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Method Statement (Bioremediation of hydrocarbon impacted soils&water)



METHOD STATEMENT FOR THE REMEDIATION OF HYDROCARBON

IMPACTED SOILS AND WATER ON BMM BY ECO-CON



3 TREATMENT OF HYDROCARBON CONTAMINATED SOILS

3.1 Overview

The soils requiring treatment will all be sourced from the Storage Site. The aim of the bioremediation works is to reduce the Total Petroleum Hydrocarbons (TPH) concentrations within the soils, thereby making them suitable for re-use on site. Initially only 10m³ will be sourced for the tests, should the tests be successful, the bulk material will be treated

The soils to be treated have been identified during previous site investigation, and will undergo further delineation as part of the ground remediation works. The soils requiring treatment will be excavated and taken to a specially designated bioremediation treatment area located in the same evaporation pond. The soils will then be processed, formed into windrows and undergo ex-situ bioremediation.

In light of this the works will be executed in accordance with the Quotation as agreed by Eco-Con and Vedanta

3.2 Treatment Methodology

Hydrocarbon contaminated material will be transported from the site identified, and end tipped within the designated demarcated area in order to undergo processing and final windrow formation. The windrows are typically 2.5m across the base and up to 0.5m in height. Their length will be determined by the available space.

The contaminated material will then be mixed with suitable organic matter, the amount of organic matter not to exceed 5% by volume of the final mixture.

Following introduction of the organic matter, the windrow will be turned and aerated regularly during the works (for up to 10 weeks) using workers and spades and TLB's.

All windrows will routinely remain covered by a rain-resistant membrane, weighted and secured with rocks or sandbags (except when turning or sampling operations are being conducted). This will mitigate the risk of rain infiltration and subsequent leaching of contaminants.

Hydrocarbon contaminated water will be treated with bacteria in the form of Eco H Tablets and Shock. The product is direct applied into the separator at the facility. Data sheets for the product will accompany the product to site.

Additional product may be applied depending on the outcome of test results. Considering the environmentally friendly nature of the products, overdosing is not possible.

3.3 Identified Hydrocarbon Contamination

Locations of potential TPH contamination shall be excavated and mixed to an even distribution over the windrow. This is to ensure that concentrated patches does not prolong the remediation process



**METHOD STATEMENT FOR BIOREMEDIATION OF HYDROCARBON
IMPACTED SOILS
At
BMM**

1 INTRODUCTION.

ECO-CON has undertaken the project at BMM Vedanta Company.

The purpose of the work is to remediate ground conditions on the mine with bioremediation and water treatment. The aim is to reduce the TPH levels.

Following this work ECO-CON were appointed to undertake ground and water remediation works in order to provide a site application to remediate all future contamination

The ground remediation works comprise of bulk soil already excavated and stored at a predetermined area lined with concrete. This area is suitable for the work we need to conduct. The water treatment will occur in the wash bay at BMM South Mine workshop near the entrance gate. The site is in close proximity of the exiting wash bay and is in use. There is an oil separator on site and should be serviced by the mine and kept running.

The aim of this document is to detail the bioremediation works proposed for the treatment of hydrocarbon impacted soils at South Mine and water treatment at South Mine

2 THE SITE.

2.1 Site Location.

Aggenheys – Northern Cape

2.2 Current Site Description.

Bioremediation Facility with water tank, sprinklers and solar pump installed



3.4 Sampling Protocol

Soil samples will be taken from the windrows every 3 or 4 weeks to monitor the rate of hydrocarbon biodegradation. The rate of sampling will be approximately one sample per 5m³.

Each sample will be an admixture of at least 5 sub-samples taken from a windrow. Sub-samples will be thoroughly admixed in a bucket, then half the composite discarded, the remainder remixed, half discarded and so on, until there is just enough material to fill the sample container. This mixing procedure ensures that the sample is highly representative of the soil in question.

Samples will be taken until TPH concentrations have reduced to a level deemed acceptable.

Collected samples will be transferred to a cool-box, prior to dispatch to the laboratory. Full Chain of Custody Documentation will be retained.

Bioremediation performance analysis will comprise of Aliphatic Aromatic Split Petroleum Hydrocarbon analysis. All laboratory testing will be undertaken by Potchefstroom University laboratory. Once all TPH results are found to have achieved the remedial criteria agreed upon, Eco-Con will recommend redeposit of the treated material and confirm completion of the bioremediation works. This will be communicated to the BMM Environmental team for approval.

4 ENVIRONMENTAL CONTROL AND MONITORING.

4.1 Site Security

The site is located within the boundaries of the BMM which is considered sufficiently secure.

4.2 Leachate

Bioremediation windrows in the evaporation pond will remain covered with rain resistant membranes, except when turning or sampling. This system prevents rain ingress into the windrows, and hence subsequent leaching. To further mitigate against leaching, the windrows will be located on concrete lining, and will prevent vertical migration of hydrocarbon contamination.

4.3 Dust

All operations on the evaporation pond will be visually monitored by Eco-Con staff, and should significant airborne dust be generated, works will be suspended until appropriate control measures have been put in place. However, due to the anticipated moisture content of the soils contained within the windrows, it is considered unlikely that airborne dust generation will be a problem during soils turning operations. Furthermore, the addition of organic matter is known to promote soil moisture retention.

4.4 Odours

The majority of odour release occurs during the initial excavation which will last for a relatively short period of time.

With regard to the bioremediation works, some odour release may occur during the initial turning phases of treatment. However, the addition of organic matter and the bioremediation

Method Statement (Bioremediation of hydrocarbon impacted soils&water)



process tends to bind in odours, which should mitigate against the generation of excessive odours. In addition, the location of the site is in an area of the mine, which is considered to be of relatively low sensitivity with regard to odour generation.

5 RECORDS

Information relating to the treatment of contaminated soils will be recorded and collated by Eco-Con. The following information will be obtained, and made available to Vedanta on request:

- Records of approximate windrow and stockpile volumes
- Records of samples taken from the windrows and laboratory test results obtained;
- Windrow monitoring records, in spreadsheet form.
- Reports of any accidents or incidents, and subsequent investigations, in line with company policy and legislative requirements.

Task/Activity	Hazard Description	Risk Effect	Consequence	Pre - Controls Risk			Pre Mitigation Risk Rating	Current Controls			Post - Controls Risk			Post Mitigation Risk Rating
				E	P	C		Engineering Ctrl	Operational Ctrl	Admin Ctrl	E	P	C	
Removing equipment from LDM	Spills	Material spills in uncontrolled area	Foreign material introduced into the environment	3	6	7	0	Rest in between			3	2	1	0
							128							6

Covering Soil with plastic sheets	Fire	Plastic sheets catching fire	Fatal Personal Injuries	10 10	3 3	40 15	1200 450	0	Fire extinguishers	No open fire are permitted on site. NO grinding, welding may be done in	10 10	1 1	15 7	150 70
<p>Participants: Garies Lambrecht / Jaco Geyser</p> <p>Doc no: BMM Biorem Rev no: Ver 2</p>														

Task/Activity	Hazard Description	Risk Effect	Consequence	Pre - Controls Risk			PPE	Current Controls			Post - Controls Risk			PPE	PPE Mitigation
				E	P	C		Engineering Ctrl	Operational Ctrl	Admin Ctrl	E	P	C		
Driving to evaporation ponds with LDV or TLB	Interacting with other TMM's in the area	Collisions between TMM's	Fatal Personal Injuries	10	3	40	1200	0	Traffic management plan, TMM COP			10	1	15	150
Collecting soil samples	Loose gravel/rocks	Sip and Fall	Personal Injuries	10	3	15	450	450	Safe mine	Competency training		10	1	7	70
Damping soil with water	Muddy/wet conditions	Sip and Fall	Personal Injuries	2	3	7	42			Look where you walk		2	2	3	12
Air rating soil by hand using shovel and wheelbarrow	Uneven ground	Sip and fall	Personal Injuries	10	3	7	210			Look where you walk		10	2	3	60
Removing equipment from LDV	Material falling	Material can fall onto personnel	Personal Injuries due to falling material	3	3	7	63			look where you walk		3	2	1	6
Operate TLB to aerate soil	Interaction with personnel	Coalition with persons	Fatal Personal Injuries	5	9	15	675			Rest in between, do not lift		3	2	1	6
Using TLB to transport water to site	Interaction with other TMM's	Coalitions between TMM's	Fatal Personal Injuries	10	3	40	450			Reverse alarm.		10	1	15	150
Covering Soil with plastic sheets	Fire	Plastic sheets catching fire	Fatal Personal Injuries	10	3	40	1200			Load tests to be done on lifting forks	Traffic management plan, TMM COP	10	1	15	150
Operate TLB to aerate soil	Ergonomics	Operator sitting for a full shift	Fatigue	10	3	15	450			no open fire are permitted on site. NO grinding, welding may be done in	Competency training	10	1	7	70
				12	11	40	5900			every 60 min of		10	1	15	150

Participants: Garies Lambrecht / Jaco Geyser														
Department	Black Mountain Mining													
Work Place Process	Bioremediation of soil													
Risk Type	Health													

Task/Activity	Hazard Description	Risk Effect	Consequence	Pre - Controls Risk			PPE	Current Controls			Post - Controls Risk			PPE	PPE Mitigation
				E	P	C		Engineering Ctrl	Operational Ctrl	Admin Ctrl	E	P	C		
Collecting soil samples	Dust, hydrocarbon vapours	Risk to respiratory system and health	Illness or disease	5	1	15	0		taking samples	done by person taking		2	2	3	12
Air rating soil with TLB	Noise	Generating excessive Noise	NJHL	8	3	8	192		Licensed Operator	noisy conditions is		3	2	4	24
Air rating soil with TLB	Creating Dust	Excessive dust	Dust inhalation	5	6	8	240		Closed cab for operator	dusty conditions is		3	2	1	6

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