

**Laboratory** Global Environment & Mining Services, 3rd Cross, 60 feet Main Road, 16th Ward, Basaveshwara Badavane, Hospet, Karnataka

**Accreditation Standard** ISO/IEC 17025: 2005

**Certificate Number** TC-5323

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**Validity** 12.10.2017 to 11.10.2019

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**CHEMICAL TESTING**

| I. | <b>ATMOSPHERIC POLLUTION</b>  |  |  |   |
|----|-------------------------------|--|--|---|
| 1. | <b>Stack Emission</b>         | Particulate matter (PM)                              | IS 11255 (Part 1): 1985 (RA 2012)<br>IS 11255 (Part 3): 2008 | 1.0 mg/Nm <sup>3</sup> to 1000 mg/Nm <sup>3</sup> |
|    |                               | Sulphur di oxide(SO <sub>2</sub> )                   | IS 11255 (Part 2): 1985 (RA 2012)                            | 3.0 mg/Nm <sup>3</sup> to 500 mg/Nm <sup>3</sup>  |
|    |                               | Oxides of Nitrogen (NO <sub>2</sub> )                | IS 11255 (Part7): 2005 (RA 2012)                             | 3.0 mg/Nm <sup>3</sup> to 400 mg/Nm <sup>3</sup>  |
|    |                               | Carbon monoxide(CO)                                  | GEMS/SOP/69<br>Issue No.01<br>Issue Date:12.03.2014          | Upto 2 % V/V                                      |
|    |                               | Oxygen (O <sub>2</sub> )                             | GEMS/SOP/70<br>Issue No.01<br>Issue Date:12.03.2014          | Upto 21 % V/V                                     |
|    |                               | Carbon Dioxide(CO <sub>2</sub> )                     | GEMS/SOP/71<br>Issue No.01<br>Issue Date:12.03.2014          | Upto 20 % V/V                                     |
|    |                               | Non methane hydrocarbons(NMHC)                       | GEMS/SOP/72<br>Issue No.01<br>Issue Date:12.03.2014          | Upto 20 % V/V                                     |
| 2. | <b>Ambient Noise</b>          | Ambient Noise  | IS 9989:1981 (RA 2008)                                       | 35 dB(A) to 100 dB(A)                             |
| 3. | <b>Ambient Air Monitoring</b> | Particulate Matter (Size less than10 µm) or PM10     | IS 5182 (Part 23): 2006 (RA 2012)                            | 5.0 µg/m <sup>3</sup> to 1000 µg/m <sup>3</sup>   |
|    |                               | Particulate Matter (Size less than 2.5µm) or PM2.5   | USEPA 2001   | 5.0 µg/m <sup>3</sup> to 500 µg/m <sup>3</sup>    |
|    |                               | Sulphur Dioxide (SO <sub>2</sub> ) µg/m <sup>3</sup> | IS 5182 (Part 2): 2001 (RA 2014)                             | 4.0 µg/m <sup>3</sup> to 200 µg/m <sup>3</sup>    |

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|------------|------------------------------------|--|---|---|
|            |                                    | Nitrogen Dioxide (NO <sub>2</sub> )<br>µg/m <sup>3</sup> | IS 5182 (Part 6): 2006<br>(RA 2014)                         | 6.0 µg/m <sup>3</sup> to 200 µg/m <sup>3</sup>  |
|            |                                    | Ozone as O <sub>3</sub>                                  | GEMS/SOP/84<br>Issue No.01<br>Issue Date:18.06.2016         | 2 µg/m <sup>3</sup> to 500 µg/m <sup>3</sup>    |
|            |                                    | Ammonia as NH <sub>3</sub>                               | GEMS/SOP/85<br>Issue No.01<br>Issue Date:18.06.2016         | 4.0 µg/m <sup>3</sup> to 50 µg/m <sup>3</sup>   |
|            |                                    | Lead as Pb   | IS 5182 (Part 22): 2004<br>(RA 2014)                        | 0.01 µg/m <sup>3</sup> to 5 µg/m <sup>3</sup>   |
|            |                                    | Arsenic as As  | GEMS/SOP/87<br>Issue No.01<br>Issue Date:18.06.2016         | 1.0 ng/m <sup>3</sup> to 10 ng/m <sup>3</sup>   |
|            |                                    | Nickel as Ni   | GEMS/SOP/87<br>Issue No.01<br>Issue Date:18.06.2016         | 1.0 ng/m <sup>3</sup> to 50 ng/m <sup>3</sup>   |
|            |                                    | Benzene  | IS 5182 (Part XI) 2006<br>(RA 2012)                         | 1.0 µg/m <sup>3</sup> to 2000 µg/m <sup>3</sup> |
|            |                                    | Benzene( a) Pyrene                                       | IS 5182 (Part XI) 2006<br>(RA 2012)                         | 1.0 µg/m <sup>3</sup> to 2000 µg/m <sup>3</sup> |
| <b>II.</b> | <b>POLLUTION &amp; ENVIRONMENT</b> |  |   |   |
| <b>1.</b>  | <b>Soil</b>                        | Moisture Content   | IS 2720 (Part 18): 1992<br>(RA 2011)                        | 1 % to 50 %                                     |
|            |                                    | pH   | IS 2720 (Part 26): 1987<br>(RA 2011)                        | 0.1 to 14.0                                     |
|            |                                    | Conductivity   | IS 14767:2000 (RA 2010)                                     | 1 µS/cm to 1000 µS/cm                           |
|            |                                    | Organic Matter   | IS 2720 (Part 22): 1972<br>(RA 2010)                        | 1 % to 25 %                                     |
| <b>2.</b>  | <b>Waste Water &amp; Effluents</b> | pH   | APHA 22 <sup>nd</sup> Edition 4500 B<br>(Pg No.4-92to 4-96) | 2.0 to 12.0                                     |
|            |                                    | Total Hardness as CaCO <sub>3</sub>                      | APHA 22 <sup>nd</sup> Edition-2012,<br>2340, C (Page :2-46) | 2 mg/L to 1000 mg/L                             |

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|     |                            | Calcium as Ca                         | APHA 22 <sup>nd</sup> Edition 3500 2012, Ca B (Page :3-84)                            | 1 mg/L to 1000 mg/L                         |
|     |                            | Magnesium as Mg                       | APHA 22 <sup>nd</sup> Edition 3500 – 2012 Mg B (Page :3-67)                           | 1 mg/L to 1000 mg/L                         |
|     |                            | Total Alkalinity as CaCO <sub>3</sub> | APHA 22 <sup>nd</sup> Edition-2012 2320 B (Page 2-35)                                 | 2 mg/L to 1000 mg/L                         |
|     |                            | Conductivity                          | APHA 22 <sup>nd</sup> Edition - 20122510 B (Page :2-54)                               | 1 µS/cm to 20000 µS/cm                      |
|     |                            | Total Dissolved Solids                | APHA 22 <sup>nd</sup> Edition 20122540 C (Page :2-65)                                 | 10 mg/L to 10000 mg/L                       |
|     |                            | Sulphate as SO <sub>4</sub>           | APHA 22 <sup>nd</sup> Edition 4500-2012 SO <sub>4</sub> <sup>2-</sup> E (Page :4-190) | 1 mg/L to 100 mg/L<br>100 mg/L to 1000 mg/L |
|     |                            | Fluoride as F                         | APHA 22 <sup>nd</sup> Edition -2012 4500 F·D (Pg No.4-87 to 4-88)                     | 0.01 mg/L to 1.50 mg/L                      |
|     |                            | Turbidity                             | APHA 22 <sup>nd</sup> Edition-2012 2130, B (Page :2-14)                               | 0.1 NTU to 100 NTU                          |
|     |                            | Sodium as Na                          | APHA 22 <sup>nd</sup> Edition -2012 Na 3500 B (Pg No.3-97 to 3-98)                    | 1 mg/L to 1000 mg/L                         |
|     |                            | Potassium as K                        | APHA 22 <sup>nd</sup> Edition -3500 K B (Pg No.3-87 to 3-88)                          | 1 mg/L to 100 mg/L                          |
|     |                            | Chloride as Cl                        | APHA 22 <sup>nd</sup> Edition 4500 – 2012 Cl <sup>-</sup> , B (Page :4-72)            | 1 mg/L to 5000 mg/L                         |

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|             |                                   | Nitrate as NO <sub>3</sub>                  | APHA 22 <sup>nd</sup> Edition-4500 NO <sub>3</sub> , E (Pg No.4-125 to 4-127) | 0.1 mg/L to 10 mg/L                    |
|             |                                   | Nitrite as NO <sub>2</sub>                  | APHA 22 <sup>nd</sup> Edition -4500 NO <sub>2</sub> B (Pg No.4-120 to 4-121)  | 0.1 mg/L to 50 mg/L                    |
|             |                                   | Iron as Fe                                  | APHA 22 <sup>nd</sup> edition -3500 Fe-B (Pg No.3-77to 3-80)                  | 0.02 mg/L to 100 mg/L                  |
|             |                                   | Boron                                       | APHA 22 <sup>nd</sup> EDITION -4500 B-B (Pg No.4-25 to 4-26)                  | 0.02 mg/L to 10 mg/L                   |
|             |                                   | Chemical oxygen Demand                      | APHA 22 <sup>nd</sup> EDITION -5220 C(Pg No.5-19 to 5-20)                     | 2 mg/L to 80000 mg/L                   |
|             |                                   | Biological oxygen Demand @ 27 °C for 3 days | IS 3025 (Part 44): 1993 (RA 2014)   | 4 mg/L to 40000 mg/L                   |
|             |                                   | Oil & Grease                                | APHA 22 <sup>nd</sup> EDITION-5520 B (Pg No.5-40 to 5-41)                     | 5 mg/L to 100 mg/L                     |
|             |                                   | Total solids                                | APHA-22 <sup>nd</sup> EDITION-2540 B (Pg No.2-64)                             | 1 mg/L to 5000 mg/L                    |
|             |                                   | Total suspended solids                      | APHA-22 <sup>nd</sup> EDITION-2540 D (Pg No.2-66 to 2-67)                     | 1 mg/L to 5000 mg/L                    |
| <b>III.</b> | <b>WATER</b>                      |   |   |  |
| <b>1.</b>   | <b>Potable and Drinking Water</b> | pH  | APHA 22 <sup>nd</sup> Edition 4500 B (Pg No.4-92to 4-96)                      | 1 to 14                                |
|             |                                   | Total Hardness as CaCO <sub>3</sub>         | APHA 22 <sup>nd</sup> Edition-2012, 2340, C (Page :2-46)                      | 1 mg/L to 1000 mg/L                    |
|             |                                   | Calcium as ca                               | APHA 22 <sup>nd</sup> Edition 3500 2012, Ca B (Page :3-84)                    | 1 mg/L to 1000 mg/L                    |
|             |                                   | Magnesium as Mg                             | APHA 22 <sup>nd</sup> Edition 3500 – 2012 Mg B (Page :3-67)                   | 1 mg/L to 1000 mg/L                    |
|             |                                   | Chloride as Cl                              | APHA 22 <sup>nd</sup> Edition – 4500 Cl-B (Pg No.4-72 to 4-73)                | 1 mg/L to 5000 mg/L                    |
|             |                                   | Total Alkalinity as CaCO <sub>3</sub>       | APHA 22 <sup>nd</sup> Edition-2012 2320 B (Page 2-35)                         | 1 mg/L to 1000 mg/L                    |

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|     |                            | Conductivity                | APHA 22 <sup>nd</sup> Edition - 20122510 B (Page 2-54)                               | 1 µS/cm to 3000 µS/cm                  |
|     |                            | Total Dissolved Solids      | APHA 22 <sup>nd</sup> Edition 20122540 C (Page 2-65)                                 | 4 mg/L to 10000 mg/L                   |
|     |                            | Sulphate as SO <sub>4</sub> | APHA 22 <sup>nd</sup> Edition 4500-2012SO <sub>4</sub> <sup>2-</sup> E (Page :4-190) | 1 mg/L to 1000 mg/L                    |
|     |                            | Fluoride as F               | APHA 22 <sup>nd</sup> Edition -2012 4500 F-D (Pg No.4-87 to 4-88)                    | 0.01 mg/L to 1.50 mg/L                 |
|     |                            | Nitrate as NO <sub>3</sub>  | APHA 22 <sup>nd</sup> Edition-4500 NO <sub>3</sub> E (Pg No.4-125 to 4-127)          | 0.1 mg/L to 10 mg/L                    |
|     |                            | Nitrite as NO <sub>2</sub>  | APHA 22 <sup>nd</sup> Edition -4500 NO <sub>2</sub> B (Pg No.4-120 to 4-121)         | 0.1 mg/L to 20 mg/L                    |
|     |                            | Iron as Fe                  | APHA 22 <sup>nd</sup> Edition -3500 Fe B (Pg No.3-77 to 3-80)                        | 0.02 mg/L to 50 mg/L                   |
|     |                            | Turbidity                   | APHA 22 <sup>nd</sup> Edition -2130 B (PgNo.2-13 to 2-15)                            | 0.01 NTU to 100 NTU                    |
|     |                            | Sodium                      | APHA 22 <sup>nd</sup> Edition -3500 Na B (Pg No.3-97 to 3-98)                        | 0.1 mg/L to 1000 mg/L                  |
|     |                            | Potassium                   | APHA 22 <sup>nd</sup> Edition -3500 K B (Pg No.3-87 to 3-88)                         | 0.1 mg/L to 100 mg/L                   |
|     |                            | Boron                       | APHA 22 <sup>nd</sup> Edition -4500 B (Pg No.4-25 to 4-26)                           | 0.02 mg/L to 10 mg/L                   |
|     |                            | Total suspended solids      | APHA-22 <sup>nd</sup> Edition-2540 D (Pg No.2-66 to 2-67)                            | 1 mg/L to 5000 mg/L                    |
|     |                            | Total Solids                | APHA-22 <sup>nd</sup> Edition-2540 B (Pg No.2-64)                                    | 1 mg/L to 5000 mg/L                    |
|     |                            | Chromium as Cr              | APHA-22 <sup>nd</sup> Edition-3500 Cr B (Pg No.3-96 to 3-70)                         | 0.1 mg/L to 10 mg/L                    |

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| <b>IV.</b> | <b>ORES &amp; MINERALS</b>      |  |   |  |
| <b>1.</b>  | <b>Iron ore</b>                 | Total Iron( Fe)                                | IS 1493:1981 (RA 2006)                                      | 10 % W/W to 70 % W/W                   |
|            |                                 | Silica (SiO <sub>2</sub> )                     | IS 1493:1981 (RA 2006)                                      | 0.5 % W/W to 25 % W/W                  |
|            |                                 | Aluminum (Al <sub>2</sub> O <sub>3</sub> )     | IS 1493:1981 (RA 2006)                                      | 0.5 % W/W to 20 % W/W                  |
|            |                                 | Phosphorus ( P)                                | IS 1493:1981 (RA 2006)                                      | 0.02 % W/W to 0.1 % W/W                |
|            |                                 | Sulphur (S)                                    | IS:1493:1959 (RA 2006)                                      | 0.01 % W/W to 0.02 % W/W               |
|            |                                 | Loss on Ignition LOI                           | IS:1493:1959 (RA 2006)                                      | 0.5 % W/W to 15 % W/W                  |
|            |                                 | Manganese (Mn)                                 | IS 1493:1959 (RA 2001)                                      | 0.1 % W/W to 2 % W/W                   |
| <b>2.</b>  | <b>Quartzite ore</b>            | Bulk density                                   | IS 5842:1986 (RA 2014)                                      | 1 g/cc to 10 g/cc                      |
|            |                                 | Silica (SiO <sub>2</sub> )                     | IS 1917 (Part 3): 1992 (RA 2005)                            | 80 % W/W to 99.5 % W/W                 |
|            |                                 | Loss on Ignition (LOI)                         | IS 1917 (Part 1): 1991 (RA 2006)                            | 0.1 % W/W to 2 % W/W                   |
| <b>3.</b>  | <b>Manganese Ore</b>            | Manganese (Mn)                                 | IS 1473:2004 (RA 2008)                                      | 5 % W/W to 50 % W/W                    |
|            |                                 | Manganese Dioxide (MnO <sub>2</sub> )          | IS 1473:2004 (RA 2008)                                      | 2 % W/W to 40 % W/W                    |
|            |                                 | Silica (SiO <sub>2</sub> )                     | IS 1473:2004 (RA 2008)                                      | 0.5 % W/W to 25 % W/W                  |
|            |                                 | Iron (Fe)                                      | IS 1473:2004 (RA 2008)                                      | 1 % W/W to 40 % W/W                    |
|            |                                 | Aluminum (Al <sub>2</sub> O <sub>3</sub> )     | IS 1473:2004 (RA 2008)                                      | 0.5 % W/W to 10 % W/W                  |
|            |                                 | Phosphorus (P)                                 | IS 1473:2004 (RA 2008)                                      | 0.01 % W/W to 0.2 % W/W                |
|            |                                 | Sulphur (S)                                    | IS 1473:2004 (RA 2008)                                      | 0.01 % W/W to 0.2 % W/W                |
| <b>4.</b>  | <b>Bauxite Ore</b>              | Aluminum (Al <sub>2</sub> O <sub>3</sub> )     | IS 2000 (Part 3): 1985 (RA 2006)                            | 1 % W/W to 90 % W/W                    |
|            |                                 | Silica (SiO <sub>2</sub> )                     | IS 2000 (Part 2): 1985 (RA 2006)                            | 0.5 % W/W to 20 % W/W                  |
|            |                                 | Loss on Ignition (LOI)                         | IS 2000 (Part 1): 1985 (RA 2006)                            | 0.5 % W/W to 40 % W/W                  |
|            |                                 | Titanium (TiO <sub>2</sub> )                   | IS 2000 (Part 5): 1985 (RA 2006)                            | 0.5 % W/W to 12.0 % W/W                |
|            |                                 | Ferric Oxide (Fe <sub>2</sub> O <sub>3</sub> ) | IS 2000 (Part 4): 1985 (RA 2006)                            | 1 % W/W to 35.0 % W/W                  |
| <b>5.</b>  | <b>Limestone &amp; Dolomite</b> | Loss on Ignition (LOI)                         | IS 1760 (Part 1): 1991 (RA 2001)                            | 1.0 % W/W to 50.0 % W/W                |

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|     |                            | Silica (SiO <sub>2</sub> )                     | IS 1760 (Part 2): 1991 (RA 2001)                            | 0.5 % W/W to 15 % W/W                  |
|     |                            | Ferric Oxide (Fe <sub>2</sub> O <sub>3</sub> ) | IS 1760 (Part 3): 1991 (RA 2001)                            | 0.2 % W/W to 2 % W/W                   |
|     |                            | Calcium (CaO)                                  | IS 1760 (Part 3): 1991 (RA 2001)                            | 0.5 % W/W to 60 % W/W                  |
|     |                            | Magnesium (MgO)                                | IS 1760 (Part 3): 1991 (RA 2001)                            | 0.2 % W/W to 40 % W/W                  |
|     |                            | Aluminum (Al <sub>2</sub> O <sub>3</sub> )     | IS 1760 (Part 3): 1991 (RA 2001)                            | 0.2 % W/W to 5.0 % W/W                 |

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Convenor

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Program Director