The next generation of polymeric ground consolidation chemical

- Non-toxic
- Non-hazardous
- Low temperature

StrataLock Pty Ltd is a company formed as a result of collaboration, beginning in 2018, between two industry recognised, long standing and innovative companies.





Both companies provide industry leading ventilation and strata control products and practices, along with design, consulting and contracting services.

STRATALOCK was established to develop and bring to the industry a real

solution to the health and safety risks that are associated with the use of traditional PUR, Silicate or Phenolic chemicals.

Why was it needed?

- 1. The underground coal mining industry currently uses ground consolidation products that contain formaldehydes, isocyanates and phenols to consolidate disturbed rock masses. These chemicals are known to cause a risk to health and safety of coal mine workers.
- Required biological surveillance monitoring is costly in terms of resources and administration

 plus it only detects an issue after the exposure.
- 3. Existing products produce exothermic temperatures in the range that causes a risk of self heating of coal to a point in which thermal runaway occurs, risking fire or explosion.
- 4. Low injection hole volume limits reduce the effectiveness of ground consolidation programs and require more holes or second rounds of pumping to achieve product pressure.
- 5. Requirements of fire watch negatively impact production and ties up the Deputy
- 6. Exclusion zones negatively impact production, other processes and reduce opportunities for multi tasking.

Our goal was to develop a product that eliminated the health risks to CMW's, improved the geotechnical performance and provided for productivity gains

人 STRATALOCK – Background

StrataLock has been a R&D Project for the past 5 years and is probably the most challenging of all the R&D we have undertaken.

Began years before the issues at Grosvenor. Actually, the project was delayed during that enquiry.

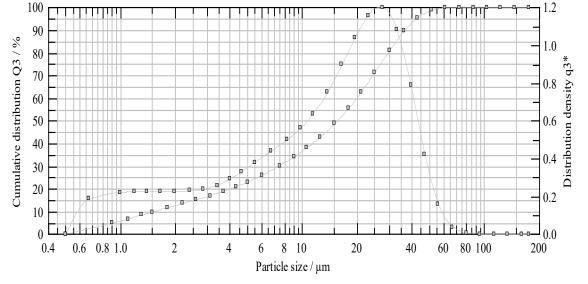
The target was to develop a strata consolidation product that is:

- **Harmless**: nil isocyanates, phenols, formaldehydes or anything else that requires exclusion zones or is toxic to life as we know it with no need for biological surveillance monitoring
- Does not generate excessive heat i.e. 40 degrees (seam temp) was the target so colder than most cement grouts or concrete used underground now.
- Has an increased volume limits per hole 600kgs or more (max limit ever allowed to date)
- Conforms to the requirements of polymeric chemical approvals process i.e. is Licensed
- Fine enough to permeate and migrate through coal and the surrounding strata
- Is strong enough to work (stronger than coal) and gets to strength FAST (2 hrs)
- Is a competent adhesive material to bind strata
- Is practical to store, transport, mix and pump
- Can be pumped with proven pumping equipment and pumped FAST
- Can use existing packers, dowels drilling etc systems
- Can be protected in terms of IP and Patents etc



STRATALOCK – Geotechnical Properties

We started at the end use – must be an effective & efficient consolidation product, from a Geotechnical Engineering perspective.





Particle Size 85% <24µm

It's a microfine product in terms of particle size and distribution.

Viscosity – 430 cps (similar to motor oil)- so it can be pumped long distances

It will permeate anything that needs to be consolidated – even clay cores in earth dams.

MMAA July 2023

STRATALOCK – Geotechnical Properties

Material Property specification were targeted to consolidate soft rock strata

- ✓ UCS 15 MPa (twice the strength of rockmass scale coal)
- ✓ Flexural Strength 2.5 MPa
- ✓ Bond Strength Failure of coal not of StrataLock
- ✓ Strength gain
 - ✓ 0.5 hrs approx. 40%
 - ✓ 1 hr approx. 50%,
 - ✓ 'Full' strength at 2.5 hrs
- ✓ Gel time 4 mins
- ✓ Can be varied (2mins several hours)

Cure Time	Compressive Strength
0.5 hrs	6 MPa
1.0 hrs	7.8 MPa
2.5 Hrs	15 MPa



人 STRATALOCK - Health and Safety

Health Assessment - Occupational Hygienist, Kerry McDougall - Certified Occupational Hygienist, MAIOH, COH[®] Occupational Hygiene Consulting Pty Ltd

- ✓ Review of potential health risk based on ingredients
 - No reason to recommend biological surveillance monitoring of operators
- Participated in operational Risk Assessment for Trial and Use on Underground Mine Sites
- ✓ Review of Safe Work Procedures
- Testing of formaldehydes, isocyanates and phenols contents
 - ✓ Below limit of reporting (<0.004%)</p>

Micro hood XRF testing

- ✓ Nil formaldehydes, isocyanates or phenols detected
- Some very low levels of VOC's targeted personal exposure monitoring during trials, results show levels lower than detectable limits



J STRATALOCK - Health and Safety

Product SDS's

- Classified as NON-HAZARDOUS and NON-TOXIC as per the Safe Work Australia Criteria
- ✓ Available on ChemAlert

PPE Requirements – based on SDS's and Health assessment

- ✓ Splash proof goggles
- ✓ PVC/Rubber Gloves
- Overalls (not-sperm suits, so increased operator comfort & less heat stress)
- ✓ P1/P2 Dust mask



MMAA July 2023







Licence No: MLA 0016121 Reference: CERT0007482

We are very proud to be able to announce that StrataLock recently (October 25th 2022) gained full licensing and approvals from the NSW Mines Department.

MDG3608 Testing for polymeric materials

- ✓ Max exothermic temperature 42.4°C
- ✓ Electrical Resistance
- ✓ Fire resistance and propagation
- ✓ Flash Point
- ✓ Oxygen Index
- ✓ FTIR for isocyanates Nil Detected
- ✓ Review SDS

LICENCE FOR UNDERTAKING A POLYMERIC PROCESS POLYMERIC PROCESS LICENCE (PUR BASED CHEMICAL)

This licence is granted, subject to conditions, to the licence holder specified below, in accordance with section 158 of the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2022* (the Regulation). This licence authorises the carrying out of the activities authorised by this licence as specified below, at the nominated facility location(s) specified below.

The conditions of this licence are:

- conditions imposed by the Regulator in accordance with sub-section 159(1) of the Regulation, set out in Schedule 1 to this licence, and
- conditions imposed by sub-section 159 (2) (4) of the Regulation.

Contravening a condition of this licence may result in suspension or cancellation of this licence, under sub-section 160(1) of the Regulation.

Licence holder	Strata Linings Pty Ltd ABN 69 102 308 707, ACN 102 308 707	
Address of licence holder	117 Moira Park Rd, MORISSET NSW 2264	
Licence number	MLA 0016121	
Issue date	25 October 2022	
Expiry date	24 October 2027	
Nominated facility location	Underground coal mines in NSW	
Polymeric chemical product	StrataLock	
Activities authorised by this licence	Consolidation of Rock Masses from injection of StrataLock under pressure,	

For any enquiries, please phone the Mining Authorisations Team on 1300 814 609 or email mca@regional.nsw.gov.au.

4 Ber

Garvin Burns Chief Inspector of Mines Resources Regulator Signed under delegation from the Secretary, Regional NSW

25 October 2022

MMAA July 2023

人 STRATALOCK-Licencing

One of the key performance criteria we had was as low an exothermic reaction temperature as possible.

We targeted 40 degrees (around the in-situ coal temperature in QLD at depths of 300m)

We achieved a maximum exothermic temperature as per **MDG3608** Testing of 42.4°C – there is no risk of thermal runaway or induced spontaneous combustion





MAXIMUM EXOTHERMIC REACTION

Samples: Strata Lock Part A & Part B liquids



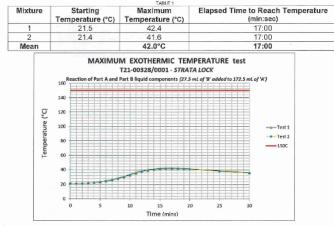


Figs.2a & 2b: Part 'A' & 'B' pre-cursor liquids - and cured resin after mixing

Test Date: 9th of June, 2021

Method of Analysis: MDG3608, Appendix D1 – Maximum Exothermic Temperature

Results:



Notes:

27.5 mL of Part B was added to 172.5 mL of Part A to make a 200 mL mix. Both solutions were stirred for 60 s and allowed to stand.

Any variation from Std./Test Method: None.

Requirements

A maximum exothermic temperature no greater than 150°C.

Sample Status:

The material complied with the Maximum Exothermic Temperature requirements of MDG3608, D1.2.

It is recommended that independent periodic type/conformance testing be repeated at least every 5-years, and whenever a change in the formulation, raw-material supply, manufacturing process or manufacturing location of the non-metallic material occurs.

G:\MSTCMsl\2021_Data\Materials\Strata Linings Pty Ltd(T21-00328_0001.docx

MMAA July 2023





(MATERIAL) SAFETY DATA SHEET ASSESSMENT

Sample:

Strata Lock ('Part A')

(Revision date: 26/5/2021)

Information Required for 16-Header SDS	Comments	
1. Identification of the Material & Supplier	*	
2. Hazards Identification	✓ Not classified as hazardous.	
3. Composition/Ingredients	 ✓ 1 hazardous (- eye-irritant) ingredient constitutes < 1% of substance only. 	
4. First Aid	✓ Specifies that eye wash facilities should be available.	
5. Fire Fighting Measures	No Hazchem code allocated. Select extinguishing agent 'suitable for surrounding fire'; no PPE specified but 'toxic gases may be evolved' in fire or when heated.	
6. Accidental Release Measures	✓ Refers Sects. 8 & 13.	
7. Handling and Storage	Advice to 'remove from incompatible substances'; incompatible substances listed in Sect 10.	
8. Exposure Controls/PPE	*	
9. Physical & Chemical Properties	✓ Very limited information/details provided.	
10. Stability and Reactivity	4	
11. Toxicological Information	1	
12. Ecological Information	 No information provided. 	
13. Disposal Considerations	*	
14. Transport Information	✓ Not a DG; no transport regulations applicable.	
15. Regulatory Information	✓ No Poisons schedule allocated.	
16. Other Information	1	

The Safety Data Sheet was assessed as specified in MDG3608, Appendix E.





(MATERIAL) SAFETY DATA SHEET ASSESSMENT

Sample:

Strata Lock Reagent ('Part B')

(Revision date: 26/5/2021)

Information Required for 16-Header SDS		Comments	
1. Identification of the Material & Supplier	~		
2. Hazards Identification	~	Not classified as hazardous.	
3. Composition/Ingredients	~	2 components only ; the 1 hazardous (- eye- irritant) ingredient constitutes '<10%' of total (2 nd ingredient '> 80%').	
4. First Aid	~	Specifies that eye wash facilities should be available.	
5. Fire Fighting Measures	~	Select extinguishing agent 'suitable for surrounding fire'; no Hazchern code; PPE specified; 'toxic gases may be evolved'.	
6. Accidental Release Measures	~	Refers Sects. 8 & 13.	
7. Handling and Storage	~	Advice to 'remove from incompatible substances'; incompatible substances listed in Sect 10.	
8. Exposure Controls/PPE	~		
9. Physical & Chemical Properties	~	Very limited information/details; pH 2.0 - 2.5.	
10. Stability and Reactivity	~		
11. Toxicological Information	1	Skin & eye irritation; 'may result in (eye) burns with prolonged contact'	
12. Ecological Information	~	No information provided.	
13. Disposal Considerations	~	Needs to be neutralised with a basic solution.	
14. Transport Information	~	Not a DG; no transport regulations applicable.	
15. Regulatory Information	~	No Poisons schedule allocated.	
16. Other Information	~		

Sample Status:

The Safety Data Sheet was assessed as specified in MDG3608, Appendix E.

Sample Status:

人 STRATALOCK – Licencing

The product complied with every requirement of MDG3608

M.S.T.C. TEST REPORT T21-00328/0001

Company:	Strata Linings Pty. Ltd.	
Sample Description:	Strata Lock	
Intended Use:	Material Polymerised Underground	[refer MDG3608, Section 5]
Sample No.:	T21-00328/0001	



Figs.1a & 1b: Cured/solid sample material as supplied

SUMMARY

The material complied with the Maximum Exothermic Temperature requirements of MDG3608, D1.

The material complied with the Electrical Resistance requirements of MDG3608, Appx. D2.

The material complied with the Fire Resistance requirements of MDG3608, Appx. D3.

The material complied with the requirements for Fire Propagation of MDG3608, Appx. D4.

The material complied with the Flash Point requirements of MDG3608, Appx. D5.

The material complied with the Oxygen Index requirements of MDG3608, Appx. D6.

The material complied with the Chemical Characterisation of Components requirements of MDG3608, Appx. D7.

The Safety Data Sheets for the liquid components were assessed as specified in MDG3608, Appx. E

Analysed by: A.Thompson, J.Sanders, C.Teasdale

Checked by:

Authorised by:

G. Slater Manager, Mine Safety Technology Centre

Endorsed tests indicated by logo on test page

It is recommended that independent periodic type/conformance testing be repeated at least every 5-years, and whenever a change in the formulation, raw-material supply, manufacturing process or manufacturing location of the non-metallic material occurs.

> Department of Regional NSW - Mine Safety Technology Centre 8 Hartley Drive, Thornton NSW 2322 - PO Box 343, HRNC NSW 2310 PH: +61 2 4963 8700 - ABN 19 948 325 463

p.1 of

人 STRATALOCK – Licencing

As with all License conditions we have the ability to seek variations by providing evidence-based information, which we are in the process of doing.

The key StrataLock License conditions are:

- 1) Maximum hole volume 600kgs (this is the highest volume ever allowed to date we are seeking an increase based on the very low exothermic reaction temperature)
 - Currently seeking to increase hole volume to 1200kgs
 - Less holes to drill for maximum consolidation effectiveness
- 2) Zone of operation is 10m outbye and 50m on the return side of the application site, authorised persons can enter the ZoO authorisation can be given to any person who is trained in the product, aware of the hazards during pumping- there is no chemical hazard associated with the product.
- 3) No biological or surveillance monitoring required as the product is deemed nonhazardous/dangerous as per the Safe Work Australia Criteria.
- 4) No requirement for a fire watch.
- 5) Any CMW who is trained, deemed competent in the application of the product, operation of the pump and is authorised on site can apply the product.

MMAA July 2023

人 STRATALOCK – Application

Once we had a product, we had to make it practical to apply and easy to use.

- Pump configuration similar to current equipment – faster high volume pump 2 x as fast
- ✓ Use of standard injection consumables
 - ✓ Hydraulic hoses
 - ✓ Packers/lances
 - ✓ Gun and static mixers
- ✓ Common injection practices
- Neither Part A or Part B will set in lines until mixed at nozzle
- ✓ Residence time in hose is not an issue reducing waste and increasing efficiency



MMAA July 2023

人 STRATALOCK – Application

Everything is transported via custom designed bulk pods and ducks bills- removes the manual handling risks.

- 1. Transport material to site in bulk pods
- 2. Fill the Part A holding tank on the pump pod
- 3. Fill the Part B holding tank on the pump pod
- 4. Pump from holding tanks to injection site (Part A and Part B in separate lines)
- 5. Combine Part A and Part B at nozzle in static mixer
- 6. Product will Gel in 4 mins after combining

Large capacity pumping system means we can pump 600kgs in under 30 minutes



STRATALOCK– Site Introduction and Risk Management

As with all processes on a mine site StrataLock comes with the full dossier for:

- Equipment designed to be mine site compliant (manufactured in Emerald)
- Equipment includes operational & design Risk Assessments
- TDS and SDS for the products
- PPE & first aid requirements
- Training packages for equipment, transport and storage and applications (RII as per requirements of QLDs Recognised Standard 16)
- Training and competency accreditation
- License for the mine record
- Risk assessment for the application of the product
- Reporting templates
- QA system for ensuring performance

Turn key system.



J STRATALOCK– Manufacturing and QA

Ingredients only sourced from secure, high quality, ISO 9001 (or higher) accredited European and Australian suppliers

Currently StrataLock is manufactured in NSW, with a second plant being designed and built in Mackay in 2023.

The facilities are state of the art in terms of digital process control, inbuilt QA, batch tracking and testing – exceeds ISO9001 requirements.

Product manufactured at 20 tonnes per day per site, with ability to bolt on additional capacity with extra modules as demand grows.

Product has a nominal 12 month shelf life, with no need for onerous temperature-controlled storage conditions so we can keep a lot of stock on hand.

All manufacturing is undertaken under the ISO 9001 QA systems

Minimal environmental conditions on manufacturing, transport, storage or disposal due to the non-hazardous non-toxic nature of the product.

人 STRATALOCK – Summary

The target was to develop a strata consolidation product that is:

- ✓ Harmless: nil isocyanates, phenols, formaldehydes or anything else that requires exclusion zones or is toxic to life as we know it – with no need for biological surveillance monitoring
- ✓ Does not generate excessive heat i.e. 40 degrees (seam temp) was the target so colder than roof bolt resin, most cement grouts or concrete used underground now.
- ✓ Will have an increased volume limits per hole 600kgs or more (maximum ever allowed to date)
- Conforms to the requirements of polymeric chemical approvals process i.e. is Licensed
- ✓ Fine enough to permeate and migrate through coal and the surrounding strata
- ✓ Is strong enough to work (stronger than coal) and gets there FAST (2 hrs)
- \checkmark Is a competent adhesive material to bind strata
- \checkmark Is practical to store, transport, mix and pump
- \checkmark Can be pumped with existing equipment and pumped FAST
- ✓ Can use existing packers, dowels drilling etc systems
- ✓ Can be protected in terms of IP and Patents etc

STRATALOCK – Applications So Far

To date over 67,000 kgs of product has been used in real world applications at Carborough Downs Coal Mine in Queensland.

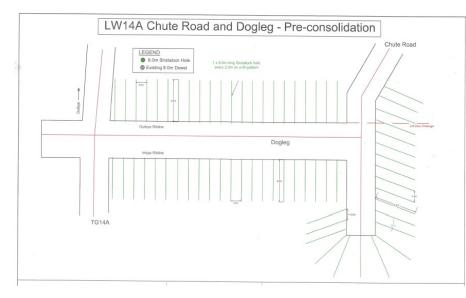
The applications include:

- 1) Pre-consolidation of the ribs in LW pre-driven recovery road and chute road
- 2) Longwall face strata stabilisation to regain control and resume normal operations after significant falls
- 3) Faulted ground stabilisation on a LW install face to stop deterioration and strata deformation
- 4) Sealing around ventilation devices to eliminate oxygen ingress in fractured roof, rib and floor (including stopping water flows from the floor)
- 5) Rib consolidation in faulted ground in the TG roadway to improve stability in front of the LW face

So far, we have not found an application that StrataLock cannot be used for in terms of ground consolidation

STRATALOCK – Applications So Far

Pre-consolidation of the ribs in LW pre-driven recovery road and chute road



Completed with no delays – including belt installation and VCD work being completed on the return side while injection was occurring

Significant migration of product noted – 15m away in the roof along a fault plane.



J STRATALOCK – Applications So Far

Faulted ground stabilisation on a LW install face to stop deterioration and strata deformation – "stood up like a brick wall"

From: Trent Andersen <<u>TAndersen@FitzroyOZ.com</u>> Sent: Wednesday, June 14, 2023 5:36:39 PM To: Gavin Byrne <<u>g.byrne@blackrockmining.net</u>> Subject: Strata lock

I am writing to express my satisfaction and provide a testimonial for your Blackrock product, Strata Lock. Our company recently utilized Strata Lock on our longwall face during the bolting process in MG14, in conjunction with Carbo Fill on bolting row 3. I wanted to commend your product for its excellent performance and the advantages it offered compared to other products.

The utilization of Strata Lock proved to be a remarkable asset for our operation. It allowed us to consolidate the face effectively while simultaneously carrying out parallel tasks on the face during pumping activities. This feature significantly enhanced our efficiency and productivity on the longwall face. We were able to complete the bolt up and recovery with minimal issues after using Strata Lock to consolidate the face.

Based on the success of this trial, we have made the decision to pre-consolidate our pre-driven stubs on our next Longwall block using Strata Lock. I firmly believe that this product will continue to deliver excellent results for us. We are particularly impressed by its ability to consolidate the ground effectively, as well as its capacity to allow parallel tasking on the longwall face during pumping activities. These features are crucial to optimizing our operation and achieving our desired outcomes.

We would like to extend our appreciation to your team for developing such a reliable and effective product. The performance of Strata Lock has positively impacted our operation, and we are confident that it will continue to do so in the future. We look forward to continuing our partnership with Blackrock and using Strata Lock as an integral part of our longwall operation.

Trent Andersen Longwall Superintendent



Fitzroy Coal Management Pty Ltd Peak Downs Highway, 13kms west of Coppabella, Coppabella Qld 4741 PO Box 532, Moranbah Qld 4744 M: 0437836982 E: TAndersen@FitzroyOZ.com W: www.fitzroyoz.com iii NOTICE

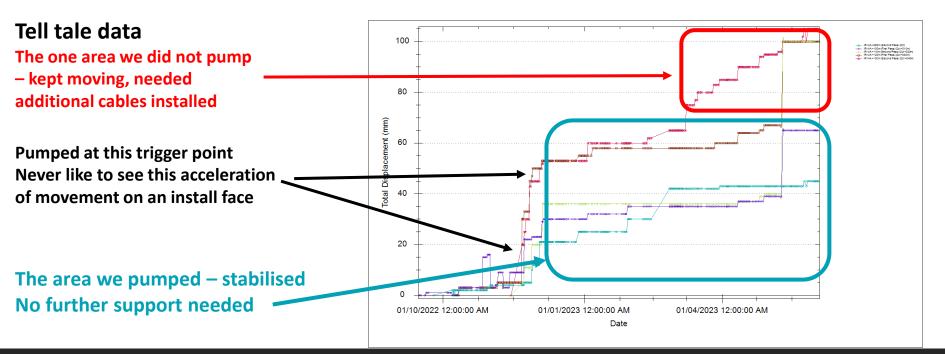
J STRATALOCK – Applications So Far

Faulted ground stabilisation on a LW install face to stop deterioration and strata deformation

9m wide install face in faulted ground – started to move rapidly.

Injected a series of rib and roof holes – stabilising the ground with no additional strata support required.

Injection occurred while pan line, TG drive and cable work was occurring on the pre-install.





J STRATALOCK – Applications So Far

Sealing around ventilation devices to eliminate oxygen ingress in fractured roof, rib and floor (including stopping water flows from the floor)

From: Sean Ewart <<u>sewart@fitzroyoz.com</u>> Sent: Friday, June 16, 2023 2:08:54 PM To: Gavin Byrne <<u>gbyrne@fitzroyoz.com</u>> Subject: FW: Testimonial for Strata Lock

Dear Gavin

Following a successful trial of the Strata Lock product at Carborough Downs, it has commenced use as an alternative to polymeric chemicals for strata injection. We recently had need to consolidate the ribs at one of our seal sites to provide a permanent control for methane emissions, rather than continued dilution. An application of Strata Lock successfully sealed leakage paths through the strata, effectively mitigating both methane emissions to the roadway and potential future oxygen ingress to the seal.

Following this success, it will be the product of choice for situations where rib consolidation is required in conjunction with seal construction.

Sean Ewart

SENIOR VENTILATION OFFICER



Fitzroy Coal Management Pty Ltd Peak Downs Highway, 13kms west of Coppabella, Coppabella Qld 4741 PO Box 532, Moranbah Qld 4744 T: +61749580818 M: 0409888939 E: sewart@fitzroyoz.com W: www.fitzroyoz.com M: Mortice

The information contained in this email message is confidential and intended only for the use of the addressee. It may also contain legally privileged information. If you have received this email message in error, you must not read, copy



JACK - Applications So Far

Testimonial from one very experienced ground consolidation applicator Unsolicited – he just loves this product.

	BMS STRATA SYSTEMS
	BMS·Strata·Systems·Pty·Ltd
	40 Creek Street, Level 6
	Brisbane City, QLD 4000
	ABN-91-383-829-253
To-Whom-it-may-concern¶	
Offices of Stratalock	
ſ	
Friday, 16-June 2023¶	
ſ	

·RE: Application of Stratalock¶

I-would-like to express my appreciation for Stratalock®. Having been involved in several applications now it has proven to be an effective replacement for previously used consolidation chemicals, with the added benefit of being non-hazardous and non-toxic which has resulted in lower levels of PPE being used (those chemical impervious coveralls were hot to work in). With the requirement of biological health monitoring no longer needed we can save time by moving directly onto the next job.¶

The familiar operation and controls made is extremely easy to adapt to the new pumping system which runs smoothly.

The migration of Stratalock® I have witnessed has been amazing, sometimes up to 12m from the injection point ¶

I-would like to thank-you for bringing this into the industry as it has been much anticipated and long overdue with personnel exposure to hazardous substances.

¶ Yours·sincerely,¶

Samuel-Tyson¤ Training Coordinator¶ BMS Strata Systems Pty Ltde



Operators in the correct PPE for pumping



The Next Step

We are currently finalising the design of StrataFoam – a cavity fill product that is based on the chemistry of StrataLock

So far we have achieved:

- Fast setting (same as conventional foams)
- 0.3 MPa closed cell (individual sealed bubbles for high deformation/compression)
- 8 15 x expansion factor working on increasing it
- Same application methods, same pump etc

Non-hazardous

No biological surveillance monitoring

Very low temperature

No chemical exclusion zones





Any Questions?

Thankyou