurry can be further adjusted by manipulation of the slurry's yield strength, for example by addition of Bentocryl86 or Bauer LTA 16. The typical mix design for fresh slurry is a dosage of 35-40kg bentonite powder on 1000 litres of water. The common bentonite products are:

Table 1: Bentonite types

Additive	Chemical composition	Purpose	Typical dosage	Concentration in slurry (density 1.15 kg/m^3)
Berkbent 100	Hydrated Alumino Silicate	Transform water into trench supporting slurry	35 kg/ m^3	3.04 %
Berkbent 163	Hydrated Alumino Silicate	Transform water into trench supporting slurry	35 kg/ m^3	3.04 %
Berkbent CGB	Hydrated Alumino Silicate	Transform water into trench supporting slurry	35 kg/ m^3	3.04 %

Additives can be used to adjust slurry properties which cannot be controlled by mechanical treatment. The common additives and associated concentrations are:

Table 2: Bentonite slurry additives

Additive	Chemical composition	Purpose	Typical dosage	Concentration in slurry (density 1.15 kg/m^3)
Sodium-Bicarbonate	Sodium-Bicarbonate	Reduce viscosity by pH level adjustment	5 kg per m^3	0.43 %
Bentocryl 86	Sodium polyacrylate	Reduce density and filtrate water loss by reduction of yield point	0.5 litre per m^3	0.04 %
LTA 3	Sodium polyacrylate	Close fractures and reduce slurry loss	0.5 kg per m^3	0.04 %
LTA 16	Sodium polyacrylate	Reduce density and filtrate water loss by reduction of yield point	1.0 litre per m^3	0.09 %

Note: Technical datasheets and material safety datasheets attached as Appendix B.

A full assessment of dosage and concentration of bentonite and additives can be found in Appendix D.

Depending on specific requirements, e.g. to increase resistance against pH level increase caused by overcutting concrete, the slurry can be enhanced with additives before or during excavation in order to stabilise or reinstate the required slurry parameters.

The slurry properties vary for excavation and concreting phases and will be defined in a comprehensive inspection and test plan. The typical control parameters and associated tests are:

- Density (electric scale or mud balance)
- Viscosity (marsh funnel)
- pH level (litmus pH strips or electric pH tester)
- Temperature (thermometer)
- Effective yield point (ball harp)
- Fluid loss and filter cake thickness (filter press)
- Sand content (sand content vial)

Slurry properties will change from fresh slurry to working slurry, as the support fluid gets charged with soil particles during the construction process.

5. SLURRY LOSSES

Whilst excavation support fluids are designed to minimise losses to the ground, slurry losses of certain extent will initially occur in any permeable strata. If there are continuing losses, the slurry level in the panel may drop and the stability of the excavation can be compromised. Action therefore will be taken to control losses beyond those which are normal to soil clogging and filter cake formation.

Typically, total excavation fluid losses for the excavation & desanding process may be between one third and one half of the volume of soil excavated. In this first instance, one third of the volume of fluid is lost to the ground which would amount to a volume of about 0.18 m^3 per m^2 of trench wall on each side of the trench (a volume of 0.33 m^3 per m^2 half penetrating to each side). In rock which is generally tight but with minor fissures losses may be less. A part of the loss of excavation support fluid will be mixed with the soil for disposal which drops out of the desanding units. Depending on the soil cutting properties and the impact of concrete on the slurry, the support fluid lifecycle may be reduced and slurry will require disposal as waste slurry (see section 7).

The slurry penetration into the surrounding area is depending on the ground and its open channels or channel network. Depending on the size of the soil and rock openings, the slurry loss in normal pores, cracks and fissures can vary from less than 1 meter up to several 10 meters. Due to the inhomogeneity of the ground, the slurry loss migration cannot be limited with certainty. If channel networks and cavities are encountered, lost slurry can travel even further. Due to the inhomogeneity of soil and rock over the depth of the diaphragm wall, it is not possible to predict total slurry losses or the exact slurry infiltration distance. Assuming various slurry loss scenarios, the total amount of lost slurry and additives could be in the range presented in the following table:

Table 3: Slurry loss and associated additive losses

Total slurry loss per panel	Lost sodium-bicarbonate (at 0.43%)	Lost LTA 3 (at 0.04%)	Lost LTA 16 (at 0.09%)
25% of panel (50 m^3)	250 kg	25 kg	50 l
50% of panel (100 m^3)	500 kg	50 kg	100 l
100% of panel (200 m^3)	1000 kg	100 kg	200 l
200% of panel (400 m^3)	2000 kg	200 kg	400 l

Note: Based on panel size of 2.8m x 1.2m x 60m depth. All loss volumes are estimates.

The driver for excavation support fluid to be lost from a trench is the necessary difference in pressure between the fluid in the trench and that of the adjacent groundwater. For stability of the excavation the pressure difference between support fluid in the trench and the adjacent groundwater must be about 3m of water and so driving pressure for fluid loss is modest. If the external groundwater level is below ground level so that the driving pressure is much higher, fluid losses can increase depending on the permeability of the ground itself.

Excavation support fluid can be lost from the hole by two mechanisms:

1) Bulk loss of fluid to the ground as cracks and fissures are being clogged, in very open grounds substantial penetration distances may occur if clogging material is not available.

2) Once cracks and fissures (void size below 10micron) are clogged a filter cake will form and losses thereafter will be limited to water. Once a filter cake has formed liquid loss rates drop very substantially, the rate of loss decreasing with time as the cake thickens (typically the volume lost scales with the square root of the time for which the hole is open). The fluid that passes through the cake will be water plus salts from the mix water (i.e. normal salts in potable quality water), salts picked up from the soil and ions from bentonite and additives (mainly sodium).

Permeability values for the Woodsmith Mine site geologic cross section have been described to be in the range of 10^{-3} to 10^{-7} m/s for the upper 60m below ground level. Significant bulk loss of fluid (mechanism (1) above) would not be expected in a soil of permeability less than 10^{-3} m/s (clogging of the exposed face of the soil would be expected to be rapid). Indeed below 10^{-5} m/s liquid losses to the ground may be so small that only a minimal filter cake develops. Open fractures / fissures are more difficult to seal than a soil matrix as the flow path is less tortuous and more loss may occur as a clogging develops. Open ground and fissures can be clogged with coarse material in the excavation support fluid. This may be cut soil as well as sand or LTA3 deliberately added to the fluid if excessive losses occur. Once clogging has occurred a filter cake will form at the fluid – clogged soil interface and will collect progressively finer material so becoming progressively thicker and of lower permeability. During excavation, the soil/rock is cut by the teeth on the cutter wheels and the slurry of cut soil and excavation support fluid is pumped from the cutter head to a soil-fluid separation plant. The excavation region of the cutter head is thus rich in cut soil and so constitutes a suitable clogging fluid.

Major losses may occur if there are greater fissures or even open fractures and cavities, which are not currently expected.

The slurry level in the excavation will be monitored visually by the cutter operator and cutter banksman. The cutter operator can regulate the feed flow through use of a remotely controlled feed pump. During excavation of the panels, some slurry loss is expected due to filling of pores in the ground and creation of the filter cake. The associated minor losses cannot be recorded (note that the excavation process circulates approximately 300m^3 of slurry per hour through the desanding plant between cutter return and feed line). Only major and sudden drops of the slurry level can be recognized and will be recorded in the operators report and daily supervisors report. Major losses start a contingency plan which typically consists of the following steps:

1) Increase feed volume of slurry to trench
2) Recover cutter up
3) Fill sand into trench
4) Backfill panel with sand, muck or backfill concrete.

A typical emergency procedure flow chart can be found in Appendix C.

6. IMPACT ON PLANNED SITE DEWATERING

It is understood that the dewatering wells will be 6 m deep and the intention is that they should be trimmed so that the groundwater level adjacent to the trench is at least 3 m below the fluid level in the trench. Flow rates are expected to 2 to 3 litres/sec once the initial groundwater lowering period is complete. There is a risk that excavation fluid may reach the dewatering wells and so prevent the flow from these wells being discharged to a brook (where water quality standards must be met). Some pre-treatment could be required. Each dewatering well will be fitted with a sampling port and monitored so that any affected well can be identified and switched off and the water from the well can be contained and treated until preventive measures have been put in place to minimise bulk excavation support fluid loss. Should the ground-water level rise, the cutter needs to be recovered and trench stability needs to be assessed before works continue.

In addition, a deep well monitoring system for bentonite permeation will be designed, installed and operated by others.

7. ENVIRONMENTAL IMPACT

Bentonite and most of the additives in diaphragm walling slurries will be in the sodium form and are slightly alkaline. It has to be considered, that a pH slightly higher than neutral is not by itself a contaminant. Typically, excavation support fluids will have a pH in the range from 7 to 10 – though higher pH levels up to 12 can occur if cement becomes intermixed with the fluid (typically fresh concrete will have a pH of about 13.7). Sodium salts are a part of the additives themselves and responsible for the anionic charge. They do not make them alkaline; consider table salt (sodium chloride) which is of neutral pH level. Fresh support slurry will have the pH of the mixing water. pH of itself is seldom a concern for diaphragm walling. pH will be rapidly reduced by dilution in the adjacent groundwater. High pH due to concrete cutting will be treated as described above.

Whilst bentonite and sodium bicarbonate are fully compliant with environmental toxicity limits, some of the additives in pure form possess some light eco-toxic properties (as per datasheets in Appendix A and Slurry Ingredient Summary in Appendix D). Considering that these additives do not constitute a default ingredient of the slurry and will only be used as and when required in order to adjust rheology of the slurry, the actual concentration of additives in the slurry will be significantly lower which mitigates the eco-toxic concerns. Should slurry loss in the surrounding ground be experienced, the lost slurry will merge the groundwater which dilutes additive concentration even further (note that due to the inhomogeneous nature of the ground it is not possible to quantify this dilution). Bauer have no evidence of detrimental chemical impact of enhanced bentonite support slurries on the surrounding ground (Note that Bauer have used these or similar products on numerous international projects within environmentally sensitive areas, e.g. cut-off wall construction for water reservoir dams).

8. WASTE SLURRY DISPOSAL

During panel excavation, desanding and concreting (as described in Section 2.), support slurry properties may get detrimentally affected to a point from where the required parameters cannot be adjusted anymore by desanding or use of additives. Generally, the density is irreparably affected by a high content of ultra-fines and/or the viscosity is chronically high through pH level changes, e.g. through contact with concrete. In these instances, the slurry will be pumped into open skips or designated storage tanks from where the waste support slurry will be disposed of as per the AMC UK Site Waste Management Plan (SWMP) Woodsmith Mine Site - Phase 4 –Diaphragm Wall Construction 40-AMC-WS-71-EN-PL-0006. The disposable waste slurry quantity will be reduced by pre-treating the waste slurry with desilter and decanter units which separate a part of the waste slurry into solids and process water. The solids will be re-used on site if possible as per the Site Waste Management Plan. The process water from decanting may be re-used in the slurry dependent on checking for pH and contaminants. Unusable decanted process water will be tankered off site. Final disposal usually involves transport of waste slurry from site to a tip using bulk tanker lorries. The appointed specialist disposal contractor will hold a valid waste carrier licence as per the project's Site Waste Management Plan mentioned above. At the tip, waste slurry is generally treated by separation of solids and water which are subsequently disposed of individually as solid waste and waste water.

Storage, handling and truck loading of the waste slurry are performed within the confines of the concrete containment pad for the slurry plant so as to prevent contamination of the surrounding environment.

Figure 6: Typical tanker wagon

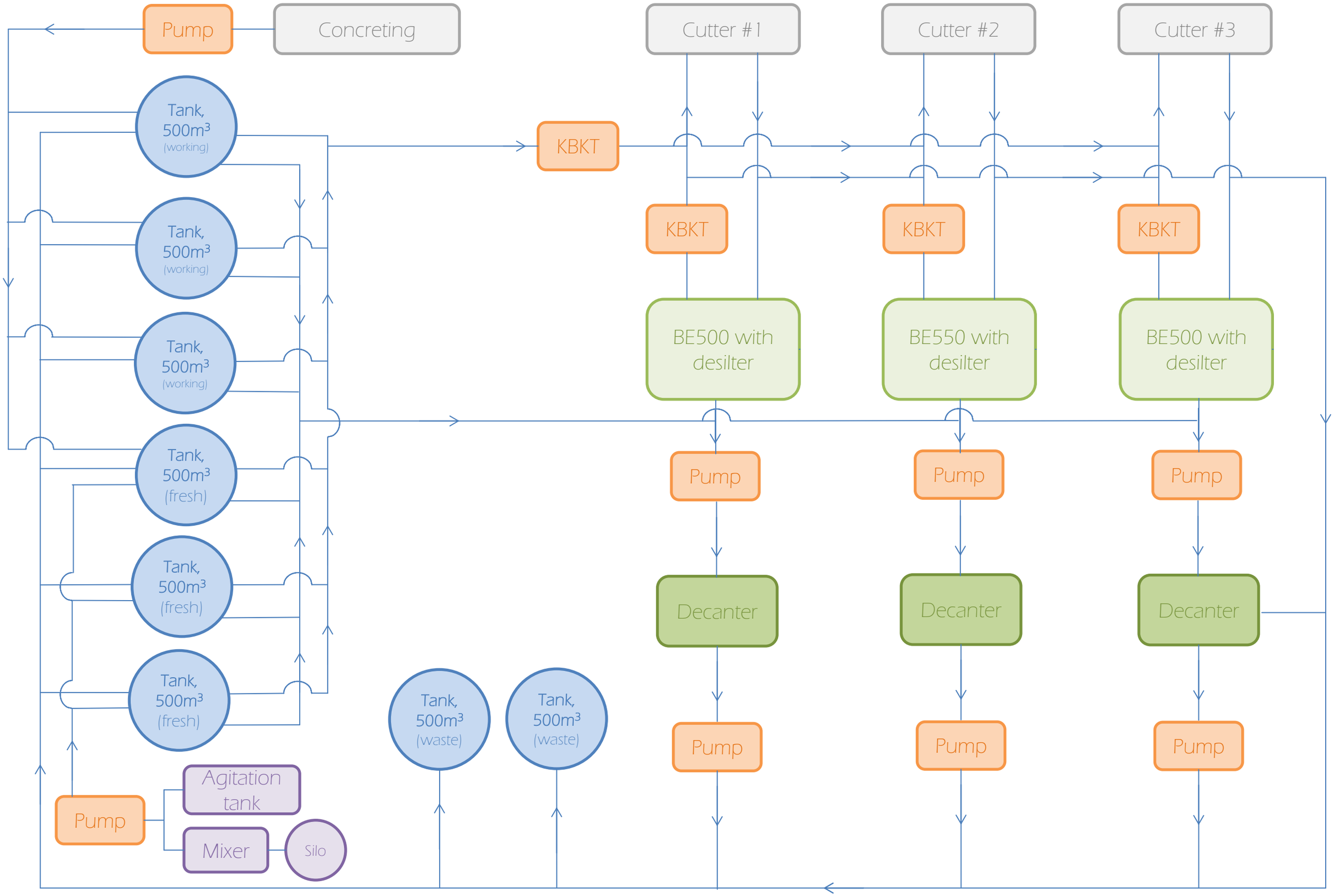
9. CONCLUSION

The support slurry proposed for use during construction of the Woodsmith Mine diaphragm wall shafts is compliant with industry practice and has been used successfully on previous projects. Diaphragm walls under bentonite support have been installed on numerous projects in environmentally sensitive areas, for example as cut-off walls in dams containing drinking water reservoirs. Whilst there will be a natural slurry loss into the surrounding ground during the excavation, the slurry loss will be minimised by the pore clogging properties of the support fluid. Whilst some slurry additives carry slightly eco-toxic properties in their pure form, their dilution with bentonite slurry mitigated concerns about detrimental impacts on aquatic life. Furthermore, the main slurry ingredients and additives are not classified as eco-toxic as per environmental assessment in line with applicable EC Regulations. In summary, the environmental impact on the surrounding eco-system is considered to be non-critical.

APPENDIX A – SLURRY MANAGEMENT FLOW CHART

SLURRY TREATMENT PLANT

Flowchart - BENTONITE



APPENDIX B – SLURRY COMPONENT DATASHEETS

Drilling Fluid Additive for underground projects

BERKBENT 100

Description

BERKBENT 100 is a high yielding, high quality bentonite with well-balanced rheological properties, designed to fit with necessities of diaphragm walling, piling and similar applications.

BERKBENT 100 matches perfectly the requirements of EN 1538
.

Uses

- Specifically designed for diaphragm walling and piling
- Suitable for all kind of soil
- Can be used also for tunnelling, micro tunnelling, pipe jacking and similar applications

Characteristics

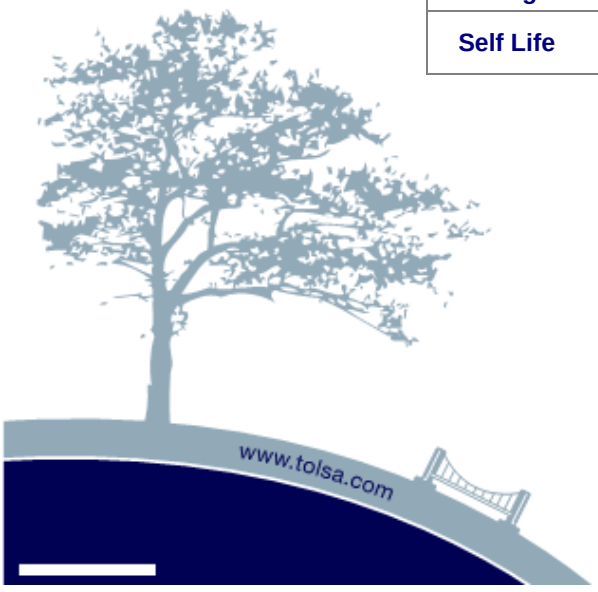
- Simply mix with water using an efficient mixer
- Resistant against brackish water
- Fast swelling (to get best properties, at least 4 hours of swelling are required)

Dosage

BERKBENT 100 dosage depends on application and technical requirements. The typical concentration varies from 3 - 8%.

For technical questions, please refer to your TOLSA Representative.

Presentation	
Colour	Light Cream
Aspect	Powder
Package	Multilayer 25 kg bags or Big Bags
Storage	Dry places protected from humidity
Self Life	1 year since production, conserved in original packaging



BERKBENT 100

Material Safety Data Sheet

According to Regulation (EC) 1907/2006 and Regulation (EC) 453/2010

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Identification of the substance/mixture:	BERKBENT 100
CAS Number:	--
EC number:	--
REACH Registration number:	Mixture

1.2. Relevant identified uses of the substance or mixture and uses advised against

This material should only be used for industrial purposes.
Rheological Additive

1.3. Details of the supplier of the safety data sheet

Manufacturer/Supplier:	Grupo TOLSA
Address:	Núñez de Balboa, 51 E-28001 MADRID - Spain
Telephone:	

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to directives 67/548/EEC and 1999/45/EC

Substance/mixture is not classified as dangerous according to Directive 67/548/EEC and 1999/45/EC

Classification according to Regulation (EC) 1272/2008
Substance/mixture is not classified as hazardous according to Regulation (EC) 1272/2008

2.2. Label Elements

Labelling according to directives 67/548/EEC and 1999/45/EC

Substance/mixture is not classified as dangerous according to Directive 67/548/EEC and 1999/45/EC

Labelling according to Regulation (EC) 1272/2008
Substance/mixture is not classified as hazardous according to Regulation (EC) 1272/2008

2.3. Other hazards

This product may generate dust during handling and use. This product may contain quartz (crystalline silica). Long term overexposure to crystalline silica dust may cause silicosis.

BERKBENT 100

Material Safety Data Sheet

According to Regulation (EC) 1907/2006 and Regulation (EC) 453/2010

SECTION 3: Composition/information on ingredients

3.1. Substance/preparation

I
This product may contain crystalline silica in quantity up to 5%.

Bentonite is not listed as dangerous substance in the Annex I of Directive 67/548/EEC as amended, not listed in Annex VI of Regulation (EC) 1272/2008.

Bentonite is an exemption from the obligation to register in compliance with Annex V of Regulation (EC) 1907/2006

SECTION 4: First aid measures

4.1. Description of necessary first aid measures

In case of inhalation :	Allow resting in a well-ventilated area if high concentration is inhalated and mechainica irritation or discomfort occurs. Seek medical attention if irritation persits.
In case of contact with skin :	Wash with mild soap and water and rinse with plenty of water.
IF IN EYES:	Rinse with plenty of water. Seek medical advice if irritation persists..
In case of ingestion:	Symptomatic treatment and seek medical advice in case of prolonged discomfort.
Individual protection of the person providing first aid :	No information available.

4.2. Most important symptoms and effects, both acute and delayed

Most important symptoms and effects, both acute and delayed :	Mechanical Irritation.

4.3. Indication of any immediate medical attention and special treatment needed

Indication of any immediate medical attention and special treatment needed :	No information available.

SECTION 5: Firefighting measures

5.1. Extinguishing Media

Suitable extinguishing media:	Water spray, carbon dioxide, dry chemical powder or appropriate foam.
Unsuitable extinguishing media:	For safety reasons do not use full water jet.

5.2. Special hazards arising from the substance or mixture

Special hazards arising from the substance or mixture:	None special

5.3. Advice for firefighters

Protective equipment and actions:	No special requirements. Do not allow spillage of fire will be poured into drains or watercourses.

BERKBENT 100

Material Safety Data Sheet

According to Regulation (EC) 1907/2006 and Regulation (EC) 453/2010

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

For non-emergency personnel:	Avoid dust formation Avoid breathing dust and contact with eyes Use respiratory protection if high dust conditions, chemical resistant gloves and safety glasses
For emergency responders:	None special

6.2. Environmental precautions

Environmental precautions:	Do not discharge into any drains, surface waters or groundwaters.

6.3. Methods and material for containment and cleaning up

Methods and material for containment and cleaning up:	Scoop up or vacuum soil spillages, if appropiated, use gentle water spray to wet down Ventilate area and wash spill site after material pickup is complete. Place in a closed container prior to disposal. Dispose of in accordance with current laws and regulations.

6.4. Reference to other sections

Reference to other sections :	No information available.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Recommendations:	Avoid contact with the eyes, skin and clothing. Wear protective clothing and use glasses.
Advice on general occupational hygiene:	Provide suitable air extraction ventilation in the work areas. Observe the rules of hygiene and safety at work.
Other information:	Keep only in the original container.

7.2. Conditions for safe storage, including any incompatibilities

Conditions for safe storage, including any incompatibilities:	Store in dry area Keep away from incompatible materials (see section of incompatibility). Do not store this material near food or drinking water. To be stored in tightly sealed and preferably full containers in cool, dry and ventilated area.

7.3. Specific end use(s)

Specific end use(s):	None.

BERKBENT 100

Material Safety Data Sheet

According to Regulation (EC) 1907/2006 and Regulation (EC) 453/2010

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

This product has no specific Occupational Exposure Limit (OEL).
Respect regulatory provisions for dust (inhalable and respirable)

8.2. Exposure controls

Appropriate engineering controls :	General ventilation. Local exhaust ventilation is recommended to keep airbone dust levels below exposure limits
Individual protection measures, such as personal protective equipment :	
Eye/face protection:	Chemical safety goggles are recommended. Wash contaminated goggles before reuse.
Skin protection :	Light protective clothing recommended. Wash contaminated clothing before reuse. Avoid inhalation and contact with skin and eyes.
Hand protection:	Compatible chemical-resistant gloves are recommended. Wash contaminated gloves before reuse.
Other:	Measures should be taken to prevent materials from being splashed into the eyes or on the skin. Wear eyeslilds and protective clothing.
Respiratory protection:	Use air-purifying dust respirator if airbone dust concentration is above exposure limits. In the case of brief exposure, use a device filter.
Thermal hazards :	No information available.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance:	Cream to grey powder
Odour:	Odourless
pH :	10.5 ± 0.5.
Melting point:	No information available.
Boiling Point :	No information available.
Flash Point:	Not applicable
Evaporation Rate :	No information available.
Flammability (solid, gas) :	No information available.
Upper/lower flammability or explosive limits :	No information available
Lower and upper explosive (flammable) limits :	No information available
Vapor pressure at 20ºC :	No information available.
Vapor density :	No information available.
Relative density:	2.7
Solubility(ies) :	Insoluble in water
Partition coefficient: n-octanol/water :	No information available.
Auto-ignition temperature :	No information available.
Decomposition temperature :	No information available.
Viscosity :	No information available.

9.2. Other information

Other information :	No information available.

BERKBENT 100

Material Safety Data Sheet

According to Regulation (EC) 1907/2006 and Regulation (EC) 453/2010

SECTION 10: Stability and reactivity

10.1. Reactivity

Reactivity : None hazardous reactions are expected

10.2. Chemical stability

Chemical stability : This product is stable in normal conditions.

10.3. Possibility of hazardous reactions

Possibility of hazardous reactions : None hazardous reactions are expected

10.4. Conditions to Avoid

Conditions to Avoid: No special requirements.

10.5. Incompatible materials

Incompatible materials: None known

10.6. Hazardous decomposition products

Hazardous decomposition products: None hazardous reactions or by-products are expected

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Information on toxicological acute effects : May cause eye irritation if exposed to large amounts of dust
Skin irritation may result from physical contact
Inhalation of high concentrations may cause irritation

Information on toxicological chronical effects : This product may contain quartz (crystalline silica). In 1997, IARC concluded that the respirable fraction of crystalline silica inhaled from occupational sources can cause lung cancer in humans. However, it pointed out that not all industrial circumstances, nor all crystalline silica types, were to be incriminated (IARC Monographs, Vol 68)

In June 2003, the EU Scientific Committe on Occupational Exposure Limits (SCOEL) concluded that the main effect in humans of the inhalation of respirable crystalline silica dust is silicosis. “There is sufficient information to conclude that the relative risk of lung cancer is increased in persons with silicosis. Therefore preventing the onset of silicosis will also reduce the cancer risk…”. (SCOEL SUM Doc 94-final, July 2003)

Other relevant information : No mutagenic, teratogenic or developmental toxicity effects are known

There is body of evidence supporting the fact that increased cancer risk would be limited to people already suffering from silicosis. According to the current state of the art, worker protection against silicosis can be consistently assured by respecting the existing regulatory occupational exposure limits.

BERKBENT 100

Material Safety Data Sheet

According to Regulation (EC) 1907/2006 and Regulation (EC) 453/2010

SECTION 12: Ecological information

12.1. Toxicity

Toxicity :	No specific adverse effects are known

12.2. Persistence and degradability

Persistence and degradability :	Not biodegradable

12.3. Bioaccumulative potential

Bioaccumulative potential :	Not bioaccumulative

12.4. Soil mobility

Soil mobility :	No information available.

12.5. Results of PBT and vPvB assessment

Results of PBT and vPvB assessment :	No information available.

12.6. Other adverse effects

Other adverse effects:	See also Sections 6, 7, 13 and 15 Avoid contamination of soil, groundwater and surface water.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste treatment containers :	Dispose in a safe manner in accordance with local/national regulations.
Appropiate methods of waste treatment of both substance or mixtures :	Dispose in a safe manner in accordance with local/national regulations
Appropiate methods of waste treatment of contaminated packaging :	Dispose in a safe manner in accordance with local/national regulations.
Wastewater discharge :	No information available.
Community/national/regional provisiones relating to waste :	No information available.

SECTION 14: Transport information

14.1. Land Transport (ADR/RID)
Substance/mixture is not classified as hazardous for transport

14.2. Sea Transport (IMDG)
Substance/mixture is not classified as hazardous for transport

14.3. Air Transport (IATA)
Substance/mixture is not classified as hazardous for transport

BERKBENT 100

Material Safety Data Sheet

According to Regulation (EC) 1907/2006 and Regulation (EC) 453/2010

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

Other :	No information available.
Authorisations :	No information available.
Usage: :	No information available.

15.2. Chemical Safety Assessment

Chemical Safety Assessment :	No information available.

SECTION 16: Other information

Substance/mixture is not classified as dangerous according to Directive 67/548/EEC and 1999/45/EC

Substance/mixture is not classified as hazardous according to Regulation (EC) 1272/2008

Reason for revision: Adaptation to CLP Regulation

The information in this Material Safety Data Sheet should be provided to all who will use, handle, storage, transport or otherwise be exposed to these products. This information has been prepared for the guidance of plant engineering, operations, management and for people working with or handling these products. This information is believed to be reliable and updated at Revision Date, and represents the best information currently available and known by TOLSA. However, TOLSA makes no guarantee or warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. The information related herein is based in proper handling and anticipated uses and is for the material without chemical additions/alterations Users should make their own investigations to determinate the suitability of the information for their particular purposes.

A premium grade bentonite powder that provides a rapid build up of viscosity and gelling properties in civil engineering slurries.

BERKBENT 163

Premium quality activated bentonite for water-based slurries

Properties

BERKBENT 163 is a premium grade rheological product based upon high quality sodium carbonate activated bentonite, specially formulated to provide rapid development of viscosity and gel strength for civil engineering slurries.

When dispersed in water, BERKBENT 163 swells to many times its volume, rapidly forming a thixotropic gel that provides:

- Stable suspension
- Rapid build up of viscosity
- High gel strength
- Stiffening
- Plastering and sealing
- Suitable for immediate use after mixing
- Low bleed values in cut-off wall applications

Field of application

- Structural diaphragm walls
- Plastic cut-off walls
- Grouting
- Caisson sinking
- Tunnelling and boring
- Transportation of solids
- Plasticising concrete
- Electrical earthing and measuring
- Sealing gas well heads

BERKBENT 163 is specifically designed to provide an immediate build up of high viscosity and gelling in site situations where aging is not possible or desirable. It provides re-assurance to the engineer and can improve site operations since less time is required for slurry preparation.

Instructions for use

BERKBENT 163 is delivered to site as a fine powder. It should be added slowly to water in a mixing vessel having means of vigorous agitation to completely disperse the powder.

Properties of the mixed slurry are improved by increased agitation, leading to greater efficiency and economy. On-site mixers suitable for use are:

- Propietory colloid grout mixers
- Propeller - type mixers
- Compressed air agitators
- Re-circulating centrifuge pumps
- Venturi jet mixers

The entire suspension should be continuously agitated for complete dispersal.

Dosage

For civil engineering applications, BERKBENT 163 slurries containing 3 to 8% BERKBENT 163 can be used (depending on local conditions). They will form a gel-like consistency on standing which will revert to a fluid on agitation (thixotropy).

Should you wish to receive advice for a more precise dosage, please contact our sales agents.

Technical data

Colour	Cream-coloured.
Appearance	Fine powder.
Presentation	Available in multi-walled 25 kilo bags, IBC's or delivered by road tanker.
Size grading (Dry)	5% max above 150 microns.
Viscosity (6% solids, Fann Viscometer)	600 rpm immediate 20 minimum. 10 minute gel strength 20 minimum.
Storage conditions	Cool, dry, well ventilated area.
Shelf life	Infinite, if properly stored.

AGA-23-0-ING-2009-1000

www.tolsa.com

Tolsa U.K.
West Carr Road
Retford
Nottinghamshire DN22 7ZF
United Kingdom

Berkbent 163 formulated to provide a rapid build up of viscosity and gelling properties

Material Safety Data Sheet

(In compliance with Directive 2001/058/EC and Regulation (EC) 1907/2006)

Section I. Identification of the Substance/Preparation and of the Company/Undertaking

Trade Name	**Berkbent 163**		
Product Name	Bentonite	**CAS #**	1302-78-9
Chemical Name	Hydrated Alumino Silicate		
Supplier	TOLSA UK, Ltd. West Carr Road Retford Nottinghamshire DN22 7ZF (United Kingdom)	**Protective Clothing** 	
Manufacturer	TOLSA UK, Ltd. West Carr Road -Retford Nottinghamshire DN22 7ZF (United Kingdom)	**Material Uses**	Processing aid in paper manufacture

Section II. Hazards Identification

Classification	**This product is not dangerous preparations according to Directive 1999/45/EC. Constituents/compounds not listed in Annex VI of the Regulation (EC) 1982/2008.**
Potential Adverse Human Health Effects	This product may generate dust during handling and use. As any natural occurring mineral, bentonite may contain quartz (crystalline silica). Long term overexposure to crystalline silica dust may cause silicosis.
Potential Adverse Effects for Environment	No specific adverse effects are known
Target Organs	Eyes and Skin (irritation risk). Pulmonary System (irritation and chronic risk)
Protective Measures	In case of exposure to high level of airbone dust, it is recommended the use of safety glasses and approved dust respirator. Use in well ventilated areas. Avoid breathing dust and contact with eyes. It is recommended the use of latex or chemical resistant gloves in handling.

Section III. Composition/Information on Ingredients

Name	*EINECS #*	*CAS #*	*Annex I/Annex VI*.*	*% wt*	*Symbols*	*REACH Number*	*R-Phrases*
Bentonite	215-108-5	1302-78-9	N/C	>98		Exempted	
Sodium Carbonate	207-838-8	497-19-8	N/C	<2	Xi	N/A	36

Asbestos free

N/C: Not Classified

Bentonite may contain crystalline silica (not listed in Annex I of Directive 67/548/EEC, not listed in Annex VI of Regulation (EC) 1272/2008*) in quantity up to 1%.

Bentonite is not listed as dangerous substance in the Annex I of Directive 67/548/EEC, not listed in Annex VI of Regulation (EC) 1272/2008 as amended.

Bentonite is an exemption from the obligation to register in compliance with Annex V of Regulation (EC) 1907/2006

Section IV. First Aid Measures

Emergency Medical Treatment	No special instructions are required
Special Provisions	No special requirements

FIRST AID

Eye Contact	Flush with plenty of flowing water. Seek medical attention if irritation persists.
Skin Contact	Wash off with water.
Inhalation	Allow resting in a well-ventilated area if high concentration is inhaled and mechanical irritation or discomfort occurs. Seek medical attention if irritation persists.
Ingestion	Provide symptomatic treatment and seek medical attention.

SYMPTOMS AND EFFECTS

Eye Contact	May cause irritation
Skin Contact	None expected in normal conditions
Inhalation	Mechanical Irritation
Ingestion	None expected in normal conditions

Section V. Fire-Fighting Measures

General Advice	Non flammable, non explosive.
Extinguishing Media	*Suitable*: All extinguishing media can be used *Not to be used*: None known
Products of Combustion	Not applicable
Protection for firemen	No special requirements
Special risks	No hazardous releases in case of fire are expected

Section VI. Accidental Release Measures

Personal Precautions	Avoid dust formation. Avoid breathing dust and contact with eyes Use safety glasses and respiratory protection in case of high level airbone
Environmental Precautions	This product is based on natural clay and no special precautions are required
Spill Procedures	*Soil*: Scoop up or vacuum soil spillages, if appropriated, use gentle water spray to wet down. *Water*: Clean up any spillage.
Disposal	Place in a closed container prior to disposal. Can be landfilled in compliance with local regulations

Section VII. Handling and Storage

Precautions in handling and storage	Use good housekeeping practices to avoid generating airborne dust. Do not breathe dust. Avoid contact with eyes

HANDLING

Technical Measures	No special requirements
Fire/Explosion Controls	No special requirements
Advice for Safe Handling	Handle in accordance with good industrial hygiene and safety procedures
Incompatible Products	None expected

STORAGE

Suitable storage Circumstances	Store in dry area
Storage – away from	No special requirements
Recommended packing materials	No special requirements

Section VIII. Exposure Controls/Personal Protection

Exposure Limit Values

(for Respirable Crystalline silica)

(mg/m^3), (January, 2006)

Respect regulatory provisions for dust (inhalable and respirable). This product has no specific Occupational Exposure Limit (OEL). A non-intentional substance (quartz) in the composition of this product has not community OEL but in some Member States are regulated as follows:

Austria: **0,15** (Maximale Arbeitspaltz Koncentration)

Belgium: **0,1**

Denmark: **0,1** (Threshold Limit Value)

Finland: **0,2** (Occupational Exposure Standard)

France: **0,1** (Valeur limite de Moyenne d'Exposition)

Germany: There are no OELs for crystalline silica since 2005; instead of an OEL there is a workers health protection system

Greece: **0,1** (Legislation for mining activities)

Ireland: **0,05** (2002 Code of Practice for the Safety, Health & Welfare at Work)

Italy: **0,05** (Threshold Limit Value)

Luxemburg: **0,15** (Grenzwert nach TRGS 900)

The Netherlands: **0,075** (Maximaal Aanvarde Concentratie)

Norway: **0,1** (Administrative Nomer (8hTWA) for Forurensing I Arbeldsmilljöet)

Portugal: **0,1** (Threshold Limit Value)

Spain: **0,1** (Valores límite, INSHT)

Sweden: **0,1** (Yrkeshygieniska Gränsvärden)

Switzerland: **0,15** (Valeur limite de Moyenne d'Exposition)

United Kingdom: **0,3** (Workplace Exposure Limit, HSE)

Exposure Controls

General ventilation

Local exhaust ventilation is recommended to keep airborne levels below exposure limits.

Personal Protection	*Respiratory*: Use air-purifying dust respirator if airborne concentration levels are above exposure limits. *Hands*: No special hands protection is required in normal conditions but the use of gloves is recommended. *Skin*: No special skin protection is required in normal conditions. Wash skin if mechanical irritation is experienced. *Eyes*: Use safety glasses with side shields if large amounts of product that could cause dust is handled.
Industrial Hygiene	Wash hands and other exposed areas with mild soap and water before eating, drinking, smoking and when leaving work. Keep the working area as clean and tidy as possible.
Environmental Exposure Controls	Do not allow product to reach sewage system or any watercourse.

Section IX. Physical and Chemical Properties

Appearance	Cream free flowing powder
Odour	Odourless
pH (10% in water)	10.5 ± 0.5
Boiling Point	Not applicable
Flash Point	Not applicable
Flammability	Non-flammable
Explosive Properties	None
Oxidising Properties	None
Vapour pressure	Not applicable
Relative Density	2.7 (Water = 1)
Solubility	Insoluble in water. Insoluble in fats
Partition Coefficient	Not applicable
Viscosity	Not applicable
Vapour density	Not applicable
Evaporation rate	Not applicable
Melting/Sublimation Point	Not available / Not applicable
Auto-Ignition Temperature	Not applicable

Section X. Stability and Reactivity

Stability Data	This product is stable in normal conditions
Hazard reactions	None expected
Conditions to avoid	No special requirements
Materials to avoid (Incompatibility)	None known
Hazardous Decomposition	No hazardous decomposition or by-products are expected.

Section XI. Toxicological Information

Routes of Entry	Inhalation. Ingestion.

EFFECTS OF ACUTE EXPOSURE

Eye contact	Mild irritant to eyes (according to the modified Kay & Calandra criteria)
Skin contact	Minor skin irritation may result from physical contact.
Sensitisation	No adverse effects are known
Ingestion	No adverse effects are known
Inhalation	Inhalation of high concentrations of dust may cause slight mechanical irritation
Additional Remarks	No additional remarks

EFFECTS OF CHRONIC OVEREXPOSURE

Main Effects	As any natural occurring mineral, bentonite may contain quartz (crystalline silica). In 1997, IARC concluded that the respirable fraction of crystalline silica inhaled from occupational sources can cause lung cancer in humans. However, it pointed out that not all industrial circumstances, nor all crystalline silica types, were to be incriminated (IARC Monographs, Vol 68) In June 2003, the EU Scientific Committe on Occupational Exposure Limits (SCOEL) concluded that the main effect in humans of the inhalation of respirable crystalline silica dust is silicosis. "There is sufficient information to conclude that the relative risk of lung cancer is increased in persons with silicosis. Therefore preventing the onset of silicosis will also reduce the cancer risk…". (SCOEL SUM Doc 94-final, July 2003)
Other Effects	No mutagenic, teratogenic or developmental toxicity effects are known
Additional Remarks	There is body of evidence supporting the fact that increased cancer risk would be limited to people already suffering from silicosis. According to the current state of the art, worker protection against silicosis can be consistently assured by respecting the existing regulatory occupational exposure limits.

Section XII. Ecological Information

Ecotoxicity	No specific adverse effects are known
Mobility	No data available
Persistence and Degradability	No data available
Bioaccumulative Potential	No data available
Other adverse effects	None known

Section XIII. Disposal Considerations

Methods of disposal	Dispose of in a safe manner in accordance with local/national regulations
Contaminated Packages	Dispose of in a safe manner in accordance with local/national regulations

Section XIV. Transport Information

Shipping Name	Not regulated
Transport Classification	*ADR*: Not classified *IMDG*: Not classified *ICAO/IATA*: Not classified *RID*: Not classified

Section XV. Regulatory Information and Pictograms

Trade Name	Berkbent 163
EEC Labelling	Not classified
Symbol(s)	None
Contains	None
R-Phrases	None
S-Phrases	None
Annex I Number	Not applicable
EEC Number(s)	Not applicable

Protective Clothing (Pictograms)

Section XVI. Other Information

R- Phrases Text (section III)	R36: Irritating to eyes
Revision Number	#1
Revision Date	January, 2009

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BERKBENT CGB is specially formulated for use in cementitious slurries which provide excellent stability properties

BERKBENT CGB

Specially formulated for use in cementitious slurries

Properties

BERKBENT CGB is a premium grade product based upon high quality sodium carbonate activated bentonite, which provides excellent high structure to slurries used in civil engineering and is specially formulated for the use in cementitious slurries.

Very resistant against contaminated water. BERKBENT CGB meets the requirements of EN1538.

Field of application

- Plastic cut-off walls
- Structural diaphragm walls
- Grouting
- Cement slurries for slurry trenches

Instructions for use

BERKBENT CGB is delivered to site as a fine powder. It should be added slowly to water in a mixing vessel having the means of vigorous agitation to completely disperse the powder before adding cement.

Once the cement has been added, maintain stirring.

Dosage

Specifically for use in cement slurries, BERKBENT CGB should be used in standard conditions from 3.5% to 4.5% and for aggressive waters from 4.5% to 5.5%. A typical starting dosage is 3.5%. The properties of the grout can be altered depending on the quality of water and cement.

Concentration BERKBENT CGB (kg/m^3)	35	45	55
Marsh-funnel time (sec)	41	74	>180
Mud density (t/m^3)	1.13	1.14	1.16

*BERKBENT CGB with 200 kg/m^3 CEM IIIc

Should you wish to receive advice for a more precise dosage, please contact our sales agents.

Product Information	
Colour	Grey
Appearance	Free flowing powder
Presentation	Available in multi-walled 25 kilo bags or IBC´s delivered by road tanker
Storage conditions	Cool, dry and well ventilated area
Shelf Life	2 years properly stored
Size Grading	5% max. above 150microns
Marsh-funnel time (35 kg/m^3 with 200 kg/m^3 CEM IIIc)	41 seconds

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BERKBENT CGB

Material Safety Data Sheet

According to Regulation (EC) 1907/2006 and Regulation (EC) 453/2010

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Identification of the substance/mixture:	BERKBENT CGB
CAS Number:	--
EC number:	--
REACH Registration number:	Mixture

1.2. Relevant identified uses of the substance or mixture and uses advised against

This material should only be used for industrial purposes.
Rheological Additive

1.3. Details of the supplier of the safety data sheet

Manufacturer/Supplier:	TOLSA Group
Address:	Núñez de Balboa, 51 E-28001 MADRID - Spain

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to directives 67/548/EEC and 1999/45/EC

Substance/mixture is not classified as dangerous according to Directive 67/548/EEC and 1999/45/EC

Classification according to Regulation (EC) 1272/2008
Substance/mixture is not classified as hazardous according to Regulation (EC) 1272/2008

2.2. Label Elements

Labelling according to directives 67/548/EEC and 1999/45/EC

Substance/mixture is not classified as dangerous according to Directive 67/548/EEC and 1999/45/EC

Labelling according to Regulation (EC) 1272/2008
Substance/mixture is not classified as hazardous according to Regulation (EC) 1272/2008

2.3. Other hazards

This product may generate dust during handling and use. This product may contain quartz (crystalline silica). Long term overexposure to crystalline silica dust may cause silicosis.

BERKBENT CGB

Material Safety Data Sheet

According to Regulation (EC) 1907/2006 and Regulation (EC) 453/2010

SECTION 3: Composition/information on ingredients

3.1. Substance/preparation

I
This product may contain crystalline silica in quantity up to 5%.

Bentonite is not listed as dangerous substance in the Annex I of Directive 67/548/EEC as amended, not listed in Annex VI of Regulation (EC) 1272/2008.

Bentonite is an exemption from the obligation to register in compliance with Annex V of Regulation (EC) 1907/2006

SECTION 4: First aid measures

4.1. Description of necessary first aid measures

In case of inhalation :	Allow resting in a well-ventilated area if high concentration is inhalated and mechainica irritation or discomfort occurs. Seek medical attention if irritation persits.
In case of contact with skin :	Wash with mild soap and water and rinse with plenty of water.
IF IN EYES:	Rinse with plenty of water. Seek medical advice if irritation persists..
In case of ingestion:	Symptomatic treatment and seek medical advice in case of prolonged discomfort.
Individual protection of the person providing first aid :	No information available.

4.2. Most important symptoms and effects, both acute and delayed

Most important symptoms and effects, both acute and delayed :	Mechanical Irritation.

4.3. Indication of any immediate medical attention and special treatment needed

Indication of any immediate medical attention and special treatment needed :	No information available.

SECTION 5: Firefighting measures

5.1. Extinguishing Media

Suitable extinguishing media:	Water spray, carbon dioxide, dry chemical powder or appropriate foam.
Unsuitable extinguishing media:	For safety reasons do not use full water jet.

5.2. Special hazards arising from the substance or mixture

Special hazards arising from the substance or mixture:	None special

5.3. Advice for firefighters

Protective equipment and actions:	No special requirements. Do not allow spillage of fire will be poured into drains or watercourses.

BERKBENT CGB

Material Safety Data Sheet

According to Regulation (EC) 1907/2006 and Regulation (EC) 453/2010

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

For non-emergency personnel:	Avoid dust formation Avoid breathing dust and contact with eyes Use respiratory protection if high dust conditions, chemical resistant gloves and safety glasses
For emergency responders:	None special

6.2. Environmental precautions

Environmental precautions:	Do not discharge into any drains, surface waters or groundwaters.

6.3. Methods and material for containment and cleaning up

Methods and material for containment and cleaning up:	Scoop up or vacuum soil spillages, if appropiated, use gentle water spray to wet down Ventilate area and wash spill site after material pickup is complete. Place in a closed container prior to disposal. Dispose of in accordance with current laws and regulations.

6.4. Reference to other sections

Reference to other sections :	No information available.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Recommendations:	Avoid contact with the eyes, skin and clothing. Wear protective clothing and use glasses.
Advice on general occupational hygiene:	Provide suitable air extraction ventilation in the work areas. Observe the rules of hygiene and safety at work.
Other information:	Keep only in the original container.

7.2. Conditions for safe storage, including any incompatibilities

Conditions for safe storage, including any incompatibilities:	Store in dry area Keep away from incompatible materials (see section of incompatibility). Do not store this material near food or drinking water. To be stored in tightly sealed and preferably full containers in cool, dry and ventilated area.

7.3. Specific end use(s)

Specific end use(s):	None.

BERKBENT CGB

Material Safety Data Sheet

According to Regulation (EC) 1907/2006 and Regulation (EC) 453/2010

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

This product has no specific Occupational Exposure Limit (OEL).
Respect regulatory provisions for dust (inhalable and respirable)

8.2. Exposure controls

Appropriate engineering controls :	General ventilation. Local exhaust ventilation is recommended to keep airbone dust levels below exposure limits
Individual protection measures, such as personal protective equipment :	
Eye/face protection:	Chemical safety goggles are recommended. Wash contaminated goggles before reuse.
Skin protection :	Light protective clothing recommended. Wash contaminated clothing before reuse. Avoid inhalation and contact with skin and eyes.
Hand protection:	Compatible chemical-resistant gloves are recommended. Wash contaminated gloves before reuse.
Other:	Measures should be taken to prevent materials from being splashed into the eyes or on the skin. Wear eyeslilds and protective clothing.
Respiratory protection:	Use air-purifying dust respirator if airbone dust concentration is above exposure limits. In the case of brief exposure, use a device filter.
Thermal hazards :	No information available.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance:	Cream to grey powder
Odour:	Odourless
pH :	10.5 ± 0.5.
Melting point:	No information available.
Boiling Point :	No information available.
Flash Point:	Not applicable
Evaporation Rate :	No information available.
Flammability (solid, gas) :	No information available.
Upper/lower flammability or explosive limits :	No information available
Lower and upper explosive (flammable) limits :	No information available
Vapor pressure at 20ºC :	No information available.
Vapor density :	No information available.
Relative density:	2.7
Solubility(ies) :	Insoluble in water
Partition coefficient: n-octanol/water :	No information available.
Auto-ignition temperature :	No information available.
Decomposition temperature :	No information available.
Viscosity :	No information available.

9.2. Other information

Other information :	No information available.

BERKBENT CGB

Material Safety Data Sheet

According to Regulation (EC) 1907/2006 and Regulation (EC) 453/2010

SECTION 10: Stability and reactivity

10.1. Reactivity

Reactivity : None hazardous reactions are expected

10.2. Chemical stability

Chemical stability : This product is stable in normal conditions.

10.3. Possibility of hazardous reactions

Possibility of hazardous reactions : None hazardous reactions are expected

10.4. Conditions to Avoid

Conditions to Avoid: No special requirements.

10.5. Incompatible materials

Incompatible materials: None known

10.6. Hazardous decomposition products

Hazardous decomposition products: None hazardous reactions or by-products are expected

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Information on toxicological acute effects : May cause eye irritation if exposed to large amounts of dust
Skin irritation may result from physical contact
Inhalation of high concentrations may cause irritation

Information on toxicological chronical effects : This product may contain quartz (crystalline silica). In 1997, IARC concluded that the respirable fraction of crystalline silica inhaled from occupational sources can cause lung cancer in humans. However, it pointed out that not all industrial circumstances, nor all crystalline silica types, were to be incriminated (IARC Monographs, Vol 68)

In June 2003, the EU Scientific Committe on Occupational Exposure Limits (SCOEL) concluded that the main effect in humans of the inhalation of respirable crystalline silica dust is silicosis. “There is sufficient information to conclude that the relative risk of lung cancer is increased in persons with silicosis. Therefore preventing the onset of silicosis will also reduce the cancer risk…”. (SCOEL SUM Doc 94-final, July 2003)

Other relevant information : No mutagenic, teratogenic or developmental toxicity effects are known

There is body of evidence supporting the fact that increased cancer risk would be limited to people already suffering from silicosis. According to the current state of the art, worker protection against silicosis can be consistently assured by respecting the existing regulatory occupational exposure limits.

BERKBENT CGB

Material Safety Data Sheet

According to Regulation (EC) 1907/2006 and Regulation (EC) 453/2010

SECTION 12: Ecological information

12.1. Toxicity

Toxicity :	No specific adverse effects are known

12.2. Persistence and degradability

Persistence and degradability :	Not biodegradable

12.3. Bioaccumulative potential

Bioaccumulative potential :	Not bioaccumulative

12.4. Soil mobility

Soil mobility :	No information available.

12.5. Results of PBT and vPvB assessment

Results of PBT and vPvB assessment :	No information available.

12.6. Other adverse effects

Other adverse effects:	See also Sections 6, 7, 13 and 15 Avoid contamination of soil, groundwater and surface water.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste treatment containers :	Dispose in a safe manner in accordance with local/national regulations.
Appropiate methods of waste treatment of both substance or mixtures :	Dispose in a safe manner in accordance with local/national regulations
Appropiate methods of waste treatment of contaminated packaging :	Dispose in a safe manner in accordance with local/national regulations.
Wastewater discharge :	No information available.
Community/national/regional provisiones relating to waste :	No information available.

SECTION 14: Transport information

14.1. Land Transport (ADR/RID)
Substance/mixture is not classified as hazardous for transport

14.2. Sea Transport (IMDG)
Substance/mixture is not classified as hazardous for transport

14.3. Air Transport (IATA)
Substance/mixture is not classified as hazardous for transport

BERKBENT CGB

Material Safety Data Sheet

According to Regulation (EC) 1907/2006 and Regulation (EC) 453/2010

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

Other :	No information available.
Authorisations :	No information available.
Usage: :	No information available.

15.2. Chemical Safety Assessment

Chemical Safety Assessment :	No information available.

SECTION 16: Other information

Substance/mixture is not classified as dangerous according to Directive 67/548/EEC and 1999/45/EC

Substance/mixture is not classified as hazardous according to Regulation (EC) 1272/2008

Reason for revision: Adaptation to CLP Regulation

The information in this Material Safety Data Sheet should be provided to all who will use, handle, storage, transport or otherwise be exposed to these products. This information has been prepared for the guidance of plant engineering, operations, management and for people working with or handling these products. This information is believed to be reliable and updated at Revision Date, and represents the best information currently available and known by TOLSA. However, TOLSA makes no guarantee or warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. The information related herein is based in proper handling and anticipated uses and is for the material without chemical additions/alterations Users should make their own investigations to determinate the suitability of the information for their particular purposes.

MATERIAL SAFETY DATA SHEET
SODIUM BICARBONATE

1. IDENTIFICATION OF THE SUBSTANCE AND COMPANY

Product	:	SODIUM BICARBONATE
Chemical Name	:	Sodium Bicarbonate.
Alternative Name	:	Bicarbonate of Soda. Baking Soda, Soda Bicarb Sodium Hydrogen Carbonate.
Chemical Formula	:	NaHCO3
Manufacturing Sites	:	Gujarat, Saurashtra
Company Address	:	GHCL Limited, Sutrapada, Dist. Gir Somnath Gujarat.

2. COMPOSITION / INFORMATION ON INGREDIENTS

- Sodium Bicarbonate

CAS Number	:	144 - 55 - 8
EC Number	:	205 - 633 8

3. HAZARDS IDENTIFICATION

- A substance of low toxicity widely used in food and medicine.
- Treat as low toxicity dust
- No significant health or environmental hazards associated with the material

4. FIRST AID MEASURES

Inhalation
- Remove to fresh air

Skin Contact
- Wash skin with plenty of water
- If irritation occurs and persists seek medical advice

Eye Contact
- Irrigate eye thoroughly with eye wash solution or clean water for at least 10 minutes.
- Eyelids should be held away from the eyeball to ensure through rinsing.
- Obtain medical attention if necessary.

Ingestion
- DO NOT induce vomiting
- Wash out mouth with water and give plenty of water to drink (at least 300 ml.
- Obtain medical attention if necessary.

5. FIRE-FIGHTING MEASURES

Flash Point
- Non-combustible

Extinguishing Media
- All extinguishing products are allowed

Special Hazards
- Non-combustible

Hazardous Decomposition Products (under fire conditions)
- Not applicable

6. ACCIDENTAL RELEASE MEASURES

Environmental Precautions
- Prevent discharges into the environment (rivers, water courses, sewers etc.)

Methods for clean up
- Clear up spillages by suitable means, avoiding dust formation
- Collect as much as possible in a suitable clean container, preferably for re-use, otherwise for disposal.
- Wash the spillage area with large quantities of water.

7. HANDLING AND STORAGE

Handling
- Atmospheric levels should be controlled in compliance with the occupational exposure limit.
- Skin protection should be worn for regular and continuous use.

Storage
- Store in a cool dry place (in humid conditions the product will absorb moisture from the atmosphere and this will eventually cause caking and loss of free flowing properties).
- Do not store adjacent to acids.

Fire and Explosion Prevention
- Non-combustible

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Controls
- Provide adequate ventilation
- In the case of insufficient ventilation, wear suitable respiratory equipment

Occupational Exposure Standards
- Not listed by H&SE
- Nuisance Dust Recommended Limits: OES 10mg/m3 (total dust) (8hr TWA)
  5mg/m3 (respirable dust) 8hr TWA).

Respiratory Protection
- In the case of high dust levels wear suitable respiratory protective equipment, i.e. Dust masks or respirator.

Hand Protection
- Wear suitable chemical resistant protective gloves for frequent or prolonged operations.

Eye Protection
- Suitable eye / tace protection.

Skin and Body Protection
- Protective clothing is required, overalls as a minimum.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Crystalline Powder	**Oxidizing Properties**	None known
Color	White	**Vapor Pressure**	Not applicable
Odors	Odorless	**Specific Gravity**	2.22
Melting Point	Decomposes	**Bulk Density**	980 kg/m3
Flash Point	Not applicable	**Solubility in water**	9.5%w/w @25^{0}C
Flammability	Not applicable	**Solubility in other solvents**	Not applicable
Auto Ignition Temp.	Not applicable	**pH value**	8.3 (1%w/w solution)
Explosive properties	None known	**Partition Coefficient (n-octanol/water)**	Not applicable
Explosion Limits	Not applicable	**Relative vapor density (air-1)**	Not applicable

10. STABILITY AND REACTIVITY

Stability
- Stable under recommended storage and handling conditions (see Section 7).

Conditions to avoid
- Contact with acids unless under controlled conditions
- Heating the product above 60 deg cel.
- Humidity and moisture can cause caking of product.

Materials to avoid
- Acids

Hazarous decomposition proctus
- Not applicable

11. TOXICOLOGICAL INFORMATION

Acute Toxicity
- Oral LD 50, rat : 4220 mg/kg.
- Inhalation : Dust may cause discomfort

Eye Irritation
- Dust may cause discomfort

Skin Irritation
- No known effect

Long Term Exposure
- No known effect

12. ECOLOGICAL INFORMATION

Acute Ecotoxicity
- Fish, Lepomis macrochirus : 96hr-LC50 : 8600mg/l
- Daphnia sp. : 48hr-LC50 : 2350mg/l

Bio - degradability
- Aerobic / Anaerobic degradation : Not applicable (inorganic compound)

13. DISPOSAL CONSIDERATIONS

Product
- Must be disposed in accordance with local, state or national regulations
- Do not dispose of directly with acids
- Dissolve in water and neutralize with an acid

Packaging
- Must be disposed in accordance with local, state or natural regulations
- Contact the manufacturer about recycling.

14. TRANSPORT INFORMATION

- Not classified as hazardous for transport.

*** Land Transport**

ADS Class	Not restricted	**ADR item number**	Not relevant
RID Class	Not restricted	**RID item number**	Not relevant
TREM - Card	Not relevant	**UN Number**	None
Hazard Identification number	None	**Substance Identification**	None
Proper shipping name	None	**number**	

*** Sea Transport**

IMO / IMGD	Not regulated	**Class**	Not relevant
Packing group	None	**UN Number**	None
EMS	Not relevant	**MFAG**	Not relevant
Marine Pollutant	No		
Proper shipping name	Not relevant		

*** Air Transport**

ICAO/IATA-DGR Class	Not regulated	**UN number**	None
Proper shipping name	None	**Packing number**	None

15. Regulatory Information

- Safety, health and environmental regulations/legislation specific for the substance or mixture

EU Regulations

Major Accident Hazard	96/82/EC
Legislation	Directive 96/82/EC does not apply

National Legislation

Storage Class	10-13

16. Other Information

Provide adequate information, instruction and training for operators

Product Data Sheet

SÜD-CHEMIE
Creating Performance Technology

BENTOFRANCE
ZI et Portuaire – Rue Louis Saillant
26800 Portes les Valence – FRANCE

www.sud-chemie.com

ADDITIVES FOR CIVIL ENGINEERING WORKS

BENTOCRYL 86

Thinner, Deflocculant and Filtrate loss reducer

9.A.2/FT/UK/01
Creation date: 01.12.04
Edition n° : 01 of 01.12.04
Page 1/1

Description

BENTOCRYL 86 is a solution of synthetic polymers supplied as a pale yellow to colorless viscous liquid.

The **dispersive** and **deflocculating** properties exhibited with clays by BENTOCRYL 86 make it the choice additive for any bentonite based drilling mud.

Applications

BENTOCRYL 86 is the product of choice for BENTONIL based muds as well as Cement / Bentonite slurries.:

Benefits

- Cost effective as small amount are required
- Easy to use product
- Degradable
- Friendly to the environment

Physical Properties

Appearance :	transparent to amber liquid
Specific gravity :	1.2 – 1.3
Bulk viscosity :	600 – 1000 mPa.s
pH :	8 – 9

Guidelines for Use

- ***Drilling muds***
  - *Fluidifier for bentonite slurry*

0.05 to 0.1% by volume of mud i.e. 0,5 to 1,0 l/m^3 help to cope with excessive suspended fines or swelling clay shale

  - *Deflocculating agent for contaminated muds*

0.05 to 0.1% by volume of mud i.e. 0,5 to 1,0 l/m^3 are recommended to recover original mud properties.

- ***Cement - Bentonite slurry***
  - *Fluidifier*

    Addition at the end of the mixing cycles reduces efficiently the slurry viscosity.

  - *Filtrate reducer*

    0.05 to 0.15% i.e. 0,5 to 1,5 l/m^3 improve filtrate loss properties

  - Retarder

    Improved workability of B/C slurry is achieved by addition of BENTOCRYL 86 proportioning to cement content.

Contact your SC technical representative for further information.

Origin & Packaging

Portes-lès-Valence production plant (France).

25 kg plastic drums and 1200 kg IBC container

Storage

Keep the product in its original closed packaging above 0°C and no longer than 12 months.

Related Documents

MSDS & Application sheets available on demand.

EURO-QUALITY SYSTEM
ISO 9001

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

Product information

Commercial Product Name : BENTOCRYL 86

Company : Süd-Chemie AG
Business Unit Adsorbents and Additives
Ostenriederstrasse 15
85368 Moosburg

ncy
)

2. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical nature : Sodium polyacrylate in aqueous solution

Usage : Adsorbing medium for technical applications

Components	EINECS	Symbol(s)	R-phrase(s)	Concentration

3. HAZARDS IDENTIFICATION

Special sliding risk through leaking of spilled product in connection with water.

4. FIRST AID MEASURES

General advice : none
Eye contact : Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Skin contact : Wash off with soap and plenty of water.
Inhalation : Call a physician immediately.

Notes to physician

Treatment : none

5. FIRE-FIGHTING MEASURES

Specific hazards during fire fighting : none
Special protective equipment for fire-fighters : Standard procedure for chemical fires.
Suitable extinguishing media : water spray
carbon dioxide (CO_2)

dry powder
foam
water

Extinguishing media which must not be used for safety reasons : Do not use a solid water stream as it may scatter and spread fire.

6. ACCIDENTAL RELEASE MEASURES

Environmental precautions : Do not flush into surface water or sanitary sewer system.
Methods for cleaning up : Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Dispose collected material in according to prescription.

7. HANDLING AND STORAGE

Handling

Safe handling advice : Avoid contact with skin and eyes. Avoid shaking and spraying.

Storage

Requirements for storage areas and containers : Please store under 35°C Perishable if frozen. Keep tightly closed in a dry and cool place.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Additional technical information on the plant : none

Components with workplace control parameters

Components	CAS-No.	Value	Basis / Remarks

Personal protective equipment

Respiratory protection : No special protective equipment required.
Hand protection : Chemical-resistant protective gloves according to EN 374, EN 388, EN 420
Eye protection : safety glasses with side-shields
Skin and body protection : Chemical resistant apron protective suit
Hygiene measures : Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form : liquid

Colour : Amber

Odour : none

Other data

melting point : n.a.

boiling point	:	n.a.
Flash point	:	n.a.
Ignition temperature	:	n.a.
Autoignition temperature	:	none
Upper explosion limit	:	n.a.
Lower explosion limit	:	n.a.
Vapour pressure	:	n.a.
Density	:	n.a.
Bulk density	:	n.a.
Water solubility	:	
pH	:	7 - 9
Explosive properties	:	Remarks: none

10. STABILITY AND REACTIVITY

Hazardous reactions (Conditions to avoid)	:	None known.
Hazardous reactions (Materials to avoid)	:	carbon monoxide, carbon monoxides (NOx)
Information about decomposition	:	No decomposition if stored and applied as directed.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Acute oral toxicity	:	LD50 rat Dose: > 2.000 mg/kg

Irritation, Sensitization, Other data Toxicology

(Skin-)Irritation	:	Result: none
Eye irritation	:	Result: Mild eye irritation

12. ECOLOGICAL INFORMATION

Elimination information (persistence and degradability)

Decomposition : Result: not readily biodegradable.

Bioaccumulation : none

Ecotoxicity effects

Toxicity to fish :

LC50Brachydanio rerio
Dose: > 100 mg/l

Testing period: 96 h

Toxicity to algae :

LC50
daphnia
Dose: > 100 mg/l

Exposure time: 48 h

Water contaminating class : (Selbsteinstufung nach VwVwS-Konzept)
WGK 1 slightly water endangering

13. DISPOSAL CONSIDERATIONS

Product : Dispose collected material in according to prescription.

Contaminated packaging : Rinse empty containers with water and use the rinse-water to prepare the working solution. Can be re-used after emptying and cleaning.

14. TRANSPORT INFORMATION

Land transport : ADR: Not classified as dangerous in the meaning of transport regulations.
RID: Not classified as dangerous in the meaning of transport regulations.

Sea transport : IMDG-CODE: Not classified as dangerous in the meaning of transport regulations.

Air transport : IATA_C: Not classified as dangerous in the meaning of transport regulations.
IATA_P: Not classified as dangerous in the meaning of transport regulations.

15. REGULATORY INFORMATION

General advice : The product does not need to be labelled in accordance with EC directives or respective national laws.

Hazardous components which must be listed on the label:
- Not applicable

Other information : Handle in accordance with good industrial hygiene and safety practice.

Notification status: Preparation

Components / CAS-No.	Registered in / No.	Status
all components	AICS	listed
	DSL	listed
	INV (CN)	not allowed
	ENCS (JP)	listed
	TSCA	listed
	EINECS	listed
	KECI (KR)	not allowed
	PICCS (PH)	not allowed

16. OTHER INFORMATION

Relevant R-Phrases acc. Chapter 2 and 3 : Not applicable

Responsible for SDS: Environmental Protection Contact person: Dep. CEQ Tel.: 08761/82-654

The information presented herein is believed to be accurate, but is not warranted.
It does not represent any assurance of properties of the product.
The specifications are to be drawn from the corresponding leaflet.

A vertical bar (|) in the left margin indicates an amendment from the previous version.

Legend

n.a.: not applicable
n.av.: not available
n.r.: not relevant

BAUER Slurry LTA 3

BAUER Slurry LTA offers a wide range of admixtures for Slurries as used in most special foundation activities. This products help to improve properties of used slurries, as well as they are a part of the BAUER Slurry LTP-System.

Product Description:

Composition:	Anionic SAPAM Powder
Appearance:	white granular powder
Bulk Density:	600 to 800 kg/m^3
Ionic charge:	high anionic charge

Slurry Properties (0.1% in Tap water)

Viscosity:	approx. >70 sec Marsh Funnel
Viscosity (with LTP)	up to >300 sec Marsh Funnel
pH value:	approx. 6 to 7

Fields of Application:

BAUER Slurry LTA 3 had been designed as an Admixture within the BAUER LTP-System in order to improve stabilizing properties for very open granular soils. Used as an admixture, the granular structure of the material allow to increase slurry viscosity up to 300 or 400 sec and enables a blocking of voids in the ground. Due to its influence on rheological properties it is most suitable for any kind of coarse soil or in case of high slurry losses. For precautions and to have a proper handling it is necessary to check the Material Safety Data Sheet and BAUER Technical Support.

Storage and Stability:

Packaging:	25 kg plastic bags, 750 / 1000 kg/pallet
With proper storage in original packing:	at least 12 months

The product is basically sensitive to moisture, such as condensation, water droplets and humidity.

Technical Support:

Lars Liersch, BAUER Malaysia Sdn.Bhd

Safety data sheet

Regulation(EC) No. 1907/2006, 1272/2008

Printing date 01.02.2017 *Revision: 29.01.2017*

1 Identification of the substance/mixture and of the company/undertaking

- **Product identifier**
- **Trade name: BAUER Slurry LTA 3**
- **Article number:** Data not available
- **Registration number:** Data not available
- **Relevant identified uses of the substance or mixture and uses advised against**

Application of the substance/ the preparation: Baby Diaper, Agriculture, Construction, Drilling etc.

- **Details of the supplier of the safety data sheet**
- **Manufacturer/Supplier:**

BAUER (Malaysia) Sdn Bhd
Phileo Damansara1, Unit 506,Block G,No.9 Jalan 16/11
46350 Petaling Jaya, Malaysia
Tel: +60 3 79569366 Fax: +60 3 79569580

- **Only Representative / other EU contact point**

- **Further information obtainable from:** BAUER (Malaysia) Sdn. Bhd.
- **Emergency telephone number:** Tel: +60 3 79569366

- **Remark:**

This sample is likely to be classified as cosmetic product and is out of scope of a SDS as set out in Regulation (EC) No 1907/2006. This SDS is generated for client's reference only.

2 Identification

- **Classification of the substance or mixture**
- **Classification according to Regulation (EC) No 1272/2008**

GHS07

Eye Irrit. 2 H319 Causes serious eye irritation.

- **Classification according to Directive 67/548/EEC or Directive 1999/45/EC** Xi; Irritant

R36: Irritating to eyes.

- **Label elements**
- **Labelling according to Regulation (EC) No 1272/2008**

The product is classified and labelled according to Regulation (EC) No 1272/2008.

- **Hazard pictograms**

GHS07

- **Signal word** Warning
- **Hazard-determining components of labelling:** Not applicable
- **Hazard statements**

H319 Causes serious eye irritation.

- **Precautionary statements**

P101 If medical advice is needed, have product container or label at hand.
P102 Keep out of reach of children.
P103 Read label before use.
P280 Wear protective gloves/protective clothing/eye protection/face protection.

(Contd. on page 2)

Safety data sheet
Regulation(EC) No. 1907/2006, 1272/2008

Printing date 01.02.2013 Revision: 29.01.2013

Trade name: BAUER Slurry LTA 3

(Contd. of page 1)

P264 Wash thoroughly after handling.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337+P313 If eye irritation persists: Get medical advice/attention.

- **Other hazards** Not applicable
- **Results of PBT and vPvB assessment**
- **PBT:** Not applicable
- **vPvB:** Not applicable

3 Composition/information on ingredients

- **Chemical characterization: Mixtures**
- **Description:**

Mixture of the substances listed below with nonhazardous additions.
For the wording of the listed risk phrases refer to section 16.

- **Dangerous**

9003-04-7	2-Propenoic acid, homopolymer, sodium salt	Xi R36 Eye Irrit. 2, H319	93,0-97,0%

- **Non-dangerous**

CAS: 7732-18-5 EINECS: 231-791-2	water	3,0-7,0%

- **Remark:**

2-Propenoic acid, homopolymer, sodium salt (CAS No.9003-04-7)
Synonym: Polyacrylic acid, sodium salt

4 First aid measures

- **Description of first aid measures**
- **After inhalation:** Supply fresh air; consult doctor in case of complaints.
- **After skin contact:** Wash with water thoroughly.
- **After eye contact:**

Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.

- **After swallowing:**

Rinse out mouth with water.
Never give anything by mouth to an unconscious person.
If symptoms persist consult doctor.

- **Information for doctor:**
- **Most important symptoms and effects, both acute and delayed** No further relevant information available.
- **Indication of any immediate medical attention and special**

5 Firefighting measures

- **Extinguishing media**
- **Suitable extinguishing agents:**

CO , powder or water spray. Fight larger fires with water spray or alcohol resistant foam.

- **Special hazards arising from the substance or mixture** No further relevant information available.
- **Advice for firefighters**
- **Protective equipment:**

Wear fully protective suit.

(Contd. on page 3)

Safety data sheet

Trade name: BAUER Slurry LTA 3

(Contd. of page 2)

6 Accidental release measures

- **Personal precautions, protective equipment and emergency procedures**

Wear protective equipment. Keep unprotected persons away.
Ensure adequate ventilation
Avoid formation of dust.
Keep away from ignition sources.
Avoid contact with eyes.

- **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
- **Methods and material for containment and cleaning up:**

Pick up mechanically.
Dispose contaminated material as waste according to item 13.

- **Reference to other sections**

See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.

7 Handling and storage

- **Handling:**
- **Precautions for safe handling**

Ensure good ventilation/exhaustion at the workplace.
Keep receptacles tightly sealed.
Keep away from heat and direct sunlight.
Prevent formation of dust.
Avoid contact with eyes.

- **Information about fire - and explosion protection:** Keep ignition sources away - Do not smoke. Keep respiratory protective device available.
- **Storage:**
- **Conditions for safe storage, including any incompatibilities:**
- **Requirements to be met by storerooms and receptacles:** Store in a cool location.

Store only in the original receptacle.

- **Information about storage in one common storage facility:** Store away from foodstuffs. Protect from humidity and water. Store away from oxidizing agents.
- **Further information about storage conditions:**

Keep container tightly sealed.
Store in cool, dry conditions in well sealed receptacles.

8 Exposure controls/personal protection

- **Additional information about design of technical facilities:** No further data; see
- **Control parameters**
- **Ingredients with limit values that require monitoring at the workplace:**

The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.

- **DNELs:** Data not available
- **PNECs:** Data not available
- **Additional information:** The lists valid during the making were used as basis.

(Contd. on page 4)

Safety data sheet

Regulation(EC) No. 1907/2006, 1272/2008

Printing date 01.02.2013 Revision: 29.01.2013

Trade name: BAUER Slurry LTA 3

(Contd. of page 3)

- **Exposure controls**
- **Based on composition shown in Section 3, the following messures are suggested for occupational safety measure:**
- **Personal protective equipment:**
- **General protective and hygienic measures:**

Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing Wash hands before breaks and at the end of work. Avoid contact with the eyes.
Avoid contact with the eyes and skin.

- **Respiratory protection:** Suitable respiratory protective device recommended.
- **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

- **Material of gloves:**

The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.

- **Penetration time of glove material:**

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

- **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

• **Information on basic physical and chemical properties**	
• **General Information**	
• **Appearance:**	
Form:	Granule
Colour:	White
• **Odour:**	Odourless
• **Odour threshold:**	Data not available.
• **pH-value:**	5,5~6,5
• **Change in condition**	
Melting point/Melting range:	Data not available.
Boiling point/Boiling range:	Data not available
• **Freezing point:**	Data not available
• **Flash point:**	Data not available
• **Flammability (solid, gaseous):**	Date not available.
• **Auto-Ignition temperature:**	Data not available

(Contd. on page 5)

BAUER Slurry LTA 16 / 17

BAUER Slurry LTA offers a wide range of admixtures for Slurries as used in most special foundation activities. LTA 16 is a high effective dispersant for water based slurries, specially designed to be used together with other products of the BAUER Slurry LTP-System.

Product Description:

Composition:	Poly-Acrylate-Salt
Appearance:	colourless transparent liquid
Density:	1.35 kg/m^3

Fields of Application:

BAUER Slurry LTA 16 is a strong dispersive and de-flocculating additive, that had been developed as a part of the BAUER LTP-System in order to achieve best plasticizing effects on Bentonite and Cement-Slurries with minimized costs. It can be used in a dosage range of 0.5 to 1.5 l/m^3 and will result in:

- Excellent plasticization and stabilisation of bentonite slurries.
- Significant reducing of filtrate losses and filter cake thickness
- long retardation with enhanced flow ability in cement slurries

For precautions and to have a proper handling it is necessary to check the Material Safety Data Sheet and BAUER Technical Support.

Storage and Stability:

Packaging:	25 kg pail, 250 kg drum, 1000 kg container
With proper storage in original packing:	12 months

Technical Support:

Lars Liersch, BAUER Malaysia Sdn.Bhd

Revision: 05/12/2016

Material Safety Data Sheet (MSDS)

1. Product and Company Identification

Product name	**BAUER Slurry LTA 16, BAUER Slurry LTA 17**
Synonyms	Poly-acrylic Acid Sodium Salt (PAAS)
Supplier	**Bauer (Malaysia) Sdn Bhd** Unit 506, Blk G, Phileo Damansara 1 No. 9, Jalan 16/11, Off Jalan Damansara 46350 Petaling Jaya, Selangor Darul Ehsan, Malaysia.
CAS #	See section 3
Product code	-
Product use	Water treatment chemicals, scale inhibitor, dispersant.

2. Hazard(s) identification

GHS classification	
Physical hazards	Not classified
Health hazards	Not classified
Environmental hazards	Not classified
GHS label elements	
Hazard Pictograms	No hazard pictogram is used.
Signal word	No signal word is used.
Hazard statement	Not applicable.
Prevention	Not applicable.
Response	Not applicable.
Storage	Not applicable.
Disposal	Not applicable.

3. Composition / information on ingredients

Components	CAS#	Percent
Water	7732-18-5	40-70%
Polyacrylic Acid Sodium Salt (PAAS)	9003-04-7	30-60%

4. First-aid Measures

First aid procedures

Eye contact Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Consult a physician if you feel unwell.

Skin contact Take off contaminated clothing and shoes. Wash off with soap and plenty of water. If skin irritation or rash occurs: Get medical advice/attention.

Inhalation If exposed to fumes from overheating, move person into fresh air.

Ingestion Not a likely route of exposure. None necessary for small quantities.

Notes to physician Treat symptoms.

5. Fire-fighting measures

Flammable properties	Not available.
Extinguishing media	Use extinguishing agents appropriate for surrounding fire.
Suitable extinguishing media Unsuitable extinguishing media	Not available.
Firefighting equipment /instructions	Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.
Hazardous combustion products	Oxides of carbon.

6. Accidental release measures

Personal precautions	Use personal protective equipment. Avoid breathing vapors. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. For personal protection see section 8.
Environmental precautions	Do not allow material to be released to the environment without proper governmental permits.
Methods for **cleaning up**	Soak up with absorbent material (e.g. universal binding agent, sand, diatomaceous earth, sawdust) and dispose of according to Section 13.

7. Handling and storage

Handling Avoid contact with skin and eyes. Avoid inhalation of vapor. Keep away from sources of ignition - No smoking. Take measures to prevent the building up of electrostatic charge. For precautions see section 2.2.

Storage Keep out of access to unauthorised individuals. Store product closed and only in original packing. Not to be stored in gangways or stair wells. Store cool.

8. Exposure controls / personal protection

Control parameters: **OCCUPATIONAL EXPOSURE LIMITS (OEL)**
INGREDIENT DATA: Not Available
EMERGENCY LIMITS:

Ingredient	TEEL-1	TEEL-2	TEEL-3
Polacrylic Acid Sodium	Not	Not	Not

Ingredien	Original	Revised
water	Not	Not
Polacrylic Acid Sodium	Not	Not

Exposure controls: Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Appropriate engineering If user operations generate vapour, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Individual protection measures, such as personal protective equipment

Eye / face protection Safety glasses when eye contact is possible.

Skin protection Protective gloves of leather, contaminated or damaged gloves should be replaced. Skin covering working clothes.

Respiratory protection None required under normal conditions of use.

General hygiene considerations Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Keep away from foodstuffs, beverages and feed. Immediately remove all soiled and contaminated clothing

9. Physical and chemical properties Appearance

Physical state	Liquid
Form	Transparent Liquid
Color	Colorless or light yellow
Odor	Light
Odor threshold	Not available
pH	Not available
Vapor pressure	Not available
Melting point/Freezing point	Not available
initial boiling point and boiling range	Not available
Flash point	Not available
Evaporation rate	Not available
Flammability (solid, gas)	Not available
Explosion limits	Not available

Vapor density	Not available
Relative density	Not available
Solubility (water)	Not available
Partition coefficient	Not available
Auto-ignition temperature	Not available
Decomposition temperature	Not available
Specific gravity	Not available
Density	Not available
Flammability limits in air, upper, %by volume	Not available
VOC	Not available
Percent volatile	Not available
Other data	Not available
Viscosity	Not available

10. Stability and reactivity

Chemical stability	Material is stable under normal conditions.
Conditions to avoid	Incompatible materials.
Incompatible materials	Not available
Hazardous decomposition products	Oxides of carbon
Possibility of hazardous reactions	No decomposition when used as directed

11. Toxicological information

Toxicokinetics, metabolism and distribution:

Non-human toxicological data:	Not available

Information on toxicological effects:

Acute toxicity:

LD50(Oral, Rat):	Not available
LD50(Dermal, Rabbit):	Not available
LC50(Inhalation, Rat):	Not available
Skin corrosion/Irritation:	Not available
Serious eye damage/irritation:	Not classified
Respiratory or skin sensitization:	Not classified
Germ cell mutagenicity: Carcinogenicity:	Not classified
Reproductive toxicity: STOT- single exposure:	Not classified
STOT-repeated exposure: Aspiration hazard:	Not classified

12. Ecological information

Toxicity

Acute Toxicity		Time	Species	Method	Evaluation	Remarks
LC50	N / A	96 h	Fish	OECD 203	N / A	N / A
EC50	N / A	48 h	Daphnia	OECD 202	N / A	N / A
EC50	N / A	72 h	Algae	OECD 201	N / A	N / A

Persistence and degradability:	Not available.
Bioaccumulative potential:	Not available.
Mobility in soil:	Not available.
Results of PBT&vPvB assessment:	Not available.
Other adverse effects:	No known significant effects or critical hazards

13. Disposal considerations

Disposal instructions	**Dispose** of contents/container in accordance with local/ regional/ national/international regulations.
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

Basic shipping requirements:

UN number	Not regulated
Proper shipping name	Not regulated
Hazard class	Not regulated
Packing group	Not regulated
Environmental hazards	No

IATA

UN number	Not regulated
proper shipping name	Not regulated
Transport hazard class(es)	Not regulated
Packing group	Not regulated
Environmental hazards	No

IMDG

UN number	Not regulated
proper shipping name	Not regulated
Transport hazard class(es)	Not regulated
Packing group	Not regulated
Environmental hazards	No

15. Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture:

water (7732-18-5) is found on the following regulatory lists	"US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory" List.
Polacrylic Acid Sodium Salt (PAAS) (9003-04-7) is found on the following regulatory lists	"US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory" List.

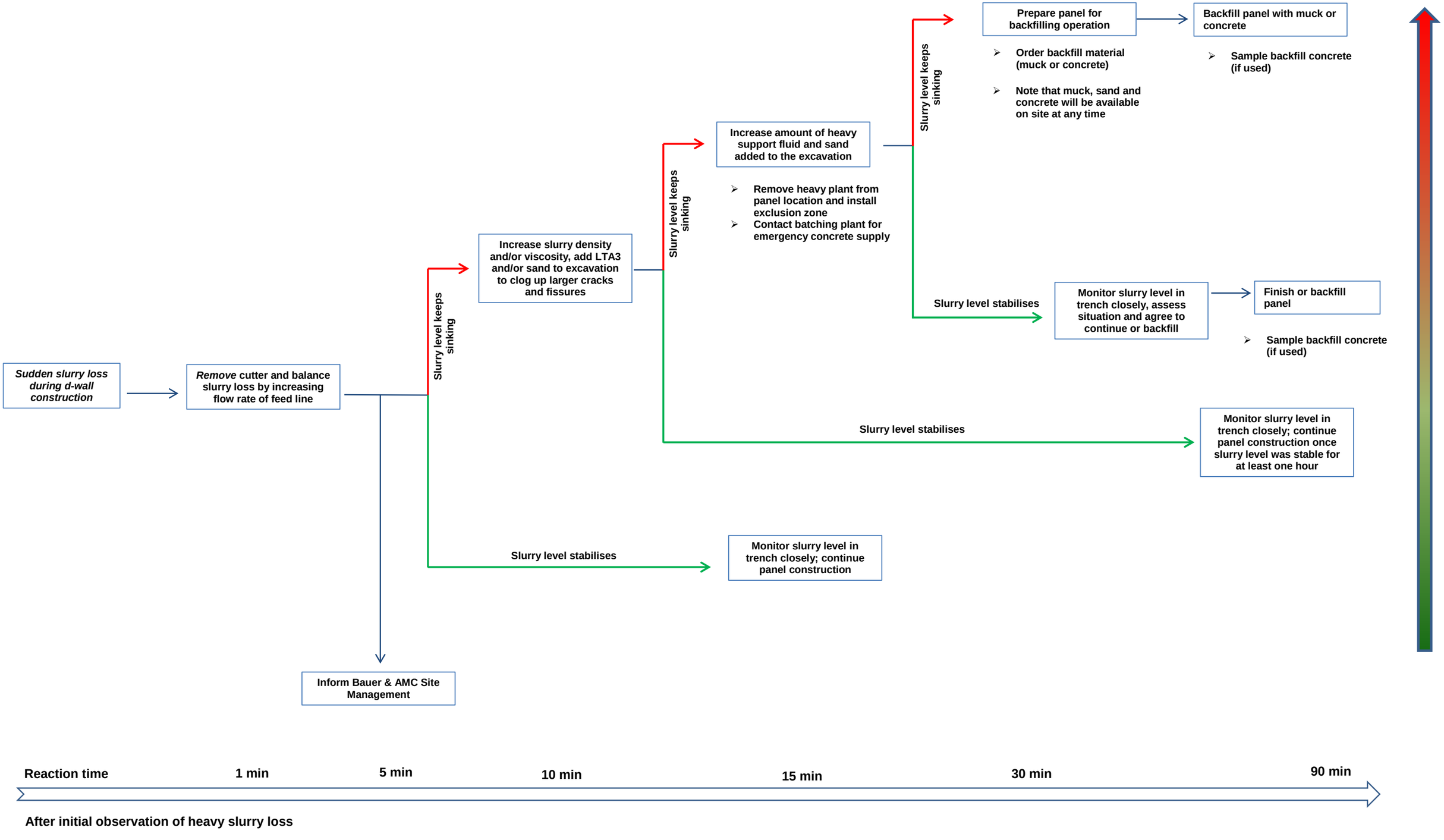
16. Other information, including date of preparation or last revision

HMIS®ratings	Health: 0 Flammability: 1 Physical hazard: 0
NFPA ratings	Health: 0 Flammability: 1 Instability: 0
Disclaimer	The information in the sheet was written based on the best knowledge and experience currently available.
Issue date	05-12-2016

APPENDIX C – EMERGENCY PREPAREDNESS FLOW CHART

NORTH YORKSHIRE POLYHALITE PROJECT - WOODSMITH MINE

Flowchart: Emergency Preparedness Plan for sudden slurry loss during d-wall construction



APPENDIX D – SLURRY INGREDIENT SUMMARY

NORTH YORKSHIORE POLYHALITE PROJECT

Bentonite and additive substance list

Author: JAG
Update: 24-May-17
Stage: Pre-construction phase

Bentonite	Chemical Name	Purpose	Chemical composition			Form
			Part 1	Part 2	Note	
Berkbent 100	Hydrated Alumino Silicate	Transform water into trench supporting slurry	100% Bentonite (CAS 1302-78-9)	-	May contain 5% crystalline silica	Powder
Berkbent 163	Hydrated Alumino Silicate	Transform water into trench supporting slurry	98% Bentonite (CAS 1302-78-9)	2% Sodium-Carbonate (CAS 497-19-8)	May contain 1% crystalline silica	Powder
Berkbent CGB	Hydrated Alumino Silicate	Transform water into trench supporting slurry	100% Bentonite (CAS 1302-78-9)	-	May contain 5% crystalline silica	Powder

Additive	Chemical Name	Purpose	Chemical composition			Form
			Part 1	Part 2	Note	
Sodium Bicarbonate	Sodium Bicarbonate	Reduce viscosity by pH level adjustment	100% Sodium Bicarbonate (CAS 144-55-8)	-	-	Powder
Bentocryl	Sodium polyacrylate	Reduce density and filtrate water loss by reduction of yield point	Water (CAS 7732-18-5)	Polyacrylic Acid Salt (CAS 9003-04-7)	-	Liquid
LTA 3	Sodium polyacrylate	Close fractures and reduce slurry loss	95% Polyacrylic Acid Salt (CAS 9003-04-7)	5% Water (CAS 7732-18-5)	-	Powder
LTA 16	Sodium polyacrylate	Reduce density and filtrate water loss by reduction of yield point	60% Water (CAS 7732-18-5)	40% Polyacrylic Acid Salt (CAS 9003-04-7)	-	Liquid

Note: *Depending on availability and operational requirements, alternative additives may be used.*

NORTH YORKSHIORE POLYHALITE PROJECT

Bentonite and additive dosage

Author: JAG
Update: 26-May-17
Stage: Pre-construction phase

Substance	Dosage (per m^3 of slurry with density 1150 kg/m^3)			
	Density	Dosage	% (weight)	mg per litre
Berkbent 100	2.70 g/cm3	35 kg/m3	3.04%	35,000
Berkbent 163	2.70 g/cm3	35 kg/m3	3.04%	35,000
Berkbent CGB	2.70 g/cm3	35 kg/m3	3.04%	35,000
Sodium Bicarbonate*	2.22 g/cm3	5 kg/m3	0.43%	5,000
Bentocryl*	1.25 g/cm3	0.5 l/m3	0.04%	625
LTA 3*	1.35 g/cm3	0.5 kg/m3	0.04%	500
Sodium Polyacrylate from LTA3[a]	1.35 g/cm3	0.5 kg/m3	0.04%	475
LTA 16*	1.35 g/cm3	1.0 kg/m3	0.09%	1,350
Sodium Polyacrylate from LTA16[a]	1.35 g/cm3	0.4 kg/m3	0.03%	540

Notes: **: Additives are not a default ingredients but will be added to the slurry as and when required to adjust rheological properties of the slurry*

[a] : LTA polymers consist of water and Sodium Polyacrylate as per substance description table

Shown dosages are indicative and may be adjusted in line with operational requirements.

NORTH YORKSHIORE POLYHALITE PROJECT

Bentonite and additive eco-toxicity assessment

Author: JAG
Update: 24-May-17
Stage: Pre-construction phase

Substance	Eco-toxicity						
	pH Level	LC_{50} (Lepomis macrochirus)	LC_{50} (Brachydanio rerio)	LC_{50} (Daphnia)	EC_{10}	Warning notes	Note
Berkbent 100	10 to 11	-	-	-	-	-	No specific adverse effects are known
Berkbent 163	10 to 11	-	-	-	-	-	No specific adverse effects are known
Berkbent CGB	10 to 11	-	-	-	-	-	No specific adverse effects are known
Sodium Bicarbonate	8.3	> 8600 mg/l	-	> 2350 mg/l	-	Prevent discharges into the environment (rivers, water courses, sewers etc.)	-
Bentocryl	7 to 9	-	> 100 mg/l	> 100 mg/l	-	Do not flush into surface water	-
LTA 3	5 to 7	-	-	-	-	-	-
LTA 16	not available	-	-	-	-	Do not allow material to be released to the environment without proper governmental permits.	No known significant effects or critical hazards