VULCAN MINE

Trigger Action Response Plan

Geotechnical Failure

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VUL-TAR-003-Geotechnical Failure	Tech Services Department	21/08/2023

HIGH WALLS / END WALLS				
Conditions/ Positions	**Normal State (Low)**	**Level 2 Response (Moderate)**	**Level 3 Response (High)**	**Level 4 Response (Very High)**
Trigger/ Conditions	General	General	General	General
	• As prescribed by OCE or Geotech representative.	• As prescribed by OCE or Geotech representative.	• As prescribed by OCE or Geotech representative.	• As prescribed by OCE or Geotech representative.
	Mining Practice	Mining Practice	Mining Practice	Mining Practice
	• Walls stable and excavated to design. • Batter angle at design. • Normal fretting of small-sized material from standing faces.	• Wall batter height slightly greater than allowable limits. • Batter angle slightly steeper than recommended. • Poor scaling, undercut, cling-on or ragged high-wall face.	• Wall batter height significantly greater than allowable limits. • Batter angle significantly steeper than recommended. • Significantly undercut, cling-on or excessively ragged high-wall face.	• Extensive blast damage behind presplit line or significant cling-on material in front of presplit line. • Severely undercut/over steepened wall. • Wall heights, benches or road widths severely outside allowable limits.
	Rock Structure	Rock Structure	Rock Structure	Rock Structure
	• All fallen fretted material causing no hazard and falling within established exclusion zone(s). • No extensive loose material protruding from faces. • No cracking in faces or behind crest lines. • No obvious signs of geotechnical instability • 45~50° fully blasted (buffered blasted) highwalls • Typically, presplit highwalls exhibiting "half-barrels" drill holes along length of highwall	• Frequent spalling/dribbling of rocks. • Notable amount of material falling from the high-wall, but still within the nominal 10m drop zone of the high-wall toe. • Opening of previously unseen cracks or joints on benches or batter faces. • Cracking <10mm in aperture (unless advised by Geotech engineer/consultant). • Total movement <2mm/hr (unless advised by Geotech engineer/consultant). (Applicable if laser scanner deployed) • Observation of fresh lipping in wall strata.	• Increased unexpected frequency of spalling/dribbling of rocks. • Significant amount of material falling from the high-wall, but still within the nominal 10m drop zone of the high-wall toe. • Increased opening of previously unseen cracks or joints on benches or batter faces. • Cracking between 10mm-20mm in aperture (unless advised by Geotech engineer/consultant). • Total movement between 2mm/hr – 5mm/hr (unless advised by Geotech engineer/consultant). (Applicable if laser scanner deployed) • Increased observation of fresh lipping in wall strata.	• Severe increase in quantity/rate of wall fretting or dribbling of rocks. • Severe widening of observed cracks or joints on benches or batter faces. • Large quantity of material falling off the high-wall, that extends outside the 10m safe working distance. • Increased lipping (overriding) of strata from a previous observation. • Cracking >20mm in aperture. • Total movement >5mm/hr. (Applicable if laser scanner deployed) • Unexpected movements measured by monitoring equipment.
	Water	Water	Water	Water
		• Wet weather conditions (intermittent showers or rainfall). • Increased accumulation of water along high-wall crest. • Minor water seepage from slope.	• Wet weather conditions (longer duration rainfall/storms). • Significant accumulation of water along high-wall crest. • Significant change in water flow in/out of slope.	• Wet weather conditions (low pressure systems/cyclones). • Severe accumulation of water along high-wall crest. • Severe change in water flow in/out of slope.
	Event	Event	Event	Event
	• Normal working conditions	• Slight shifting or movement of wall strata, creating abnormalities in the wall or bench above.	• Significant shifting or movement of wall strata, creating abnormalities in the wall or bench above.	• Wall or face failure, producing a significant volume of material.

Conditions/ Positions	Normal State (Low)	Level 2 Response (Moderate)	Level 3 Response (High)	Level 4 Response (Very High)
Coal Mine Workers	• Exclusion zone as per procedure. • To enter the drop zone in earthmoving equipment, the completion of a TAKE5 with attention to geotechnical risks and controls shall be completed prior to entry. • To enter the drop zone on foot, the completion of a JHA reviewed and signed off by both the OCE and the Mining Supervisor shall be completed prior to entry. Spotter to be used. • Lighting plants, pumps and other types of equipment can be set up within the drop zone following the completion of a JHA reviewed and signed off by both the OCE and Mining Supervisor. The positioning of this type of equipment in the drop zone should be seen as a last resort and alternative locations should be sought. • Parking areas and operator change out locations should be set up outside of normal stand-off area.	• Exclusion zone as per procedure. • Notify / report to Supervisor or OCE • To enter the drop zone on foot or within the cab of mobile equipment the completion of a JHA reviewed and signed off by both the OCE and the Mining Supervisor shall be completed prior to entry. Spotter to be used. • The time within the drop zone must be strictly limited to the task required. No parking or waiting to occur within the drop zone • Parking areas and operator change out locations should be set up in the middle of the working area between the High Wall and Low Wall.	• Withdraw from area (await further instructions from the OCE) • Notify OCE/Supervisor/Crew members. • Only the excavator bucket can enter the drop zone area. The excavator cabin and machine house are not to enter the drop zone at any time. No other mobile equipment can enter the drop zone at any time. • Assist in developing JHA as required.	• Withdraw from area (await further instructions from the OCE). • Notify OCE/Supervisor and fellow crew members. • Assist in developing JHA as required.
OCE/ Supervisors	• Visually inspect walls • Monitor for change • Check for signs of cracking and floor heave • Look for signs of wall fretting	• OCE shall inspect high walls at the working face as soon as reasonably practicable. • Reference in the OCE report shall include the Yellow (Moderate) TARP level zone and the identified hazard. • Barricade area or restrict affected area if required to assist in the identification of the drop zone. A grader rill of material may be placed approximately 10m out from the base of the High Wall. • Advise all affected personnel of any changes as required. • Investigate event • Assess risk to Coal Mine Workers and issue direction to Coal Mine Workers • Inform Superintendents / Managers • Document risk to Coal Mine Worker via OCE report. • OCE to confirm to all operations personnel when Trigger level has returned to Normal State	• Communicate hazard to crew and on-coming OCE/Supervisor. • Reference in the OCE report shall include the Orange (High) TARP level zone and the identified hazard. • Withdraw persons from affected areas. • Barricade, restrict, sign-post area as necessary. • Liaise with geotechnical experts and seek analysis and advice, if required • Develop mitigating action plan with technical services department. • Increased frequency of High wall or Low wall inspections by Mining Supervisor and the OCE shall be undertaken. • Report to Technical Services and SSE • Investigate event as an incident. • Implement additional controls to ensure safety of Coal Mine Workers as required.	• Ensure people and equipment are removed from the affected area. • Reference in the OCE report shall include the Red (Very High) TARP level zone and the identified hazard. • Ensure access is restricted to the affected area. • Continue monitoring (e.g laser scanner deployed) • Develop mitigation and/or recovery plan in consultation with technical services department and Geotech Representative. • Initiate emergency response if necessary. • Record and report via OCE reports. • Inform Line Superintendent / Manager and the SSE. • Participate in investigation and monitoring

Conditions/ Positions	Normal State (Low)	Level 2 Response (Moderate)	Level 3 Response (High)	Level 4 Response (Very High)
Operation Superintendent	• Maintain routine inspections. • Monitor inspection reports • Conduct regular wall inspections	• Review inspection reports. • Conduct regular wall inspections and monitor.	• Investigate and report to SSE • Review plan to continue safe mining • Review PHMP and risk control effectiveness.	• Delegate responsibilities to recover area • Review PHMP and risk control effectiveness.
Technical Services Department	• Maintain routine inspections. • Ensure periodic geotechnical review of mine conditions. • Maintain Geotechnical database	• Review/assess the problem area. • Implement monitoring procedures • Conduct regular wall inspections • Monitor and record signs in database • Issue Geotechnical Hazard Alert	• Detailed review/assessment of the problem area. • Continue monitoring procedures and inspections • Ensure appropriate Geotechnical review. • Provide technical advice/direction on mitigating action plan with OCE. • Consider JHA to document and communicate controls. • Review available reports • Issue Geotechnical Hazard Alert • Report to internal and external stakeholders as required. • Operation – Technical services department to confirm to all operations personnel when Trigger level has returned to Yellow (Moderate) or lower	• Provide technical advice/direction on mitigating action plan with Geotech representative OCE. • Facilitate Geotechnical advice as requested. • Oversee adequacy of resources for emergency response. • Review PHMP • Issue Geotechnical Hazard Alert • Report to internal and external stakeholders. • Participate in investigation as required. • Commission advice from geotechnical consultants to determine the controls necessary to achieve an acceptable level of risk. • Confirm to all operations personnel when TARP Trigger level has returned to Orange (High) or lower
HST	• Monitor all training and competence for relevant activities on site	• Monitor responses against documented controls. • Review and/or reallocate monitoring for emerging issues.	• Monitor responses against documented controls. • Review and/or reallocate monitoring for emerging issues.	• Assist incident investigation.
Senior Site Executive	• Monitor the application of the Geotechnical Principal Hazard Management Plan. • Monitor for compliance and application of the SHMS.	• Monitor and review team actions. • Increase inspections of hazard area • Delegate responsibilities of geotechnical PHMP as required	• Monitor and review team actions. • Increase inspections of hazard area • Delegate responsibilities of geotechnical PHMP as required	• Monitor and review team actions. • Direct appropriate implementation of geotechnical PHMP as necessary. • Initiate review of geotechnical PHMP if necessary. • Review emergency response. • Inform relevant stakeholders as required (e.g. Mines Inspectorate). • Delegate responsibilities of geotechnical PHMP as required.

LOW WALLS/ SPOIL DUMPS				
Conditions/ Positions	**Normal State (Low)**	**Level 2 Response (Moderate)**	**Level 3 Response (High)**	**Level 4 Response (Very High)**
Trigger/ Conditions	General	General	General	General
	• As prescribed by OCE or Geotech representative.	• As prescribed by OCE or Geotech representative.	• As prescribed by OCE or Geotech representative.	• As prescribed by OCE or Geotech representative.
	Mining Practice	Mining Practice	Mining Practice	Mining Practice
	• Tip head height less than or equal to 20m. • Overall dump slope angle at design recommended.	• Tip head height less than or equal to 20m ~ 25m • Overall dump slope angle slightly greater than design recommended.	• Tip head height is greater than 25m~30m • Overall dump slope angle significantly greater than design recommended.	• Tip head height is greater than 30m • Overall dump slope angle severely greater than design recommended.
	Slope Behaviour	Slope Behaviour	Slope Behaviour	Slope Behaviour
	• Stable Dumps • Minimal Compaction at Dump Tip Head • No cracking at Dumps • Tip head bund constructed of competent material	• Preliminary signs of Slumping at Dump Tip Head. • Cracking Developing at Dumps • Tip head bund constructed of non-competent material • Minor cracks are developing at dump crest; or • Windrow showing signs of slumping; or • Occasional dumping of weak and inadequate material (wet, muddy material); or • Water seepage from dump toe; or Bulging dump toe • Cracking observed • Minor skin slippage on the low-wall batter. • Floor dip ≥ 10% (6 deg).	• Major Cracking at Dump • Tip head bund missing • Imminent failure of dump indicated by rapid opening of cracks, floor heave, bulging toe, constant movement of spoil material. • Unsuitable dump floor. • Absence of windrows due to slumping. • Muddy water flowing freely from dump toe. • Imminent failure of dump toe due to excessive bulging. • Increased rate of cracking • Minor skin slippage on the low-wall batter. • Floor dip ≥ 15% (8.5 deg).	• Rapid opening and development of cracks. • Rapid onset of floor heave at dump toe. • Excessive cracking • Severe changes in the level of the dump, bench or batter face that presents an immediate risk to persons or equipment. • Floor dip ≥ 21% (12 deg). • Dump failure. • Abnormal or large variation in slope movement
	Water	Water	Water	Water
	• No water pooling near dump edges.	• Accumulation/ponding of water near dump edges that is not free draining.	• Significant accumulation/ponding of water near dump edges that is not free draining.	• Severe accumulation of water at dump crest line or water flowing over dump. • Muddy water flowing freely from toe of dump.

Conditions/ Positions	Normal State (Low)	Level 2 Response (Moderate)	Level 3 Response (High)	Level 4 Response (Very High)
Coal Mine Workers	• Frequently check tip head • Look for signs of slumping, low windrows or cracking • A truck operator could reliably expect that the dump edge could support the haul truck and that the safety berm was made of competent material	• Report to OCE • Keep a minimum of 20m from tip head (await further instructions). • If continual dumping of weak and inadequate material (wet, muddy material) advises Mining Supervisor / OCE of requirement to dump unsuitable material and seek confirmation for correct dumping location. • Haul Trucks Operators shall dump in accordance with OCE direction (e.g. Dump 50/50) for repair of the dump surface.	• Notify OCE/Supervisor/Crew members. • Keep a minimum of 20m from last cracks at tip head • Await further instructions. • Haul Truck Operators to Dump Short in accordance with OCE direction. • Assist in developing JHA as required.	• Immediately evacuate affected area. • Notify OCE/Supervisor and fellow crew members. • Await instructions. • Assist in developing JHA as required.
OCE/ Supervisors	• Visually inspect dumps. • Monitor for change. • Check for signs of cracking and slumping. • Ensure windrow heights are maintained Record and report via OCE reports.	• Increase inspection frequency. • Change dump status as required. • Monitor, record signs and dump status in OCE Report. • Initiate monitoring (e.g laser scanner deployed). • Advise all affected personnel of any changes as required. • Communicate to haul trucks to modify dumping strategy as required (dump short and push, 50% short 50% over-tiphead). • OCE to confirm to all operations personnel when Trigger level has returned to Normal State.	• Communicate hazard to crew and on-coming OCE/Supervisor. • Withdraw persons from area. • Barricade area or restrict affected area. • Seek geotechnical advice and report to SSE. • Continue monitoring (e.g. laser scanner deployed). • Develop mitigating action plan with technical services department. • Consider JHA to document and communicate controls. • Record and report via OCE reports.	• Ensure people and equipment are removed from the affected area. • Ensure access is restricted to the affected area. • Continue monitoring (e.g, laser scanner deployed). • Implement emergency response in event of injury or equipment loss. • Report to Site Manager/SSE. • Participate in investigation. • Record and report via OCE reports.
Mining Operations Superintendent	• Monitor inspection reports. • Conduct regular inspections.	• Review inspection reports. • Conduct regular inspections.	• Investigate and report to SSE. • Review plan to continue safe mining. • Review PHMP risk control effectiveness. • Supervisors to confirm to all operations personnel when Trigger level has returned to Yellow (Moderate) or lower.	• Contribute to mitigation plan as required. • Delegate responsibilities to recover area. • Review PHMP risk control effectiveness.

Conditions/ Positions	Normal State (Low)	Level 2 Response (Moderate)	Level 3 Response (High)	Level 4 Response (Very High)
Technical Services Department	• Maintain routine inspections. • Ensure periodic geotechnical review of mine conditions. • Conduct regular dump inspections.	• Implement monitoring procedures • Conduct regular dump inspections. • Issue Geotechnical Hazard Alert.	• Detailed review/assessment of the problem area. • Ensure appropriate geotechnical review. • Provide technical advice/direction on mitigating action plan with OCE/SSE. • Consider JHA to document and communicate controls. • Review reports. • Receive regular updates. • Issue Geotechnical Hazard Alert. • Report to internal and external stakeholders as required.	• Provide technical advice/direction on mitigating action plan with Geotech representative, OCE & SSE. • Facilitate geotechnical advice as requested. • Participate in incident investigation as required. • Issue Geotechnical Hazard Alert. • Review PHMP risk control effectiveness. • Report to internal and external stakeholders. • Commission advice from geotechnical experts to determine the controls necessary to achieve an acceptable level of risk. • A formal risk assessment will then be conducted and a plan developed for resumption of work in this area (i.e., confirm to all operations personnel when Trigger level has returned to Orange (High) or lower.
HST	• Monitor all training and competence for relevant activities on site.	• Monitor responses against documented controls. • Review and/or reallocate monitoring for emerging issues.	• Monitor responses against documented controls. • Review and/or reallocate monitoring for emerging issues.	• Assist incident investigation.
Senior Site Executive	• Monitor the application of the geotechnical PHMP. • Monitor for compliance and application of the SHMS.	• Monitor and review team actions. • Inspections of hazard area. • Delegate responsibilities of geotechnical PHMP as required.	• Monitor and review team actions. • Frequent inspections of hazard area. • Delegate responsibilities of geotechnical PHMP as required.	• Monitor and review team actions. • Direct appropriate implementation of PHMP as necessary. • Initiate review of PHMP if necessary. • Review emergency response. • Participate in incident investigation. • Inform relevant stakeholders as required (e.g., Mines Inspectorate).