



Debswana Jwaneng Cut 8 Project Report

Dust management technology provider Benmarc's chemical treatment system for dust suppression at the cut 8 expansion project at open cast diamond mine Jwaneng in Botswana, is in the final stage of its commissioning process. Benmarc was awarded the contract for the temporary and final positioning of the mineral sizer, as well as the installation of a dust suppression treatment system for the materials handling process at Jwaneng.

The temporary position was completed in November 2010 which enabled its effectiveness to be tested and allow for any modifications prior to its final positioning.

For the final positioning of the mineral sizer, a new dust suppression system was manufactured off-site, ensuring cost-effectiveness and efficient implementation.

OBJECTIVES OF THE PROJECT

To minimize dust levels during the tipping, crushing, conveying & stacking processes to levels below both 10mg/m³ 8-hour time weighted average total inhalable dust and 5mg/m³ time weighted average respirable dust per the MHSA. *(NO mg/m³ dust level was specified as part of the enquiry document. However, Benmarc will ensure that dust levels are brought well below these levels, as has already been proven on site at Jwaneng and all other sites of operation);*

- To improve the general working environment and conditions of employees by adequately suppressing such dust generated;
- To meet and exceed health, safety and environmental standards;
- To meet the ISO 14000 Environmental Management Certification requirements;
- To reduce impact of environmental risk to the surrounding vegetation;
- To utilise a system that is self-contained, secure and compatible with the integral Plant Control System.

Benmarc Environmental (Pty) Ltd; Unit 3, The Gables Office Estate, Weltevreden Park, 1715; PO Box 5192, Weltevreden Park, 1715

Tel: (011)679-3051; Fax: (011)679-3871; support@benmarc.co.za

APPLICATION LOCATIONS

The BENMARC ENVIRONMENTAL Dust Suppression Systems proposed in this document would cover the following process areas at JWANENG:- **AX22**

'MAIN TREATMENT AREA'

- a) Truck tip / reception bin
- b) Crusher
- c) Transfer tower / stockpile feed conveyor (tail-end)

'MINERAL SIZER TREATMENT AREA'

- a) Mineral sizer 'inlet' / tip
- b) Sizer
- c) Mineral sizer 'outlet' / stockpile feed

DESIGN PARAMETERS

Provisional design parameters for the dust suppression system are as follows:

Moisture Addition: 0.5% Maximum (0.2 – 0.5% per application)

Electrical: 525VAC, three phase, 50Hz for motors

Product: Kimberlite

Suppressant: BM210E 'Short-term' Suppressant;

BM-515E 'Residual' Suppressant;

Treatment Rates: 0.002 – 0.006 ℓ/ton of ore (BM210E);

0.02 – 0.06 ℓ/ton of ore (BM515E).

(These treatment rates will be optimized to best suit the actual site conditions during the commissioning and optimization phase).

EQUIPMENT DESCRIPTION

The dust suppression system is contained within a lockable 6m steel container. A 6m container allows for easier access to the equipment contained therein, and also allows sufficient space for future expansions / upgrades.

The containerised system houses the appropriately sized chemical pump(s), piping, chemical control valves, pressure reducing valves, non-return valves, water recirculation valves, pressure transmitters, local pump / motor isolator boxes, lighting, air-conditioning & electrical control panel amongst others. The water booster pump is located *outside* of the container, with a flanged off connection inside the container for possible future relocation of the booster pump inside of the container.

Container size – 6.1 x 2.44 x 2.59.



DUST MANAGEMENT

The system will suppress dust generation on the conveyor transfer, as well as dust generated from material dropping onto the stockpile

‘MAIN TREATMENT AREA’

Treatment points are as follows,

Truck tip / reception bin

A pair of manifolds will be located alongside the truck tip / reception bin area, running the length of this structure. An additional manifold will be installed below the walkway over the reception bin, which will act as a defensive barrier against the sudden rush of dust pushing through to the control room when tipping. These manifolds will operate as *one* unit.

The sensing of the truck tipping motion needs to be finalised between Bateman and Jwaneng. Whichever sensing device is chosen, this signal will activate the DSS, spraying across all manifolds in this area for a predetermined time period. At other sites, which will be the case for this system too, a selector switch is used varying the spray time between 30, 45 and 60 seconds per tip. The difference in time intervals can be modified on site, as can the final spray time selection – *programming changes performed by others.*

Product to be used is BM210E. The truck tip / reception bin shares the chemical pump for the mineral sizer inlet, as these two are identical process areas for their respective periods of operation during the year.

Crusher

A *pair* of manifolds will be located on opposite sides of the crusher. The apron feeder running signal (*supplied by others*) will be used to activate this part of the DSS. This treatment area requires its own dedicated BM210E chemical line (*installed by others*), as well as its own dedicated chemical pump, due to the large differences in chemical dilution and water flow rates between the truck tip and crusher.

This chemical pump is shared with the mineral sizer treatment point as these two are identical process areas for their respective periods of operation during the year.

Transfer tower / stockpile feed conveyor

Where the material transfers at this point, a pair of manifolds will be installed, one covering the top of the material, the other covering the bottom of the material as it is transferring through. In this way, all of the material is treated.

Chemical to be used is BM515E, the residual / 'stockpile' suppressant already in use at the current AX22 system, as well as the AX05 unit. Due to the different chemical, this treatment point requires its own dedicated BM515E chemical pump.

This pump is shared with the mineral sizer outlet suppression point, which feeds directly to the stockpile, as these two points are identical process areas for their respective periods of operation during the period.

MINERAL SIZER TREATMENT AREA

The sizer refers to the physical sizer as part of the mineral sizer structure. Currently, with the temporary position, a manifold has been installed over the sizer, which shares the *same line* as the inlet manifolds. For the final system, this application point will have its own dedicated BM515E line and chemical pump, *which is shared with the mineral sizer 'outlet' / stockpile feed point below*. The reason BM515E has been maintained as the suppressant for this point, instead of using BM210E, is to allow for better mixing time between the sizer and outlet of the mineral sizer, as the contact time of the suppressant and material is significantly shorter in this area when compared to the main treatment area.

Sizer

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Mineral sizer 'outlet' / stockpile feed

As with the temporary position, a pair of manifolds will be installed at the outlet of the mineral sizer – one in 'front', and one at the 'back' of the outlet. This has proven to provide the most effective dust suppression, as it is not possible to install the manifolds as with a normal transfer chute set-up.

The BM515E line and chemical pump is shared with the transfer tower / stockpile feed suppression point of the main treatment area, as well as the sizer point above.

Chemical flow rates are split between the sizer and sizer outlet

Benmarc Equipment Container

The dust suppression container itself will contain the chemical pumps, chemical actuators (*pneumatic, including air piping, separator, regulator and control solenoids*), pressure transmitters, pressure gauges, pressure reducing valves, incoming water line, outgoing chemical lines, chemical injection lines etc. Each pump includes a local isolator for lock-out purposes, as well as for emergency purposes. Other standard items include the electrical control panel, ultrasonic displays, magnetic flowmeter, air conditioner, lighting etc. The system is fabricated and tested off site, and will only be shipped to site once full pressure tests are performed on the piping and welds, as well as functional testing of the systems' operation, all of which require client acceptance and sign-off prior to shipment

To Summarize

There are two distinct areas of operation, namely the main treatment area which comprises the truck tip / reception bin, crusher and transfer tower / stockpile feed conveyor; and the mineral sizer treatment area comprising the mineral sizer inlet, sizer and mineral sizer outlet. The truck tip / reception bin and mineral sizer inlet are identical in principle in terms of moisture and chemical addition rates, as are the crusher and sizer, and transfer tower / mineral sizer outlet points.

Furthermore, the mineral sizer is only intended to operate for 2 weeks of the month, and thus all pumps sizing etc has been based on the main treatment area of 3 600t/hr. For this reason, chemical pumps are shared between the similar points, and each chemical pump will have ONE outgoing line from the DSS container, which will be teed off and split at an appropriate point in the field. An actuator will be placed at this point, allowing for fully automatic switching between application areas, as opposed to installing manual valves which are subject to human interference and tampering with, which ultimately affects the performance of the DSS and the level of suppression offered.

Every suppression point comprises a pair of manifolds, which will each have their own pneumatic actuator to control the suppression at these points. Nozzle sizes are determined based on coverage required at each point, as well as targeted moisture addition. Each manifold also includes a pressure gauge coupling, whereby a pressure gauge can be inserted during operation to determine actual pressure delivery at each point. This assists with the optimisation of the system, as well as ensuring exact moisture addition rates are achieved, further improving dust suppression capabilities of the system.

Commissioning and Testing

After installation of the Benmarc equipment Benmarc staff performed extensive functional commissioning on all equipment. At this time field staff “tuned” all application points. This is a very critical task and our staff’s extensive experience is an important assets. Attention is placed on achieving the lowest moisture addition and insuring sprays are only hitting material and not equipment. After several weeks of operational testing and tuning a series of dust test was preformed and presented to the customer.

The following picture show the visual difference of the testing performed

Stacking With No Treatment



Stacking With Water Treating Only



Stacking With Benmarc BM515E Treatment

