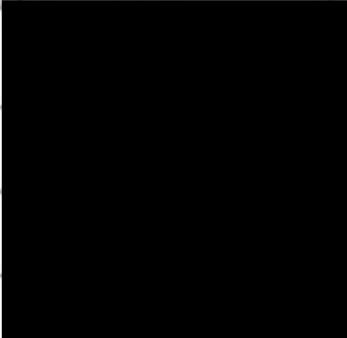
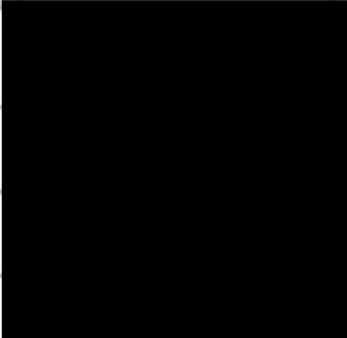
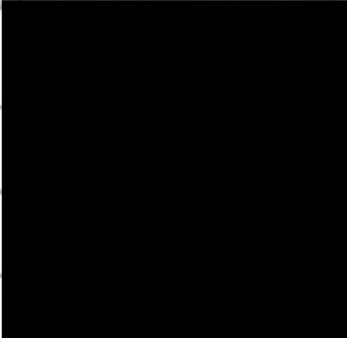


HAZARD MANAGEMENT PLAN (HMP)

Use of Polymeric Chemicals

Coal Mining Safety and Health Regulation 2017: Recognised Standard 16: The Use and Control of Polymeric Chemicals at Underground Mines.

GRO-5026-HMP- Use of Polymeric Chemicals			
Version 7.0 Sign Off			
Role	Name	Signature	Date
Statutory Owner (as required)	Wouter Niehaus		5/2/2020
Document Owner	Rob Nowell		10/2/2020.
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1 Purpose

The purpose of this Hazard Management Plan (HMP) is to provide a documented process at Grosvenor Coal Mine for the use of polymeric chemicals to achieve an acceptable level of risk.

2 Scope

This HMP applies to all coal mine workers at the Grosvenor Coal Mine engaged in activities referred to in this document.

3 Definitions

The following definitions are specific to this HMP. Term	Definition
Mining Supervisor	In relation to a coal operation, means a person identified in the management structure as a Deputy, Undermanager or Manager.
Biological Monitoring	Monitoring a person for a level of hazardous chemical, or metabolites of a hazardous chemical that is an indicator of exposure to a hazardous chemical.
Biological Monitoring Guideline Value (BMGV)	Biological monitoring guideline values are not health based. If they are exceeded it does not always mean ill health will occur, but it does indicate that control of exposure may not be adequate.
Biological Occupational Exposure Limit (BOEL)	Limits that are set at a level at which there is no indication from scientific evidence available that the substance being monitored is likely to be injurious to health.
DPI	Department of Primary Industries
Injection Point (IP)	11 those points within 10 meter radius of the site where polymeric chemicals are injected or free flow for the purpose of void filling, consolidation or injection into strata.
JSA	Job Safety Analysis
Phenol-formaldehyde resins (Phenolic Resins)	Phenolic Resins are a two-component system with Part A being the phenol and formaldehyde and Part B comprising an acid. Phenolic resins are intended for cavity filling, air and gas sealing and stabilisation of highly fractured strata. The mixing of resin and catalyst produces an immediate foaming reaction, followed by a rapid expansion of the product to as much as 35 times its original volume which then hardens in approximately 5 minutes. Brand specific and colloquial names include; Foaming - Carbofill, Rocsil, Minefill and injectables are Minebond, Fenoflex, Carbomine and Fixorapid.
Urea Silicate Resin	The chemical formulations of silicate resins are more complex than those of PUR. It essentially involves the mixing of an isocyanate (polymeric MDI) with a water-based sodium silicate solution. The resultant exothermic reaction cures to form a strong binding resin. Brand specific and colloquial names include; Mineral Bond A&B, Mineral Bolt A&B, Silcrete A&B, Geoflex A&B, Carbofix A&B
Polymeric Chemicals	Generic name given to an extremely fast reacting two-component injection resin specifically designed and used for the rapid stabilisation of coal and rock. Brand specific and colloquial names include; PUR, Bevedol, Bevedan and Geoflex.
Pump Zone (PZ)	All those points within a 10-metre radius of the pump in which containers of polymeric chemicals are being set up, pumped or demobilised.
Polyurethane Resin (PUR)	These resins are formed by mixing a Diisocyanate and a polyol in the presence of a catalyst. Isocyanates are a low molecular weight compound which are highly reactive. The diisocyanate used in PUR is methylene biphenyl diisocyanate (MDI). For example: Stratabond A & B, Bevedan & Bevadol, Marithan A & B.
Restricted Access Zone (RAZ)	All points for 350 metres on return airway side of ZOO whilst the product pump is energised. The RAZ ceases when pump is de-energised and confirmed by the ERZ Controller.
SDS	Safety Data Sheet

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ZOO	Zone of operation. The operational area between the pump zone and injection point where active hose lines run and the ventilation path from the pump to the injection point.
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4 Risk Summary

A Risk Assessment **GRO-1486-RA-Use of Polymeric Chemicals for Strata Consolidation and Sealing** was reviewed on the **10/07/2019** following the principles outlined in AS/NZS ISO 31000 format and complying with the Anglo American Integrated Risk Management requirements.

- A representative cross-section of affected coal mine workers were involved and identified hazards that exposed personnel to an unacceptable level of risk.
- The proposed controls have been deemed to provide an acceptable level of risk.
- No hazards identified were deemed unquantifiable.
- No non-consensus issues were raised during the risk assessment.

The following hazards and unwanted events have been identified during the Workplace Risk Assessment and Control (WRAC).

Describe the Energy Hazard that may be present	Describe the Potential Unwanted Event
Transportation and Storage	• Exposure of personnel to chemical by skin contact/breathing
	• Spill of chemicals leading to exposure
	• Personnel transporting material does not understand the product
	• Damage to containers during loading, transport and unloading resulting in spillage and reagent mixing
Pumping	• Exposure of personnel to chemical by skin contact/breathing
	• Chemicals at pressure (burst of hose / pumping device)
	• Strata failure due to overpressure or the of mix ratio
	• Injury to personnel while handling hoses and other equipment
	• Inadequate ventilation at pump site
Setting time of resin	• Self-generated fire of resin
Mining Process	• Contact with polymer chemicals particles (dust or lumps)
	• Shearing chemical foam
Return of Containers / Equipment	• Empty containers leading to the risk of personal injury or contamination
Completion of Tasks / Closeout communication	• Task incorrectly completed (strata failure)
	• Chemical exposure during flushing lines
	• Poor housekeeping (equipment left behind, chemical leaks)
	• Records not kept

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5 Chemical Testing

Only polymeric chemicals that have been subjected to the two (2) testing criteria specified below and have been issued with a report detailing compliance with these criteria will be acceptable for use:

Testing criteria 1: “Arnsberg Test” detailed in Appendix 1 or equivalent, and

Testing criteria 2: “MDG 3608 Appendix D – Polymeric Materials Test Manual – TM003”.

6 Training

CMW’s engaged in the storage, handling, use and disposal of polymeric chemicals must be trained and deemed competent. This training must cover the safety and health hazards associated with these chemicals and response to any uncontrolled releases of these products. Awareness training shall be conducted for all CMW’s in the chemical injection workforce as well as the ERZ controller in control of the area where the work is being conducted. Training packages relevant to the above must be provided by the polymeric chemical contractor for inclusion into the Grosvenor SHMS.

7 Plant & Equipment

7.1 Mixing & Pumping Equipment

The use of hoses, piping and fittings shall be undertaken in accordance with Mining Design Guideline 41: Guidelines for fluid power safety systems at mines (MDG 41). This shall include consideration of the following to ensure equipment is fit for purpose:

- Prior to use, all components (containers, pumps, hoses, o-rings, back-up rings, connectors, stand-pipes etc.) to be confirmed as being compatible with the chemicals being utilised.
- All fittings should be secured in place and have a safety factor of 4:1 on rated working pressure to the failure of the component to perform its function.
- All hoses should have a factor of safety of at least 4:1 on rated working pressure to burst pressure.
- All other components of the system should have a safety factor of at least 2.5:1 on rated working pressure to burst pressure.
- Hoses should not be interchangeable between chemical components. Where hoses are to be interchanged, this must only be done following a risk assessment that considers cleaning / rinsing requirements, compatibility of the chemicals being used and the potential impact of any reaction on the integrity of the hoses and fittings.
- Pumping equipment should be provided with a pressure relief safety valve on the pump that bleeds the over pressure back through the pumping system lines such that chemicals are not vented to atmosphere.
- Evidence of pump relief valve settings and calibration to be provided.

All hoses used shall be clearly identified:

- Polyurethane and Urea Silicate hoses - Component ‘A’ hoses are identified by WHITE tape, Component B by BLACK tape;
- Phenolic resin hoses - Component ‘A’ hoses are identified by GREEN tape and are 1” in diameter, Component B by RED tape and are ¾” in diameter. The last hose on the A and B Component lines are ¾” in diameter and 3/8” in diameter respectively.

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7.2 Inspection & Maintenance

7.2.1 Daily Maintenance Checks

Prior to commencing application, the polymeric chemical injection crew shall function test pump and perform ratio checks. Additionally, visual checks shall be conducted on pumps, hoses, product drums, fittings and pressure relief valves.

7.2.2 Weekly Maintenance Checks

The same checks as above shall be performed on a weekly basis by the crew, regardless of application work being conducted.

7.2.3 Monthly Maintenance Checks

A work order to capture monthly checks shall be in place, and these checks are to be conducted by a fitter referring to the pump operating manual.

8 Storage & Disposal of Polymeric Chemicals

Polymeric chemicals must be stored and disposed of in accordance with the manufactures instructions, the SDS and GRO-238-SOP-Using Hazardous Substances. All chemical containers including IBC's shall be bunged and have a means to prevent rain incursion. All chemical containers must be returned for disposal completely empty or with as little residue as possible. Partially full or contaminated waste containers will be tagged out of service with the tag identifying the product. All drums are to be resealed with original lids. Only enough polymeric chemicals for the planned application shall be taken into the mine. Any materials that are not used as part of the planned application shall be removed from the underground workings within 48 Hours.

8.1 Storage of Phenolic Resins

Phenolic resins are impacted by temperatures and must be stored in a refrigerated container and applied at a temperature ranging from 15 – 30° Celsius. As such, it is not to be removed from refrigerated storage until it is time for use. The catalyst must not be stored below 5°C or crystals will form.

9 Application of Polymeric Chemicals

9.1 Site Inspection / Job Assessment

- ERZ Controller is to inspect the area where the injection works are to be conducted identifying and demarcating high risk areas.
- Supervisor of injection crew is to conduct a site inspection with the ERZ Controller to identify material, equipment and manning needs as well as material pod and pump placement.
- Depending on the activity, the GRO-9458-FRM- Polyurethane Resin (PUR) / Urea Silicate Resin (USR) Application Report or the GRO-10063-FRM-Phenolic Cavity Fill Application Report is to be signed off by the injection crew supervisor as each section is completed.

9.2 Transportation of Pods Underground

- Pods are to be transported as per Mine Traffic Rules.
- All Pods shall be locked and fitted with product labels, SDS's and spill kits.
- All pods and equipment to be set up in designated areas as planned and communicated.

9.3 Setting up Pump and Associated Services

- Adhere to GRO-241-SOP-Control of Energy for identified sources of stored energy.
- ERZ Controller is to confirm ventilation requirements are adequate (a minimum of 0.7m/sec).

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- When using a Phenolic resin, conduct Draeger tube tests to determine Formaldehyde / Phenol concentrations at the pump site and injection point prior to pump start.
- Ensure DAC has been set up between pump and injection site.
- Establish the first aid kit and eye wash station at pump site and injection point.
- Ensure firefighting equipment is on pump pod and at the injection point.
- Establish restricted and exclusion zones as per below.

10 Restrictions

- Polymeric chemicals will not be injected where a cement or grout has not had at least 24hrs to cure.
- Maximum product volumes per hole are as per table 1 below.
- Injection resins must not be sprayed or used as a cavity fill.
- Do not stand on AFC while pressurising hole, as face may be encouraged to spall; and
- Do not stand directly behind feed pipe being injected, packer and consumables as they can be ejected from the hole under pressure.
- Access Restrictions (RAZ, ZOO, PUMP ZONE) are provided as Appendix A.

Table 1: Quantity (kg) of polymeric chemical not be exceeded per injection hole.















Polymeric injection chemical	Maximum quantity to be injected per hole
Phenolic injection resins (excludes phenolic cavity fillers)	600 kg
Polyurethane injection resins (PUR)	200 kg
Urea silicate resins	400 kg
Pumpable resin grouting systems	400 kg

11 PPE for the Task

11.1 Mandatory Task PPE requirements

As well as Grosvenor standard PPE requirements, the following PPE must be worn by all personnel decanting chemicals, operating the pump, operating the nozzle, flushing lines or manual handling product drums.

- Impervious chemical gloves, chemical resistant coveralls, chemical goggles, chemical resistant boots.
- GP1 Organic vapour respirators are to be worn when formaldehyde or phenol concentrations reach levels set out in GRO-10063-FRM-Phenolic Cavity Fill Application Report. GP1 Organic vapour respirators are to be available to all personnel accessing the ZOO or the RAZ.

						
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12 Health Effects

12.1 Health Effects from Exposure to PCI (Polymeric Chemical Injections)

Health effects from polyurethane resin (PUR) which is used for polymeric chemical injections (PCI) are associated with the use of isocyanates including irritation to the eyes, skin and the respiratory system. The most significant health effect associated with exposure to isocyanates for some individuals is occupational asthma caused by exposure as it is a respiratory sensitiser. Skin contact with unreacted catalyst can result in rashes, blistering and redness. Contact with the eyes can cause irritation, conjunctivitis and eye tissue damage

Urea silicate resins are a two-part system combining a sodium silicate mixed with di-isocyanate in the presence of a catalyst used in polymeric chemical injection processes. Like polyurethane resins the urea silicates have similar hazards and health effects to the PUR's. In addition, these products are strongly alkaline which is severely irritating to the eyes, respiratory system and skin.

12.2 Health Effects from Exposure to PCF (Polymeric Cavity Filling)

The health effects from phenolic resins which are used for polymeric cavity filling (PCF) are associated with the active ingredients including phenol, formaldehyde and the acid catalyst. Phenol is a highly corrosive and toxic substance that may enter the body through inhalation, ingestion and skin absorption as a vapour, liquid or solid. Exposure to phenol may result in acute irritant effects and systemic toxic effects. Phenol exposure may result in irritation of the nose, throat, eyes and skin burns. Systemic effects are nervous system impairment, liver and kidney damage;

Formaldehyde which is classified as a suspected human carcinogen is toxic by inhalation, skin contact and ingestion, and gives off formaldehyde gas which has a pungent odour. Breathing this vapour can result in irritation of nerves in the eyes and nose causing burning, stinging or itching, a sore throat, watery eyes, blocked sinuses and runny nose. Skin contact can cause skin rashes and allergic skin reactions, splashes in the eyes can cause irritation, corrosion of the cornea and possible blindness. Sulfuric acid is classified as a suspected human carcinogen when contained in strong inorganic acid mists, acids are highly irritating to the skin, eyes, mucous membranes and respiratory system.

13 Health Surveillance and Biological Monitoring

13.1 Health Surveillance Before Starting Work with Polymeric Chemicals

Persons with a history of asthma, atopic conditions, hay fever, recurrent acute bronchitis, interstitial pulmonary fibrosis, pulmonary tuberculosis, occupational chest disease and impaired lung function shall not be assigned roles undertaken in the zone of operation. A person with proven sensitivity shall not be further exposed to polymeric chemicals. A significant proportion of people who become sensitized do so in the first two months of exposure. It has been recommended that no person with liver damage be exposed to phenol at any concentration.

Coal mine workers who apply polymeric chemicals containing isocyanates must participate in routine health surveillance **prior** to starting work in an isocyanate process to obtain a baseline. This health surveillance medical will include:

- Collection of Demographic data, occupational and medical history;
- Standardised respiratory function test;
- Respiratory questionnaire;
- Skin examination.

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13.2 Health Surveillance During Work with Polymeric Chemicals

Another health surveillance medical shall be performed at **six weeks and then at six monthly** intervals during continued exposure. Where no adverse health effects occur, the Nominated Medical Advisor (NMA) may extend the interval to annually. This health surveillance medical shall include the following:

- Standardised respiratory function test;
- Skin examination.

13.3 Biological Monitoring

Exposure through skin absorption is the major route of entry when mixing and pumping polymeric chemicals and as such, biological monitoring using urine sampling provides the most accurate assessment of worker exposure.

At the completion of the shift, CMW's directly involved in the injection of Polymeric chemicals will be subject to random post shift urine testing at a rate of one in five (20%). This testing shall take place on site in accordance with "GRO-8387-SWI Collecting Urine Samples for Drug and Alcohol Testing and Health Monitoring". Specimens must be kept cool after collection and during transport to maintain specimen integrity. Specimens shall be transported to a NATA accredited laboratory as soon as practicable after collection.

13.3.1 Biological Exposure Limits and Guideline Values

The values listed in Table 2 have been established for the hazardous chemicals contained in polymeric resins and cavity filling products. The values listed in Table 2 do not represent the difference between safe and unsafe conditions.

Table 2: Guideline biological limits for polymeric chemical ingredients.

Polymeric Group	Chemical	Ingredient	Test	BOEL / BMGV
Polyurethane resins (PUR)		MDI / PMDI	Urinary isocyanate metabolites	1µmol of isocyanate-derived diamine/ mol creatinine in urine ^a
Silicate resins				
Phenolic resins and cavity filler		Phenol	Urinary phenol	2.1 mmol/ L ^b

a. This value is a Biological Monitoring Guideline Value (BMGV)

b. This value is a Biological Occupational Exposure Limit (BOEL)

13.3.2 Exceedance of Biological Exposure Limits or Guideline Values

Where airborne / biological guidance values or exposure limits are exceeded, the following personnel will be notified, and an internal investigation commence:

- Relevant CMW.
- Representative for the ground consolidation company.
- Anglo American company representative.
- Anglo American Occupational Hygienist.

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14 Atmospheric Monitoring

Although biological monitoring is the most accurate method to measure worker exposure, there may be circumstances where atmospheric monitoring may be desirable such as:

- Assessing the risk of airborne exposure through inhalation;
- Determining the effectiveness of ventilation quantities;
- Determining the level of respiratory protection required;
- Establishing restricted access zones.

14.1 Workplace Exposure Standards

Airborne concentrations of the individual chemical ingredients contained in polymeric chemicals formulations shall not exceed the limits specified in Table 2. These limits are taken from Safe Work Australia's "Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC: 1003(1995)]". Where extended shifts or unusual work schedules are worked, the allowable time weighted average concentrations shall be adjusted to consider the extended exposure time and reduced recovery time.

Chemical	TWA (mg/m ³)	STEL (mg/m ³)	Notices
MDI and PMDI	0.02	0.07	Sen
Phenol	4	-	Sk
Formaldehyde	1.2	2.5	Sen

*Sen: Sensitising agent – After sensitisation occurs an affected individual may react to very small exposures to the substance. Caution should be exercised where any exposure to these substances can occur.

**Sk: Absorption through skin may be a significant source of exposure

14.2 Formaldehyde Monitoring for PCF (Polymeric Cavity Filling)

The chemical injection contractor must ensure that Drager pumps and tubes required for monitoring formaldehyde levels are part of the equipment kit when undertaking PCF, with employees having received the relevant training required to undertake the monitoring. Drager tubes should only be used to assess the environment and not for providing an estimate of personal exposure. Formaldehyde monitoring is to be conducted as per GRO-10224-SWI-Application of Phenolic Cavity Fill.

15 Workplace inspections

Workplace inspections are to be carried out whilst pumping or injection is taking place. All zones and areas shall be thoroughly inspected for any evidence of heating by ERZC appointed to the zone. If any excess heating is observed, pumping shall be immediately stopped, and appropriate measure activated including cooling water and stone dust applied to the site.

15.1 Fire Watch Inspection

Commencing immediately following the injection of PUR and urea silicate products, the site of operation shall be inspected at intervals of not more than 30 minutes for a period of 4 hours to ensure that no undue heating occurs. This inspection should be conducted in accordance with section 305 of the CMSHR.

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16 Competencies and Authorisations

The following appointments, authorisations or competencies are required to implement this plan:

Designation	Training / Competencies / Authorisations required
Polymeric Chemical Awareness Trained	The trainee has gained a satisfactory knowledge of the hazards and first aid associated with the handling, storage and disposal of polymeric chemicals.

17 Roles and Responsibilities

17.1 SSE

The SSE shall:

- Ensure that the required actions specified within this plan are effectively implemented and applied across the Grosvenor Coal Mine.
- Ensure that adequate resources are provided to maintain compliance with the requirements of this procedure.
- Ensure that training, supervision and monitoring are provided to those bound by this procedure.

17.2 Supervisors

Shall ensure that:

- The ventilation measurement at the application site is taken prior to work commencing
- Ensure any relevant Isolations have been carried out prior to injection work.
- Check that Restricted Access Zone (RAZ) and Zone Of Operation (ZOO) barricades are in place with signage erected during application operations.
- Ensure all unauthorised personnel are removed from the ZOO and the RAZ when barricades are erected.
- To sign off the checklist steps prior to energizing the application system with chemicals and subsequently sign for the completion of the works.

17.3 Coal Mine Workers involved in the task

Shall ensure that:

- They comply with the requirements of this procedure.
- Ensure the required authorisation is in place to undertake the task;
- Ensure that the personnel assigned to the task have had the required training to undertake the task in a safe and efficient manner;
- Ensure that at the job site there are the relevant Standard, SWI, SDS, Injection Report and DII Licence;
- Ensure all Mandatory Personal Protective Equipment is worn and spares are available;
- Ensure that the equipment has the appropriate site introduction and approval;
- Check that the equipment is well maintained and regularly serviced and has the appropriate guarding and safety features; and
- Ensure all hoses are tested and tagged.

17.4 Contractor Engaged for Use of Polymeric Chemicals

- Comply with the requirements of this plan.

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- Ensure health surveillance and monitoring meets the requirements set out in this plan.
- Provide authority permits at start of contractual agreements and during work.
- Provide information to Grosvenor regarding overheating, disposing of spills, waste and spent containers by the way of SDS and procedures.

18 Records

The following records shall be maintained in accordance with this HMP:

- Health monitoring results.
- Training in this HMP.
- Incident investigations pertaining to use of polymeric chemicals.

19 Internal References

19.1 Grosvenor Coal Mine SHMS

- GRO-1486-RA-Use of Polymeric Chemicals for Strata Consolidation and Sealing
- GRO-241-SOP-Control of Energy
- GRO-8888-SWI-Unloading, Loading and Storing of Polymeric Chemical Deliveries
- GRO-9456-SWI-Application of Polyurethane Resin (PUR) and Urea Silicate Resin (USR)
- GRO-10224-SWI-Application of Phenolic Cavity Fill

19.2 Other Internal References

- Anglo American Fatal Risk Standards.
- Anglo American Golden Rules.

19.3 Forms/Registers/Checklists/Other

- GRO-2985-FRM-Permit to Pump Strata Consolidation Chemicals
- GRO-9458-FRM- Polyurethane Resin (PUR) and Urea Silicate Resin (USR) Application Report
- GRO-10063-FRM-Phenolic Cavity Fill Application Report

20 External References

20.1 Legislation

- Coal Mining Health and Safety Act 1999.
- Coal Mining Health and Safety Regulation 2017.
- Recognised Standard 16 – The Use and Control of Polymeric Chemicals at Underground Coal Mines

20.2 Other References

- Product specific SDS – to be included at work/pump location.
- Product specific DII License– to be included at work/pump location
- Safe Work Australia’s “Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC: 1003(1995)]”.

21 Review Criteria

This document shall be developed and reviewed in accordance with:

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- GRO-205-PRO-Communication, Consultation & Involvement.
- GRO-206-PRO-Document and Data Control.

22 Record of Consultation

The record of consultation and any objections shall be maintained in accordance with:

- GRO-206-PRO-Document and Data Control.

23 Document Control

ISSUE NO.	ISSUE DATE	DESCRIPTION	APPROVER
1	30/07/2015	New Anglo Grosvenor document.	Karl Barnsdale Brad Watson Justin Joubert
2	6/07/2016	Addition of Health Monitoring requirements/ contractor roles and responsibilities.	Wayne Pate Justin Joubert Wayne Bull
3	2/08/2016	Minor Wording change to health monitoring	Justin Joubert Wayne Pate Wayne Bull
4	20/12/18	Addition of ventilation requirements at injection point to align with WRAC	Kristie Davies Kate Bachmann Rob Nowell
5	23/01/2019	Changes to Section 4.5.4 RAZ Zones for Carbofill and PUR/ Geoflex Operations to align with licencing requirement for contractor MLA106900-2, MLA106899-2 and MLA1066897- 2	Kristie Davies Kate Bachmann W Niehaus M Kirsten
6	2/12/2019	Changes to entire document to align with Recognised Standard 16 – The Use and Control of Polymeric Chemicals at Underground Coal Mines.	Ryan Pitt Kate Bachmann Wouter Niehaus Rob Nowell

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APPENDIX A ACCESS RESTRICTIONS

Pump Zone (PZ) - Shall be treated as a Restricted Access Zone within a 10-metre radius of the pump in which containers of polymeric chemicals are being set up, pumped or demobilised. The only persons allowed to work within that zone will be the Pump Operator/s and individuals directly associated with the decanting or transfer of polymeric chemicals. These persons must be appropriately trained and wear the required personal protective equipment (PPE) as per the relevant SWI. The ERZ controller may enter this zone during pumping activities for the purposes of inspecting the workplace or auditing the work processes and procedures within that zone. Any other CMWs passing through this zone must have familiarisation training in the hazards associated with polymeric chemicals, have obtained permission from the ERZC and wear the appropriate PPE.

Injection Point (IP) - Shall always be treated as an exclusion zone when the pump is operating, and injection or free flow application is taking place. The only persons allowed within that zone will be the Injection Point Operator/s. The ERZ Controller may only enter this zone and remain in it whilst pumping and injection or application continues for the purposes of inspecting the workplace or auditing the work processes. It is understood that various other individuals may need to inspect the injection or void filling site, but this will only be undertaken during periods when all pumping and injection or application activities have suspended.

Zone of Operations (ZOO) – Shall be treated as a restricted zone at all times whilst the pump is operating. This zone will be restricted to persons and activities associated directly related to the pumping, or processes for the injection or application of polymeric chemicals. The only works able to be carried out in this zone whilst the pump is operating and injection or application is taking place will be such works directly related to the pumping, or processes for the injection or application of polymeric chemicals and shall be controlled by the outcomes of a formal risk assessment.

Note: Where the polymeric substance pump is located on the surface of the mine and the polymeric substances reach the workings of a mine via a borehole – all those points within 10 metres of the bottom of the borehole will be treated as a Pump Zone.

Restricted Access Zone (RAZ) – All access and works in this area will be restricted. Only the ERZC responsible for that zone can access the RAZ whilst the pump is operating. The only works that can be carried out in that zone, are those work required for the inspection of such places required by the mines health and safety management system to maintain the mine in safe condition and for any signs abnormal nature of polymeric substances. No other CMWs are permitted to access this zone whilst the pump is operating.

Boundaries of the ZOO and RAZ shall be clearly marked using caution tape and relevant signage.

Figure 1: Example of signage for ZOO



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Figure 2: Antitropical configuration

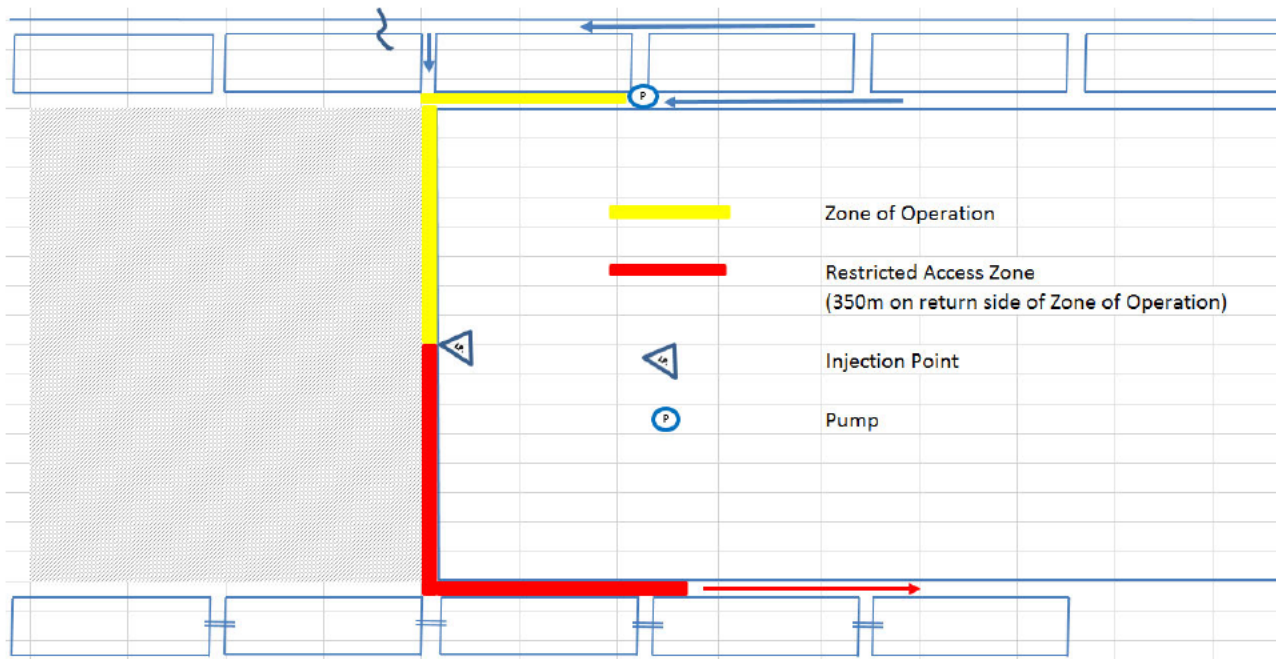


Figure 3: Homotropical configuration

