



RISK ASSESSMENT

TEKFLEX



FACILITATED BY: JAG PEARSON

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INTRODUCTION

Fosroc Stratabolt was formed in 1997, by the merger of Stratabolt Products, and Fosroc, both leading suppliers of rock support products to the South African Mining industry. Fosroc Stratabolt now trades as Minova RSA, and is a member of the Minova International Group which manufactures and supplies advanced rock-engineering materials in all of the world's major mining countries.

The company operates an integrated research, development and manufacturing facility in the hub of the diverse and technically demanding Southern African Mining Industry. Minova RSA's products are used in every sector of that industry and are exported world-wide.

Through our own research and access to the research of other Minova International companies we aim to ensure that our customers maintain leadership in improving the safety and productivity of underground excavation. The spectrum of products supplied enables mining engineers to choose unique solutions to unique rock engineering problems. We invite the active participation of our customers in product conception and improvement.

We manufacture resin grouting capsules, cement grouting capsules, high-yield and foamed grouts and other advanced technology cements. We also supply backfilling systems.

MAIN PRODUCTS

LOKSET ® polyester resin capsules

Minova RSA manufactures Lokset ® resin rock-bolting capsules under licence from E.I. du Pont de Nemours & Co. (Inc). Lokset ® is the leading rock-bolting resin in Southern Africa and has long held a similar position in North America.

Lokset ® capsules have a unique composition and construction. The resin compartment contains coarse filler particles, which aid in shredding the sheath and then interlock to increase the strength and rigidity of the grout. The catalyst compartment comprises 30 percent of the capsule, which materially improves intermixing of the components. These characteristics give the user unparalleled reliability of installation, tolerance of wide bar/hole annuli and simplicity of operation.

Lokset® is available ex-stock in setting times from 15 seconds to 15 minutes and diameters from 19mm to 35mm. Special setting times and sizes are available on

request. The Lokset® capsules manufactured by Minova RSA comply with South African National Standard ("SABS") No. 1534: 1991 and carry the SABS mark of quality.

Minova RSA also manufactures the unique 2-Speedie resin capsule system which contains two different resin set times within the same capsule.

CAPCEM® cement grouting capsules

Cement capsules are used with grout bars to achieve full-column cement grouting.

The blended cement is encapsulated in a porous sheath, which allows controlled water absorption for correct wetting of the grout.

Capcem® capsules are available in 25mm and 28mm diameters and fast setting times allowing a 500mm length of grout to support a 50 kN load applied to an embedded 16mm rebar, after only 1 hour.

TEKSET® high-yield grouts

These patented high-yield grout formulations are designed to be mixed with a fixed quantity of water and pumped under pressure into high strength polypropylene bags for timber pack pre-stressing. The grout will generate a minimum strength of 0,3 MPa in two hours and achieve a minimum strength of 4 MPa within 7 days.

Their primary use is to pre-stress timber packs, giving semi-active and immediate support as well as making the packs blast-resistant. The grouts are also suitable for void filling.

TEKSET® is supplied in nominal 11kg bags.

AIR-O-CEM® and TEKSEAL® foamed grouts.

When placed with a custom-made pump, these grouts produce low-density foams suitable for void filling and the creation of ventilation, backfill and blast barriers. They are supplied in nominal 25kg bags.

Pumped cement grouting Systems

The Capram® system is manufactured by Minova RSA under licence from Delkor Technik.

The system is designed to afford an easy method of reliably achieving full column cement grouting in a hole of any size. It can be used for pre- or post- grouting.

The equipment components are a simple pressure-differential axial pump which operates on compressed air (minimum pressure 3 bar) and a lance of 12mm to 30mm diameter. The grout is pre-packed in a porous sheath designed to optimise water absorption. The wetted grout bag is inserted into the pump and the grout ejected through flexible piping and the lance to the back of the hole. The sheath is retained in the pump and discarded after use.

The pumps are available ex-stock and the grouts are supplied in packages of nominal dimensions 90mm x 400mm long. Setting times are medium (2 hours) and slow (4-6 hours).

The Capcem Injection Grout System consists of blended cement grout (each bag sufficient to fill one typical rockbolt hole) and a hand held, air driven injector. The grout is mixed in its bag with water and then pumped into the hole with the injector.

LOKSET ANCHOR PACK pourable resin grouts

Scraper winches and other machinery may be rapidly bolted in place with LOKSET ANCHOR PACKS, which are a high-strength pourable resin grouts. They are supplied as a 10kg two-component pack in a mixing bucket. In use, the two components are mixed and poured into the anchoring holes, around the hold-down bolts. The equipment may be used within 2 hours.

TEKFLEX® structural membrane

Tekflex is a high-strength flexible coating for rock. When sprayed onto the surface of mine drives or tunnels it quickly forms a membrane which restrains loose rock, inhibits further deterioration and protects against weathering.

CABLESEAL® fire-retardant coating for cable and pipes

Cableseal is applied as a coating on cables and plastic pipes in mines. It prevents spread of fire along the cable or pipe runs. It is strongly adherent but flexible enough to accommodate flexure of the cable or pipe without breaking off.

FIRESHIELD® fire-resistant coating for timber

Fireshield is sprayed or painted onto timber support in underground workings to prevent spread of fire between packs or poles. It has passed stringent tests that convincingly demonstrate that a timber pack protected by Fireshield will remain intact despite adjacent packs burning completely.

FILLSET® AND CONBEX® backfilling systems

Minova RSA has developed additives that make run-of-mine tailings into effective backfill material. The additives bind the tailings and chemically retain water, accelerating strength gain and preventing shrinkage as the backfill sets. Each backfilling operation is unique so Minova RSA provides advice on design of backfill formulations and placing systems.

FACILITIES

LOKSET ® resin capsule production

Four capsule production lines employ mechanised and automated mixing to produce polyester and catalyst mastics for encapsulation by modified Kartridge Pak (KP) chub machines. The production lines are supported by a dedicated analytical laboratory for checking of incoming, in-process and finished goods.

Capacity: 500 tonnes per month

Cementitious grout manufacture

Two automatically controlled blenders produce the grout blends for the packaging lines. Small diameter grouting capsules (Capcem) are formed on 3 banks of automatic filling machines. Large diameter capsules (Capram and Injection Grout) have their own filling section. Two bagging lines produce Tekset, Air-O-Cem, Tekseal and other bagged products. The cements plant has its own Quality establishment, including laboratories for routine quality control and product testing.

Capacity: 2500 tonnes per month

Research and Development

A central laboratory and workshops are available for development and testing of new formulations and components. Equipment includes compressive and tensile testing machines, apparatus for conventional chemical analyses and rigs for testing anchor installation equipment and techniques.

Technical Service

All field staff are experienced in mining and have received training in the characteristics and proper use of all our products. Minova RSA service includes:

- * Product selection
- * Application training and in-use auditing
- * Stock management, transport and packaging

KEY PERSONNEL

Chief Executive Officer – Pete Ferreira		
Educational Qualifications	B.Sc. Eng. (Mining) Pr. Eng, MDP, DPLR, AEP, FSAIMM	
Experience	Section Manager	Anglo American Corporation
	Business Unit Manager	Cementation Mining
	Contract Manager	M&R RUC Ltd – Mining Division
	Operations Manager	M&R RUC Ltd – Mining Division
	Manager Marketing and Business Services	M&R RUC Ltd
	General Manager Mining Services	Murray and Roberts, Cementation (Pty) Limited
Director – Donald O’Connor		
Educational Qualifications	B.Sc. Hons (Geophysics), MBA	
Experience	Project Leader	Western Deep levels Mine
	Project Manager	NPI Group
	General Manager	Strataloc Resins
	Managing Director	Dantex Explosives
	Technical Director	RSA Products
Technical Director – Rod Smart		
Educational Qualifications	Ph.D (Chemistry) Post Doctoral study - Pennsylvania State University, USA	
Experience	Product Development Manager	Fosroc Technology, UK
	Technical Manager	Fosroc South Africa
	Technical Director	Minova RSA
Financial Director – Lindsay Harris-Dewey		
Educational Qualifications	B. Comm., B. Acc., C.A. (S.A.)	
Experience	Audit Senior	Ernest and Young – Springs
	Financial Manager	Bevcan - a Division of Crown Nampac
	Commercial Manager	Bevcan - a Division of Crown Nampac
	Financial Manager	P.F.G. Building Glass
Operations Director – Alfredo Piroddi		
Educational Qualifications	BSc Hons (Management and Industrial Technology)	
Experience	Maintenance Foreman	MCMS
	Production Manager	Coca Cola South Africa
	Factory Manager	Fosroc Stratabolt
	Operations Manager	Minova RSA
Human Resources Manager – Lorraine Coughlan		
Educational Qualifications	B Com. (Personnel Management) Hons	
Experience	Human Resources Manager	HMR and Noristan
	Personnel Consultant	Johann Ribbens and Associates
	Personnel Officer	ESD

The following members contributed in forwarding information in the assessment:

- Dr. R. Smart - Technical Director - 18 Years experience
- W.J. Crous - Technical Manager - 7 Years experience
- J. Bester - Loading Controller - 10 Years experience
- J. Ferreira - Technical demonstrator - 25 Years experience

Mr. Jack Pearson from BRM facilitated the assessment.

SCOPE OF WORK

Objective – To conduct a suitable and sufficient risk assessment that will, as far as reasonably practicable, identify all potential health, safety and financial hazards the articles could pose to the user and measure the level of risk of each hazard identified in order to recommend controls to mitigate or control the relevant risks.

Aim – To provide the user with sufficient information – specified steps - that can/should be used to train and guide employees to enable them to use the articles properly.

The risk assessment on Tekflex were structured as follows:

- A** - **Loading, transport and off-loading of articles by supplier**
- B** - **Storage of articles on surface by user**
- C** - **Loading, transport and off-loading of articles by user**
- D** - **Storage of articles underground by user**
- E** - **Application of Tekflex by user**
- F** - **Inspections on articles by user before application**
- G** - **Inspections on articles by user after application**
- H** - **Underground and surface impacts on articles**
- I** - **Chemical / Health hazards**

EXECUTIVE SUMMARY

Introduction - The risk assessment on the support protective membrane considered activities such as loading, off-loading, transport, storage, application and inspections, which are typical activities the user performance when ever using the articles being supplied. These activities are normally performed on surface and mainly underground. The risk assessment was therefore structured in such a manner that all potential health, safety and financial hazards and relevant risks could be identified, as far as reasonably practicable, whenever performing any of the activities using the articles being supplied. The format of the risk assessment was laid out such, that the user can use the information as specified steps, whenever performing any of the activities using the articles. Mentioned activities were broken down into specific task steps, as the supplier foresees the user using the articles, then all potential hazards were identified, related risks measured and recommendations made to guide the user of the most effective means in handling the articles when performing such activities.

Risks were measured using a risk index, which considers the three factors influencing the degree of risk such as consequence, exposure and probability (**Refer to APPENDIX 1 for an example of the Risk Index used**). The reason for risk measurement is to prioritize the hazards identified looking at the significant risks it poses, and then deciding whether the risks should be eliminated, controlled, minimized or are the risks perhaps tolerable as is.

Result – A detailed hazard identification and risk measurement database is available in section 4 of this report, in summary the highest risks pertaining to each activity is listed below:

A -Loading, off-loading and transport by supplier:

- **Loading** - Forklift off-loading pallet incorrectly on truck
- **Transport** - Hi-jacking of truck
- **Off-loading** - Truck on unstable / uneven surface for off-loading
- Inadequate moving space for off-loading

B - Storage of articles on surface by user:

- Poor accessibility for forklift

C - Loading, transport and off-loading of articles by user:

- **Loading** - Insufficient space for loading with forklift
- **Transport** - Transporting material car by hand
- Using a defective loco for transport
- **Off-loading** - Off-loading into traveling or escape routes

D - Storage of articles underground by user:

- Fire hazard from plastic buckets

E - Application of articles by user

Ensure immediate area is safe

F - Inspection on articles by user before application:

- Serves as checklist only

G - Inspection on articles by user after application:

- Serves as checklist only

H - Underground and surface impacts on articles

- Using articles for purposes not designed for.

I - Chemical / Health hazards

- Skin contact
- Respiratory contact

Benefits – The following benefits resulted from the risk assessment being conducted:

- Legal compliance;
- Mutual understanding between user and supplier regarding hazards and risks when using the articles;
- Specified steps for the user to use the articles properly;
- Revision on the adequacy of design of the articles;
- Recommended safe use of the articles; therefore
- Health and safe working practices;
- Prevention of downtime;
- Reduce potential for production loss;
- Reduce potential for financial loss;
- Reduce potential for personal injury;
- Reduce potential for equipment damage;
- Specified steps can/should be used as training material; therefore
- Improved hazard awareness;
- Improved workmanship; and
- Quality applications; therefore
- Improved safety;
- Less falls of ground occurrences;
- Improved production;
- Financial gain;
- Improved health and safety work environment and
- Improved workforce output.

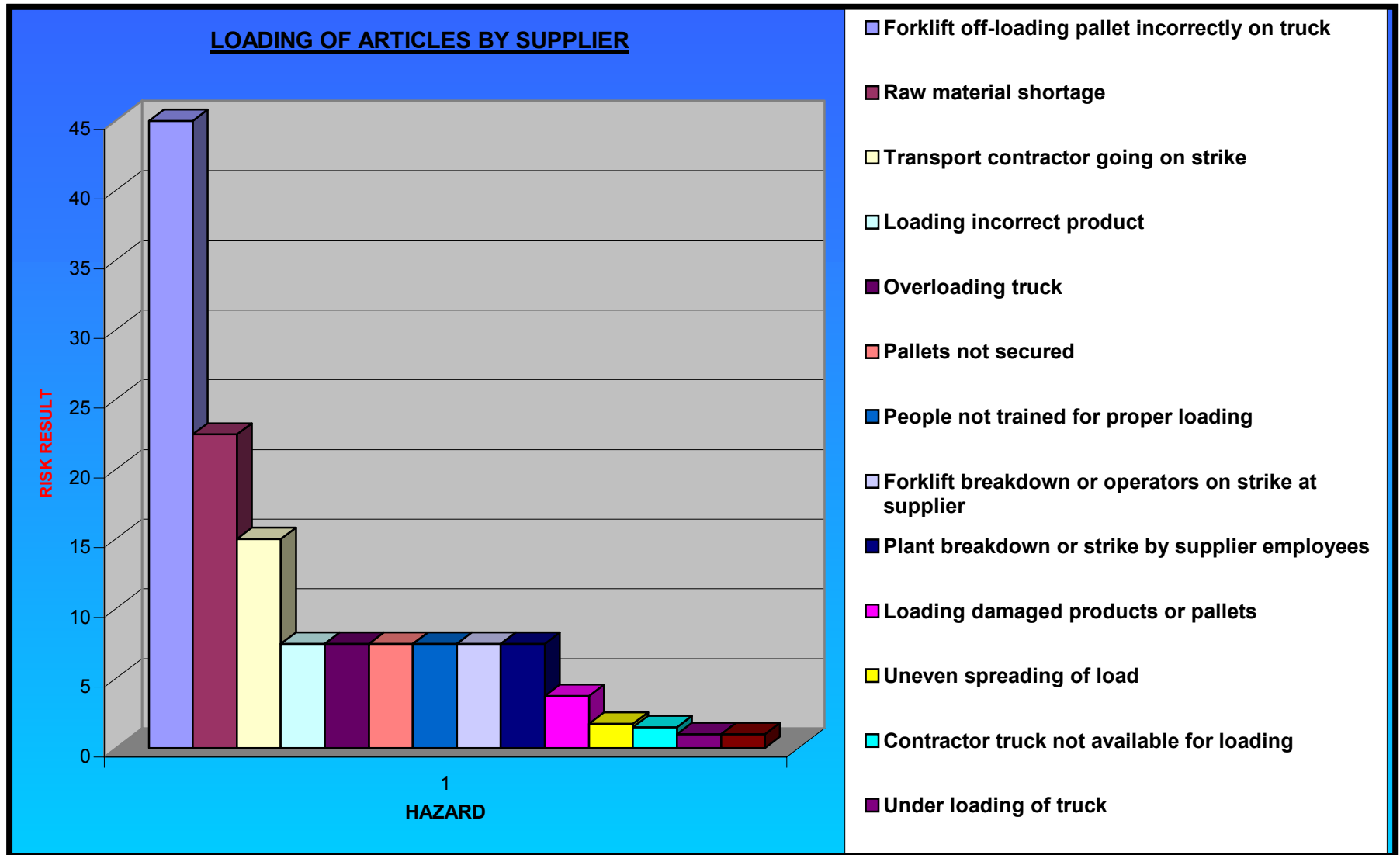
RISK ASSESSMENT DATABASE

The following is incorporated in the risk assessment database of all the issues as described in the structure of the risk assessment explained under the scope of work:

- a. Risk profiles
- b. Hazard identification and risk measurement database
- c. Recommended safe working procedures/practices

A - LOADING, TRANSPORT AND OFF-LOADING OF ARTICLES BY SUPPLIER:

LOADING OF ARTICLES BY SUPPLIER



No.	Activity	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation/Controls
1.	Loading	Loading incorrect product	Sub standard application, personal injury, production loss, financial loss, down time, property damage	15	1	0.5	7.5	Loading controller ensures and over inspects load being loaded for dispatch. If the user receives the incorrect product the supplier or area representative should be notified so that the correct action can be taken to prevent a re-occurrence. The supplier will supply the user with the correct product within 24 hours as far as reasonably practicable.
		Overloading truck	Financial loss for supplier, vehicle damage, road damage, ignoring of road rules, lack of truck control	15	1	0.5	7.5	The supplier uses a weighbridge and picking slips to prevent the overloading of the truck. Driver will confirm if the truck is overloaded and will not move with truck if it is overloaded. If the user observes an overloaded truck the supplier to be contacted to ensure a re-occurrence to not take place.
		Under loading of truck	User running out of stock, sub standard conditions, personal injury, property damage, financial loss	1	1	1	1	Loading controller over inspects and ensures correct loading of truck. User to notify supplier if an under loaded truck is observed. The full load will be delivered at no additional costs to the user or credit will be forwarded for the next delivery.
		Uneven spreading of load	Road accidents, down time, loss of product, using inferior product, insurance claims, increased premiums	7	0.5	0.5	1.75	Loading controller and driver over inspects truck to ensure load is evenly spread. If the user observes an uneven load he should notify the supplier, or area representative who will assess the situation and act accordingly or advice the user alternatively.
		Transport contractor going on strike	Financial loss, shortage of product to client, sub standard installations, personal injury, down time, production loss	15	1	1	15	Supplier uses alternative transporters or use trucks hired by them to ensure deliveries reach users on time. Supplier will notify the user of any business interruptions at the supplier's earliest convenience.

No.	Activity	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation/Controls
		Pallets not secured	Unstable load, falling load, road accidents, personal injury, financial loss, down time	15	1	0.5	7.5	Loading controller and driver ensures competent load before truck leaves premises. User to notify the supplier and area representative if any unsecured pallets are observed to ensure the correct action is taken to prevent a re-occurrence.
		Loading damaged products or pallets	Financial loss, loss of stocks, down time, using inferior products, sub standard installations, possible injury, possible production loss, possible property damage	15	0.5	0.5	3.75	Loading controller and driver over inspects load before the truck leaves the premises to ensure the load is in order for delivery. Should the user observe any damaged products or pallets the user should notify the supplier and area representative who will assess the situation and advise the user accordingly.
		Loading incorrect quantities	User running out of stock, sub standard conditions, personal injury, property damage, financial loss	1	1	1	1	Loading controller over inspects and ensures correct loading of truck. User to notify supplier if the incorrect quantity is delivered. The full load will be delivered at no additional costs to the user or credit will be forwarded for the next delivery.
		Forklift off-loading pallet incorrectly on truck	Damaged pallets or product, use of inferior products, sub standard installations, possible injury, possible property damage, financial loss	15	3	1	45	Loading controller and driver over inspects the loading of pallets onto the truck to reduce the possibility of the pallets being damaged during loading. Forklift drivers receive training in house with the supplier to ensure the products are correctly loaded.
		Contractor truck not available for loading	Financial loss, shortage of product to client, sub standard installations, personal injury, down time, production loss	3	1	0.5	1.5	Supplier uses alternative transporters or use trucks hired by them to ensure deliveries reach users on time. Supplier will notify the user of any business interruptions at the supplier's earliest convenience.
		People not trained for proper loading	Personal injury, incorrect loading of product, no stock, down time	15	0.5	1	7.5	The supplier runs an in house training programme, forklift drivers are trained and licensed and re-checked every second year. If the user observes any defects, as far as the product or loading there of is concerned, the supplier and area representative to be notified so that the necessary investigation can take place and relevant issue be resolved in due time.

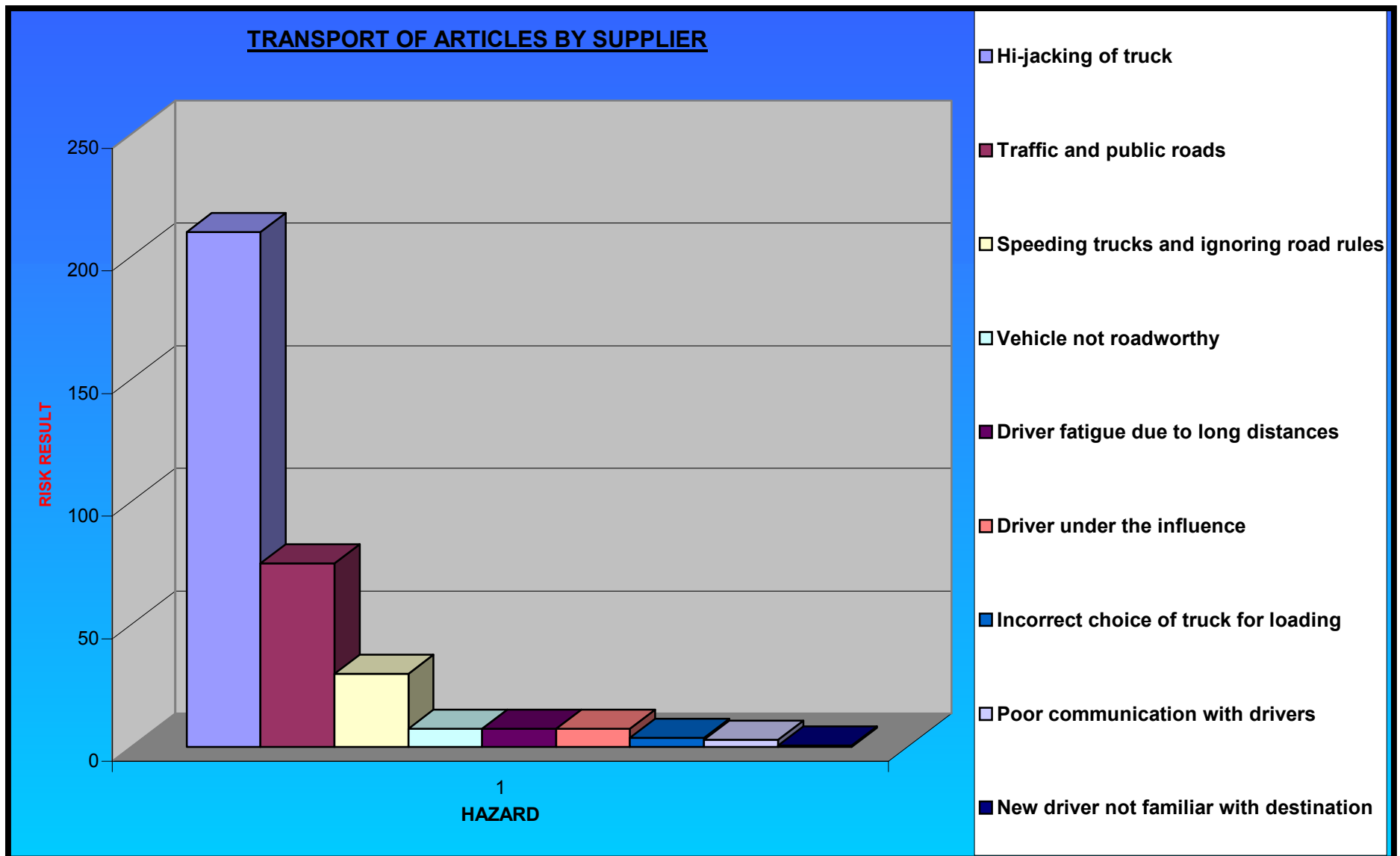
No.	Activity	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation/Controls
		Forklift breakdown or operators on strike at supplier	Delay in loading, financial loss, loss of production, sub standard installation, possible injury	15	1	0.5	7.5	Supplier has a service agreement in place with forklift supplier, regular maintenance is conducted on forklifts. On site a total of four forklifts are operating. Supplier has sound working relationship with employees and in the past twenty five years only one strike were recorded but no client were affected.
		Plant breakdown or strike by supplier employees	Delay in loading, financial loss, loss of production, sub standard installation, possible injury	15	1	0.5	7.5	Supplier has sound maintenance program in place, and uses alternative production lines to ensure continuous manufacturing of products. Supplier has sound working relationship with employees and in the past twenty five years only one strike were recorded but no client were affected.
		Raw material shortage	Delay in production, delay in loading, financial loss, loss of production, sub standard installation, possible injury	15	3	0.5	22.5	Supplier ensures minimum stock levels are maintained. Supplier has alternative raw material suppliers.

RECOMMENDED SAFE WORKING PRACTICE FOR LOADING OF ARTICLES BY SUPPLIER

Activity	Potential Hazard	Recommendation/Controls
Loading	Loading incorrect product	Loading controller ensures and over inspects load being loaded for dispatch. If the user receives the incorrect product the supplier or area representative should be notified so that the correct action can be taken to prevent a re-occurrence. The supplier will supply the user with the correct product within 24 hours as far as reasonably practicable.
	Overloading truck	The supplier uses a weighbridge and picking slips to prevent the overloading of the truck. Driver will confirm if the truck is overloaded and will not move with truck if it is overloaded. If the user observes an overloaded truck the supplier to be contacted to ensure a re-occurrence to not take place.
	Under loading of truck	Loading controller over inspects and ensures correct loading of truck. User to notify supplier if an under loaded truck is observed. The full load will be delivered at no additional costs to the user or credit will be forwarded for the next delivery.
	Uneven spreading of load	Loading controller and driver over inspects truck to ensure load is evenly spread. If the user observes an uneven load he should notify the supplier, or area representative who will assess the situation and act accordingly or advice the user alternatively.
	Transport contractor going on strike	Supplier uses alternative transporters or use trucks hired by them to ensure deliveries reach users on time. Supplier will notify the user of any business interruptions at the supplier's earliest convenience.
	Pallets not secured	Loading controller and driver ensures competent load before truck leaves premises. User to notify the supplier and area representative if any unsecured pallets are observed to ensure the correct action is taken to prevent a re-occurrence.
	Loading damaged products or pallets	Loading controller and driver over inspects load before the truck leaves the premises to ensure the load is in order for delivery. Should the user observe any damaged products or pallets the user should notify the supplier and area representative who will assess the situation and advise the user accordingly.
	Loading incorrect quantities	Loading controller over inspects and ensures correct loading of truck. User to notify supplier if the incorrect quantity is delivered. The full load will be delivered at no additional costs to the user or credit will be forwarded for the next delivery.

Activity	Potential Hazard	Recommendation/Controls
	Forklift off-loading pallet incorrectly on truck	Loading controller and driver over inspects the loading of pallets onto the truck to reduce the possibility of the pallets being damaged during loading. Forklift drivers receive training in house with the supplier to ensure the products are correctly loaded.
	Contractor truck not available for loading	Supplier uses alternative transporters or use trucks hired by them to ensure deliveries reach users on time. Supplier will notify the user of any business interruptions at the supplier's earliest convenience.
	People not trained for proper loading	The supplier runs an in house training programme, forklift drivers are trained and licensed and re-checked every second year. If the user observes any defects, as far as the product or loading there of is concerned, the supplier and area representative to be notified so that the necessary investigation can take place and relevant issue be resolved in due time.
	Forklift breakdown or operators on strike at supplier	Supplier has a service agreement in place with forklift supplier, regular maintenance is conducted on forklifts. On site a total of four forklifts are operating. Supplier has sound working relationship with employees and in the past twenty five years only one strike were recorded but no client were affected.
	Plant breakdown or strike by supplier employees	Supplier has sound maintenance program in place, and uses alternative production lines to ensure continuous manufacturing of products. Supplier has sound working relationship with employees and in the past twenty five years only one strike were recorded but no client were affected.
	Raw material shortage	Supplier ensures minimum stock levels are maintained. Supplier has alternative raw material suppliers.

TRANSPORTING OF ARTICLES BY SUPPLIER



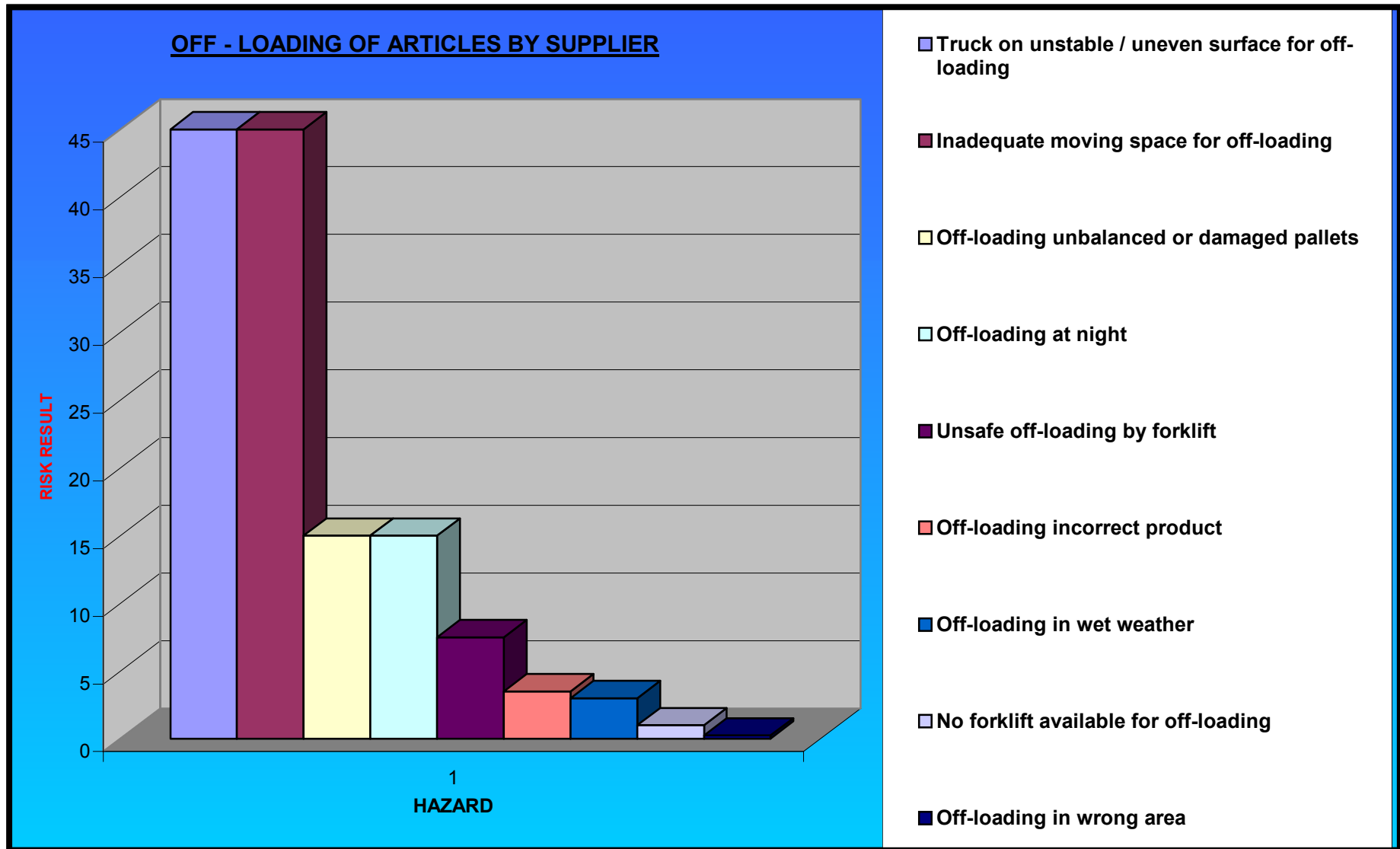
No.	Activity	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation/Controls
2.	Transport	Vehicle not roadworthy	Road accidents, personal injury, product damage, delay in delivery, shortage of product on mine, sub standard installation, production loss, financial loss	15	1	0.5	7.5	Supplier uses reputable transporters and uses alternatives if necessary. Track history proofs that trucks used are road worthy and in good condition for transport.
		Driver fatigue due to long distances	Road accidents, personal injury, product damage, delay in delivery, shortage of product on mine, sub standard installation, production loss, financial loss	15	1	0.5	7.5	Track history has proven that drivers are cautious and no fatigue is taking place.
		Driver under the influence	Road accidents, personal injury, product damage, delay in delivery, shortage of product on mine, sub standard installation, production loss, financial loss	15	1	0.5	7.5	Track history has proven that the transport contractor is of reputable source.
		Hi-jacking of truck	Loss of load, financial loss, shortage of stock, production loss, possible injury, sub standard installation	7	10	3	210	Trucks equipped with satellite tracking, drivers equipped with communication systems, supplier can have hi-jacked load on the road to user in a matter of a few hours.
		New driver not familiar with destination	Delay in delivery, shortage of stock on mine	3	0.5	0.5	0.75	Communication systems are used and drivers are in possession of maps for specific destinations.

No.	Activity	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation/Controls
		Incorrect choice of truck for loading	Short loads, delay, overloads, financial loss, short or over supply on order	15	0.5	0.5	3.75	Pre-load planning is done on a daily basis and the correct size of truck is arranged for loading.
		Traffic and public roads	Road accidents, personal injury, product damage, delay in delivery, shortage of product on mine, sub standard installation, production loss, financial loss	15	10	0.5	75	Supplier uses a reputable transport contractor and track history is proof of sound driving experience.
		Poor communication with drivers	Delay in delivery, shortage of stock on mine	3	1	1	3	Communication systems are fitted in the truck, which gives direct communication with drivers, and contractor attends supplier meetings where relevant issues are discussed and resolved.
		Speeding trucks and ignoring road rules	Road accidents, personal injury, product damage, delay in delivery, shortage of product on mine, sub standard installation, production loss, financial loss	15	2	1	30	Trucks are governed by national speed limits, track history is proof of transport contractors sound operations as far as speeding and road rules are concerned.

***RECOMMENDED SAFE WORKING PRACTICE FOR TRANSPORTING OF
ARTICLES BY SUPPLIER***

Activity	Potential Hazard	Recommendation/Controls
Transport	Vehicle not roadworthy	Supplier uses reputable transporters and uses alternative s if necessary. Track history proofs that trucks used are road worthy and in good condition for transport.
	Driver fatigue due to long distances	Track history has proven that drivers are cautious and no fatigue is taking place.
	Driver under the influence	Track history has proven that the transport contractor is of reputable source.
	Hi-jacking of truck	Trucks equipped with satellite tracking, drivers equipped with communication systems, supplier can have hi-jacked load on the road to user in a matter of a few hours.
	New driver not familiar with destination	Communication systems are used and drivers are in possession of maps for specific destinations.
	Incorrect choice of truck for loading	Pre-load planning is done on a daily basis and the correct size of truck is arranged for loading.
	Traffic and public roads	Supplier uses a reputable transport contractor and track history is proof of sound driving experience.
	Poor communication with drivers	Communication systems are fitted in the truck, which gives direct communication with drivers, and contractor attends supplier meetings where relevant issues are discussed and resolved.
	Speeding trucks and ignoring road rules	Trucks are governed by national speed limits, track history is proof of transport contractors sound operations as far as speeding and road rules are concerned.

OFF-LOADING OF ARTICLES BY SUPPLIER

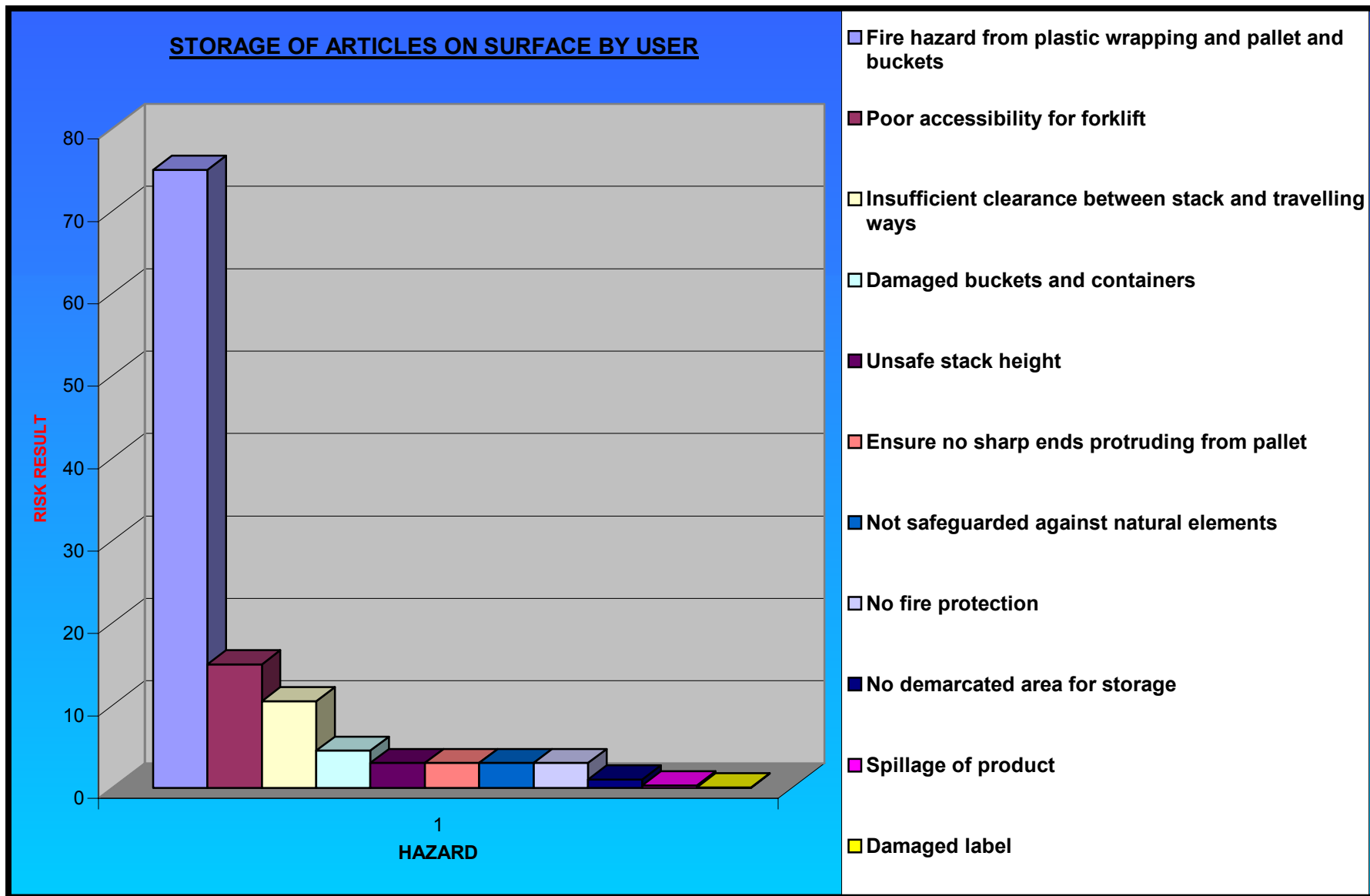


No.	Activity	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation/Controls
3.	Off-loading	Truck on unstable / uneven surface for off-loading	Personal injury, product damage	15	1	3	45	User to ensure that a demarcated even area is available for off-loading to ensure safe off-loading of product.
		Inadequate moving space for off-loading	Personal injury, property damage, product damage, delay	15	1	3	45	User to ensure that adequate space for off-loading is available for trucks to enter and exit without any restriction.
		Unsafe off-loading by forklift	Personal injury, property damage, product damage, delay	15	1	0.5	7.5	User to ensure that only a competent forklift driver is used for off-loading pallets, due to the weight of the pallets, ranging up to 360 kg requires a competent person for off-loading.
		Off-loading unbalanced or damaged pallets	Personal injury, property damage, product damage, delay	15	1	1	15	Pallets are inspected before leaving the supplier to ensure pallets are in tact, should a pallet be damaged or unbalanced on arrival at the user the user should off-load pallet with at most care, if pallet is badly damaged, buckets should be removed or off-loaded manually onto a stable pallet for off-loading by a forklift.
		Off-loading in wrong area	Delay	1	0.5	0.5	0.25	Supplier issues driver with a delivery note, which is verified by the client for correct delivery.
		No forklift available for off-loading	Delay	2	0.5	1	1	At all cost the user to ensure that a forklift is available for off-loading to prevent pallets being stripped to enable manual off-loading which increases the chance of personal injury.
		Off-loading in wet weather	Loss of product, personal injury, inferior product going underground, financial loss	1	1	3	3	If off-loading has to be done in wet weather the user to ensure a covered area is available for off-loading or alternatively wait until rain has stopped and then off-load, pallets are rapped and covered with a u/v stabilised shrink rapping to minimise the effect of natural elements on the product which may cause it to become inferior.
		Off-loading at night	Product damage, personal injury, property damage	15	2	0.5	15	If off-loading has to take place the user to ensure the area for off-loading is well illuminated to prevent any damage or injury-taking place due to poor visibility.
		Off-loading incorrect product	Delay, financial loss, run out of stock	7	1	0.5	3.5	Supplier uses a delivery note by which the user confirms correct product for delivery, should the incorrect product be delivered the user to notify the supplier and the supplier will deliver correct product within 24 hours.

RECOMMENDED SAFE WORKING PRACTICE FOR OFF-LOADING OF ARTICLES BY SUPPLIER

Activity	Potential Hazard	Recommendation/Controls
Off-loading	Truck on unstable / uneven surface for off-loading	User to ensure that a demarcated even area is available for off-loading to ensure safe off-loading of product.
	Inadequate moving space for off-loading	User to ensure that adequate space for off-loading is available for trucks to enter and exit without any restriction.
	Unsafe off-loading by forklift	User to ensure that only a competent forklift driver is used for off-loading pallets, due to the weight of the pallets, ranging up to 360 kg requires a competent person for off-loading.
	Off-loading unbalanced or damaged pallets	Pallets are inspected before leaving the supplier to ensure pallets are in tact, should a pallet be damaged or unbalanced on arrival at the user the user should off-load pallet with at most care, if pallet is badly damaged, buckets should be removed or off-loaded manually onto a stable pallet for off-loading by a forklift.
	Off-loading in wrong area	Supplier issues driver with a delivery note, which is verified by the client for correct delivery.
	No forklift available for off-loading	At all cost the user to ensure that a forklift is available for off-loading to prevent pallets being stripped to enable manual off-loading which increases the chance of personal injury.
	Off-loading in wet weather	If off-loading has to be done in wet weather the user to ensure a covered area is available for off-loading or alternatively wait until rain has stopped and then off-load, pallets are rapped and covered with a u/v stabilized shrink rapping to minimize the effect of natural elements on the product which may cause it to become inferior.
	Off-loading at night	If off-loading has to take place the user to ensure the area for off-loading is well illuminated to prevent any damage or injury-taking place due to poor visibility.
	Off-loading incorrect product	Supplier uses a delivery note by which the user confirms correct product for delivery, should the incorrect product be delivered the user to notify the supplier and the supplier will deliver correct product within 24 hours.

B - STORAGE OF ARTICLES ON SURFACE BY USER



STORAGE OF ARTICLES ON SURFACE BY USER

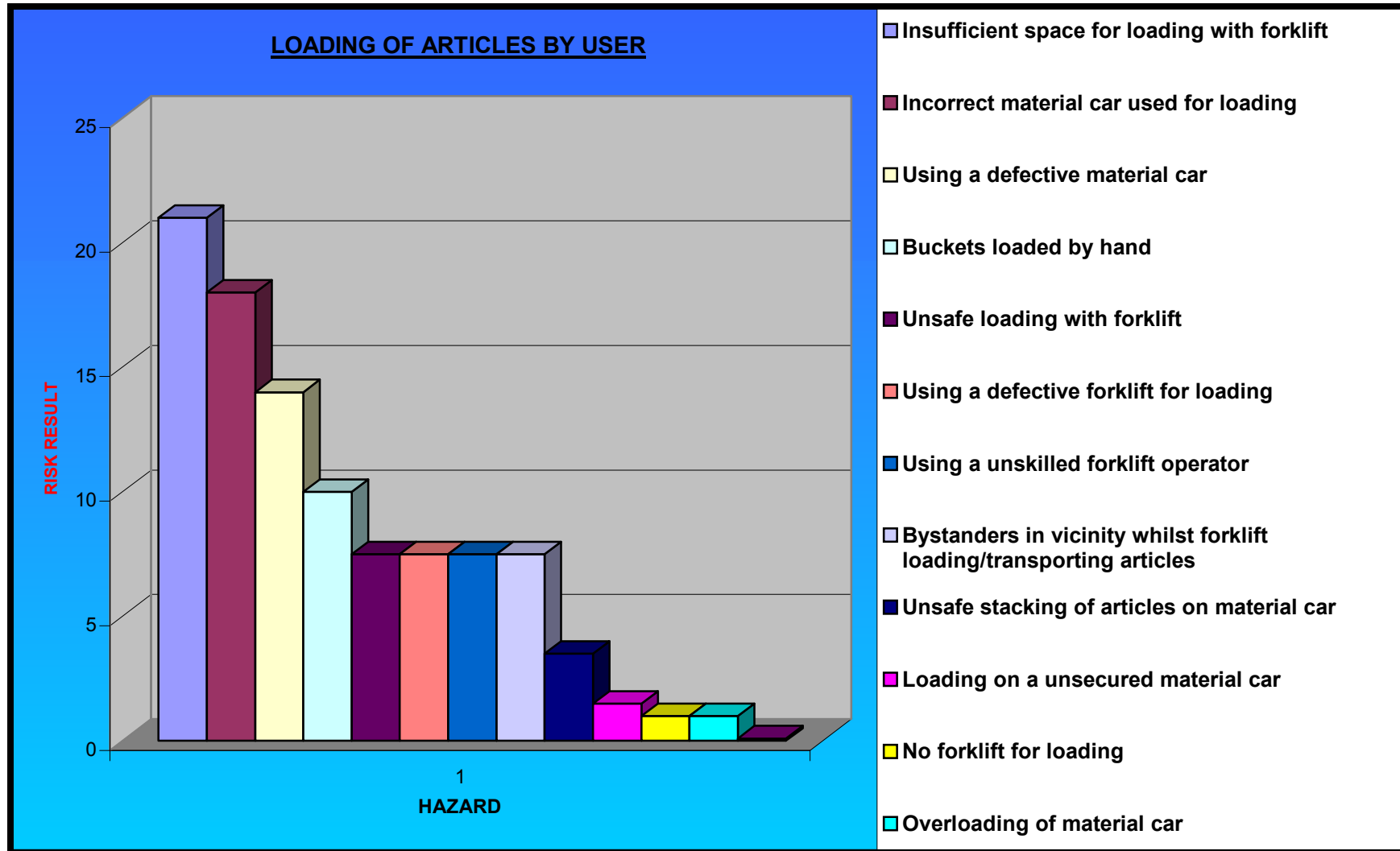
No.	Activity	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation/Controls
1.	Storage of Tekflex	No demarcated area for storage	Product damage, product loss, poor accessibility	1	2	0.5	1	User to ensure that a demarcated area for storage is available for storage of the product. Well-illuminated and easy accessibility.
		Unsafe stack height	Falling stacks, personal injury, product damage, equipment damage, financial loss	15	3	0.1	3	User to ensure no more than two pallet stack height, a pallet weighs approximately 180 kg and can cause severe damage or injury if stacked too high and falling of the stack takes place.
		Insufficient clearance between stack and travelling ways	Damage of product, financial loss, possible injury, financial loss, property damage	7	3	0.5	10.5	User to ensure safe and sufficient clearances between stacks and travelling ways for the safe use of forklifts and safe travelling of people.
		Ensure no sharp ends protruding from pallet	Personal injury, property damage	3	2	0.5	3	Ensure demarcated areas and no sharp ends, if sharp ends are visible, user to remove sharp ends.
		Poor accessibility for forklift	Damage of product, financial loss, possible injury, financial loss, property damage	15	2	0.5	15	Ensure correct accessibility for forklifts for the safe transport, loading and off-loading of pallets.
		Not safeguarded against natural elements	Damage to product	1	3	1	3	User to ensure that the product is stored under cover, in dry conditions, and exercise stock rotation to prevent product exceeding shelf life.
		No fire protection	Loss of product	3	2	0.5	3	User to ensure that sufficient fire protection is available.
		Damaged buckets and containers	Product loss, financial loss, spillages, slip and fall	3	3	0.5	4.5	User to remove damaged product or containers, and disposes of in allocated containers for waste disposal and removed by a reputable waste handling company.
		Spillage of product	Loss of product, slip and fall	3	1	0.1	0.3	If any spillage is observed, user to clear by means of sweeping up powder and damping up liquid or wash liquid away.
		Fire hazard from plastic wrapping and pallet and buckets	Fire, loss of product, property damage, possible injury	15	10	0.1	75	User to ensure that sufficient fire protection is available.
		Damaged label	Incorrect product issue, down time	1	0.5	0.1	0.05	If label is damaged user to identify product by opening bucket and label with marker pen.

RECOMMENDED SAFE WORKING PRACTICE FOR STORAGE OF ARTICLES ON SURFACE BY USER

Activity	Potential Hazard	Recommendation/Controls
Storage of Tekflex	No demarcated area for storage	User to ensure that a demarcated area for storage is available for storage of the product. Well-illuminated and easy accessibility.
	Unsafe stack height	User to ensure no more than two pallet stack height, a pallet weighs approximately 180 kg and can cause severe damage or injury if stacked too high and falling of the stack takes place.
	Insufficient clearance between stack and traveling ways	User to ensure safe and sufficient clearances between stacks and traveling ways for the safe use of forklifts and safe traveling of people.
	Ensure no sharp ends protruding from pallet	Ensure demarcated areas and no sharp ends, if sharp ends are visible, user to remove sharp ends.
	Poor accessibility for forklift	Ensure correct accessibility for forklifts for the safe transport, loading and off-loading of pallets.
	Not safeguarded against natural elements	User to ensure that the product is stored under cover, in dry conditions, and exercise stock rotation to prevent product exceeding shelve life.
	No fire protection	User to ensure that sufficient fire protection is available.
	Damaged buckets and containers	User to remove damaged product or containers, and disposes of in allocated containers for waste disposal and removed by a reputable waste handling company.
	Spillage of product	If any spillage is observed, user to clear by means of sweeping up powder and damping up liquid or wash liquid away.
	Fire hazard from plastic wrapping and pallet and buckets	User to ensure that sufficient fire protection is available.
	Damaged label	If label is damaged user to identify product by opening bucket and label with marker pen.

C - LOADING, TRANSPORT AND OFF-LOADING OF ARTICLES BY USER

LOADING OF ARTICLES BY USER



No.	Activity	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation/Controls
1.	Loading	No forklift for loading	Delay, handling bags by hand	1	1	1	1	The user must as far as reasonably practicable use a forklift for loading articles and prevent loading by hand as far as possible to reduce any possibility of injury or over exertion by workers. Should manual loading take place the user then to ensure that employees performing the task use the correct PPE such as gloves, goggles, rubber boots and dust masks.
		Unsafe loading with forklift	Property damage, product damage, possible injury	15	1	0.5	7.5	User to ensure that a competent forklift operator is used for loading the pallets due to the size of the pallets, to reduce the possibility of injury or damage.
		Using a defective forklift for loading	Property damage, product damage, possible injury	15	1	0.5	7.5	User to ensure that a well maintained forklift, which is in order, is used for loading the pallets due to the size of the pallets, to reduce the possibility of injury or damage.
		Insufficient space for loading with forklift	Property damage, product damage, possible injury	7	3	1	21	User to ensure sufficient demarcated areas and required space for loading and off-loading articles with a forklift to reduce the possibility of injury or damage.
		Using a unskilled forklift operator	Property damage, product damage, possible injury	15	1	0.5	7.5	User to ensure that a competent forklift operator is used for loading the pallets due to the size of the pallets, to reduce the possibility of injury or damage.
		Bystanders in vicinity whilst forklift loading/transporting articles	Property damage, product damage, possible injury	15	1	0.5	7.5	User to ensure that personnel not related to task being performed to be well cleared from area when forklift is loading pallets, to reduce the possibility of injury or damage.
		Unsafe stacking of articles on material car	Property damage, product damage, possible injury	7	1	0.5	3.5	Users to load buckets in a proper material car allocated for this purpose and not load on flat cars to prevent any unsafe loading, when using a material car with closed sides the car not to be overloaded to prevent falling buckets and subsequent damage to the product.
		Loose or damaged pallets/product being loaded	Property damage, product damage, possible injury	1	1	0.1	0.1	Avoid loading any material that is damaged or broken, which may be used on installation and result in a sub standard installation, which may have serious consequences.
		Loading on a unsecured material car	Property damage, product damage, possible injury	3	1	0.5	1.5	User to ensure material car is properly secured for loading to prevent a run away car that may cause personal injury or damage to the product or property.

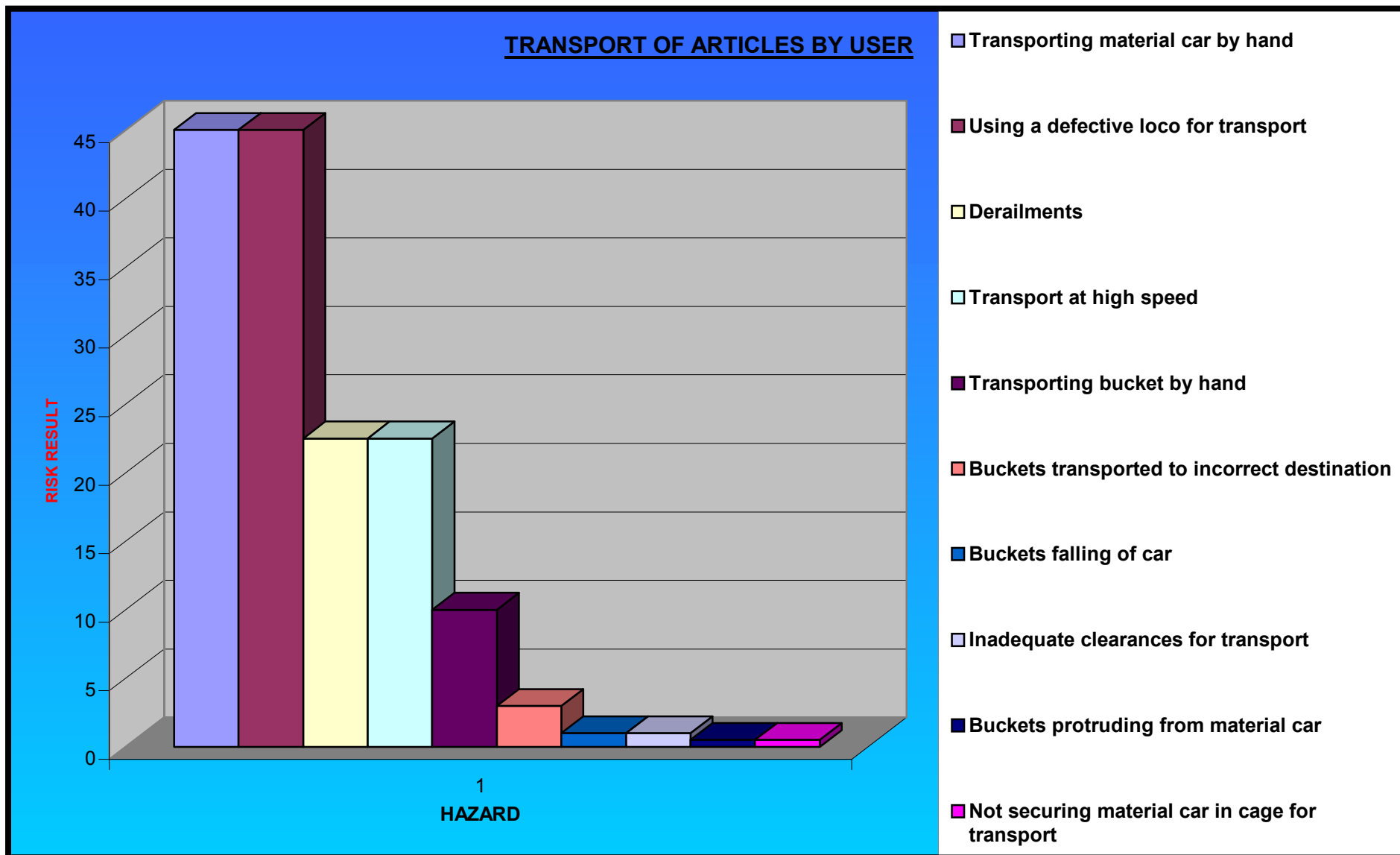
No.	Activity	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation/Controls
		Overloading of material car	Property damage, product damage, possible injury	1	2	0.5	1	User not to load in excess of the rim of material car to avoid buckets protruding from the top of the car, which may cause buckets falling of car during transit, which may cause product damage or injury.
		Incorrect material car used for loading	Property damage, product damage, possible injury	3	6	1	18	As far as reasonably practicable the user only to use proper enclosed material cars for the transport of the articles to reduce the possibility of falling buckets during transit if a flat car were to be used.
		Using a defective material car	Property damage, product damage, possible injury	7	2	1	14	User to ensure material car is in order with no defects for transport of articles, a defective car may cause derailments which may result in down time or injury and damage to the product.
		Buckets loaded by hand	Product damage, personal injury, health problems	1	10	1	10	Supplier manufactures bucket with a handle grip to facilitate easier handling of the bucket, which has a weight of 20 kg's or less. Do not handle more than two buckets at any one time to reduce the possibility of injury.

RECOMMENDED SAFE WORKING PRACTICE FOR LOADING OF ARTICLES BY USER

Activity	Potential Hazard	Recommendation/Controls
Loading	No forklift for loading	The user must as far as reasonably practicable use a forklift for loading articles and prevent loading by hand as far as possible to reduce any possibility of injury or over exertion by workers. Should manual loading take place the user then to ensure that employees performing the task use the correct PPE such as gloves, goggles, rubber boots and dust masks.
	Unsafe loading with forklift	User to ensure that a competent forklift operator is used for loading the pallets due to the size of the pallets, to reduce the possibility of injury or damage.
	Using a defective forklift for loading	User to ensure that a well maintained forklift, which is in order, is used for loading the pallets due to the size of the pallets, to reduce the possibility of injury or damage.
	Insufficient space for loading with forklift	User to ensure sufficient demarcated areas and required space for loading and off-loading articles with a forklift to reduce the possibility of injury or damage.
	Using a unskilled forklift operator	User to ensure that a competent forklift operator is used for loading the pallets due to the size of the pallets, to reduce the possibility of injury or damage.
	Bystanders in vicinity whilst forklift loading/transporting articles	User to ensure that personnel not related to task being performed to be well cleared from area when forklift is loading pallets, to reduce the possibility of injury or damage.
	Unsafe stacking of articles on material car	Users to load buckets in a proper material car allocated for this purpose and not load on flat cars to prevent any unsafe loading, when using a material car with closed sides the car not to be overloaded to prevent falling buckets and subsequent damage to the product.

Activity	Potential Hazard	Recommendation/Controls
	Loose or damaged pallets/product being loaded	Avoid loading any material that is damaged or broken, which may be used on installation and result in a sub standard installation, which may have serious consequences.
	Loading on a unsecured material car	User to ensure material car is properly secured for loading to prevent a run away car that may cause personal injury or damage to the product or property.
	Overloading of material car	User not to load in excess of the rim of material car to avoid buckets protruding from the top of the car, which may cause buckets falling of car during transit, which may cause product damage or injury.
	Incorrect material car used for loading	As far as reasonably practicable the user only to use proper enclosed material cars for the transport of the articles to reduce the possibility of falling buckets during transit if a flat car were to be used.
	Using a defective material car	User to ensure material car is in order with no defects for transport of articles, a defective car may cause derailments which may result in down time or injury and damage to the product.
	Buckets loaded by hand	Supplier manufactures bucket with a handle grip to facilitate easier handling of the bucket, which has a weight of 20 kg's or less. Do not handle more than two buckets at any one time to reduce the possibility of injury.

TRANSPORTING OF ARTICLES BY USER



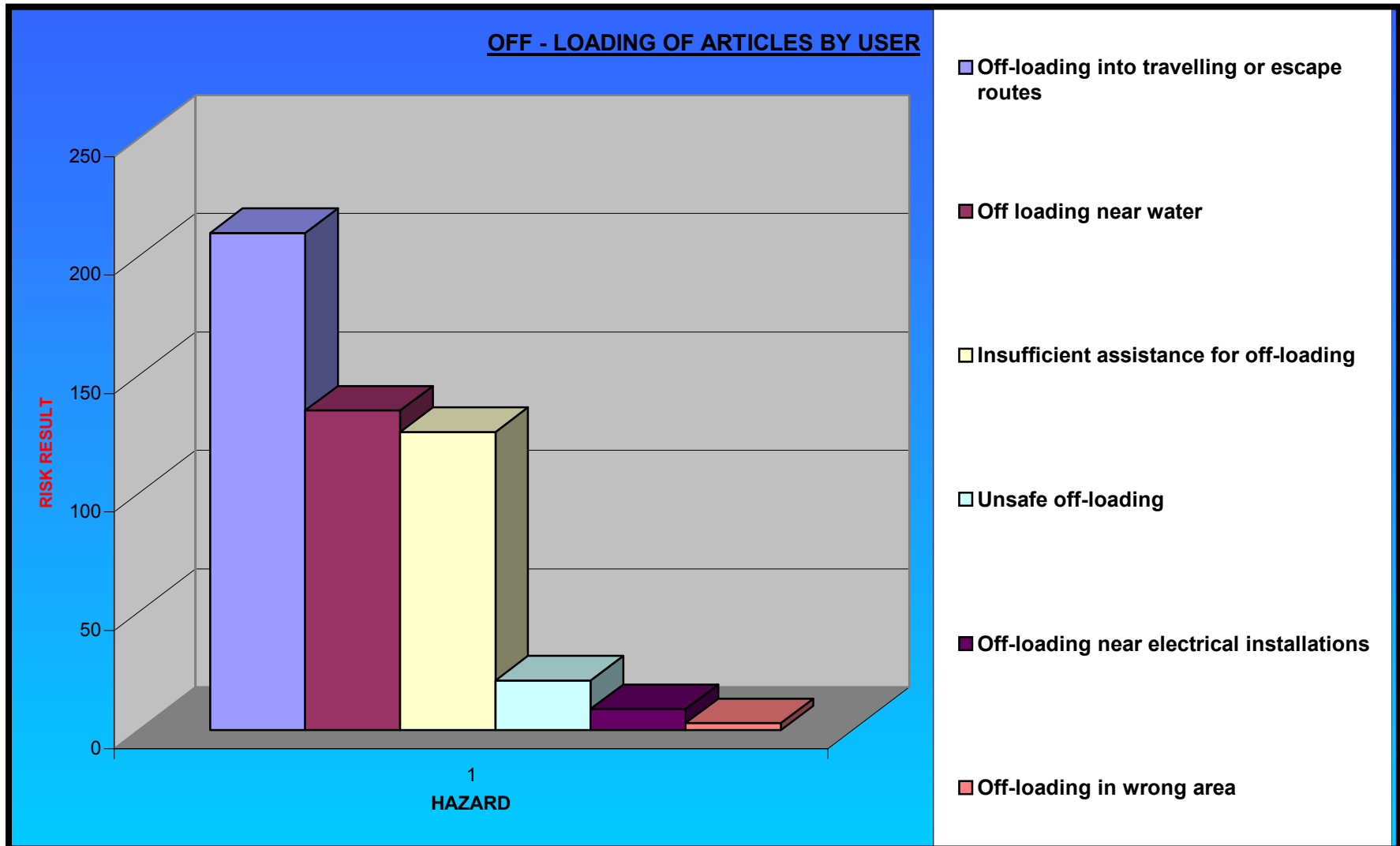
TRANSPORTING OF ARTICLES BY USER

No.	Activity	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation/Controls
2.	Transport	Derailments	Property damage, product damage, personal injury	15	3	0.5	22.5	User to ensure that a well maintained material car is used for transport to reduce the possibility of any derailments.
		Buckets falling of car	Product loss	1	1	1	1	User not to load in excess of the rim of material car
		Transport at high speed	Property damage, product damage, personal injury	15	3	0.5	22.5	User not to overload material cars and keep to underground speed limits.
		Buckets protruding from material car	Loss of product	1	1	0.5	0.5	User not to load in excess of the rim of material car
		Buckets transported to incorrect destination	Time delay	1	3	1	3	User to clearly demarcate material cars for designated areas to prevent incorrect off-loading in wrong area.
		Inadequate clearances for transport	Product loss	1	1	1	1	User not to load in excess of the rim of material car
		Transporting material car by hand	Product loss, time delay, personal injury, property damage	15	6	0.5	45	User not transport material using flat cars pushed by hand, but rather enclosed material cars using a locomotive to reduce the possibility of injury and damage.
		Using a defective loco for transport	Product loss, time delay, personal injury, property damage	15	1	3	45	If the user uses a defective loco for transport the weight of the articles could result in substantial momentum created therefore it is essential that no defective loco be used.
		Not securing material car in cage for transport	Product loss, time delay, personal injury, property damage	1	1	0.5	0.5	User not to load in excess of the rim of material car, and ensure car is secured in cage.
		Transporting bucket by hand	Product damage, personal injury	1	10	1	10	Supplier manufactures bucket with a handle grip to facilitate easier handling of the bucket, which has a weight of 20 kg's or less. Do not handle more than two buckets at any one time to reduce the possibility of injury.

***RECOMMENDED SAFE WORKING PRACTICE FOR TRANSPORTING OF ARTICLES
BY USER***

Activity	Potential Hazard	Recommendation/Controls
Transport	Derailments	User to ensure that a well maintained material car is used for transport to reduce the possibility of any derailments.
	Buckets falling of car	User not to load in excess of the rim of material car
	Transport at high speed	User not to overload material cars and keep to underground speed limits.
	Buckets protruding from material car	User not to load in excess of the rim of material car
	Buckets transported to incorrect destination	User to clearly demarcate material cars for designated areas to prevent incorrect off-loading in wrong area.
	Inadequate clearances for transport	User not to load in excess of the rim of material car
	Transporting material car by hand	User not transport material using flat cars pushed by hand, but rather enclosed material cars using a locomotive to reduce the possibility of injury and damage.
	Using a defective loco for transport	If the user uses a defective loco for transport the weight of the articles could result in substantial momentum created therefore it is essential that no defective loco be used.
	Not securing material car in cage for transport	User not to load in excess of the rim of material car, and ensure car is secured in cage.
	Transporting bucket by hand	Supplier manufactures bucket with a handle grip to facilitate easier handling of the bucket, which has a weight of 20 kg's or less. Do not handle more than two buckets at any one time to reduce the possibility of injury.

OFF-LOADING OF ARTICLES BY USER



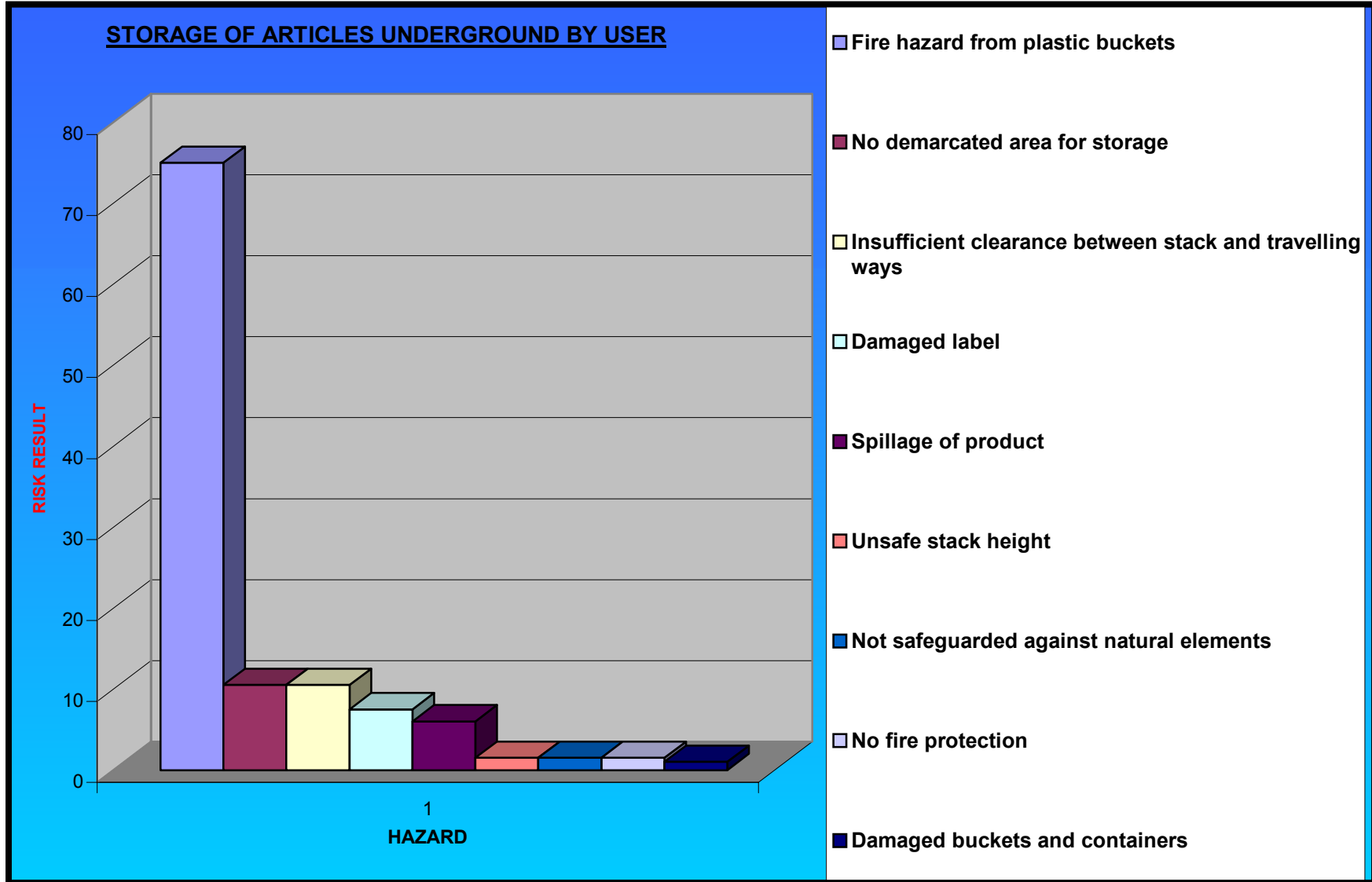
No.	Activity	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation/Controls
3.	Off-loading	Unsafe off-loading	Product loss, personal injury	7	6	0.5	21	Off loading to be done in designated areas and at all times the employees to take caution to not stand on top of the material car for off-loading.
		Off-loading in wrong area	Time delay	1	3	1	3	User to clearly demarcate material cars for designated areas to prevent incorrect off-loading in wrong area.
		Off-loading into travelling or escape routes	Obstructed travelling and escape routes, personal injury	7	10	3	210	User only to unload in designated areas
		Off-loading near electrical installations	Possible fir hazard, possible restriction of ventilation flow	3	6	0.5	9	Off load in designated area and avoid electrical installations due to buckets posing a fire risk.
		Off loading near water	Damage to product, sub standard installation, loss of product, financial loss	15	3	3	135	Buckets are supplied as sealed units protecting the product and should be kept sealed until used for maximum protection against water, which may cause the product to become inferior.
		Insufficient assistance for off-loading	Time delay, product damage, financial loss, sub standard installations	7	6	3	126	Always ensure sufficient assistance for off-loading to reduce the possibility of damage to the buckets

D - STORAGE OF ARTICLES UNDERGROUND BY USER:



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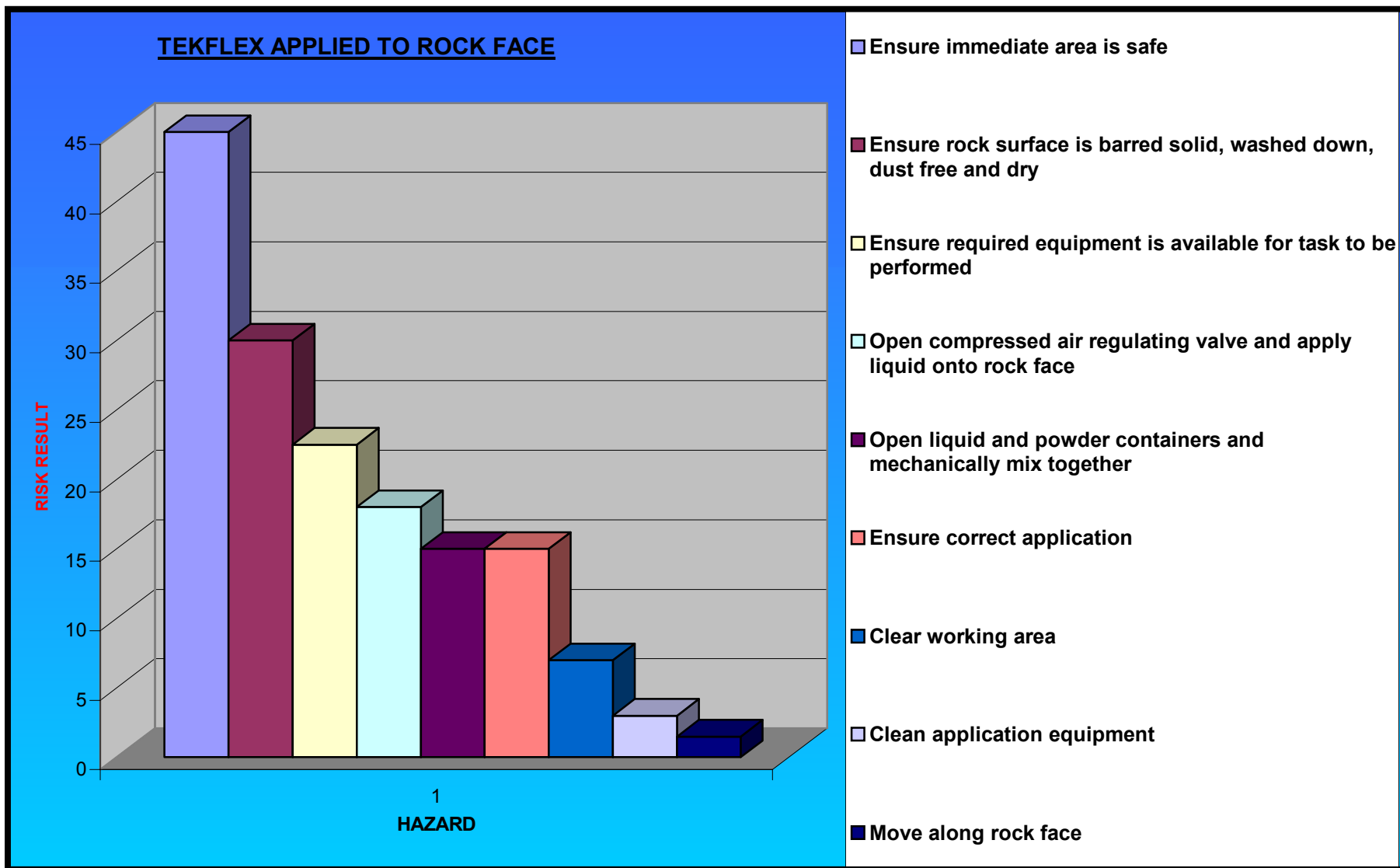
No.	Activity	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation/Controls
1.	Storage of Tekflex	No demarcated area for storage	Product damage, product loss, poor accessibility	7	3	0.5	10.5	User to ensure that a demarcated area for storage is available for storage of the product. Well-illuminated and easy accessibility.
		Unsafe stack height	Falling stacks, personal injury, product damage, equipment damage, financial loss	1	3	0.5	1.5	User to ensure no more than two pallet stack height, a pallet weighs approximately 180 kg and can cause severe damage or injury if stacked too high and falling of the stack takes place.
		Insufficient clearance between stack and travelling ways	Damage of product, financial loss, possible injury, financial loss, property damage	7	3	0.5	10.5	User to ensure safe and sufficient clearances between stacks and travelling ways for the safe travelling of people and rolling stock.
		Not safeguarded against natural elements	Damage to product	1	3	0.5	1.5	User to ensure that the product is stored under cover, in dry conditions, and exercise stock rotation to prevent product exceeding shelf life.
		No fire protection	Loss of product	15	1	0.1	1.5	User to ensure that sufficient fire protection is available.
		Damaged buckets and containers	Product loss, financial loss, spillages, slip and fall	1	2	0.5	1	User to remove damaged product or containers, and disposes of in allocated containers for waste disposal and removed by a reputable waste handling company.
		Spillage of product	Loss of product, slip and fall	1	6	1	6	If any spillage is observed, user to clear by means of sweeping up powder and damping up liquid or wash liquid away.
		Fire hazard from plastic buckets	Fire, loss of product, property damage, possible injury	15	10	0.1	75	User to ensure that sufficient fire protection is available.
		Damaged label	Wrong application	15	1	0.5	7.5	If label is damaged user to identify product by opening bucket and label with marker pen.

***RECOMMENDED SAFE WORKING PRACTICE FOR THE STORAGE OF
ARTICLES UNDERGROUND BY THE USER***

Activity	Potential Hazard	Recommendation/Controls
Storage of Tekflex	No demarcated area for storage	User to ensure that a demarcated area for storage is available for storage of the product. Well-illuminated and easy accessibility.
	Unsafe stack height	User to ensure no more than two pallet stack height, a pallet weighs approximately 180 kg and can cause severe damage or injury if stacked too high and falling of the stack takes place.
	Insufficient clearance between stack and traveling ways	User to ensure safe and sufficient clearances between stacks and traveling ways for the safe traveling of people and rolling stock.
	Not safeguarded against natural elements	User to ensure that the product is stored under cover, in dry conditions, and exercise stock rotation to prevent product exceeding shelf life.
	No fire protection	User to ensure that sufficient fire protection is available.
	Damaged buckets and containers	User to remove damaged product or containers, and disposes of in allocated containers for waste disposal and removed by a reputable waste handling company.
	Spillage of product	If any spillage is observed, user to clear by means of sweeping up powder and damping up liquid or wash liquid away.
	Fire hazard from plastic buckets	User to ensure that sufficient fire protection is available.
	Damaged label	If label is damaged user to identify product by opening bucket and label with marker pen.

E - APPLICATION OF ARTICLES BY USER

TEKFLEX APPLIED TO ROCK FACE



No.	Activity	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation/Controls
1.	Ensure immediate area is safe	Not making safe, falls of ground, poor ventilation, poor visibility, fumes and gasses, slip and fall, entering old areas	Personal injury, product damage, property damage, financial loss	15	6	0.5	45	User to ensure that a competent person declares area safe for application of product, area should be barred down, supported or temporary support installed for safe working purposes where required. The working area should be well ventilated to prevent a build up of dust or fumes. If work is done in tramming areas the necessary warning notices to be placed and caution to be given to rolling stock operators about work to commence. Special precautions as per mine procedure to be taken if application of products is to be done in old or abandoned areas.
2.	Ensure required equipment is available for task to be performed	Using defective equipment, no compressed air available, no product available, not using PPE, using incorrect equipment, using product beyond shelf life, poor hose connection	Incorrect application, defective coating, improper fire protection, alkaline skin burns, eye burns, cause slippery footwall, personal injury, financial loss, production loss	15	3	0.5	22.5	User to ensure that the correct equipment is in working order. It is recommended that the Spedel pump be used for application with a 6 mm nozzle. If a Spedel pump is used the recommended operating air pressure is 4-6 bars. User to ensure that all safety precautions as set out by the Spedel pump supplier is adhered to when using the Spedel pump. If the Spedel pump is not used the product can be brush applied. Ensure the employees required to perform the task has the necessary PPE available such as PVC gloves, goggles and dust mask to protect them against any possible exposure from the product. Ensure the product to be used is not beyond shelf life.
3.	Ensure rock surface is barred solid, washed down, dust free and dry	Loose rocks, falling rocks, slip and fall, dust, not using PPE, not using correct pinch bar lengths, wet rock surface	Personal injury, property damage, financial loss, defective coating	15	2	0.5	30	No application of the product to take place unless the rock surface is safe, dry and dust free for application purposes.
4.	Open liquid and powder containers and mechanically mix together	Not using PPE, dust, spillage, slip and fall	Personal injury, product loss, improper mixing proportions, improper coating	15	2	0.5	15	User to open bucket, remove powder and liquid containers, pour liquid into mechanical mixer, start mixing whilst slowly adding powder until mixture is homogeneous, use the contents of two kits to fill the mixer. Employees to ensure the required PPE are used during the mixing process.

No.	Activity	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation/Controls
5.	Open compressed air regulating valve and apply liquid onto rock face	Not using PPE, product under pressure, bystanders, ventilation to strong	Loss of product, eye injuries, skin irritation, inhalation	3	2	3	18	Technical trainer is provided to assist the user in the correct application of air regulation for application of the product. It is recommended that the user using the product for the first time make use of the trainer provided by the supplier to induct employees in the correct use of the product especially when using the Spedel pump.
6.	Ensure correct application	Incomplete coverage, exposed rock face	Defective coverage	15	2	0.5	15	Technical trainer provided to initially train user in the complete application of the product to ensure complete coverage of the rock face. Ensure 3mm thickness.
7.	Move along rock face	Air line coming loose, spillage of product, slip and fall	Personal injury, loss of product, financial loss	3	1	0.5	1.5	Technical trainer provided to train employees on the correct movement of equipment.
8.	Clean application equipment	Not cleaning application equipment, compressed air, water under pressure, not using PPE, bystanders	Blockages, personal injury	3	1	1	3	Technical trainer provided to assist user in the correct flushing of application equipment after use.
9.	Clear working area	Spillages, leaving product lying around, equipment left in travelling ways unsafely	Slip and fall, possible fire hazard because of buckets, equipment struck by rolling stock, product loss, financial loss, personal injury	7	1	1	7	User to ensure area of work is cleared after application. Especially tramming ways, where equipment could be left in travelling ways, should be cleared to ensure the necessary travelling clearances are adhered to.

RECOMMENDED SAFE WORKING PROCEDURE FOR THE APPLICATION OF THE ARTICLES BY USER

Activity	Potential Hazard	Recommendation/Controls
Ensure immediate area is safe	Not making safe, falls of ground, poor ventilation, poor visibility, fumes and gasses, slip and fall, entering old areas	User to ensure that a competent person declares area safe for application of product, area should be barred down, supported or temporary support installed for safe working purposes where required. The working area should be well ventilated to prevent a build up of dust or fumes. If work is done in tramming areas the necessary warning notices to be placed and caution to be given to rolling stock operators about work to commence. Special precautions as per mine procedure to be taken if application of products is to be done in old or abandoned areas.
Ensure required equipment is available for task to be performed	Using defective equipment, no compressed air available, no product available, not using PPE, using incorrect equipment, using product beyond shelf life, poor hose connection	User to ensure that the correct equipment is in working order. It is recommended that the Spedel pump be used for application with a 6 mm nozzle. If a Spedel pump is used the recommended operating air pressure is 4-6 bars. User to ensure that all safety precautions as set out by the Spedel pump supplier is adhered to when using the Spedel pump. If the Spedel pump is not used the product can be brush applied. Ensure the employees required to perform the task has the necessary PPE available such as PVC gloves, goggles and dust mask to protect them against any possible exposure from the product. Ensure the product to be used is not beyond shelving life.
Ensure rock surface is barred solid, washed down, dust free and dry	Loose rocks, falling rocks, slip and fall, dust, not using PPE, not using correct pinch bar lengths, wet rock surface	No application of the product to take place unless the rock surface is safe, dry and dust free for application purposes.

Activity	Potential Hazard	Recommendation/Controls
Open liquid and powder containers and mechanically mix together	Not using PPE, dust, spillage, slip and fall	User to open bucket, remove powder and liquid containers, pour liquid into mechanical mixer, start mixing whilst slowly adding powder until mixture is homogeneous, use the contents of two kits to fill the mixer. Employees to ensure the required PPE are used during the mixing process.
Open compressed air regulating valve and apply liquid onto rock face	Not using PPE, product under pressure, bystanders, ventilation to strong	Technical trainer is provided to assist the user in the correct application of air regulation for application of the product. It is recommended that the user using the product for the first time make use of the trainer provided by the supplier to induct employees in the correct use of the product especially when using the Spedel pump.
Ensure correct application	Incomplete coverage, exposed rock face	Technical trainer provided to initially train user in the complete application of the product to ensure complete coverage of the rock face. Ensure 3mm thickness
Move along rock face	Air line coming loose, spillage of product, slip and fall	Technical trainer provided to train employees on the correct movement of equipment.
Clean application equipment	Not cleaning application equipment, compressed air, water under pressure, not using PPE, bystanders	Technical trainer provided to assist user in the correct flushing of application equipment after use.
Clear working area	Spillages, leaving product lying around, equipment left in traveling ways unsafely	User to ensure area of work is cleared after application. Especially tramming ways, where equipment could be left in traveling ways, should be cleared to ensure the necessary traveling clearances are adhered to.

F - INSPECTION ON ARTICLES BY USER BEFORE APPLICATION

Component	Check/Test	In order	Out of order	Possible causes if not in order	Recommended controls
TEKFLEX					
Liquid	Ensure liquid container in tact and visible leakage			Damage in transit and tampering	User to discard and not use product
Powder	Ensure powder bag in tact or any visible damage			Damage in transit and tampering	User to discard and not use product
Bucket	Sealed and no visible damage			Damage in transit and tampering	User to check if contents still in tact if not, discard
Bucket expiry date	Date of use not beyond date of expiry			Improper stock rotation	Consult with supplier, to check and test and extend shelf life. User not to use a product with expired shelf life date.

***RECOMMENDED INSPECTION PROCEDURE FOR INSPECTION ON THE
ARTICLES BY THE USER BEFORE APPLICATION***

Component	Check/Test	Recommended controls
TEKFLEX		
Liquid	Ensure liquid container in tact and visible leakage	User to discard and not use product
Powder	Ensure powder bag in tact or any visible damage	User to discard and not use product
Bucket	Sealed and no visible damage	User to check if contents still in tact if not, discard
Bucket expiry date	Date of use not beyond date of expiry	Consult with supplier, to check and test and extend shelf life. User not to use a product with expired shelf life date.

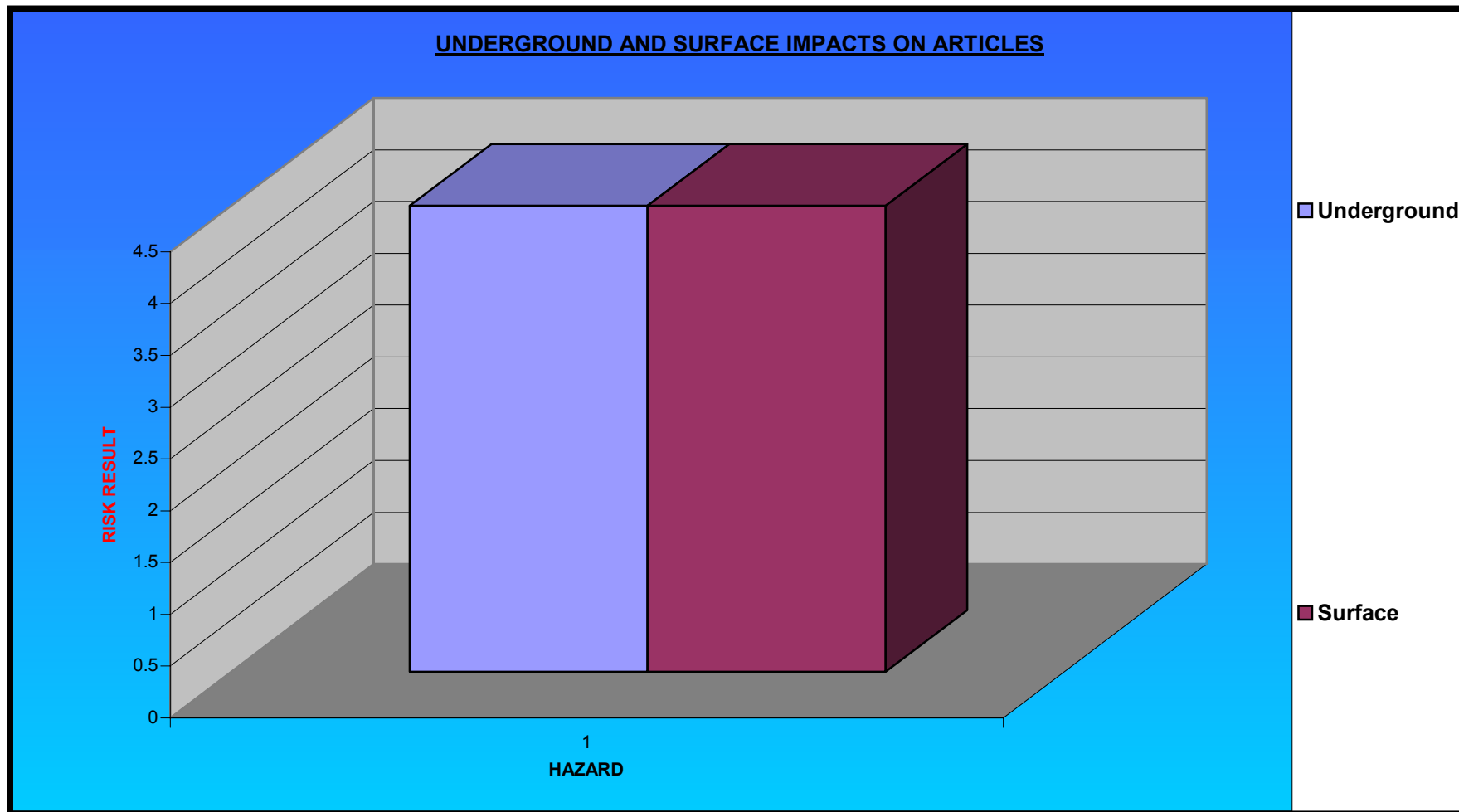
G - INSPECTION ON ARTICLES BY USER AFTER APPLICATION

Component	Check/Test	In order	Out of order	Possible causes if not in order	Recommended controls
TEKFLEX					User to check for touch dryness after an hour to ensure correct curing
Liquid	NA				
Powder	NA				
Bucket	NA				
Bucket expiry date	NA				

***RECOMMENDED INSPECTION PROCEDURE FOR INSPECTION ON THE
ARTICLES BY THE USER AFTER APPLICATION***

Component	Check/Test	Recommended controls
TEKFLEX		User to check for touch dryness after an hour to ensure correct curing
Liquid	NA	
Powder	NA	
Bucket	NA	
Bucket expiry date	NA	

H - UNDERGROUND AND SURFACE IMPACTS ON ARTICLES



H - UNDERGROUND AND SURFACE IMPACTS ON ARTICLES

Unit	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation
Underground	Used as coating for covering any surfaces, bucket contents discarded for use of buckets only, using liquid containers for drinking purposes	Product loss, financial loss, running out of stock, down time, illness	3	3	0.5	4.5	User to ensure product is only used for intended purpose.
Surface	Used as coating for covering any surfaces, bucket contents discarded for use of buckets only, using liquid containers for drinking purposes	Product loss, financial loss, running out of stock, down time, illness	3	3	0.5	4.5	User to ensure product is only used for intended purpose.

RECOMMENDATIONS FOR THE PREVENTION OF SURFACE AND UNDERGROUND IMPACTS ON THE ARTICLES

Unit	Potential Hazard	Recommendation
Underground	Used as coating for covering any surfaces, bucket contents discarded for use of buckets only, using liquid containers for drinking purposes	User to ensure product is only used for intended purpose.
Surface	Used as coating for covering any surfaces, bucket contents discarded for use of buckets only, using liquid containers for drinking purposes	User to ensure product is only used for intended purpose.

I - CHEMICAL / HEALTH HAZARDS

Chemical	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation
TEKFLEX							
Cement, hydraulic	Eye contact	Irritation	1	2	6	12	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to ensure affected person washes eye with clean water. Obtain medical attention urgently.
	Skin contact	Irritation	1	3	6	18	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to ensure affected person washes skin with water thoroughly, remove contaminated clothing immediately, and obtain medical advice if skin disorders develop.
	Respiratory contact	Irritation	1	6	3	18	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to remove persons from exposure, rest and keep warm and obtain medical attention urgently.
	Ingestion contact	Irritation	1	1	3	3	User to prevent any contact by ensuring the correct PPE is worn; if any contact does take place user to ensure person washes out mouth with water and obtain medical attention, do not induce vomiting. No food to be ingested in vicinity of Tekflex application.
Calcium Hydroxide	Eye contact	Irritation	1	2	6	12	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to ensure affected person washes eye with clean water. Obtain medical attention urgently.
	Skin contact	Irritation	1	3	6	18	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to ensure affected person washes skin with water thoroughly, remove contaminated clothing immediately, and obtain medical advice if skin disorders develop.
	Respiratory contact	Irritation	1	6	3	18	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to remove persons from exposure, rest and keep warm and obtain medical attention urgently.
	Ingestion	Irritation	1	1	3	3	User to prevent any contact by ensuring the correct PPE is worn; if any contact does take place user to ensure person washes out mouth with water and obtain medical attention, do not induce vomiting. No food to be ingested in vicinity of Tekflex application.

Chemical	Potential Hazard	Consequences	C	E	P	Risk Result	Recommendation
Chlorinated hydrocarbon	Eye contact	Irritation	1	2	6	12	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to ensure affected person washes eye with clean water. Obtain medical attention urgently.
	Skin contact	Irritation	1	3	6	18	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to ensure affected person washes skin with water thoroughly, remove contaminated clothing immediately, and obtain medical advice if skin disorders develop.
	Respiratory contact	Irritation	1	6	3	18	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to remove persons from exposure, rest and keep warm and obtain medical attention urgently.
	Ingestion	Irritation	1	1	3	3	User to prevent any contact by ensuring the correct PPE is worn; if any contact does take place user to ensure person washes out mouth with water and obtain medical attention, do not induce vomiting. No food to be ingested in vicinity of Tekflex application.
EVA copolymer	Eye contact	Irritation	1	2	6	12	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to ensure affected person washes eye with clean water. Obtain medical attention urgently.
	Skin contact	Irritation	1	3	6	18	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to ensure affected person washes skin with water thoroughly, remove contaminated clothing immediately, and obtain medical advice if skin disorders develop.
	Ingestion	Irritation	1	1	3	3	User to prevent any contact by ensuring the correct PPE is worn; if any contact does take place user to ensure person washes out mouth with water and obtain medical attention, do not induce vomiting. No food to be ingested in vicinity of Tekflex application.

RECOMMENDATIONS FOR THE TREATMENT OF CHEMICAL CONTACTS

Chemical	Potential Hazard	Recommendation
Cement, hydraulic	Eye contact	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to ensure affected person washes eye with clean water. Obtain medical attention urgently.
	Skin contact	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to ensure affected person washes skin with water thoroughly, remove contaminated clothing immediately, and obtain medical advice if skin disorders develop.
	Respiratory contact	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to remove persons from exposure, rest and keep warm and obtain medical attention urgently.
	Ingestion contact	User to prevent any contact by ensuring the correct PPE is worn; if any contact does take place user to ensure person washes out mouth with water and obtain medical attention, do not induce vomiting. No food to be ingested in vicinity of Tekflex application.
Calcium Hydroxide	Eye contact	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to ensure affected person washes eye with clean water. Obtain medical attention urgently.
	Skin contact	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to ensure affected person washes skin with water thoroughly, remove contaminated clothing immediately, and obtain medical advice if skin disorders develop.
	Respiratory contact	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to remove persons from exposure, rest and keep warm and obtain medical attention urgently.
	Ingestion	User to prevent any contact by ensuring the correct PPE is worn; if any contact does take place user to ensure person washes out mouth with water and obtain medical attention, do not induce vomiting. No food to be ingested in vicinity of Tekflex application.

Chemical	Potential Hazard	Recommendation
Chlorinated hydrocarbon	Eye contact	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to ensure affected person washes eye with clean water. Obtain medical attention urgently.
	Skin contact	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to ensure affected person washes skin with water thoroughly, remove contaminated clothing immediately, and obtain medical advice if skin disorders develop.
	Respiratory contact	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to remove persons from exposure, rest and keep warm and obtain medical attention urgently.
	Ingestion	User to prevent any contact by ensuring the correct PPE is worn; if any contact does take place user to ensure person washes out mouth with water and obtain medical attention, do not induce vomiting. No food to be ingested in vicinity of Tekflex application.
EVA copolymer	Eye contact	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to ensure affected person washes eye with clean water. Obtain medical attention urgently.
	Skin contact	User to prevent any contact by ensuring the correct PPE is worn, if any contact does take place user to ensure affected person washes skin with water thoroughly, remove contaminated clothing immediately, and obtain medical advice if skin disorders develop.
	Ingestion	User to prevent any contact by ensuring the correct PPE is worn; if any contact does take place user to ensure person washes out mouth with water and obtain medical attention, do not induce vomiting. No food to be ingested in vicinity of Tekflex application.

SPECIFICATIONS

Refer to ***APPENDIX*** for details on Material Safety Data Sheets.

DESIGN INTENTION

TEKFLEX – Is a cement modified polymer coating with superb flexibility, high tensile strength, and excellent adhesive qualities. The product forms a flexible barrier and strength membrane that enables the rock to retain its initial strength by eliminating the degrading effects of scaling and weathering. Tekflex may be spray or brush applied.

ADVANTAGES:

- Water based
- Fast drying
- No solvents or resins
- Non flammable
- Non toxic
- Cleaned with water
- Cost effective
- Test results proofs effectiveness
- Easy handling
- Package limits wastage
- SABS approved

DISADVANTAGES:

- Alkaline
- Personal protective gear required
- Highly adhesive
- Correct application procedure required
- Application area to be dust free
- Application equipment to be cleaned with water

CONCLUSION

This risk assessment is not absolute and should always be seen as a live document, because risk assessment in any form is a process and not a once-off activity.

Part of this process is that the user receiving the risk assessment from the supplier should scrutinize it, make recommendation or relevant comments and contribute to the assessment to make it more suitable and sufficient and thus more applicable for the proper use of the articles.

Should any recommendations be made from the user, or the supplier should add or remove anything as far as the design of the article is concerned, such recommendations or changes should be incorporated into this risk assessment, thus, the risk assessment should be revised for its adequacy.

Most importantly is that the user should take the recommended specified steps made by the supplier, evaluate them for practical implementation, and incorporate the information into the organizations specific training material, and train employees accordingly. This must be done to ensure the employees responsible for using the articles are familiar with potential hazards and risks they or any other employee might be exposed to.

Only then one can ensure as far as reasonably practicable the articles will be used properly.

If any significant problems or health and safety issues is identified by the user, and the user would like to bring it under the attention of the supplier, the supplier can be contacted at the following numbers:

Office - **011-908-1980; or**

E-mail - **info@minovarsa.co.za**

RISK MEASUREMENT INDEX**CONSEQUENCES (Worst case scenario if hazard should realize)**

	Index Value	Result
Catastrophic (many fatalities or damage over R100,000,000)	100	<input type="text"/>
Disaster (a few fatalities or damage over R10,000,000)	40	
Very Serious (one fatality or damage over R1,000,000)	15	
Serious (serious injury or damage over R 100,000)	7	
Important (temporary disability or damage over R10,000)	3	
Of Concern (minor injury or damage over R1,000)	1	

EXPOSURE (How often hazardous event occurs or is present)

	Index Value	Result
Continuous (many times daily)	10	<input type="text"/>
Frequent (once daily)	6	
Occasionally (once per week to monthly)	3	
Unusual (once / month to once / year)	2	
Rare (yearly)	1	
Very rarely (not known to have occurred but remotely possible)	0.5	

PROBABILITY (Chance of loss / harm during the exposure period)

Current controls / safeguards in place to be objectively assessed for sufficiency.

	Index Value	Result
Is the most likely and expected result if event occurs	10	<input type="text"/>
Quite possible (50/50 chance)	6	
Unusual but possible	3	
Only remotely possible (has happened somewhere)	1	
Conceivable but very unlikely (hasn't happened yet)	0.5	
Practically impossible (one in a million)	0.1	

$$\text{RISK RESULT} = \text{CONSEQUENCE} \times \text{EXPOSURE} \times \text{PROBABILITY}$$

RISK CLASSIFICATION

MORE THAN 400 **Very High Risk, immediate correction with high level input**

200 to 400 **High Risk, immediate correction required**

70 to 200 **Substantial Risk, correction needed**

20 to 70 **Possible Risk, attention indicated**

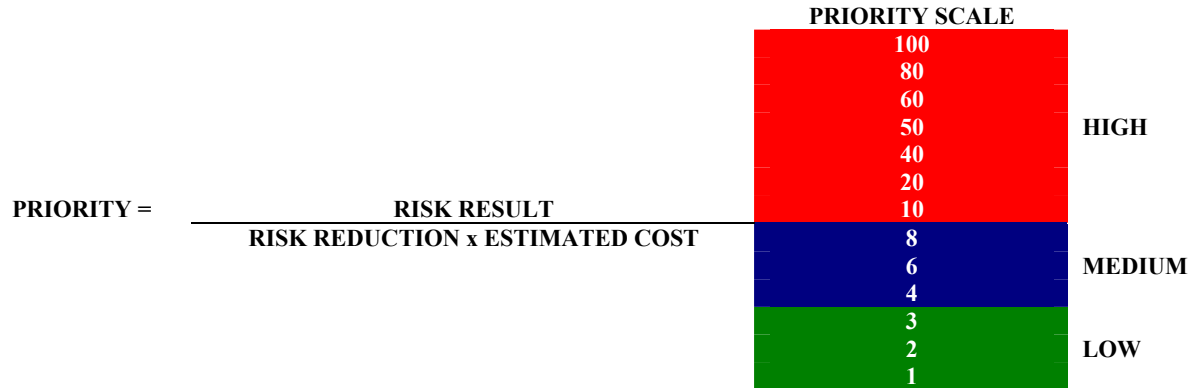
LESS THAN 20 **Risk perhaps tolerable as is**

RISK REDUCTION

% REDUCTION	DESCRIPTION	VALUE
10%	SMALL	6
20%	SMALL	4
50%	EFFECTIVE	3
75%	VERY EFFECTIVE	2
100%	ELIMINATED	1

ESTIMATED COSTS

More than R1 000 000	10
R500 000 – R1 000 000	6
R100 000 – R500 000	4
R50 000 – R100 000	3
R20 000 – R50 000	2
R10 000 – R20 000	1
Less than R10 000	0.5



TECHNICAL INFORMATION

A flexible coating for support and protection against weathering designed for spray application.

Uses

Tekflex coating is a high tensile strength flexible coating suitable for the following applications :

- consolidation of loose rock surfaces
- protection against weathering
- construction of ventilation walls

Advantages

- **Simple Mixing** - Convenient packaging of liquid and powder components minimises mixing errors, no further addition of water is required.
- **Flexible** - Ability to stretch and deform, tensile characteristics with the option of fibre reinforcing to assist in maintaining coating integrity after strata deformation.
- **Adhesion** - High degree of adhesion permits permanent effectiveness on most rock surfaces.
- **Non-flammable** - Water based, no special storage or ventilation requirements, equipment clean-up procedures, or waste disposal, are required.

Description

Tekflex coating is a cement modified polymer coating with good flexibility, and tensile strength with excellent adhesive qualities. The product forms a flexible barrier and support membrane that enables the rock to retain its initial integrity by eliminating the degrading effects of scaling, spalling and weathering. Tekflex is available in black or white, with or without additional fibre reinforcement for added tensile strength.

Properties

Pot Life : 30 minutes at 30°C, 60% RH
 Relative Density (RD) : 1.10 – 1.28
 Drying Time (Touch Dry) : 1 hour
 Tensile Strength (MPa) : 3.0 - 5.0

Standards Compliance

Fire Classification : SABS 0177 Pt. 111-1981 Class 2

Fire Toxicity : Meets requirements of NES 713 - Toxicity of Combustion Products.

Packaging

Tekflex is supplied as a two part pack of liquid and powder in one 20 litre container as follows:

TEKFLEX				
	BLACK		WHITE	
	no fibre	F (fibre)	no fibre	F (fibre)
PACK SIZE (kg)	18	16.8	18	18
POWDER (kg):	6	4.8	6	6
LIQUID (kg):	12.0	12.0	12.0	12.0
YIELD (ℓ):	14	15	14	15
COVERAGE (m ²) (Approx.)				
3mm:	4.5	5	4.5	5
2mm:	7	7.5	7	7.5
Tensile Strength psi, 30°C, 65% RH				
4 hour:	40	60	20	40
24 hour:	250	300	200	300
7 days:	450	525	400	600
28 days:	550	650	500	700

Note: 1MPa approximates to 145 psi

Instructions for Use

No special ventilation requirements are needed during application. Workers should take general precautions including wearing of protective clothing, gloves, dust masks, and adequate eye protection.

1. Remove or protect any objects that are not to be covered with Tekflex coating.
2. Remove as much dust and loose material as possible. Spray onto a dry, dust-free substrate for best results.
3. As Tekflex may be mixed and sprayed using various types of equipment, follow the instructions for the particular equipment you are using.

Notes:

- a) The best time to spray is right after excavation, when rock is first exposed.
 - b) Rock temperature should be 20°C, or higher, ideal is roughly 30°C.
 - c) The practical thickness achievable will depend somewhat on the orientation of the rock. Suggested thickness is 3mm. In no circumstances should the thickness be reached where the material sags or slumps, as this can affect the bond at the point of contact. Should this occur, allow the material to set before reapplication.
4. Pot life is approximately one half hour dependent on ambient temperature. Water may be used for clean up during this time. Warmer temperatures will shorten pot life and accelerate setting.
 5. Thoroughly purge all Tekflex material from the machine and lines with water when preparing for clean-up, follow any machine manufacturer's recommendations.

Shelf-Life

Both components: 12 months unopened, in cool, dry conditions.

Consult your local Minova RSA representative for additional information.

Precautions

Health and Safety

Tekflex is alkaline. The use of gloves and goggles is recommended. Splashes must be removed from the skin and eyes by washing with clean water. In case of splashes in the eyes, medical attention should be sought immediately. Refer to Material Safety Data Sheet.

Technical Support

Minova RSA provides a technical advisory service by a team of specialists in the field. The service includes on site assistance and advice on evaluation trials and laboratory work.

Additional information

Minova RSA is a market leader specialising in the supply of high performance chemical products for the mining and tunnelling industries.

The Minova RSA range of mining products includes anchoring and backfill systems, bagged cement products, high yield grouts, mine sealants, equipment and accessories.

Important note

Minova RSA products are guaranteed against defective materials and manufacture and are sold subject to its standard terms and conditions of sale, copies of which may be obtained on request. Whilst Minova RSA endeavours to ensure that any advice, recommendation, specification or information it may give is accurate and correct, it cannot, because it has no direct or continuous control over where or how its products are applied, accept any liability either directly or indirectly arising from the use of its products, whether or not in accordance with any advice, specification, recommendation or information given by it.

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MATERIAL SAFETY DATA SHEET – TEKFLEX LIQUID

SECTION I: PRODUCT INFORMATION & USE

Product Use: Mine Sealant Component (To be mixed with Tekflex Powder before application)

Chemical Family: Polymer Latex Emulsion (Mixed final product would be classified as a Hydraulic Cement for health and safety concerns)

DOT Shipping Name: Not Regulated

IATA Shipping Name: Not Regulated

Hazard Warning Labels: None

WHMIS Classification: Not a Controlled Product (Mixed final product would be classified as Class D, Division 2A; Class E)

NMFC Name: Chemicals, NOI

NMFC Number: 60000 LTL: 70 TL: 30

Codes used in this MSDS: NA = Not Applicable NE = Not Established NR = Not Reported
NDF = No Data Found ND = Not Determined

SECTION II: HAZARDOUS INGREDIENTS

OSHA <u>Ingredient</u> <u>Carcinogen</u>	<u>CAS #</u>	<u>%</u>	IARC <u>Carcinogen</u>	NTP <u>Carcinogen</u>
• Polymer Latex No	NR	40-70	No	No
• Water No	7732-18-5	30-60	No	No

SECTION III: PHYSICAL DATA

Physical State: Liquid white	Colour: Milky
Odour: Slight acetic	Odour threshold: NA
Volatility: 30-60 % as water	Solubility in Water: NA
Vapor Pressure: NA	Specific Gravity: 1.07
Vapor Density: Heavier than air	Evaporation Rate: NA
Boiling Point: 212°F (100°C) (0°C)	Freezing/Melting Point: 32°F
pH: 4.5, Mixed final product is alkaline (10.5-11.5)	Dist. Coeff. of Oil/H₂O: NR
VOC Content: Negligible	Physical Hazards: None

SECTION IV: FIRE & EXPLOSION DATA

Flash Point: NA	Autoignition Temperature: NA
Upper Explosive Limit: NA	Lower Explosive Limit: NA

Extinguishing Media: Use CO₂, dry chemical, foam or water as appropriate for surrounding fire.

Special Firefighting Procedures: As with any fire, use a positive-pressure MSHA/NIOSH approved self-contained breathing apparatus with protective clothing and full emergency equipment. Only properly trained personnel should respond to a significant fire episode involving this material.

Unusual Fire/Explosion Data: As with any sealed container, heat can cause pressure build-up, leading to an explosive rupture.

SECTION V: REACTIVITY DATA

Stability: Stable.

Incompatibility: None known.

Hazardous Decomposition: Will not occur. Under fire conditions, some components of this product may decompose releasing NO_x, CO_x, smoke and other potentially irritating, toxic fumes.

Hazardous Polymerization: Will not occur.

Other: Avoid temperatures below 32°F (0°C) which will cause Tekflex Liquid to freeze.

SECTION VI: TOXICOLOGICAL / HEALTH HAZARD DATA

Product Threshold Limit Value: TLV/PELs have not been established for the individual ingredients of this product. TLV/PELs for final mixed product: 10 mg/m³ as nuisance particulates.

Health Hazards: Eye, skin and respiratory irritant. Mixed final product is an eye, skin and respiratory irritant and can damage eyes, skin and lungs as hydraulic cement.

Potential Routes of Entry

Skin Absorption:	No	Skin Contact:	Yes	Eye Contact:	Yes
Ingestion:	Yes	Inhalation:	Yes		

Effects of Overexposure

Acute: Direct contact with material may cause eye and skin irritation. Inhalation of vapors or mist may cause respiratory irritation. Tekflex Liquid and Tekflex Powder are mixed to yield the final product which can dry skin and cause chemical burns as hydraulic cement. Inhalation of mist from mixed final product may cause respiratory irritation.

Chronic: See acute effects. Tekflex Liquid and Tekflex Powder are mixed to yield the final product which contains portland cement and may cause hypersensitive individuals to develop an allergic dermatitis.

Other: Avoid contact with skin or eyes. Avoid prolonged breathing of airborne dusts, vapors, mists or fumes. Avoid ingestion.

Toxicological Data

DERMAL

Ingredient

LD₅₀ (rabbit)

No toxicological data found on any ingredient.

Refer to Tekflex Powder MSDS for information on Tekflex Powder ingredients which would be present in the mixed final product.

ORAL

LD₅₀ (rat)

INHALATION

LC₅₀ (rat)

Exposure Limits

Ingredient

CEIL Skin

	OSHA				ACGIH	
	<u>PEL-TWA</u>	<u>STEL</u>	<u>CEIL</u>	<u>Skin</u>	<u>TLV-TWA</u>	<u>STEL</u>

TLV/PEL's have not been established for the individual ingredients.

Refer to Tekflex Powder MSDS for information on Tekflex Powder ingredients which would be present in the mixed final product.

SECTION VII: PREVENTIVE MEASURES

Special Protection Information

- Respiratory:** As with all chemical spray applications, wear a NIOSH/MSHA approved air respirator (dust mask) when spraying this product. Observe OSHA 29 CFR 1910.134 for respirator use.
- Ventilation:** Provide adequate ventilation to prevent build-up of airborne dusts, vapors, mists or fumes.
- Protective Gloves:** Use chemical resistant gloves or an equivalent that is suitable for handling hydraulic cement.
- Eye Protection:** Use safety glasses, goggles, or faceshield as appropriate to prevent eye contact.
- Other:** Wear protective clothing appropriate to prevent skin contact. Wash all contaminated clothing prior to re-use. Thoroughly wash and clean before eating or performing hygienic activities.

Spill or Leak Procedures

- Spill:** Refer to this MSDS for safety precautions, protective equipment, and other data. In the event of a Tekflex Liquid spill, dike and absorb with inert material and place in a container. In the event of a mixed final product spill, scoop up spilled material and place in a container.
- Waste Disposal:** Dispose of material in accordance with all applicable federal, state, and local regulations.
- Storage:** Store in a cool, dry area between 40°F (4°C) and 110°F (43°C). If Tekflex Liquid freezes, the thawed material will coagulate and render the material unusable. Keep containers sealed when not in use.
- Other:** None noted.

SECTION VIII: FIRST AID MEASURES

- Eyes:** Immediately flush eyes with water for at least 15 minutes. Consult a physician.
- Skin:** Remove contaminated clothing and wash affected area immediately with soap and water. If effects occur, consult a physician.
- Inhalation:** If effects occur, remove to fresh air immediately away from risk of further exposure. Administer oxygen or artificial respiration as needed. Consult a physician immediately.
- Ingestion:** Consult a physician immediately. Do not induce vomiting unless instructed to do so by a physician. Never give anything to drink to an unconscious person.

MATERIAL SAFETY DATA SHEET – TEKFLX POWDER

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

Application : Mine Sealant (To be mixed with Tekflex Liquid before application)
Company : Minova RSA
Address : P.O. Box 52, Isando, 1600.
Telephone : (011) 923-1900 **Telefax** : (011) 864-4311

2. COMPOSITION / INFORMATION ON INGREDIENTS

Composition : Hydraulic Cement.

Hazardous Ingredient(s)	Symbol	Risk Phrases	Other Information	%
Cement Hydraulic	Xi	R36/37/38	Cas No.: -----	>25<50%

All constituents of this product are listed in EINECS (European Inventory of Existing Commercial Chemical Substances) or ELINCS (European List of New Chemical Substances) or are exempt. Refer to Section 8 for Occupational Exposure Limits.

3. HAZARDS IDENTIFICATION

Irritating to eyes, respiratory system and skin.

IRRITANT

4. FIRST AID MEASURES

Eyes : Irrigate immediately with copious quantities of water for several minutes. Obtain medical attention urgently.
Skin : Wash immediately with copious quantities of water. Remove contaminated clothing immediately. Obtain medical advice if skin disorders develop.
Inhalation : Remove from exposure. If feeling unwell obtain medical attention.
Ingestion : Wash out mouth with water. **DO NOT** induce vomiting. Obtain medical attention.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media : None, not flammable.
Special Exposure Hazards : None.
Special Protective Equipment : None.

=====

6. ACCIDENTAL RELEASE MEASURES

- Personal Precautions** : Wear rubber boots in addition to the recommended protective clothing.
- Environmental Precautions** : Prevent entry into drains, sewers and water courses.
- Decontamination Procedures** : Avoid the creation of dust in atmosphere. Gather into containers. Residues may be flushed to drain with large volumes of water. Prior consent must be obtained from the local Water Company if discharged to sewer.

=====

7. HANDLING AND STORAGE

- Handling** : Avoid creating dust. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid skin and eye contact.
- Storage** : Store in a cool, dry area.

=====

8. EXPOSURE CONTROL / PERSONAL PROTECTION

Occupational Exposure Limits	:-		
Substance	8 Hour TWA	STEL	Source/Other Information
Portland Cement :			EH 40
Total inhalable dust	10mgm ⁻³	---	
Respirable dust	5mgm ⁻³	---	

- Engineering Control Measures** : Atmospheric levels of dust must be maintained within the Occupational Exposure Limit. Where mechanical methods are inadequate or impractical, appropriate personal protective equipment must be used.
- Personal Protective Equipment** : Impervious gloves (eg PVC). Goggles / Safety Glasses. Approved dust mask. Change contaminated clothing and clean before re-use.

=====

9. PHYSICAL AND CHEMICAL PROPERTIES

- Physical State** : Granulated Powder.
- Colour** : Grey.
- Odour** : Odourless.
- pH (working dilution)** : >12.
- Boiling Point / Range (°C)** : Not applicable.
- Flash Point (closed, °C)** : None.
- Autoflammability (°C)** : Not applicable.
- Oxidising Properties** : Not determined.
- Relative Density (at 20°C)** : 1.3 (Loose bulk).
- Water Solubility** : Partially soluble.

=====

10. STABILITY AND REACTIVITY

Stability	:	Stable.
Conditions to avoid	:	Exposure to air. Contamination with water.
Materials to avoid	:	Strong acids.
Hazardous Decomposition Products	:	None.

=====

11. TOXICOLOGICAL INFORMATION

Health Effects

On Eyes	:	Irritating and may injure eye tissue if not removed promptly.
On Skin	:	Irritation.
By Inhalation	:	Irritating to respiratory system.
By Ingestion	:	May cause irritation of mouth, throat and digestive tract.
Chronic	:	Repeated and prolonged skin contact may lead to skin disorders.

=====

12. ECOLOGICAL INFORMATION

Environmental Assessment	:	Little detailed information is available on the ecological effects of this product, but its overall environmental impact is not regarded as significant.
Mobility	:	Insoluble in water.
Persistence and Degradability	:	Not readily biodegradable.
Bioaccumulative Potential	:	Not expected to be bioaccumulative.
Ecotoxicity	:	Not expected to be ecotoxic to fish/daphnia/algae in cured state.

=====

13. DISPOSAL CONSIDERATIONS

Disposal must be in accordance with local and national legislation.

Unused Product	:	Disposed of in an approved manner.
Used/Contaminated Product	:	As for Unused product.
Packaging	:	The method of disposal must be acceptable to the local authority.

=====

14. TRANSPORT INFORMATION

This product is NOT classified as dangerous for transport.

=====

15. REGULATORY INFORMATION

Hazard Label Data	:	-
Named Ingredients	:	Cement Powders
Symbol(s)	:	Xi
Risk Phrases	:	Irritating to eyes, respiratory system and skin..
Safety Phrases	:	Do not breathe dust. Avoid contact with skin and eyes. Wear suitable gloves and eye / face protection. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of soap and water.
EC Directives	:	Dangerous Substances Directive, 67/548/EEC and adaptations. Dangerous Preparations Directive, 88/379/EEC. Safety Data Sheets Directive, 91/155/EEC.
Statutory Instruments	:	Chemicals (Hazard Information and Packaging for Supply) (Amendment) Regs. 1996 (SI 1092). Health & Safety at Work etc. Act 1974. Control of Substances Hazardous to Health Regs. 1994 (SI 3246).
Codes of Practice	:	Waste Management. The Duty of Care.
Guidance Notes	:	Occupational skin diseases : Health and Safety Precautions (EH 26). Dust in the workplace : general principles of protection (EH 44). Occupational exposure limits (EH 40).

=====

16. OTHER INFORMATION

Minova RSA is an ISO 9002 accredited company.

The data advice given apply when the product is used for the stated application or applications. The product is not sold as suitable for any other application. Use of the product for applications other than as stated in this sheet may give rise to risks not mentioned in this sheet. The product should not be used other than for the stated application or applications without seeking advice from Minova RSA.

If this product has been purchased for supply to a third party for use at work, it is the purchaser's duty to take all necessary steps to secure that any person handling or using the product is provided with the information in this sheet.

It is the responsibility and duty of the employer to inform employees and others who may be affected of any hazards described in this sheet and of any precautions which should be taken.

This sheet does not constitute or substitute for the users own assessment of workplace risk, as required by other health and safety legislation.

CSIR REPORT – BF204/018(A)_ZT455_FOSROC

(Copy CSIR Report)

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Fosroc Stratabolt (Pty) Ltd
P.O. Box 123910
Alrode
1451

For Attention: Mr Willem Crous
Telephone : (011) 908-1980

21 August 2000

Dear Sir

**EVALUATION OF THE FIRE PROPERTIES AND COMBUSTION TOXICITY OF "ZT 455", A TAN COLOURED CEMENTATIOUS ELASTOMER / STRUCTURAL MEMBRANE
BY
SABS 0177 PART 3 TEST PROTOCOL, "SURFACE FIRE INDEX OF FINISHING MATERIALS"
AND BY THE NES 713 METHOD**

Please note that the following report is subject to the attached *General Contract Conditions*.

1. SAMPLE DESCRIPTION

The material submitted for evaluation was described as a cementitious-based structural, membrane and is envisaged for underground use, mainly for rock and soil consolidation and also in the protective coating of cables, ducting and similar. The product was identified as "ZT.454". The sample delivered, had been applied at a normal thickness of between 3 and 5mm on 6mm *Nu-Tech* board.

The purpose of this investigation was to determine the fire characteristics of the material and to assess its suitability for its intended use as a consolidation coating in underground haulage areas, from a fire safety point of view. -The flame spread characteristics was determined in accordance with the SABS 0177 Part 3 test protocol while the toxicity index for the material was determined in accordance with the NES 713 test method. A further advanced Toxicity screening procedure was also conducted by GC/MS (Gas Chromatography, Mass Spectrometry) and by IC (Ion Chromatography)

2. TEST METHODS AND RESULTS

2.1 SABS 0177 Part 3- Surface Fire Index of Finishing Materials

For this evaluation two panels, each comprising a single length of 2400mm long and 350 mm in width, were delivered. The material was applied to non-combustible fibre-cements boards to a thickness of between 3 and 5 mm. These test specimens, (each length of 2.44 m) were subjected to the SABS 0177 Part 3 test protocol for the standard test duration of 18,5 minutes.

A photoelectric cell with a predetermined light path in the chimney of the test apparatus recorded the percentage light obscuration while two thermocouples embedded in a copper rod, also located in the chimney, recorded the stack temperature. Flame spread distance was recorded, by visual observation of surface burning through a series of uniformly spaced observation ports, each port 75mm apart.

Based on the readings and observations, a Smoke Emitted Index, a Heat Contributed Index and a Spread of Flame Index was calculated. The arithmetic mean of these three indices is referred to as the Surface Fire Index. The table below shows the maximum allowable values for the different classifications, of these indexes.

TABLE 1: SURFACE FIRE INDEX / Maximum allowable values per index

Class	Spread of Flame Index	Heat Contribution Index	Smoke Emission Index	Surface Fire Index
1.	0.1	0.1	0.2	0.1
2.	0.7	0.8	1.0	0.6
3.	1.5	1.7	2.0	1.2
4.	3.5	3.8	4.0	2.9
5.	5.5	5.8	6.0	4.5

Should a particular index exceed this class maximum, the material will be classified accordingly even if the overall index falls within a lower class. The following results were obtained:

2.2 RESULTS

The sample panels were tested in the CSIR Fire Laboratory as described above on 30 May 2000 and the results of those tests are summarised in Table 2.

TABLE 2: TEST RESULTS: ZT455

Index	Sample 1	Sample 2
Spread of Flame Index	0.225 (2)	0.000 (1)
Heat Contribution Index	0.189 (2)	0.081 (1)
Smoke Index	0.238 (2)	0.000 (1)
Surface Fire Index	0.217 (2)	0.027 (1)
Class	2**	1

**** Without testing a third panel, the result is thus that which exceeds a class maximum, irrespective of average. The result is thus class 2.**

2.3 NES 713- Toxicity of combustion products

One gram of material was burned in a chamber with a volume of 1 m³. The concentration of certain specified gases were determined by means of colorimetric (Dräger) tubes.

These concentrations were then used to calculate the quantities of gases, by extrapolation, which would have been given off by burning 100 g of material in a cubic metre of air. The toxicity index is calculated from the summation of the ratios of these concentrations, to the concentrations causing fatality to man after a 30 minutes exposure time, these LEL limits listed in Table 3.

TABLE 3: GASES TO BE DETERMINED AND THEIR FATALITY LIMITS

Gas	Conc. (PPM)	Gas	Conc. (PPM)
Carbon Dioxide	100 000	Nitrous Oxides	250
Carbon Monoxide	4 000	Hydrogen Cyanide	150
Formaldehyde	500	Acrylonitrile	400
Hydrogen Fluoride	100	Ammonia	750
Hydrogen Chloride	500	Sulphur Dioxide	400
Hydrogen Bromide	150	Hydrogen Sulphide	750
Phenol	250	Phosgene	25

The actual mass of material burnt in the chamber is recorded and the conversion factor used to extrapolate the results to the 100g equivalent. The extrapolated concentration of toxic gasses that would be released if 100g had been burnt, is determined by multiplying the actual recordings with the conversion factor and the calculated figures recorded. The ratio of this concentration to the theoretical Lethal Exposure Limit, (LEL) after 30 minutes, (Table 3), forms the toxicity index for that gas and is listed in the last column of table 4.

TABLE 4: DETECTED GASSES

TEST MASS: <u>1,06g</u>	CONVERSION FACTOR: <u>_100</u>	DATE: 20/06/2000
Gas Detected	Conc. for 100 g of Material Burned (PPM)	Toxicity Index
Carbon Dioxide	1000	0.01
Carbon Monoxide	2000	0.50
NOx	100	0.40
Acrylonitrile	20	0.50
TOTAL TOXICITY INDEX		0.96

2.4 ADVANCED TOXICITY SCREEN : GC/MS AND IC ANALYSIS

Samples of 2.5 litres of the combustion gases in the chamber were drawn over silica and activated charcoal, these absorbents trapping inorganic and organic components respectively. The silica sample was desorbed and subjected to ion chromatography analysis, primarily to detect the presence of any halogen derivative acid and other organic based acid or toxic substance. The charcoal was desorbed and injected into a Gas Chromatograph which was coupled to a mass spectrometer.

Results

No inorganic components derived from halogenated base materials could be found. There were limited organic pyrolysis products detected in the GC/MS analysis, none of which can be considered to be toxic at LEL³⁰ levels. The material can thus be considered to be safe for use.

3. CONCLUSION

The Fosroc tan coloured elastomer product, "ZT455", displayed little propensity to support flame spread, (Class 2 [test 1], Class 1 [test 2], and Class 1 on average) and there was very little smoke generation, (Class 1_{ave}) in the thermal degradation of some of the material.

The degradation process contributed an insignificant amount of heat to the process, (Class 2_{ave}). The smoke density produced was not significant, (Class 1_{ave}) and the thermal decomposition products have a very low Toxicity Index of 0.96. It is therefore our opinion that this material, with regard to its fire spread properties, and the relative Toxicity Index of its combustion products, may be considered suitable for underground applications.

I trust the fore going will be of assistance to you, but should you require any further information, please do not hesitate to approach the undersigned,

AJH Young

A handwritten signature in black ink, appearing to be 'AJH Young', with a horizontal line extending to the right from the end of the signature.

Fire Engineering Sciences
Division of Building And Construction Technology-CSIR

CSIR - GENERAL CONTRACT CONDITIONS



**Building
Technology**

CSIR

1. PURPOSE

The purpose of the investigation must be fully disclosed to the CSIR. The client will use the results of the investigation only for the purpose disclosed to the CSIR, unless otherwise agreed.

2. RISK RELATING TO MATERIALS, APPARATUS, OR EQUIPMENT

Materials, apparatus or equipment delivered by or on behalf of the client to the CSIR pursuant to the contract, shall be accepted, retained and used at the owner's risk.

3. PUBLICATION OF REPORTS

(a) The contents of any interim reports issued are confidential and may not be published by the CSIR or the client, and the results of any discussions with CSIR personnel relating to this investigation may not be communicated to the press or technical journals or be given publicity in any other manner until the formal report has been issued.

(b) The final report will be the property of the client and may be published by him provided that

(i) the CSIR be acknowledged in the publication;

(ii) it is published in full or, when only extracts or a summary or an abridgment are published, the CSIR's written approval of the extracts, summary or abridged report be obtained prior to publication; and

(iii) the CSIR be indemnified against any claim for damages which may result from publication.

4. CONFIDENTIALITY

The CSIR will not publish any results without the client's consent. The CSIR is, however, entitled to use technical information obtained from the investigation, but undertakes in doing so not to identify the sponsor or the subject of this investigation.

5. ADVERTISING

No reference may be made to the CSIR or any of its strategic units or employees in advertisements or for sale or publicity purposes without the CSIR's prior written consent.

6. OWNERSHIP OF INTELLECTUAL PROPERTY

In terms of Act No.46 of 1988 all intellectual property developed by CSIR during the course of the investigation vests in the CSIR unless otherwise agreed in writing.

7. DOMICILIUM CITANDI ET EXECUTANDI

The parties hereto respectively choose as their *domicilium citandi et executandi* for all purposes of, and in connection with, this contract, the addresses stated in the letter of proposal.

8. WAVER

Failure of either party hereto at any time to demand performance of any provision of the contract shall not affect that party's rights to require full performance thereof at any time thereafter and a waiver by either party of a breach by the other of any such provision shall not be taken to be a waiver of any subsequent or similar breach, or as nullifying the effectiveness of such provision.

9. NOTICES

Any notice to be given hereunder shall be given in writing and may be given either personally or may be sent by post or telex or telefax and addressed to the relevant party at its *domicilium* or to such other address as shall be notified in writing by any of the parties to the other. Any notice given by post shall be deemed to have been served on the expiry of 7 (seven) working days after the same is posted by registered post by (land or airmail). Any notice delivered personally or sent by telex or telefax shall be deemed to have been served at the time of delivery or sending.

Any notice to be given shall be given to the client at his principal place of business and to the CSIR, Scientia (BOUTEK) at Meiring Naude Road, Pretoria.

10. AMENDMENTS

No amendment to this contract or the proposal shall be of any force or effect unless reduced to writing and signed by both parties.

11. VALUE ADDED TAX

It is hereby expressly recorded that any Valued Added Tax (V AT) payable in respect of the services rendered in terms of this contract shall be for the account of the client and shall be included in the final payment payable in terms of this contract.

12. LIMITATION OF LIABILITY

While every care is taken to ensure the accuracy of any work performed by the CSIR under this contract, the CSIR does not warrant the merchantability or commercial viability of the research results. Neither the CSIR nor its employees shall be liable in any way whatsoever to the client or to any other person whatsoever for any negligence, error or omission in carrying out the work or for any erroneous statement, whether in fact or opinion, contained in any report issued pursuant to the work performed.

13. GOVERNING LAW AND JURISDICTION

13.1 The contract between the parties shall be governed by and interpreted in all respects in accordance with the laws of the Republic of South Africa. The parties hereby consent to the jurisdiction of any competent Magistrate's Court for the adjudication of any claim based on this contract.

13.2 Notwithstanding the provision of 13.1, in the event of the parties failing to reach agreement in regard to the interpretation of, or the carrying into effect of, or any of the parties' rights and obligations arising from, or the termination of or arising from the termination of, or the rectification of, this agreement within 14 (fourteen) days of the dispute arising, then either party may, by notice in writing to the party, refer the dispute for determination by arbitration in South Africa under the provision of the Arbitration Act, Act No 42 of 1965, as amended.

The arbitrator shall be, if the matter in dispute is principally

- * a legal matter, a practising attorney of not less than 15 (Fifteen) years standing or a practising advocate of not less than 10 (ten) years standing;
- * an accounting matter, a practising chartered accountant of not less than 10 (ten) years standing;
- * any other matter. any independent person agreed to between parties.

Should the parties fail to agree on an arbitrator within 14 (fourteen) days after the arbitration has been demanded then the arbitrator shall be nominated by the (current) serving President of the Law Society of the Transvaal.

14. PAYMENT OF ACCOUNT

All amounts due in terms of this contract shall be payable on the due date indicated in the proposal or within 30 (thirty) days of the date of issue of an invoice where that is required. Any amount not paid on the due date shall bear interest at a rate of 2% (two per cent) above the prime overdraft rate charged by Volkskas Bank Limited to its preferred corporate clients, calculated and compounded daily as from the due date until date of payment.

15. VALIDITY

All proposals are valid for 30 (thirty) days from date of issue, unless otherwise indicated, and unless accepted within that period, will lapse automatically.

16. TERMINATION

This contract may be terminated forthwith by either party in the event of the other being liquidated or being placed under judicial management.

In the event of any party to this contract being in breach of any of the terms of the contract, the other may by written notice require the party which is in breach to remedy the breach, and if it has not done so within 7 (seven) days of receipt of such notice, or if the breach is incapable of being remedied, the other party may, in writing, terminate the contract without prejudice to its right to claim damages.

PRODUCT LABELS - TEKFLEX

<p>TEKFLEX WHITE</p> <p>EXP: 11/2001</p> <p>Prod. Code SMTEKFLEX_WHT</p> <p>B/No. : 79168</p>	<p>TEKFLEX WHITE</p> <p>EXP: 11/2001</p> <p>Prod. Code SMTEKFLEX_WHT</p> <p>B/No. : 79168</p>
<p>TEKFLEX WHITE</p> <p>EXP: 11/2001</p> <p>Prod. Code SMTEKFLEX_WHT</p> <p>B/No. : 79168</p>	<p>TEKFLEX WHITE</p> <p>EXP: 11/2001</p> <p>Prod. Code SMTEKFLEX_WHT</p> <p>B/No. : 79168</p>
<p>TEKFLEX WHITE</p> <p>EXP: 11/2001</p> <p>Prod. Code SMTEKFLEX_WHT</p> <p>B/No. : 79168</p>	<p>TEKFLEX WHITE</p> <p>EXP: 11/2001</p> <p>Prod. Code SMTEKFLEX_WHT</p> <p>B/No. : 79168</p>

COMPANY PROFILE - MINOVA RSA



**MANUFACTURERS
OF
ROCK ENGINEERING SOLUTIONS**

THE MINOVA RSA COMPANY

Fosroc Stratabolt was formed in 1997, by the merger of Stratabolt Products, and Fosroc, both leading suppliers of rock support products to the South African Mining industry. Fosroc Stratabolt now trades as Minova RSA, and is a member of the Minova International Group which manufactures and supplies advanced rock-engineering materials in all of the world's major mining countries.

The company operates an integrated research, development and manufacturing facility in the hub of the diverse and technically demanding Southern African Mining Industry. Minova RSA's products are used in every sector of that industry and are exported world-wide.

Through our own research and access to the research of other Minova International companies we aim to ensure that our customers maintain leadership in improving the safety and productivity of underground excavation. The spectrum of products supplied enables mining engineers to choose unique solutions to unique rock engineering problems. We invite the active participation of our customers in product conception and improvement.

We manufacture resin grouting capsules, cement grouting capsules, high-yield and foamed grouts and other advanced technology cements. We also supply backfilling systems.

Witwatersrand Mining Supply Corporation (Wimico), a sister company in Minova International, is a specialist mining contractor, undertaking rock stabilization, void filling and underground construction.

The combination of Minova RSA and Wimico enables us to provide complete solutions to our customers.

MAIN PRODUCTS

FASLOC® polyester resin capsules

Minova RSA manufactures Fasloc® resin rock-bolting capsules under licence from E.I. du Pont de Nemours & Co. (Inc). Fasloc® is the leading rock-bolting resin in Southern Africa and has long held a similar position in North America.

Fasloc® capsules have a unique composition and construction. The resin compartment contains coarse filler particles, which aid in shredding the sheath and then interlock to increase the strength and rigidity of the grout. The catalyst compartment comprises 30 percent of the capsule, which materially improves intermixing of the components. These characteristics give the user unparalleled reliability of installation, tolerance of wide bar/hole annuli and simplicity of operation.

Fasloc® is available ex-stock in setting times from 15 seconds to 15 minutes and diameters from 19mm to 35mm. Special setting times and sizes are available on request. The Fasloc® capsules manufactured by Minova RSA comply with South African National Standard ("SABS") No. 1534: 1991 and carry the SABS mark of quality.

Minova RSA also manufactures the unique 2-Speedie resin capsule system which contains two different resin set times within the same capsule.

CAPCEM® cement grouting capsules

Cement capsules are used with grout bars to achieve full-column cement grouting.

The blended cement is encapsulated in a porous sheath, which allows controlled water absorption for correct wetting of the grout.

Capcem® capsules are available in 25mm and 28mm diameters and fast setting times allowing a 500mm length of grout to support a 50 kN load applied to an embedded 16mm rebar, after only 1 hour.

TEKSET® high-yield grouts

These patented high-yield grout formulations are designed to be mixed with a fixed quantity of water and pumped under pressure into high strength polypropylene bags for timber pack pre-stressing. The grout will generate a minimum strength of 0,3 MPa in two hours and achieve a minimum strength of 4 MPa within 7 days.

Their primary use is to pre-stress timber packs, giving semi-active and immediate support as well as making the packs blast-resistant. The grouts are also suitable for void filling.

TEKSET® is supplied in nominal 11kg bags.

AIR-O-CEM® and TEKSEAL® foamed grouts.

When placed with a custom-made pump, these grouts produce low-density foams suitable for void filling and the creation of ventilation, backfill and blast barriers. They are supplied in nominal 25kg bags.

PUMPED CEMENT GROUTING SYSTEMS

The Capram ® system is manufactured by Minova RSA under licence from Delkor Technik.

The system is designed to afford an easy method of reliably achieving full column cement grouting in a hole of any size. It can be used for pre- or post-grouting.

The equipment components are a simple pressure-differential axial pump which operates on compressed air (minimum pressure 3 bar) and a lance of 12mm to 30mm diameter. The grout is pre-packed in a porous sheath designed to optimise water absorption. The wetted grout bag is inserted into the pump and the grout ejected through flexible piping and the lance to the back of the hole. The sheath is retained in the pump and discarded after use.

The pumps are available ex-stock and the grouts are supplied in packages of nominal dimensions 90mm x 400mm long. Setting times are medium (2 hours) and slow (4-6 hours).

The Capcem Injection Grout System consists of blended cement grout (each bag sufficient to fill one typical rockbolt hole) and a hand held, air driven injector. The grout is mixed in its bag with water and then pumped into the hole with the injector.

LOKSET ANCHOR PACK pourable resin grouts

Scraper winches and other machinery may be rapidly bolted in place with LOKSET ANCHOR PACKS, which are a high-strength pourable resin grouts. They are supplied as a 10kg two-component pack in a mixing bucket. In use, the two components are mixed and poured into the anchoring holes, around the hold-down bolts. The equipment may be used within 2 hours.

TEKFLEX® structural membrane

Tekflex is a high-strength flexible coating for rock. When sprayed onto the surface of mine drives or tunnels it quickly forms a membrane which restrains loose rock, inhibits further deterioration and protects against weathering.

CABLESEAL® fire-retardant coating for cable and pipes

Cableseal is applied as a coating on cables and plastic pipes in mines. It prevents spread of fire along the cable or pipe runs. It is strongly adherent but flexible enough to accommodate flexure of the cable or pipe without breaking off.

FIRESHIELD® fire-resistant coating for timber

Fireshield is sprayed or painted onto timber support in underground workings to prevent spread of fire between packs or poles. It has passed stringent tests that convincingly demonstrate that a timber pack protected by Fireshield will remain intact despite adjacent packs burning completely.

FILLSET® AND CONBEX® backfilling systems

Minova RSA has developed additives that make run-of-mine tailings into effective backfill material. The additives bind the tailings and chemically retain water, accelerating strength gain and preventing shrinkage as the backfill sets. Each backfilling operation is unique so Minova RSA provides advice on design of backfill formulations and placing systems.

FACILITIES

FASLOC ® resin capsule production

Four capsule production lines employ mechanised and automated mixing to produce polyester and catalyst mastics for encapsulation by modified Kartridge Pak (KP) chub machines. The production lines are supported by a dedicated analytical laboratory for checking of incoming, in-process and finished goods.

Capacity: 500 tonnes per month

Cementitious grout manufacture

Two automatically controlled blenders produce the grout blends for the packaging lines. Small diameter grouting capsules (Capcem) are formed on 3 banks of automatic filling machines. Large diameter capsules (Capram and Injection Grout) have their own filling section. Two bagging lines produce Tekset, Air-O-Cem, Tekseal and other bagged products. The cements plant has its own Quality establishment, including laboratories for routine quality control and product testing.

Capacity: 2500 tonnes per month

Research and Development

A central laboratory and workshops are available for development and testing of new formulations and components. Equipment includes compressive and tensile testing machines, apparatus for conventional chemical analyses and rigs for testing anchor installation equipment and techniques.

Technical Service

All field staff are experienced in mining and have received training in the characteristics and proper use of all our products. Minova RSA service includes:

- * Product selection
- * Application training and in-use auditing
- * Stock management, transport and packaging

QUALITY MANAGEMENT

Minova RSA gives quality management the highest priority. All incoming materials are checked against specifications before acceptance into process. Checks on the materials and process conditions are carried out at defined regular intervals, with feedback to operations to ensure continuous compliance. Samples of finished goods are rigorously tested for conformance with specifications and specimens are retained for reference. All key materials are lot-traceable through the process.

Regular analysis of the testing data is carried out to identify trends and areas for improvement. Critical areas of the plants are automated to reduce product variability.

The quality management systems used in the production of Fasloc ® resin capsules and cement grouting products are listed by the South African Bureau of Standards (SABS) as complying with the requirements of ISO 9002/1994. Fasloc ® has been granted the SABS mark for quality conforming to the requirements of National Standard SABS 1534:1991 for rock bolting resin capsules. The SABS conducts six-monthly audits of the quality systems as well as tests on the mark-bearing products.

KEY PERSONNEL

MANAGING DIRECTOR: DONALD O'CONNOR

Educational Qualifications B.Sc. Hons (Geophysics), MBA
Experience: **Project Leader:** Western Deep levels Mine
Project Manager: NPI Group
General Manager: Strataloc Resins
Managing Director: Dantex Explosives
Technical Director: RSA Products

SALES & MARKETING DIRECTOR: PIERRE LOTTER

Educational Qualifications Diploma - Metalliferous Mining
Experience: Mine Managers Certificate of Competency
Explosives Engineer & Sales Manager - AECI
Marketing Manager - Sasol Explosives
Marketing Director - VAC AIR Technology

TECHNICAL DIRECTOR: ROD SMART

Educational Qualifications Ph.D (Chemistry)
Experience: **Post Doctoral study:** Pennsylvania State University, USA
Product Development Manager: Fosroc Technology ., UK
Technical Manager: Fosroc South Africa
Technical Director: Minova RSA

FINANCIAL DIRECTOR: LINDSAY HARRIS- DEWEY

Educational Qualifications B. Comm., B. Acc., C.A. (S.A.)
Experience: **Audit Senior :** Ernest and Young – Springs
Financial Manager: Bevcan - a Division of Crown Nampac
Commercial Manager: Bevcan
Financial Manager: P.F.G. Building Glass

HUMAN RESOURCES MANAGER: LORRAINE COUGHLAN

Educational Qualifications B Comm (Personnel Management) Hons
Experience: **Human Resources Manager** - HMR and Noristan
Personnel Consultant – Johann Ribbens and Associates
Personnel Officer – ESD

OPERATIONS MANAGER: ALFREDO PIRODDI

Educational Qualifications National Diploma (Operations Management)
Experience: **Maintenance Foreman** – MCMS
Production Manager – Coca Cola South Africa
Factory Manager – Fosroc Stratabolt
Operations Manager - Minova RSA

CORPORATE INFORMATION

Official Company name

Minova RSA - trading name of Stratabolt (Pty) Limited
Company No.: 2001/027226/07

Physical Addresses:

Head Office: Isando	Cnr Anvil & Brewery Roads, Isando
Resin Factory: Isando	Cnr Anvil & Brewery Roads, Isando
Cements Factory: Alrode	No. 25, Botha Road, Alrode

Postal Addresses: PO Box 52, Isando, 1600

Telecommunications:

TELEPHONE NUMBERS	(011) 923-1900 Isando
	(011) 908-1980 Alrode
	International: +(2711)

FAX NUMBERS	ISANDO:	(011) 923-1935 Main Office
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ALRODE:	(011) 864-4311 Technical Office
	(011) 908-5640 Main Office
	(011) 908-1977 Sales Office
	(011) 908-2389 Purchasing & Despatch
	International: +(2711)

E-MAIL	info@minovarsa.co.za
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WEBSITE	www.minovainternational.com
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Bankers:

Standard Bank of South Africa
Stratabolt (PTY) Ltd T/A Minova RSA
Isando 01-25-42-43
020133049

Auditors

Ernst & Young
Johannesburg

WRITTEN UNDERTAKING FROM USER – FORMAT EXAMPLE

Organisation:

Division:

Mine:

Date:

Herewith a written undertaking, to take all specified steps sufficient to ensure, as far as reasonably practicable, that the articles will be used properly, and in such a manner that it will not effect the health and safety of persons working there with or in the vicinity of working with the articles.

It is herewith we the user accepts the information supplied to be sufficient in ensuring the proper use of the articles.

Signed on the _____ of _____ 2001, at _____.

Manager:

Engineer:

Risk Manager:

Quality Control Officer:

Training Manager: