

Date: 26/05/2017

To

Additional Director (South)  
Ministry of Environment & Forest  
Regional Office (Southern Zone)  
Kandriya Sadan, IVth Floor, E & F Wings,  
17<sup>th</sup> Main Road, II Block Koramangala,  
Bangalore-560034

**Subject: 'Six Monthly Compliance Report of Bicholim Iron Ore Mine, Goa' (T.C.No. 11/1941, 12/1941, 13/1941, 14/1941 and 15/1941) for October 2016 to March 2017**

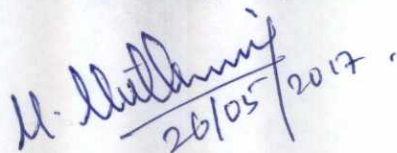
Respected Sir,

We are herewith submitting the condition wise compliance report & corresponding annexures and CD as per the conditions and their corresponding annexures laid down in the Environmental Clearance **J-11015/45/2005-IA.II(M) dtd 17.09.2007** for "Bicholim Iron Ore Mine (T.C.No. 11/1941, 12/1941, 13/1941, 14/1941 and 15/1941)" for the period **October 2016 to March 2017**.

Thanking You

Yours faithfully,

**For Sesa Mining Corporation Limited,**



M Muthumari  
Mines Manger  
Bicholim Iron Ore Mine

**Enclosures:** Six monthly compliance report & corresponding annexures and CD of Bicholim Iron Ore Mine for the period of **October 2016 to March 2017**.

**C.C – Member Secretary, Goa State Pollution Control Board**  
-- CGWB

**Compliance to conditions of Environment Clearance issued by  
Ministry of Environment & Forest for Bicholim Iron Ore Mine**

**Letter No. J-11015/45/2005-IA.II(M) dtd 17.09.2007**

**Period: October 2016 to March 2017**

Sr.No	EC Condition	Status of compliance	Remarks
<b>A.</b>	<b>Specific Conditions</b>		
(i)	Prior approval of the Chief Wild Life Warden, Govt. of Goa shall be obtained for mining within 10 km of the buffer zone of Dr. Salim Ali Bird Sanctuary.	The eco sensitive zones for the state of Goa have been notified by MoEF and Bicholim mines is out of the zone. As such the provision of Wild Life Protection Act is not applicable.	
(ii)	No dumping of overburden where natural slope is already exceeding 28° angle.	No dumping of overburden is carried out where natural slope is already exceeding 28° angle.	
(iii)	Top soil should be stacked properly with adequate measures at earmarked dump sites. It should be used for green belt development & for reclamation & rehabilitation of the mined out areas.	The mine is in operation for more than 50 years and most of the areas within the mining lease are broken up for mining. Hence there would be no generation of top soil.	
(iv)	OB and other wastes	Dumping of waste is	



	<p>should be stacked at earmarked sites and should not be kept active for long periods of time. Plantation should be taken up for soil stabilization along the slopes of the dumps and terraced after every 5-6 m of height and overall slope angle shall be maintained at 25-26°. Sedimentation pits shall be constructed at the corners of the garland drains. Retention/Toe walls shall be provided at the base of the dumps.</p>	<p>carried out at ear marked sites as per the approved mining plan. Most of the Overburden is backfilled into pits and are stabilized with geotextile &amp; plantation. Water is been channelized into the settling pit. Series of sedimentation pits are constructed at the corners of the garland drains and same are desilted before the onset of monsoon every year.</p>	
(v)	<p>Use of geotextile for dump stabilization shall be taken up in critical areas.</p>	<p>Geotextile are extensively used for covering dump slopes to prevent soil erosion.</p>	<p>Dumps are covered with the geotextile</p>
(vi)	<p>Catch drains and siltation ponds of appropriate size, gully plugs and check dams should be constructed to arrest silt and sediment flows from the mining operations. Desilting operations shall be undertaken regularly and particularly after every monsoon. Garland drain</p>	<p>All the runoff water is channelized into mining pits. Additionally garland drains and series of settling ponds of appropriate size and check dams are constructed to arrest silt and to ensure no sediment flow from the mining operations. Desilting of the settling</p>	<p>Following measures were taken: De-silting Rock wall constructions Garland drain</p>

	<p>(size, gradient and length) shall be constructed for both mine pit and for waste dump. Sump capacity should be designed keeping 50% safety margin over and above peak sudden rainfall and maximum discharge in the area adjoining the mine site. Sump capacity should also provide adequate retention period to allow proper settling of silt material. Sedimentation pits should be constructed at the corners of the garland drains. Desilted operations shall be undertaken after every monsoon.</p>	<p>ponds to increase their capacity is carried out before the onset of monsoon every year.</p>	
(vii)	<p>No drilling and blasting shall be undertaken without approval of the competent authorities.</p>	<p>No drilling and blasting is carried out in the mine. Hard material is broken by means of high capacity ripper dozer</p>	
(viii)	<p>Measures shall be taken for maintenance of vehicles used in mining operations and in transportation of mineral ore. The vehicles</p>	<p>Regular maintenance of vehicles and mining machineries are carried out by Company's own maintenance Department</p>	



	should be covered with tarpaulin and should not be overloaded.	to ensure that the emissions are within prescribed norms. Also PUC certificates for Transportation vehicles are obtained & maintained.	
(ix)	Plantation shall be done which includes a green belt of adequate width around the ML area, along roads, OB dumps (38.558 Ha), plant area by planting suitable native species in consultation with the local DFO / Agriculture Department. The density of the trees should be around 2500 plants per ha. Details of allocation of funds shall be made for afforestation and reclamation and details furnished to the ministry and to the MoEF RO, Bangalore.	Plantation of native species is being carried out on dumps	Plantation is been carried out by planting native species like cashew, arecanut, mango, coconut, guava, bamboo. Total plantation carried out for the year 2016-17 is 993 samplings planted within mine lease in an area of 1.6 ha, and 2046 samplings outside mine lease in an area of 0.2 ha
(x)	A Progressive Mine Closure Plan to reclaim an area of 220.22 Ha with plantation shall be prepared and implemented. The balance excavated	Progressive mine closure plan has been prepared and approved by IBM, wherein the details of backfilling and reclamation are covered.	

	void of 8.93 Ha shall be converted into a water reservoir and the sides shall be made gently sloping and plantation developed with peripheral fencing.		
(xi)	Wastewater from Mineral Beneficiation Plant and mine water shall not be discharged out of the ML and to agricultural fields unless it is treated to conform to prescribed norms. Regular monitoring of mine water discharged from all outlets of the mine into nearby water bodies - Bicholim River, water courses such as nallahs, tributaries, rivulets and to agricultural fields, shall be undertaken and proper records maintained thereof.	Waste water from Mineral Beneficiation Plant is discharged into tailing ponds. The beneficiation plant as well as the tailing ponds are located out side mine lease. Run off water from all parts of mine is channelized into mine pit, and suspended particles are allowed to settle through addition of flocculent and after treatment, water is pumped out. Regular monitoring of mine water discharge from all outlets of the mine into nearby water bodies is carried out and records of monitoring are maintained	Wet beneficiation plant was not in operation during this period
(xii)	Water harvesting measures should be taken up in and around mine site. Further,	Rain water is harvested by channelizing runoff water from dumps into mine pit,	



	desiltation of water harvesting structures such as check dams, water reservoirs and water channels within the lease area shall be carried out every year before the onset of monsoon.	through garland drains and trenches. The same water is used for activities like dust suppression and vehicle washing. The settling ponds constructed at the toe of the dumps also act as means for harvesting rain water and for ground water recharge. The same are desilted every year before onset of monsoon.	
(xiii)	No groundwater shall be used for mining operations. Prior approval of the MOEF and CGWA shall be obtained for using groundwater for mining/processing operations. Additional water requirement, if any shall be met from recycling of water from mining operations and from rainwater harvesting measures.	No ground water is drawn for the mining/beneficiation operations. Rainwater harvested in the mining pits is used for dust suppression and agriculture. Water treated in tailing ponds/thickener is reused for beneficiation and additional water requirement for beneficiation is met through river water.	Permission from Ground Water cell of Water Resource Department have been taken vide letter no. R-14/MIN9/16 dated:6/12/2016

(xiv)	<p>Regular monitoring of ground water level and quality should be carried out by establishing a network of existing wells and construction of new piezometers at suitable locations in project area. The frequency of monitoring should be minimum four times in a year -January, Pre-monsoon (April-May), monsoon (August), post-monsoon (November) and winter (January) seasons for groundwater level and in May for quality, particularly for heavy metals. Data generated from groundwater regime monitoring will be submitted CGWB, Regional Office on an annual basis. The monitoring shall include levels of heavy metals including iron.</p>	<p>Regular monitoring of ground water level and quality is carried out .</p>	<p>Water monitoring reports are attached in <b>annexure I</b></p>
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(xv)	A Final Mine Closure Plan, along with details of Corpus Fund, should be submitted to the Ministry of Environment & Forests 5 years in advance of final mine closure for approval.	Final closure plan approved by IBM will be submitted to MoEF in accordance with Rule 23 (c) of MCDR 1988 in due course of time.	Progressive Mine closure plan has been submitted
(xvi)	A Consent to operate should be obtained from GSPCB for expansion of mining operations.	Obtained consent to operate numbered 5/2569/15-PCB/CI-554 dated 07/09/2015 with validity upto 20/05/2017	

**B. General Conditions:**

<b>B.</b>	<b>General Conditions:</b>		
(i)	No change in mining technology and scope of working should be made without prior approval of the Ministry of Environment & Forest.	Mining is carried out as per mining plan approved by Indian Bureau of Mines	
(ii)	No change in the calendar plan including excavation, quantum of iron ore and waste dumps should be made.	Production & waste generation was carried in accordance with mining plan/ scheme by IBM.	

(iii)	Four ambient air quality - monitoring stations should be established in core zone as well as buffer zone for monitoring RPM, SPM, SO <sub>2</sub> ,NOX. Location of the ambient air quality stations should be decided on the meteorological data, topographical features and environmentally and ecologically sensitive targets and frequency of monitoring should be undertaken in consultation with the State Pollution Control Board.	Ambient air monitoring is conducted as per NAAQS in buffer zone (four locations)and Mine Specific Standard in core zone ( four locations). Monitoring is carried out by MoEF accredited lab .Reports are submitted to State Pollution Control Board.	Graphical representation of the air monitoring results are attached as <b>annexure I</b>
(iv)	Data on environmental quality should be regularly submitted to the Ministry including its Regional office located at Bangalore and the State Pollution Control Board / Central Pollution Control Board once in six months.	Environment report on water & air quality analysis is submitted to MoEF on six monthly bases with a copy to GSPCB.	
(v)	Adequate measures for control of fugitive emissions should be taken	The following measure are taken for control of fugitive dust emissions (1) Water sprinkling is carried out on	



	during drilling & blasting operations, loading & transportation of mineral, etc. Fugitive dust emission from all the sources should be regularly monitored and data recorded properly. Water spraying arrangements on haul road, loading and unloading points, and at transportation of minerals, etc. should be provided and properly maintained.	<p>haulage road to prevent the dust.</p> <p>(2) Dumps are covered with geotextile and are afforested with plants/grasses which help in minimizing the fugitive dust.</p> <p>(3) Ore carrying trucks are covered with tarpaulin &amp; free board is provided to prevent spillage.</p> <p>(4) No drilling and blasting is carried out.</p>	
(vi)	Adequate measures should be taken for control of noise levels below 85 dBA in work environment. Workers engaged in blasting and drilling operations, operations of HEMM, etc. should be provided with ear plugs / muffs.	Dumpers & Heavy Earth Moving Machinery are provided with A/C cabins which minimize the impact of noise on operator. Regular maintenance of Heavy Earth Moving Machinery is carried out, which helps in minimizing noise levels. All the employees working at mines are provided with personnel protective equipments like ear plugs / ear muffs	
(vii)	Industrial waste water (workshop, mineral processing plant and waste water from the mine) should be properly	Water from mine is properly channelized into settling ponds and treated before discharge if any outside the mine lease. Oil and grease trap is installed in the mine for treatment	

	<p>collected, treated so as to conform to the standards prescribed under GSR 422 (E) dated 19<sup>th</sup> May, 1993 and 31<sup>st</sup> December, 1993 or as amended from time to time. Oil and greases trap should be installed in the mine for treatment before discharge of workshop effluents. There shall be no discharge of waste water from the mine site even during peak monsoon season.</p>	<p>before discharge of effluents from workshop.</p>	
(viii)	<p>Personal working in dusty areas should wear protective respiratory devices and they should also be provided with adequate training and information on safety and health aspects. Occupational health surveillance program of workers should be undertaken periodically and take corrective measures, if required.</p>	<p>Regular monitoring of workers health is being carried out. However, for the safety of workers at site, engaged at strategic locations/dust generation points like loading and unloading points, dust masks are provided. Company has employed doctor who is trained in occupational health. Periodic personal dust monitoring is carried out for the employees for the exposure to dust and health records are maintained. Various awareness programmes are organized for the workers related to occupational health and safety issues.</p>	



(ix)	The data on environmental quality should be collected and analyzed either through an in-house environmental laboratory established with adequate number and type of pollution monitoring and analysis equipment or got analyzed through an approved laboratory under the Environment (Protection) Rules, 1986 in consultation with the State Pollution Control Board.	Data on environmental quality is analyzed by a MoEF approved Laboratory. The reports are submitted to MoEF and GSPCB on a regular basis.	
(x)	A separate environmental management cell with suitable qualified personnel should be set - up under the control of Senior Executive, who will report directly to the Head of the Organization.	Environment management cell consists of multidisciplinary qualified personnel. The department reports to the head of the organization.	<p>Chief Executive Officer (CEO)</p> <p>↓</p> <p>B Siva Kumar (Head HSE)</p> <p>↓</p> <p>Jagdish Desai</p> <p>↙      ↘</p> <p>Vandita      Sneha</p>

(xi)	<p>The funds earmarked for environmental protection measures should be kept in separate account and not diverted for other purpose. Year-wise expenditure should be reported to the Ministry of Environment &amp; Forests.</p>	<p>Separate funds are earmarked in the revenue budget for various environment activities like reclamation, dust suppression, erosion control measures, water treatment etc. with proper tracking.</p> <p>The environmental expenditure for FY 2016-17 for Bicholim Mine is:</p> <table><tr><th>Purpose</th><th>Amount in Rs</th></tr><tr><td>General Expenditure</td><td>1,089,147.32</td></tr><tr><td>Statutory Requirement</td><td>887,722.40</td></tr><tr><td>Mine reclamation</td><td>17,474.25</td></tr><tr><td>Erosion control</td><td>8,103,790.28</td></tr><tr><td>Water treatment</td><td>1,882,433.00</td></tr><tr><td>Dust suppression</td><td>8,349,141.92</td></tr><tr><td><b>Total</b></td><td><b>20,329,709.17</b></td></tr></table>	Purpose	Amount in Rs	General Expenditure	1,089,147.32	Statutory Requirement	887,722.40	Mine reclamation	17,474.25	Erosion control	8,103,790.28	Water treatment	1,882,433.00	Dust suppression	8,349,141.92	<b>Total</b>	<b>20,329,709.17</b>
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(xii)	<p>The project authorities should inform to the Regional Office located at Bangalore regarding date of financial closures and final approval of the project by the concerned authorities and the date of start of land development work.</p>	<p>Regional office, Bangalore is kept informed regarding date of final closure and final approval of the project by the concerned authorities.</p>																

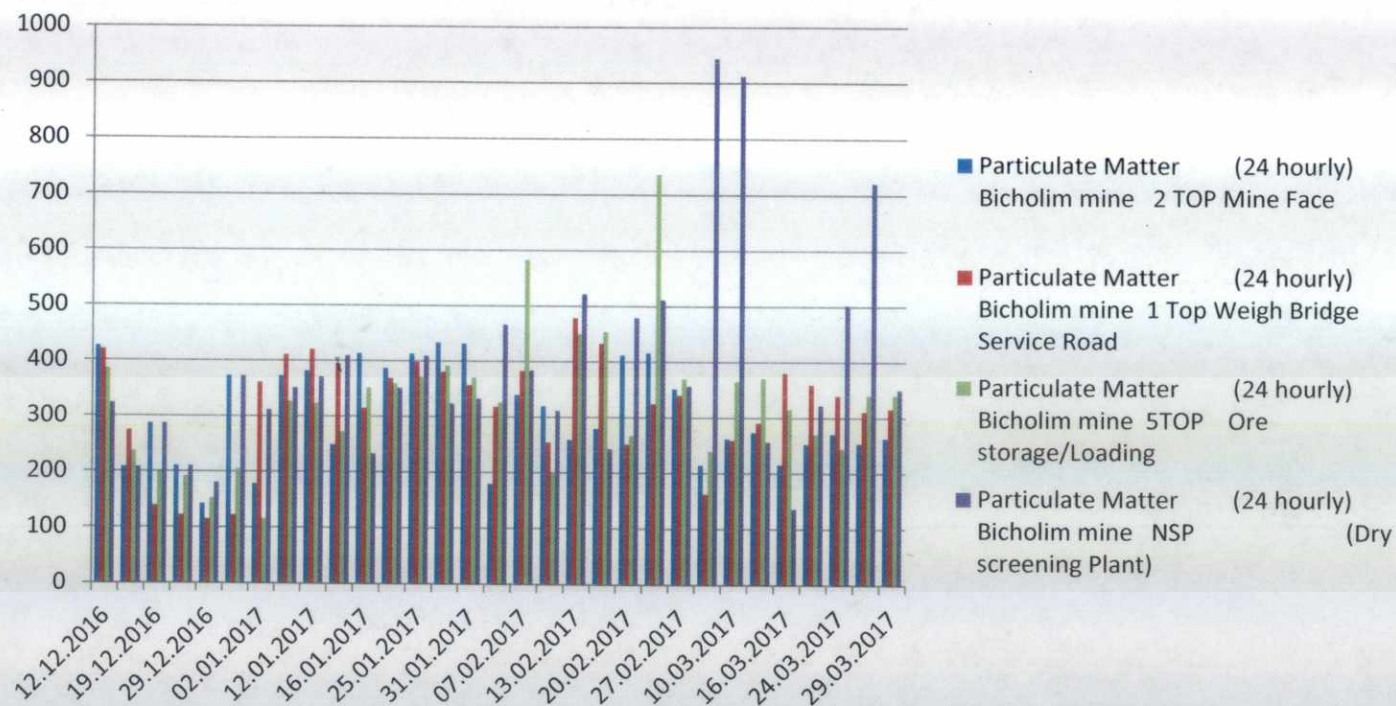


(xiii)	The regional office of the Ministry located at Bangalore shall monitor compliance of the stipulated conditions. The project authorities should extend full co-operation to the officer (s) of the Regional Office by furnishing the requisite data/information /monitoring reports.	Full co-operation and all necessary support will be provided during the visit and data will be furnished as per the requirements.	
(xiv)	A copy of clearance letter will be marked to concerned Panchayat / local NGO, if any, from whom and suggestion / representation has been received while processing the proposal.	A copy of the clearance letter has been submitted to concerned Panchayat	
(xv)	State Pollution Control Board should display a copy of the clearance letter at the Regional office, District Industry Center and collector's office / Tehsildar's Office for 30 days.		

(xvi)	<p>The project authorities should advertise at least in two local newspapers widely circulated, one which shall be in the vernacular language of the locality concerned, within 7 days of the issue of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution Control Board and also at web site of the Ministry of Environment and Forest at <a href="http://envfor.nic.in">http://envfor.nic.in</a>.</p>	<p>Advertisement of Environmental Clearance was published in two widely circulated news papers. i.e. Gomantak Daily and The Navhind Times dtd: 19.11.2005</p>	
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# **GRAPHICAL REPRESENTATION OF THE AIR QUALITY BICHOLIM IRON ORE MINE CORE ZONE**



**M/s Sesa Environment Laboratory**

Vedanta Limited, Mining Division, Codli Mines, P.O. Kirlapale, Goa-403727

Recognised by Ministry of Environment, Forests and Climate change, Govt. of India Vide Notification .S.O.137(E). Dated 12th January, valid up to 11.01.2020

\* Certified by ISO 9001:2008, ISO 14001 :2004 and OHSAS 18001:2007

**Well Water Analysis Report**

Mine Name: Bicholim Mine

Date of Sample collection :24.01.2017

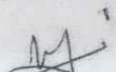
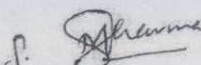
Standard method used for analysis: APHA Standard

Test Report No: 236

Date of Receipt of sample:24.01.2017

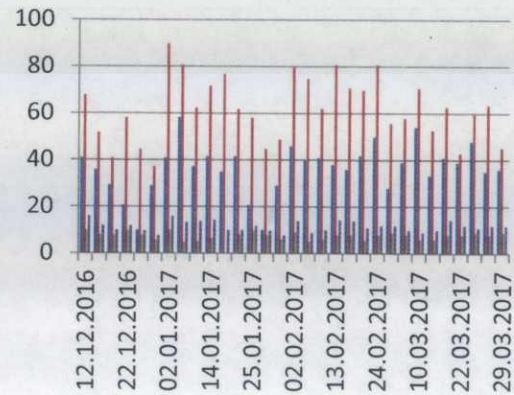
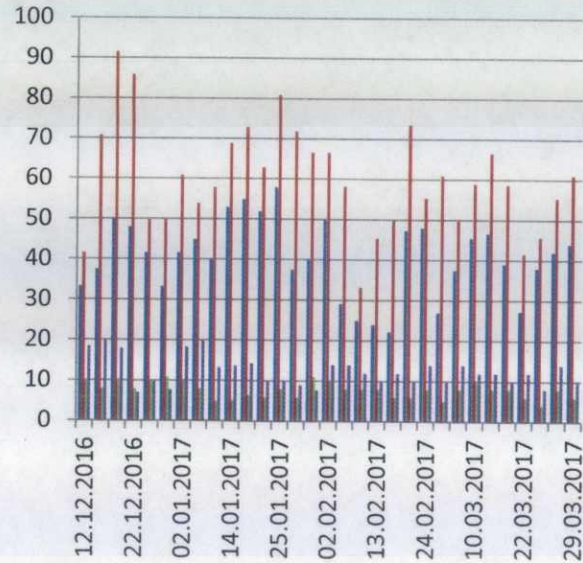
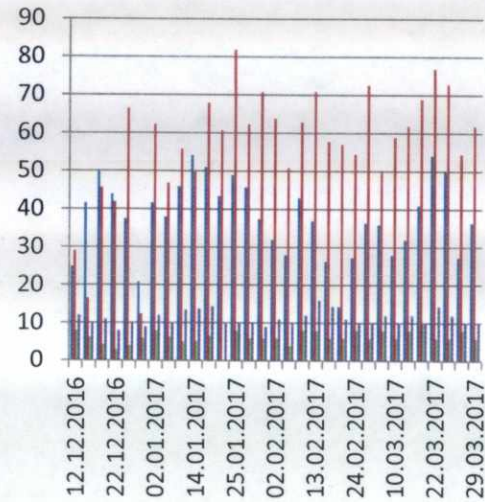
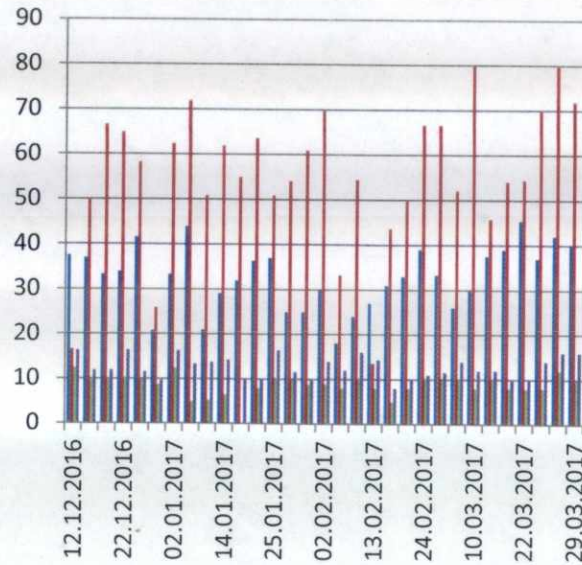
Analysis completion date:04.02.2017

Parameter	Unit	Permissible Limit	Location			
			Mayem Village Well	Pilgaon Village Well	Mulgao Well	Lamgao Well
Colour	Hazen	<5.0	<5	<5	<5	<5
pH	-	6.5-8.5	6.52	6.50	6.04	6.2
Turbidity	NTU	5	0.55	0.98	0.89	0.96
Conductivity	$\mu\text{S}/\text{cm}$	-	48.7	40	62	75
Dissolved Solids	mg/lit	500	20.8	21.5	31	41
Suspended Solids	mg/lit	-	1	1	1	1
Chloride	mg/lit	250	9.9	6.9	9.9	16.8
Total Hardness as $\text{CaCO}_3$	mg/lit	200	12	12	14	24
Calcium as $\text{Ca}^{++}$	mg/lit	75	2.4	2.4	2.4	5.6
Magnesium as $\text{mg}^{++}$	mg/lit	30	1.5	1.5	1.9	2.4
Sulphate as $\text{SO}_4$	mg/lit	200	1	1.1	1.2	1.1
Nitrate as $\text{NO}_3$	mg/lit	45	0.1	0.1	0.8	0.3
Alkalinity	mg/lit	200	14	15	11	16
Iron as Fe	mg/lit	0.3	0.09	0.07	0.03	0.06
Manganese as Mn	mg/lit	0.1	0.01	0.03	0.02	0.02
MPN/100ml	mg/lit	Absent	20	21	13	11

  
Govt. Analyst  
Laboratory Incharge



## BUFFER ZONE



### M/s Sesa Environment Laboratory

Vedanta Limited, Mining Division, Codli Mines, P.O. Kirlapale, Goa-403727

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dated 12<sup>th</sup> January 2015, Valid up to 11.01.2020


\* Certified by ISO 9001: 2008, ISO 14001:2004 and OHSAS 18001:2007

#### Well water level Report

Mine Name: Bicholim mine

Instrument Used: Well water level tape

Sr.No	Location	Total Depth of well	Depth of Water level from the reference point in mtrs	Water Column in mtrs
			24-01-2017	24-01-2017
1	Mulgao Village Well	7.1	5.5	1.6
2	Lamgao Village Well-Santosh	5.4	3.4	2
3	Pilgao Village Well- Ratur	5.75	4.4	1.35
4	Mayem Village-Mohan	9.25	7.9	1.35

  
Govt Analyst



  
Laboratory Incharge



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## Surface Water Analysis Report for the Month of January 2017

Mine Name: Bicholim Mine

Date of Sample collection : 20.01.2017

Standard method used for analysis: APHA Standard

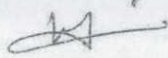
Test Report No: 227

Date of Receipt of sample: 20.01.2017


Analysis completion date: 27.01.2017

Parameter	Unit	Permissible limits	Location						
			1Top settling pond (Vagachiper lease Discharge)	2Top settling pond (Lamgao lease Discharge)	5Top settling pond (Totichomordon gor lease Discharge)	Upstream River Assanora	Downstream River Assanora	Upstream River Bicholim	Downstream River Bicholim
Colour	Hazen	----	<5	<5	<5	<5	<5	<5	<5
pH	----	5.5 to 9.0	6.74	6.13	6.08	6.8	6.72	6.9	6.91
Turbidity	NTU	----	0.9	0.9	1.0	1.0	1.1	1.2	1.0
Dissolved Solids	mg/lit	----	50	26	22	466	493	76	74
Conductivity	µS/cm	----	100	49	44	925	983	155	158
Suspended Solids	mg/lit	100	2	2	2	2	2	2	2
Chlorides	mg/lit	----	17	7	7	22	23	21	24
Total Hardness as CaCO <sub>3</sub>	mg/lit	----	30.0	16.0	14.0	12.0	12.0	52.0	54.0
Calcium as Ca <sup>++</sup>	mg/lit	----	6	3	2	2	2	10	10
Magnesium as Mg <sup>++</sup>	mg/lit	----	3	2	2	1	1	6	7
Sulphate as SO <sub>4</sub>	mg/lit	----	2.0	1.8	2.0	62	81	5	3.0
Phosphate as PO <sub>4</sub>	mg/lit	5	BDL	BDL	0.1	0.2	0.1	0.1	0.1
Nitrate as NO <sub>3</sub>	mg/lit	10	0.1	BDL	0.1	0.4	0.6	0.1	0.1
B.O.D (3days, 27°C)	mg/lit	30	<3	<3	<3	<3	<3	<3	<3
C.O.D	mg/lit	250	<10	<10	<10	18	18	<10	<10
Total Iron	mg/lit	3	0.1	0.12	0.11	0.12	0.10	0.17	0.10
Manganese as Mn	mg/lit	2	0.03	0.07	BDL	0.06	0.06	0.07	0.05
D.O	mg/lit	----	7.0	7	7	6.6	6.4	7	7
Oil & Grease	mg/lit	10	Nil	Nil	<1	1	1	<1	<1

BDL- Below Detection Limit

  
Govt. Analyst



  
Laboratory Incharge



# M/s Sesa Environment Laboratory

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## Surface Water Analysis Report for the Month of February 2017

Mine Name: Bicholim Mine

Date of Sample collection : 20.02.2017

Standard method used for analysis: APHA Standard

Test Report No: 244

Date of Receipt of sample: 20.02.2017


Analysis completion date: 27.02.2017

Parameter	Unit	Location							
		Permissible limits	1Top settling pond (Vagachiper lease Discharge)	2Top settling pond (Lamgao lease Discharge)	5Top settling pond (Totichomordon gor lease Discharge)	Upstream River Assanora	Downstream River Assanora	Upstream River Bicholim	Downstream River Bicholim
Colour	Hazen	----	<5	<5	<5	<5	<5	<5	<5
pH	----	5.5 to 9.0	6.61	6.23	6.12	6.81	6.75	6.83	6.87
Turbidity	NTU	----	0.9	0.9	0.9	1.0	0.9	1.0	1.0
Dissolved Solids	mg/lit	----	52	25	24	320	330	120	122
Conductivity	µS/cm	----	104	50	48	640	660	240	244
Suspended Solids	mg/lit	100	2	2	2	2	2	2	2
Chlorides	mg/lit	----	17	7	7	43	48	53	57
Total Hardness as CaCO <sub>3</sub>	mg/lit	----	32.0	14.0	14.0	50.0	56.0	60.0	60.0
Calcium as Ca <sup>++</sup>	mg/lit	----	7	2	2	12	14	16	15
Magnesium as Mg <sup>++</sup>	mg/lit	----	2	2	1	5	5	5	5
Sulphate as SO <sub>4</sub>	mg/lit	----	2.6	2.0	2.3	82	90	6	6.5
Phosphate as PO <sub>4</sub>	mg/lit	5	BDL	BDL	0.1	0.2	0.2	0.1	0.1
Nitrate as NO <sub>3</sub>	mg/lit	10	0.2	0.1	0.1	0.5	0.6	0.1	0.1
B.O.D (3days, 27°C)	mg/lit	30	<3	<3	<3	<3	<3	<3	<3
C.O.D	mg/lit	250	<10	<10	<10	18	18	<10	<10
Total Iron	mg/lit	3	0.15	0.16	0.21	0.16	0.17	0.16	0.10
Manganese as Mn	mg/lit	2	0.08	0.10	0.08	0.08	0.06	0.07	0.06
D.O	mg/lit	----	7.0	7	7	6.5	6.4	7	7
Oil & Grease	mg/lit	10	Nil	Nil	Nil	1	1	<1	<1

BDL- Below Detection Limit

  
Govt. Analyst



  
Laboratory Incharge



### M/s Sesa Environment Laboratory

Vedanta Limited ,Mining Division ,Codli Mines,P.O. Kirlapale ,Goa-403727

Recognised by Ministry of Environment, Forests and Climate change, Govt. of India Vide Notification .S.O.137(E).

dated 12<sup>th</sup> January 2015, Valid up to 11.01.2020

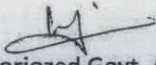
\* Certified by ISO 9001: 2008, ISO 14001:2004 and OHSAS 18001:2007

#### Well water level Report

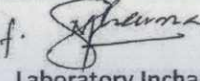
Mine Name: Bicholim mine

Instrument Used: Well water tape

Sr.No	Location	Total Depth of well in mtrs	Depth of Water level from the reference point in mtrs	Water Column in mtrs
			20.02.2017	
1	Mulgao Village Well	7.1	5.3	1.8
2	Lamgao Village Well-Santosh	5.4	3.7	1.7
3	Pilgao Village Well- Ratur	5.75	4.25	1.5
4	Mayem Village-Mohan	9.25	8.5	0.75

  
Authorized Govt. Analyst



  
Laboratory Incharge

## M/s Sesa Environment Laboratory

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### Well Water Analysis Report

Mine Name: Bicholim Mine

Date of Sample collection :20.02.2017

Standard method used for analysis: APHA Standard

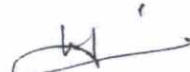
Test Report No: 245

Date of Receipt of sample:20.02.2017


Analysis completion date:27.02.2017

Parameter	Unit	Desirable Limit	Location			
			Mayem Village Well	Pilgaon Village Well	Mulgao Well	Lamgao Well
Colour	Hazen	<5.0	<5	<5	<5	<5
pH	-	6.5-8.5	6.13	6.51	6.58	6.60
Turbidity	NTU	1	0.70	1.0	1.00	1.00
Conductivity	µs/cm	-	46	28	50	78
Dissolved Solids	mg/lit	500	23	19	25	39
Suspended Solids	mg/lit	-	1	1	1	2
Chloride	mg/lit	250	8.9	6.9	9.9	16.9
Total Hardness as CaCO3	mg/lit	200	12.0	10.0	14.0	20.0
Calcium as Ca++	mg/lit	75	2.4	2.4	3.2	4.8
Magnesium as mg++	mg/lit	30	1.46	0.97	1.46	1.94
Sulphate as SO4	mg/lit	200	2.6	2.6	2.0	2.8
Nitrate as NO3	mg/lit	45	0.1	0.1	0.6	0.2
Alkalinity	mg/lit	200	18	10	15	17
Iron as Fe	mg/lit	0.3	0.11	0.08	0.06	0.07
Manganese as Mn	mg/lit	0.1	0.02	BDL	BDL	0.02
MPN/100ml	mg/lit	Absent	25	21	10	10

BDL- Below Detection Limit

  
Authorized Govt. Analyst



  
Laboratory Incharge



# M/s Sesa Environment Laboratory

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\* Certified by ISO 9001:2008, ISO 14001:2004 and OHSAS 18001:2007

## Surface Water Analysis Report for the Month of March 2017

Mine Name: Bicholim Mine

Date of Sample collection : 22.03.2017

Standard method used for analysis: APHA Standard

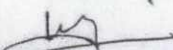
Test Report No: 267

Date of Receipt of sample: 22.03.2017


Analysis completion date: 28.03.2017

Parameter	Unit	Permissible limits	Location						
			1Top settling pond (Vagachiper lease Discharge)	2Top settling pond (Lamgao lease Discharge)	5Top settling pond (Totichomordon gor lease Discharge)	Upstream River Assanora	Downstream River Assanora	Upstream River Bicholim	Downstream River Bicholim
Colour	Hazen	----	<5	<5	<5	<5	<5	<5	<5
pH	----	5.5 to 9.0	6.71	6.58	6.52	6.96	6.93	6.89	6.92
Turbidity	NTU	----	1.0	1.1	0.9	1.3	1.1	1.0	1.0
Dissolved Solids	mg/lit	----	56	33	24	251	250	1786	1838
Conductivity	µS/cm	----	112	66	48	502	500	3572	3676
Suspended Solids	mg/lit	100	2	2	2	2	2	2	2
Chlorides	mg/lit	----	17	17	7	60	62	963	1062
Total Hardness as CaCO <sub>3</sub>	mg/lit	----	36	14	14	46	48	404	323
Calcium as Ca <sup>++</sup>	mg/lit	----	8	2	2	11	14	89	65
Magnesium as Mg <sup>++</sup>	mg/lit	----	4	2	2	4	3	44	39
Sulphate as SO <sub>4</sub>	mg/lit	----	3	2	2	96	98	53	56
Phosphate as PO <sub>4</sub>	mg/lit	5	BDL	0.1	0.1	0.2	0.2	0.2	0.1
Nitrate as NO <sub>3</sub>	mg/lit	10	0.2	0.1	0.1	0.6	0.6	0.6	0.6
B.O.D (3days, 27°C)	mg/lit	30	<3	<3	<3	5	7	<3	3
C.O.D	mg/lit	250	<10	<10	<10	19	29	<10	<10
Total Iron	mg/lit	3	0.15	0.18	0.20	0.17	0.17	0.15	0.11
Manganese as Mn	mg/lit	2	0.07	0.10	0.08	0.07	0.08	0.08	0.06
D.O	mg/lit	----	7	7	7	7	7	7	7
Oil & Grease	mg/lit	10	Nil	Nil	<1	1	1	<1	<1

BDL- Below Detection Limit

  
Govt. Analyst



  
Laboratory Incharge



### M/s Sesa Environment Laboratory

Vedanta Limited, Mining Division, Codli Mines, P.O. Kirlapale, Goa-403727

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dated 12<sup>th</sup> January 2015, Valid up to 11.01.2020

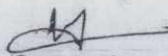
\* Certified by ISO 9001: 2008, ISO 14001:2004 and OHSAS 18001:2007

#### Well water level Report

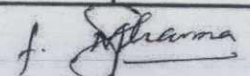
Mine Name: Bicholim mine

Instrument Used: Well water tape

Sr.No	Location	Total Depth of well in mtr	Depth of Water level from the reference point in mtr	Water Column in mtr
			22.03.2017	
1	Mulgao Village Well	7.1	5.8	1.3
2	Lamgao Village Well-Santosh	5.4	3.9	1.5
3	Pilgao Village Well- Ratur	5.75	4.35	1.4
4	Mayem Village-Mohan	9.25	8.35	0.9

  
Govt Analyst



  
Laboratory Incharge



**M/s Sesa Environment Laboratory**

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**Well Water Analysis Report**

Mine Name: Bicholim Mine

Date of Sample collection :22.03.2017

Standard method used for analysis: APHA Standard

Test Report No: 268

Date of Receipt of sample:22.03.2017

Analysis completion date:28.03.2017

Parameter	Unit	Permissible Limit	Location			
			Mayem Village Well	Pilgaon Village Well	Mulgao Well	Lamgao Well
Colour	Hazen	<5.0	<5	<5	<5	<5
pH	-	6.5-8.5	6.21	6.52	6.54	6.6
Turbidity	NTU	5	1.0	1.2	0.8	0.9
Conductivity	µs/cm	-	50	46	50	81
Dissolved Solids	mg/lit	500	25	23	25	41
Suspended Solids	mg/lit	-	1	1	2	2
Chloride	mg/lit	250	9	8	9	17
Total Hardness as CaCO <sub>3</sub>	mg/lit	200	12	12	14	22
Calcium as Ca <sup>++</sup>	mg/lit	75	2.4	2.4	3.2	2.0
Magnesium as mg <sup>++</sup>	mg/lit	30	1.5	1.5	1.5	2.9
Sulphate as SO <sub>4</sub>	mg/lit	200	3	2	2	3.0
Nitrate as NO <sub>3</sub>	mg/lit	45	0.1	0.1	0.1	0.1
Alkalinity	mg/lit	200	10	18	25	19
Iron as Fe	mg/lit	0.3	0.08	0.05	0.06	0.04
Manganese as Mn	mg/lit	0.1	0.03	0.02	0.03	0.01
MPN/100ml	mg/lit	Absent	17	20	14	13

BDL- Below Detection Limit



Govt. Analyst



Laboratory Incharge

**M/s Sesa Environment Laboratory**

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**Well Water Analysis Report**

Mine Name: Bicholim Mine

Date of Sample collection :23.12.2016

Standard method used for analysis: APHA Standard


Test Report No: 210

Date of Receipt of sample:23.12.2016

Analysis completion date:27.12.2016

Parameter	Unit	Permissible Limit	Location			
			Mayem Village Well	Pilgaon Village Well	Mulgao Well	Lamgao Well
Colour	Hazen	<5.0	<5	<5	<5	<5
pH	-	6.5-8.5	6.53	6.51	6.18	6.47
Turbidity	NTU	5	2.2	0.8	1.0	0.8
Conductivity	µs/cm	-	44	37	67	99
Dissolved Solids	mg/lit	500	22	19	33	50
Suspended Solids	mg/lit	-	2	1	2	1
Chloride	mg/lit	250	10	7	11	18
Total Hardness as CaCO <sub>3</sub>	mg/lit	200	12	10	14	26
Calcium as Ca <sup>++</sup>	mg/lit	75	2.4	1.6	2.4	5.6
Magnesium as mg <sup>++</sup>	mg/lit	30	1.5	1.5	1.9	2.9
Sulphate as SO <sub>4</sub>	mg/lit	200	1.0	1.3	3.7	7.3
Nitrate as NO <sub>3</sub>	mg/lit	45	0.1	0.1	0.1	0.1
Alkalinity	mg/lit	200	20	19	20	26
Iron as Fe	mg/lit	0.3	0.09	0.08	0.06	0.04
Manganese as Mn	mg/lit	0.1	0.02	BDL	0.02	BDL
MPN/100ml	-	Absent	17	25	13	12

BDL- Below Detection Limit

  
Govt. Analyst  
Laboratory Incharge



# M/s Sesa Environment Laboratory

Vedanta Limited, Mining Division, Codli Mines, P.O. Kirlapale, Goa-403727

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## Surface Water Analysis Report for the Month of December 2016

Mine Name: Bicholim Mine

Date of Sample collection : 23.12.2016

Standard method used for analysis: APHA Standard


Test Report No: 209

Date of Receipt of sample: 23.12.2016


Analysis completion date: 27.12.2016

Parameter	Unit	Permissible limits	Location						
			1Top settling pond (Vagachiper lease Discharge)	2Top settling pond (Lamgao lease Discharge)	3Top settling pond (Totichomordo ngor lease Discharge)	Upstream River Assanora	Downstream River Assanora	Upstream River Bicholim	Downstream River Bicholim
Colour	Hazen	----	<5	<5	<5	<5	<5	<5	<5
pH	----	5.5 to 9.0	6.98	6.13	6.02	6.8	6.86	6.9	7.02
Turbidity	NTU	----	1	0.9	1.0	1.3	1.6	1.4	1.5
Dissolved Solids	mg/lit	----	50	21	22	460	486	72	76
Conductivity	µS/cm	----	100	44	44	920	972	144	151
Suspended Solids	mg/lit	100	2	2	2	2	2	2	2
Chlorides	mg/lit	----	15	7	7	215	235	19	23
Total Hardness as CaCO <sub>3</sub>	mg/lit	----	34	12	10	100	120	46	50
Calcium as Ca <sup>++</sup>	mg/lit	----	6.4	2.4	1.6	16.0	24.1	10.4	10.4
Magnesium as Mg <sup>++</sup>	mg/lit	----	4.4	1.5	1.5	14.6	14.6	4.9	5.8
Sulphate as SO <sub>4</sub>	mg/lit	----	1.6	1.0	2.0	63	72	4	2.7
Phosphate as PO <sub>4</sub>	mg/lit	5	BDL	0.1	0.1	0.2	0.1	0.1	0.1
Nitrate as NO <sub>3</sub>	mg/lit	10	0.1	0.1	0.1	0.4	0.6	0.1	0.1
B.O.D (3days, 27°C)	mg/lit	30	<3	<3	<3	<3	<3	<3	<3
C.O.D	mg/lit	250	<10	<10	<10	18	18	<10	<10
Total Iron	mg/lit	3	0.1	0.13	0.06	0.09	0.08	0.08	BDL
Manganese as Mn	mg/lit	2	0.0	0.09	BDL	0.06	0.06	0.03	BDL
D.O	mg/lit	----	7.0	7	6.9	6.3	6.5	7	7
Oil & Grease	mg/lit	10	Nil	Nil	Nil	<1	1	<1	<1

BDL- Below Detection Limit

  
Govt. Analyst



  
Laboratory Incharge