**[FORM-V]**
**(See rule 14 of The Environment Protection Act,1986)**

## Environment Statement for the financial year ending 31 March 2021

## PART – A

| General Information | | |
|---|---|---|
| | Name of the Company | **Tata Steel BSL Limited** |
| 1. | Name & Address of the owner/occupier of the industry, operation or process | Sri Rajeev Singhal<br>Managing Director<br>Tata Steel BSL Limited<br>At: Narendrapur, PO: Kusupanga<br>Via: Meramandali, Dist.: Dhenkanal, Pin: 759121, Odisha |
| 2. | Industry Category Primary (STC Code), Secondary (STC Code) | Large Metallurgical Industry |
| 3. | Production capacity-Units | 5.6 MTPA |
| 4. | Year of establishment | 2006 |
| 5. | Date of last statement | 29.09.2020 |

## PART – B

| Water & Raw material Consumption | | |
|---|---|---|
| **B-1: Total Water Consumption ($m^3$/d)** | | |
| **Category** | **Total Water Consumption ($m^3$/d)** | |
| | **2019-20** | **2020-21** |
| Process ($m^3$/d) | 5581 | 5312 |
| Cooling ($m^3$/d) | 30974 | 34842.9 |
| Domestic ($m^3$/d) | 1476.0 | 2637.67 |
| * Used for other purpose: 8983.9 $m^3$/day | | |
| **B-2: Water Consumption per unit of the product ($m^3$/MT)** | | |
| **Name of the Products** | **Process Water Consumption per unit of product $m^3$/MT)** | |
| | **2019-20** | **2020-21** |
| Steel | 4.14 | 4.02 |

| B-3: Raw Material Consumption | | | |
|---|---|---|---|
| **Name of Raw materials** | **Name of Products** | **Raw material Consumption per unit of product (MT/MT)** | |
| | | 2019-20 | 2020-21 |
| 1. Iron Ore & Pellet | Steel (Slab & Billet) | 1.68 | 1.79 |
| 3. Limestone & Dolomite | | 0.68 | 0.42 |
| 4. Quartz | | 0.03 | 0.11 |
| 5. Coking Coal | | 0.71 | 0.58 |
| 6. Non-Coking coal | | 0.27 | 0.45 |
| 7. Scrap | | 0.07 | 0.07 |
| **Total** | | **3.16** | **3.42** |

## PART – C

**Pollution discharged to Environment per unit of Output**
**(Parameters as specified in the Consent issued)**

**C-1: Water Pollution**

| Pollutant Parameter | Prescribed Standard | Quantity discharge (kg/d) | Concentration discharge (mg/l) | Percentage of variation from prescribed standards with reasons |
|---|---|---|---|---|
| - | - | Nil | Nil | - |

Reuse of process effluent is maximum after treatment; action has already been initiated to achieve Zero discharge.

TSBSL's Sustainability framework and Environment Policy subscribe to water conservation philosophy which greatly relies on 5R principles of Reduce, Reuse, Recycle, Recover and Recharge. With continuous efforts to make steel making more water efficient, Tata Steel BSL has taken significant initiatives for water conservation. Reuse of ETP & STP water in DRI & Sinter plants enables these to consume zero fresh water. Installation of a scientifically designed HDPE (High density poly Ethelene) lined pond of capacity 50,000 $m^3$, efficiently manages the surface run offs from Coke Oven and RMHS area. However, the most significant achievement was successful trial of UV (Ultraviolet) reactor technology for total cyanide removal from coke oven wastewater by our Environment Research & Development team.

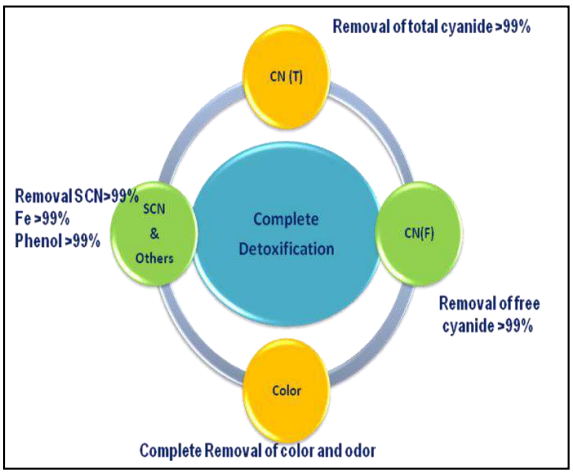
Details of few specific ETPs are given below.

**Effluent treatment plant (03 Nos.) -** The wastewater generated from DRI process and Power plant is being taken into effluent treatment plants and the treated water is being reused in Cooling towers, DRI, Sinter Plant and fire hydrant. Treated water is also being used for dust suppression and gardening purpose.


**Coke oven -** The wastewater generated from Coke-oven process is being treated in a specific effluent treatment plant called Biological Oxidation and Dephenolisation plant. A pilot UV reactor of capacity 5m3/hr is in operation and 80$m^3$/hr UV reactor has been commissioned to treat organic pollutant in place of chemical treatment. After treatment the water is being reused in coke and slag quenching.

BOD Plant

Pilot UV reactor





**Biological Oxidation and De-Phenolisation Plant (BOD)**
**& UV (Ultraviolet) reactor to treat organic compound at Coke oven**

**Blast furnace -** Waste water generated from Gas Cleaning Plant is being treated in effluent treatment plants and the treated water is being recycled back to the Gas Cleaning Plant process.

**Steel Melting Shop (SMS) -** Waste water generated from process is being treated in effluent treatment plants and the treated water is being recycled back to the Steel Melting Shop process.

**Cold Rolled Mill -** Waste water generated from process is being treated in effluent treatment plants and the treated water is being used in ash conditioning.

**Hot Strip Mill -** Process wastewater is being skimmed for oil & scale and then recycled back to the HSM cooling process.

**Sewage treatment plants (STP) –** Total five nos. of sewage treatment plant is in operation in the entire Tata steel BSL complex. Sewage generated from Colony/office is being treated in Sewage treatment plants and the treated water is 100% reused for low end application in plant, cooling tower make up and gardening purpose.

**Surface Water Quality Analysis report for period from April'20 to March'21**

| Parameters | UOM | Standard | Lingra Nala | | | Kisinda Nala | | |
|---|---|---|---|---|---|---|---|---|
| | | | Min | Max | Avg. | Min | Max | Avg. |
| pH Value | - | 6.0-9.0 | 7.45 | 8.37 | 7.82 | 7.13 | 8.22 | 7.888 |
| Total Dissolved Solids | mg/l | 1500 | 137 | 565 | 325.33 | 206 | 364 | 282.7 |
| BOD (3) days at 27˚C | mg/l | 3.0 | 1.29 | 2.9 | 2.31 | 1.45 | 2.85 | 2.22 |
| Free Cyanide (as CN) | mg/l | 0.05 | 0.03 | 0.03 | 0.029 | 0.02 | 0.03 | 0.029 |
| Chemical Oxygen Demand (COD) | mg/l | - | 12 | 124 | 31.33 | 6.0 | 28.0 | 16.3 |
| Free Ammonia | mg/l | 0.05 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |

**Effluent Quality Report for period from April'20 to March'21**

| Parameters | UOM | Standard | BOD -1 treated effluent | | | BOD -2 treated effluent | | |
|---|---|---|---|---|---|---|---|---|
| | | | Min | Max | Avg. | Min | Max | Avg. |
| pH Value | - | 6.0-9.0 | 7.1 | 8.9 | 7.8 | 7.3 | 8.4 | 8.0 |
| Total Suspended Solids | mg/l | 100 | 44 | 69 | 55 | 40 | 72 | 54 |
| BOD (3) days at 27˚C | mg/l | 30.0 | 17.6 | 25.2 | 21.8 | 20.2 | 27.8 | 23.6 |
| Total Cyanide (as CN) | mg/l | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 |
| Chemical Oxygen Demand (COD) | mg/l | 250 | 120 | 190 | 153 | 125 | 210 | 163.7 |
| Phenol | mg/l | 1.0 | 0.6 | 0.8 | 0.7 | 0.5 | 0.8 | 0.62 |

| Parameter | UoM | Standard | ETP-1 | | | ETP-2 | | | ETP-3 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Max | Avg | Min | Max | Avg | Min | Max | Avg |
| pH Value | - | 6.0-9.0 | 7.6 | 8.1 | 7.9 | 6.8 | 8.3 | 7.7 | 7.1 | 8.1 | 7.6 |
| Total Suspended Solids | mg/l | 100 | 36 | 61 | 50.2 | 40 | 63 | 49.8 | 39 | 90 | 61.8 |
| BOD (3) days at 27°C | mg/l | 30 | 2.3 | 4.6 | 3.3 | 2.4 | 5.2 | 3.6 | 3.6 | 5.8 | 4.6 |
| Total Cyanide (as CN) | mg/l | 0.2 | 0.002 | 0.005 | 0.003 | 0.001 | 0.003 | 0.002 | 0.08 | 0.12 | 0.11 |
| Chemical Oxygen Demand (COD) | mg/l | 250 | 28 | 50 | 37.2 | 18 | 52 | 39.3 | 44 | 70 | 56.3 |
| Phenol | mg/l | 1.0 | ND | ND | ND | ND | ND | ND | 0.19 | 0.51 | 0.26 |

## C-2: Air Pollution

| Pollutant Parameter | Prescribed Standard ($mg/Nm^3$) | Quantity discharge (kg/d) | Concentration discharge ($mg/Nm^3$) | Percentage of variation from prescribed standards with reasons |
|---|---|---|---|---|
| Particulate matter | Please Refer the Annexure – 1 | | | |

Point & nonpoint source emissions are major contributors in steel industries for degrading ambient air quality. Post-acquisition, Tata Steel BSL started giving special attention to improve its source emission. Completion of some major environmental improvement projects enabled Angul plant to reduce its dust load from 0.84 kg/tcs to 0.73 kg/tcs in last financial year. Technological improvements like Power supply of ESP (Electrostatic precipitator) using High frequency transformer rectifier/Micro pulse-based rectifier, revamping of old ESPs in DRI contributed a lot to improve stack emission quality. Further standardization of maintenance procedures, Spillage reduction in conveyor junction houses by installation of new technology sealing using double skirt rubber and commissioning of new dust extraction system in junction houses helped to reduce fugitive emission significantly. Moreover, as greenery always contributes for better air quality and acts as a carbon sink, TSBSL is continuously increasing its green cover throughout its all-India operations by Miyawaki method of rapid afforestation.

**Details of Air Pollution Control Equipment's**

Mix canon cum water sprinkler at SMS

Appropriate air pollution control technology has been adopted for minimizing air pollution at source itself. 28 nos. of Electrostatic precipitator, 58 nos. of bag filter and 03 nos. of scrubbers, 43 nos. of DFS with 252 nos. of nozzles, 107 nos. of gun sprinklers, cartridge filter have been installed at various departments to keep stack as well as fugitive dust emission well within the norms. Tyre mounted rotating mix canon cum water sprinkler at RMHS and at SMS are put into operation. Three Nos. of wheel washing systems one at RMHS and other two at BFPP- 1 & 2 respectively are put in operation. Special rubberized panels have been installed in screens in place of wire mesh and the same is also planned to install in all iron ore screen. IVCs (Industrial vacuum cleaner) (both wet & dry) installation is under progress.

Tyre mounted Mix Canon at RMHS

Cartridge Filter at Lime


Martin apron seal skirt system at

Wheel washing system at RMHS

Wheel Washing System at BFPP2


Gun sprinkler at RMHS


Pre-wetting of coal wagon


Auto sensor based DFDS at coal wagon unloading point


Covering of wagon


**Industrial Vacuum Cleaner (IVC)**


Portable Bag Filter

**Greenbelt Development:**

During the financial year 2020-21 total 44271 nos. of samplings have been planted in and around the Angul Energy Limited and Tata Steel BSL Limited premises.




**CAAQMS report for the period April'20 to March'21**

| Pollutant | Standard | CAAQMS | | | | |
|---|---|---|---|---|---|---|
| | | Colony | Near CRM | Near Water Complex | Near Coke Oven 2 | Near Wagon Tippler |
| PM 10 | 100 | 54.06 | 75.48 | 97.68 | 81.11 | 71.99 |
| PM 2.5 | 60 | 21.54 | 31.56 | 29.10 | 27.87 | 37.18 |
| SO2 | 80 | 21.30 | 23.19 | 12.54 | 16.57 | 15.60 |
| NOx | 80 | 9.50 | 25.91 | 29.73 | 20.45 | 29.82 |
| CO | 2 | 0.90 | 0.75 | 0.34 | 0.43 | 0.47 |

## PART – D

| Hazardous Wastes (As specified under The Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016) | | |
|---|---|---|
| **D-1: Generation from Process** | | |
| **Name** | **Total Quantity (MT)** | |
| | **2019-20** | **2020-21** |
| 1. Used Oil | 212.28 | 289.33 |
| 2. Waste residue containing oil | 19.93 | 24.036 |
| 3. Spent Resin | 3.25 | 1.25 |
| 4. Rejected Chemical Container | 31.61 | 193.47 |
| 5. Insulation Material | 131.23 | 83.47 |
| 6.Acid Residue | - | - |
| 7. Alkali Residue | 15.74 | 17.66 |
| 8.Oily Sludge | 87.25 | 93.33 |
| 9.Zinc Ash & Zinc Dross | 616.41 | 480.85 |
| **D-2: Generation from Pollution Control Facilities** | | |
| **Name** | **Total Quantity (MT)** | |
| | **2019-20** | **2020-21** |
| 1. BOD plant Sludge | 1768.52 | 1563.35 |
| 2. Decanter Tar Sludge | 1105 | 1385 |
| 3. ETP Sludge from CRM | 711.11 | 872.25 |
| 4. Flue gas cleaning residue | 40110 | 34363.9 |
| | | |

## PART – E

**Solid Wastes**

**Total Quantity Generated**

| **E-1: Generation from Process** | | |
|---|---|---|
| **Name** | **Total Quantity (MT)** | |
| | **2019-20** | **2020-21** |
| 1. Char | 86953 | 122642 |
| 2. Bottom Ash | 45583 | 38950.34 |
| 3. BF Slag | 1632566 | 1519144 |
| 4. SMS Slag | 916113 | 831438 |
| **E-2: Generation from Pollution Control Facilities** | | |
| 1. Fly Ash | 410245 | 291348.06 |
| 2. Flue Dust | 40110 | 81789 |
| 3. ESP, Bag filter Dust, DRI clod silo dust, Lime fines dust, FES dust | 175927 | 137535 |
| 4. BOF Sludge | 92607 | 67042 |
| 5. Mill Scale | 97704 | 58817 |
| 6. BF Sludge | 56098 | 67042 |

**E-3: Total Quantity Recycled/Reutilized within the Unit**

| Name of the Waste | Total Quantity (MT) | |
|---|---|---|
| | **2019-20** | **2020-21** |
| 1.Char | 86953 | 106543 |
| 2.SMS Slag | 372088 | 428571 |
| 3. Flue Dust | 40110 | 81789 |
| 4. ESP, Bag filter Dust, DRI clod silo dust, Lime fines dust, FES dust | 127781 | 68048 |
| 5. Mill Scale | 97704 | 61805 |
| 6.BOF Sludge | 14980 | 35125 |

**E-4: Total Quantity Sold**

| Name of the Waste | Total Quantity (MT) | |
|---|---|---|
| | **2019-20** | **2020-21** |
| 1. BF Slag | 1535615 | 1730873 |
| 2.SMS Slag | 412872 | 117403 |
| 3.ESP, Bag filter Dust, DRI clod silo dust, Lime fines dust, FES dust | - | 20699 |
| 4.BOF Sludge | - | 2839 |
| 5.Mill Scale | - | 984 |

**E-5: Quantity Disposed/Stored**

| Name of the Waste | Total Quantity (MT) | |
|---|---|---|
| | **2019-20** | **2020-21** |
| 1.Char | - | 16099 |
| 2. SMS Slag (Stored inside the plant) | 503241 | 285464 |
| 2. BOF Sludge (Stored inside plant to make briquette) | 77627 | 106705 |
| 3.ESP, Bag filter Dust, DRI clod silo dust, Lime fines dust, FES dust | - | 48788 |
| Fly ash of 291348.06 MT and Bottom Ash of 38950.34 MT generated during 2020-21 were used outside the plant for reclamation of stone quarry, NH construction, cement and bricks making. | | |

## PART – F

**Please specify the characterizations (in terms of composition in quantum) of hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes.**

**F-1: Hazardous Wastes**

| Description | Constituent parameter | Concentration | Disposal practice |
|---|---|---|---|
| 1. Used Oil | Analysis report attached as Annexure - 2 | | Sold to Authorized Recycler |
| 2. Waste residue containing oil | | | Storage in MS drum under covered shed for further disposal at CHTSDF |
| 3. Spent Resin | Analysis report attached as Annexure - 2 | | Stored in MS drum. When sufficient quantity is accumulated it will be disposed at Storage Disposal Facility (CHW TSDF) |
| 4. BOD plant Sludge | | | Reused in Coke oven plant |
| 5. Decanter Tar Sludge | | | |
| 6.Alkali Residue | | | Stored in a Secured manner in containers and disposed to CHWTSDF site. |
| 7. ETP Sludge from CRM and other process. | | | Disposed to CHWTSDF |
| 8. Oily Sludge | | | |
| 9. Insulation Material | – | – | |
| 10.Flue gas cleaning residue | Analysis report attached as Annexure - 2 | | Storage in designated area then internally reused. |
| 11. Rejected Chemical Container | – | - | Dispose/Sold to Authorized Recycler. |

| F-2: Solid Wastes | | | |
|---|---|---|---|
| **Description** | **Constituent parameter** | **Concentration** | **Disposal practice** |
| 1. Char | Analysis report attached as Annexure - 3 | | Reused in Power plant boiler |
| 2. Bottom Ash | Analysis report attached as Annexure - 4 | | Supply to Bricks & cement manufacturing unit, use in construction of NH and balance if any has been used for reclamation of abandoned stone quarries. |
| 3. Fly Ash | | | |
| 4. SMS Slag | Analysis report attached as Annexure - 2 | | Used in road construction and sinter making. |
| 5. BF Slag | | | Sold to Cement plant (ACC & OCL) |

**Solid Waste Management Practice:**

In the area of circular economy, the Company has undertaken various initiatives to manage solid waste in an environment friendly, socially responsible and techno-commercially viable manner. Our waste management philosophy interprets waste as a wealth.

Our Environment Policy emphasizes our commitment towards managing wastes from our operations by adopting the principle of 4R i.e., Reduce, Reuse, Recycle and Recover, through waste avoidance, reuse and, recycling where possible and beneficial utilization and converting to wealth to minimize disposal to landfills which ultimately burden the environment.

Utilization of LD slag has increased significantly from 46% (FY 20) to 66% (FY 21). Overall Solid waste utilization has increased to 96% in FY21. Company has put various efforts to increase the LD slag utilization by installation of Metal Recovery Plant, developing market for sustainable use in Brick & Cement manufacturing, increase in utilization of slag for making value added products. Ash utilization remains 100% in FY 21 through utilization in paver block, brick, cement and road construction. Supply of fly ash through rake to north-east market opened a promising future of Fly ash utilization. Other Solid wastes generated from the steel plant were recycled in Sinter making. To make this process more scientific TSBSL has installed a PSW (process solid waste) mixing and screening facility in FY 21 to make more efficient use of solid waste in Sinter making.

**Domestic Waste Management from township/plant:**

Bio-degradable plant and colony waste is being composted by organic composter and non-biodegradable waste is managed through incinerator.

**Hazardous Waste Management Practice**

4R principle is the hazardous waste management philosophy in Tata Steel BSL. TSBSL generates **15 categories** of hazardous wastes and individual management plans are prepared, well documented and dissipated among shop floor employees who are handling the waste on daily basis.

- Hazardous waste has been stored onsite in barrels under covered shed in concrete floor with Garland drains leading to sum pit.
- Total 33 nos. of hazardous waste storage shed have been constructed inside plantcomplex for storage of Used Oil drums.
- All Hazardous waste storage yards are constructed in Environmentally Sound Manner to avoid leakage and spillage of the waste material.
- The barrels are being properly marked and labeled as per Form-8 to ensure safehandling during transportation.
- The used oil barrels are sold to the authorized recyclers by maintaining all statutory guidelines.
- CRM- ETP sludge, Alkali sludge and oily sludge are sent to CHWTSDF for secure landfill in special designated container maintaining all the relevant statutory documents.
- Insulation materials (Glass Wool) are sent to CHWTSDF for secure landfill in special designated container.
- Hazardous waste like tar sludge generated from the process of Coke Oven plant is reused in the process.

**Hazardous waste storage shed at BOF**

**Hazardous waste storage shed at HSM Water Complex**

## PART – G

| Impact of pollution control measure on conservation of natural resources and cost of production | | |
|---|---|---|
| **G-1: Cost Estimation of Pollution Control** | | |
| **Description** | **Expenditure in Crores during 2020 - 21** | |
| | **Capital cost** | **Recurring cost** |
| Water Pollution | 0.67 | 17.89 |
| Air Pollution | 9.20 | 21.29 |
| Solid Waste & Hazardous Waste Management | 0.61 | 63.30 |
| Green belt development (Both TSBSL & AEL) | - | 3.01 |
| Others (Housekeeping, Scientific study & analysis) | 3.53 | 2.80 |
| **Total** | **14.01** | **108.29** |

## PART – H

**Additional measures/investment proposal for environmental protection including abatement of pollution, prevention of pollution.**

- Upgradation of the existing pollution control equipment to further bring down particulate matter level.
- Improvement in water recycling facility for reducing the specific water consumption.
- Installation of decanter to recover water from sludge of primary treatment plant.
- Enhancing green coverage by creating gardens and undertaking more Miyawaki Method of Plantation in and around the complex.
- Transfer of wet quenching to dry quenching at Coke Oven-I.
- Installation of IP camera, fluoride analyzer and Mercury analyzer.
- Installation of second organic composter.

## PART – I

**Any other undertaken project for improving the quality of environment**

- **Upgradation of DE system**

  Technical study is under progress by M N Dastur to evaluate the performance of the existing DE system installed at coke route, sinter return fines route and RMHS route. Recommendation will be reviewed and suitable implemented to keep the emission well below the standard.

- **Roads construction**

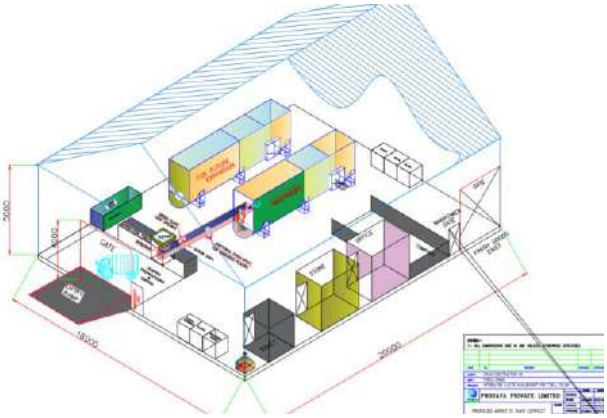
  Out of 48 kms of internal road about 39 Kms have already been concreted and rest work is under progress. Along the road's drains have also been established and roadside avenue plantation has also been carried out inside the complex.

Paving of internal roads

Concrete Road of 7.6 KM outside Plant

- **Installation of Organic composter**

  One organic composter of 750 kg/day is in operation. Organic composter of 4 to 5 ton/day is planned to install on BOO basis to compost municipal solid waste generated from plant and colony. The non-bio-degradable recyclable material will be sold to outside agencies and compost thus generated will be utilized in horticultural purpose.



- **Continual Improvement in Sustainability indicators**

  The Company has imbibed a systematic management approach for continuous improvement in its operational performance with innovation in processes, responsible utilization of resources, adoption of new technology and learning & development.

- **Carbon abatement:**

  Tata Steel BSL recognizes its role and responsibility in addressing the global issue of climate change and is taking various initiatives to support India's Intended Nationally Determined Contributions ('INDC') target and reduce carbon intensity at its integrated steel plant at Angul. For reducing carbon footprint, TSBSL is pursuing the implementation of innovative low carbon technologies. Due to COVID pandemic, crude steel production was less compared to FY20, nevertheless the company has managed to reduce overall CO2 emission from 12.3 million Ton in FY 20 to 11.5 million Ton in FY 21. In our pursuit of resource efficiency and cleaning the power mix, we are increasingly using waste gas and waste heat for power generation which accounted for 82% of total power generation of TSBSL in FY21. Energy consumption of DRI has also been reduced to 85 KWH/t of DRI in FY'21 from 94 kWh/t of DRI in FY'20. TSBSL has started construction work for Coke Dry quenching unit for Coke Oven -1 and commissioned 2nd PCI in BF 2 which will further enhance our energy efficiency.

- **Bio-diversity management:**

  Our planet is facing major conservation challenges from enormous pressure of pollution, climate change, deforestation, and illegal wildlife trade. Tata Steel BSL approaches conserving biodiversity by engaging the employees and local communities through various awareness programs and workshops. To enhance company's performance in biodiversity conservation and significantly reducing its impact on ecosystem, Tata Steel BSL launched its Biodiversity Policy in 2020. The policy provides guidelines for reducing its impact with the aim of achieving "No net Loss" on biodiversity over a period of time and distancing from any acquisition of properties whose development may result in loss of critical habitat for species conservation status.

  The journey of Tata Steel BSL in conservation and restoration of biodiversity in and around its operational area, is started with a well-defined biodiversity management plan which is being implemented in phases with the knowledge support of globally renewed biodiversity experts.

  The **key initiative taken at steel plant, Odisha:**

  a) Increase in variety of plant species those attract butterflies in the existing nursery inside the plant.
  b) Development of Eco-nest for Migratory/Local Birds. 27 no. of Bird nest installed in FY - 21.
  c) Site Development near water reservoir for Conservation of White horn (Ardea alba) Birds.

d) Development of Medicinal Garden and awareness to public about its importance.

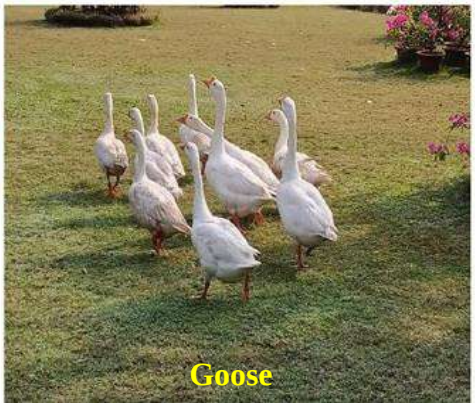
e) Site development for conservation of Weaver Birds (Baya Chadhei).

f) Development of butterfly garden at Gopabandhu High School, Khaliberena,Odisha

g) Introduced 10 nos. of goose in nursery waterbodies.

h) Undertaken maintenance & cleaning of ponds in nearby villages of Angul.

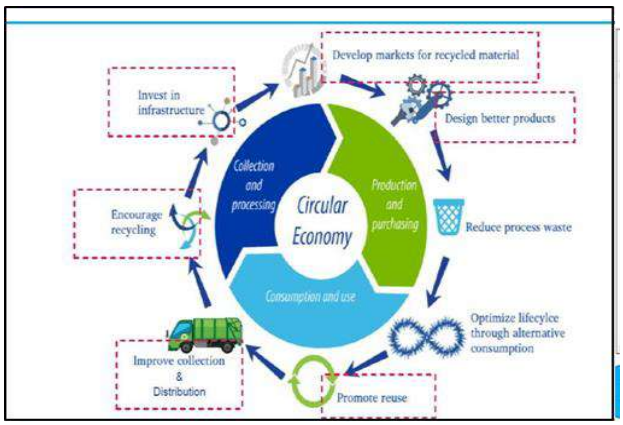

Bird Nest


Goose


Plantation

- **Circular Economy**

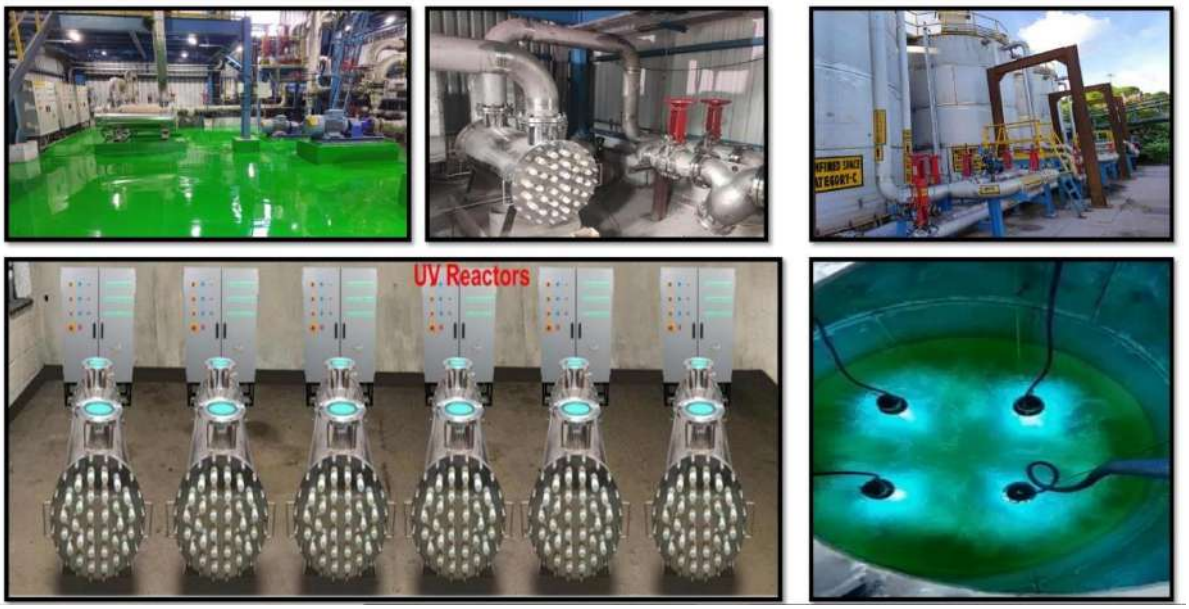
In the area of circular economy, the Company has taken various initiatives to manage solid waste in an environmentally friendly, socially responsible and techno-commercially viable manner. Utilization of LD slag and Fly ash has increased significantly from previous years. Overall Solid waste utilization has been increased up to 96% at present. Tata Steel BSL has put various efforts to increase the LD slag utilization from 28% in FY:18 to 66% in FY:21. Many initiatives have been undertaken and presently projects are in pipeline to increase the utilization up to 87% in FY'22.




- **World 1st UV- Oxidation technology for Cyanide Mitigation**

Tata Steel BSL has adopted cutting-edge Ultraviolet (UV) Oxidation technology to treat Cyanide in coke oven wastewater as a step towards achieving environmental excellence. It has established world's first UV Oxidation Plant in the steel industry at its plant located at Narendrapur in Dhenkanal district of Odisha with capacity to treat 80 Cubic meters of wastewater per hour for the purpose.

The conventional method of treating cyanide, one of the most toxic and potentially deadly pollutants, is called solid sludge separation technology which may lead towards cyanide toxicity by secondary means of toxic sludge decomposition




- **Responsible Supply Chain:**

Responsible Supply Chain is an essential element in delivering our department's vision of being the benchmark in its commitment to Sustainable Development. Tata Steel BSL's Responsible Supply Chain Policy will help in adopting the principles and communicates how we will work with our supply chain partners and sets out our expectations and minimum standards for fair business practices, health and safety, human rights, and environmental performance.

We expect our supply chain partners to comply with the provisions of our Responsible Supply Chain Policy. We expect our partners to have a similar policy for their entire supply chain. We are committed to work with our partners to implement the Policy for promoting supply chain transparency and establish long-term sustainable relationships.

It sets out our expectations and gives guidance for implementation to our immediate supply chain partners in line with the following principles:

- Fair Business Practices
- Health and Safety
- Human Rights
- Environmental Protection

- Improvement in overall rail coefficient

  The increase of Rail Co-efficient from 75 % to 78 % last year has compounding benefits to the supply chain. With increasing production, this increase in co- efficient means that a large amount of freight is being transported by greener means.

- Introduction of Rail-Road mover which has 30% lower fuel consumption.

  Titan Locos have been introduced which are a leaner and greener means of transport for our Steel melting Shops.

- Replacing wooden saddles with steel saddles for Hot Rolled Dispatch leading to reduce and reuse of saddles.

- Increase usage of Energy efficient Trucks, Trailers, and Ships.

  The total environmental benefit from the initiatives exceeds the annual plan for the reduction in $CO_2e$ of the Department. Furthermore, the initiatives planned for the next year will help us bring down the emissions even more and enable us to exceed our annual targets.

- **Introduction E- Car:**

As a part of sustainable transportation six numbers of E-car have been operated.

**Flag off six E-car, introduced in steel industry from FY20**

- **Energy saving & sustainability Projects**

**I.** Development of marginal abatement cost curve to prioritize carbon reduction projects & prepare long term road map for reduction in carbon emission.

**II.** Successfully Commissioned of Coke Dry Quenching (CDQ) Plant having carbon abatement potential of 0.13 Mn tonnes per annum. The heat recovered by inert gas from hot coke is being used to produce steam. The superheated steam of around 90 ton produced from boiler of CDQ is being used for generation of power. Additionally, the improved dry coal quality produced from CDQ will help to reduce the consumption of coke in Blast Furnace's which lead to lesser energy consumption in furnaces.

**III.** Installed 250 TPH Gas Fired Boiler using the waste Gas produced from Coke Oven and Blast Furnaces to generate steam, which in turn is used in turbine for generation of electricity. With the completion of Gas Fired Boiler, the blast furnaces have stopped flaring of BF gas which reduced the pollution load. The coal usage in coal fired boiler for generation of electricity has been reduced, which in turn helps to improve the environmental attributes and carbon usages. The carbon reduction potential for this project is 0.4 million tons per annum.

**IV.** Several other carbon reduction projects like Utilization of Scrap from 4 % to 10 % at BOF steelmaking, commissioning of BOF Gas Holder, Pulverized Coke Injection (PCI) System in Blast Furnace 2 etc have been undertaken which are having total carbon abatement potential

of 0.6 Mn tonnes per annum. Specifically, in BOF steelmaking, the scrap proportion has been increased to around 10%. This addition not only provides the required heat sink for energy balance, it also replaces the $CO_2$ intensive hot metal. Recycling of scrap provides the solid metallic Fe units and is environmentally friendly.

**V.** High Density Poly Ethylene (HDPE) lined pond of capacity 50,000 $m^3$ has been created on the eastern side of Coke Oven-2. The purpose of this pond is to hold treated industrial effluent to reuse in the process when required. Apart from holding the treated effluent, the pond has also been designed to store surface run off during monsoon as a measure towards rainwater harvesting and subsequent use for industrial application.


**VI**. Initiatives have also been taken for use of alternate sources of Energy. TSBSL's Integrated Steel plant in Dhenkanal has produced around 120 MW power in the year FY 19 through Waste heat recovery route which was about 40% of total power consumed. Feasibility study of solar energy is in progress in all the other locations with a potential of generating 30 MW power by harnessing solar energy.

- **Miyawaki Method of Plantation**

Plantation is being carried out along the boundary wall around 2KM in Miyawaki method under the guidance of Prof. K. Pathak, IIT, Kharagpur.




**Annexure-1**

| Name of the Plant | | Prescribed Standard (mg/Nm3) | Quantity Discharge (kg/d) | Concentration of discharge (mg/Nm3) | % variation from prescribed standard |
|---|---|---|---|---|---|
| DRI/ WHRB | WHRB-1 | 50 | SD | SD | - |
| | WHRB-2 | 50 | | | - |
| | WHRB-3 | 50 | 54.64 | 23.93 | - |
| | WHRB-4 | 50 | 41.32 | 24.91 | - |
| | WHRB-5 | 50 | 54.42 | 23.52 | - |
| | WHRB-6 | 50 | 58.04 | 20.65 | - |
| | WHRB-7 | 50 | 88.69 | 21.44 | - |
| | WHRB-8 | 50 | 92.73 | 24.49 | - |
| | WHRB-9 | 50 | 58.51 | 18.59 | - |
| | WHRB-10 | 50 | 70.59 | 18.64 | - |
| | DRI de Dusting-1 | 100 | SD | SD | - |
| | DRI de Dusting-2 | 100 | 116.84 | 20.10 | - |
| | DRI de Dusting-3 | 100 | 68.81 | 11.36 | - |
| | DRI de Dusting-4 | 100 | 137.37 | 18.81 | - |
| | DRI de Dusting-5 | 100 | 106.09 | 15.21 | - |
| Sinter | Sinter Plant-1 (Main ESP) | 100 | 482.67 | 28.16 | - |
| | Sinter Plant-1 (85 $M^2$ ESP) | 100 | 84.67 | 17.06 | - |
| | Sinter Plant-1 (110 $M^2$ ESP) | 100 | 158.52 | 23.16 | - |
| | Sinter Plant-1 (Bag Filter) | 100 | 191.81 | 15.39 | - |
| | Sinter Plant-2 Process | 50 | 1047.66 | 39.91 | - |
| | Sinter Plant-3 Process | 50 | 1128.92 | 42.85 | - |
| Lime | Lime Plant Kiln-1 | 50 | 29.40 | 32.39 | - |
| | Lime Plant Kiln-2 | 50 | 51.59 | 35.20 | - |
| | Lime Plant Kiln-3 | 50 | 46.81 | 34.04 | - |
| | Lime Plant Kiln-4 | 50 | 53.44 | 38.21 | - |
| | Lime Plant Kiln-5 | 50 | 60.75 | 47.73 | - |
| | Lime Plant Dedusting-2 | 100 | 13.84 | 25.67 | - |
| | Lime Plant Dedusting-3 | 100 | 45.96 | 16.71 | - |
| | Lime Plant Dedusting-4 | 100 | 35.58 | 22.75 | - |
| Power | AFBC 33MW PP | 100 | SD | SD | - |
| | BF PP-1 (Boiler-1) | 50 | 56.59 | 25.26 | - |
| | BF PP-1 (Boiler-2) | 50 | 58.22 | 26.68 | - |
| | BF PP-1 (Boiler-3) | 50 | 42.68 | 20.74 | - |
| | BFPP-2 Boiler-2 | 50 | SD | 31.03 | - |
| | BFPP-2 Boiler-3 | 50 | 164.25 | 21.62 | - |
| | Gas Fired Boiler 60TPH & 125 TPH | 50 | - | - | - |

| Name of the Plant | | Standards (mg/Nm3 | Quantity Discharge (kg/d) | Annual Average Conc. In mg/Nm3 | % variation from prescribed standard |
|---|---|---|---|---|---|
| BF | BF-1 Cast House | 100 | 155.60 | 11.92 | - |
| | BF-1 Stock House | 100 | 111.63 | 15.04 | - |
| | PCI Stack BE-1 | 50 | 16.93 | 13.89 | - |
| | BF-2 Cast House | 50 | 149.27 | 7.76 | - |
| | BF-2 Stock House | 50 | 161.07 | 14.33 | - |
| | PCI Stack BF-2 | 50 | 31.63 | 13.06 | - |
| SMS | SMS -2 FES-1 | 100 | 456.03 | 11.38 | - |
| | SMS -2 FES-2 | 100 | 765.50 | 24.40 | - |
| | SMS -3 BOF | 50 | 1238.78 | 22.36 | - |
| Coke Oven | Coke Oven (Battery1 ) | 100 | 77.00 | 32.27 | - |
| | Coke Oven (Battery-2) | 100 | 74.03 | 30.24 | - |
| | Coke Oven-2 Battery | 50 | 107.23 | 37.41 | - |
| RMPP | (RMPP) CSB-1 Bag filter | 50 | 82.82 | 14.34 | - |
| | (RMPP) CSB-2 Bag filter | 50 | 78.00 | 14.77 | - |
| HSM | HSM Stack-1 | 50 | 20.15 | 16.37 | - |
| | HSM Stack-2 | 50 | 19.33 | 13.28 | - |

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(Council of Scientific & Industrial Research)
Bhubaneswar - 751013, Odisha, INDIA

# TEST REPORT

**Ref. No. IMMT/CCD/08/2021** **Date: 03.08.2021**

| | |
|---|---|
| Name & Address of the Party: | Tata Steel BSL Ltd.<br>At-Narendrapur, P.O.-Kusupanga<br>Via-Meramandali, Dist-Dhenkanal |
| Sample Details: | Solid Waste samples (17 Nos.) |
| Date of Receiving: | 02.06.2021 |
| Date(s) of Conducting Test: | 07.06.2021 |
| Date of Completion of Test: | 23.07.2021 |

**Method Adopted:** **1.** Major element analysis of Solid waste samples through wet chemical route by using Volumetric, gravimetric, photometric, nephelometric, AAS and ICP-OES techniques.
**2.** TCLP study of waste samples as per US-EPA method 1311 or ASTM-D5233-92. Leaching solution analysis by ICP-OES and AAS.

**Detail Report:** Following data tables are enclosed

**Table-1.** Physical characteristics analysis of Solid Waste samples of Tata Steel BSL Limited, Meramandali

**Table-2.** Size (Sieve) analysis of Solid Waste samples of Tata Steel BSL Limited, Meramandali

**Table-3.** Chemical composition analysis of Solid Waste samples of Tata Steel BSL Limited, Meramandali

**Table-4(a)** Experimental variables for Toxicity Characteristic Leaching Procedure (TCLP) study of Solid Waste samples (SW1, SW2, SW3, SW4, SW5 & SW8) conducted as per US-EPA method 1311.

**Table-4(b)** Trace element analysis of TCLP or WET Procedure solutions of Solid waste samples(SW1, SW2, SW3, SW4, SW5 & SW8); Leaching studies conducted as per US-EPA method 1311 and Appendix II of section 66261 of Title 22 of California Code Regulations (CCR).

**Table-5(a)** Experimental variables for Toxicity Characteristic Leaching Procedure (TCLP) study of Solid Waste samples (SW9, SW10, SW11, SW12, SW13 & SW14) conducted as per US-EPA method 1311.

**Table-5(b)** Trace element analysis of TCLP or WET Procedure solutions of Solid waste samples(SW9, SW10, SW11, SW12, SW13 & SW14); Leaching studies conducted as per US-EPA method 1311 and Appendix II of section 66261 of Title 22 of California Code Regulations (CCR).

Contd....

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**Table-6(a)** Experimental variables for Toxicity Characteristic Leaching Procedure (TCLP) study of Solid Waste samples (SW15, SW17, SW18, SW19 & SW20) conducted as per US-EPA method 1311.

**Table-6(b)** Trace element analysis of TCLP or WET Procedure solutions of Solid waste samples (SW15, SW17, SW18, SW19 & SW20); Leaching studies conducted as per US-EPA method 1311 and Appendix II of section 66261 of Title 22 of California Code Regulations (CCR).

03/08/21
(J. Das)
Principal Technical Officer
Central Characterization Dept.

N.B.:- The samples are not drawn by CSIR-IMMT. Liability, if any, for CSIR/IMMT arising in connection with the testing shall be subject to ceiling of amount received by the institute from the client. The report should not be interpreted in part.

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# TEST REPORT

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**Table-1.** Physical characteristics analysis of Solid Waste samples of Tata Steel BSL Limited, Meramandali.

| Sl. No. | Sample ID. | Concentration in Test Solid waste samples | | | |
|---|---|---|---|---|---|
| | | pH | Bulk Density, (g/cc) | Dry Matter, % | Volatile Matter, % |
| 1 | SW-1 (ETP-1 Sludge) | 7.86 | 0.62 | 97.5 | 14.7 |
| 2 | SW-2 (ETP-2 Sludge) | 8.07 | 0.69 | 98.1 | 12.0 |
| 3 | SW-3 (ETP-3 Sludge) | 8.31 | 0.71 | 98.4 | 18.9 |
| 4 | SW-4 ( CRM ETP Sludge) | 8.45 | 0.65 | 94.5 | 37.8 |
| 5 | SW-5 ( BOD -1 Sludge) | 6.71 | 0.75 | 86.5 | 47.8 |
| 6 | SW-8 (BF-1 Flue Dust) | 9.08 | 2.04 | 99.5 | 3.18 |
| 7 | SW-9 (BF-2 Flue Dust) | 10.4 | 1.61 | 99.6 | 3.44 |
| 8 | SW-10 (BOF GCP Dust) | 11.2 | 1.15 | 99.0 | 2.75 |
| 9 | SW-11 (DRI Cold ESP Dust) | 10.9 | 0.76 | 98.1 | 4.50 |
| 10 | SW-12 ((DRI Wet Scrapper Dust) | 9.57 | 0.85 | 97.7 | 4.67 |
| 11 | SW-13 (SMS Slag) | 12.2 | 1.86 | 99.9 | 0.47 |
| 12 | SW-14 (BF Granulated Slag) | 9.60 | 1.29 | 99.8 | 0.41 |
| 13 | SW-15 (Lime Plant De-dusting Dust) | 12.5 | 0.78 | 99.7 | 14.3 |
| 14 | SW-17 (Mill Scale) | 8.61 | 2.89 | 99.9 | 0.09 |
| 15 | SW-18 (SMS-II FES Dust) | 12.6 | 1.41 | 99.8 | 4.24 |
| 16 | SW-19 (BF-1 GCP Dust) | 9.26 | 1.02 | 99.5 | 4.16 |
| 17 | SW-20 (BF-2 GCP Dust) | 9.47 | 1.25 | 99.2 | 5.17 |

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# TEST REPORT

**Ref. No. IMMT/CCD/08/2021** **Date: 03.08.2021**

**Table-2.** Size (Sieve) analysis of Solid Waste samples of Tata Steel BSL Limited, Meramandali

| Sl. No. | Sample ID | Seive Fractions | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | +2 mm | -2+1 mm | -1+500 micron | -500+250 micron | -250+150 micron | -150+75 micron | -75+45 micron | -45 micron |
| 1 | SW-1 | 73.95 | 9.31 | 5.62 | 3.50 | 0.80 | 1.32 | 1.42 | 4.08 |
| 2 | SW-2 | 62.59 | 16.21 | 8.68 | 4.09 | 0.42 | 0.38 | 0.90 | 6.74 |
| 3 | SW-3 | 36.28 | 11.91 | 10.09 | 9.46 | 6.25 | 6.67 | 11.89 | 7.46 |
| 4 | SW-4 | 88.51 | 6.70 | 2.84 | 0.93 | 0.52 | 0.50 | 0 | 0 |
| 5 | SW-5 | 83.54 | 11.30 | 3.49 | 0.42 | 0.87 | 0.16 | 0.10 | 0.11 |
| 6 | SW-8 | 6.05 | 3.02 | 3.77 | 3.75 | 4.78 | 11.69 | 13.44 | 53.48 |
| 7 | SW-9 | 0 | 0.09 | 0.25 | 0.51 | 1.91 | 29.37 | 56.56 | 11.30 |
| 8 | SW-10 | 33.52 | 15.92 | 15.29 | 11.98 | 5.10 | 6.67 | 8.29 | 3.22 |
| 9 | SW-11 | 6.40 | 7.13 | 4.61 | 5.65 | 3.44 | 14.33 | 40.13 | 18.31 |
| 10 | SW-12 | 5.12 | 4.75 | 7.91 | 10.29 | 11.28 | 23.15 | 17.61 | 19.89 |
| 11 | SW-13 | 57.97 | 9.22 | 6.74 | 4.73 | 3.00 | 5.44 | 3.53 | 9.38 |
| 12 | SW-14 | 2.31 | 12.91 | 43.91 | 16.23 | 4.56 | 6.46 | 5.05 | 8.57 |
| 13 | SW 15 | 0.93 | 0.63 | 0.96 | 1.47 | 2.50 | 15.33 | 52.18 | 26.00 |
| 14 | SW-17 | 39.15 | 13.71 | 12.83 | 16.48 | 8.68 | 6.29 | 2.09 | 0.77 |
| 15 | SW-18 | 0.49 | 1.06 | 2.55 | 7.33 | 47.34 | 21.35 | 12.43 | 7.46 |
| 16 | SW-19 | 45.08 | 3.33 | 2.71 | 3.70 | 7.08 | 17.62 | 10.22 | 10.26 |
| 17 | SW-20 | 29.96 | 12.53 | 5.22 | 3.78 | 7.02 | 17.35 | 13.72 | 10.42 |

N. B.: SW1-ETP-1 Sludge, SW2-ETP-2 Sludge, SW3-ETP-3 Sludge, SW4-CRM ETP Sludge, SW5-BOD-1 Sludge, SW8-BF-1 Flue Dust, SW9-BF-2 Flue Dust, SW10-BOF GCP Dust, SW11-DRI Cold ESP Dust, SW12-DRI Wet Scrapper Dust, SW13-SMS Slag, SW14-BF Granulated Slag, SW15-Lime Plant De-dusting Dust, SW17-Mill Scale, SW18-SMS-II FES Dust, SW19-BF-1 GCP Dust & SW20-BF-2 GCP Dust

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# TEST REPORT

**Ref. No. IMMT/CCD/08/2021** **Date: 03.08.2021**

**Table-3.** Chemical composition analysis of Solid Waste samples of Tata Steel BSL Limited, Meramandali.

| Sl. No. | Sample Ids. | Concentration in Test Solid waste samples, % | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $SiO_2$ | $Al_2O_3$ | Fe (T) | $TiO_2$ | MnO | CaO | MgO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $SO_3$ | C | $Cl^-$ | LOI |
| 1 | SW-1 | 39.21 | 23.32 | 10.3 | 0.36 | 0.049 | 0.78 | 1.21 | 0.41 | 1.65 | 0.06 | 0.28 | 3.51 | 0.23 | 16.28 |
| 2 | SW-2 | 37.91 | 19.30 | 12.5 | 0.94 | 0.085 | 5.07 | 1.40 | 0.65 | 1.24 | 0.16 | 0.07 | 6.02 | 0.29 | 16.46 |
| 3 | SW-3 | 9.07 | 4.01 | 5.11 | 0.21 | 0.038 | 3.16 | 0.94 | 0.40 | 0.69 | 0.001 | 0.85 | 56.0 | 0.16 | 73.22 |
| 4 | SW-4 | 2.40 | 1.15 | 3.72 | 0.03 | 0.10 | 21.81 | 2.54 | 1.22 | 0.52 | 0.45 | 0.17 | 17.5 | 1.13 | 42.75 |
| 5 | SW-5 | 1.29 | 2.02 | 16.2 | 0.19 | 0.021 | 0.69 | 0.62 | 1.29 | 0.65 | 0.001 | 7.70 | 30.6 | 0.48 | 75.98 |
| 6 | SW-8 | 4.17 | 1.88 | 59.15 | 0.10 | 0.093 | 2.09 | 0.58 | 1.47 | 1.02 | 0.001 | 0.82 | 2.12 | 0.40 | 3.18 |
| 7 | SW-9 | 4.18 | 1.79 | 57.7 | 0.09 | 0.056 | 2.28 | 0.74 | 1.13 | 1.37 | 0.001 | 1.78 | 10.24 | 0.13 | 11.4 |
| 8 | SW-10 | 4.32 | 1.78 | 53.1 | 0.12 | 0.095 | 12.45 | 4.02 | 1.16 | 0.97 | 0.001 | 0.31 | 0.85 | 0.075 | 2.75 |
| 9 | SW-11 | 24.28 | 12.61 | 10.98 | 0.56 | 0.039 | 5.36 | 2.32 | 1.29 | 1.16 | 0.35 | 2.49 | 33.4 | 0.09 | 35.57 |
| 10 | SW-12 | 12.76 | 7.96 | 22.74 | 0.39 | 0.025 | 2.60 | 0.71 | 1.19 | 0.99 | 0.20 | 0.42 | 30.3 | 0.03 | 46.21 |
| 11 | SW-13 | 13.42 | 1.78 | 26.7 | 0.84 | 0.022 | 45.22 | 10.80 | 1.58 | 0.88 | 1.20 | 0.20 | 0.07 | 0.27 | 0.52 |
| 12 | SW-14 | 32.99 | 15.58 | 1.10 | 0.71 | 0.065 | 31.77 | 9.14 | 1.55 | 1.34 | 0.001 | 1.61 | 0.24 | 0.14 | 0.61 |
| 13 | SW 15 | 2.41 | 1.12 | 2.68 | 0.10 | 0.066 | 45.63 | 12.8 | 3.01 | 0.89 | 0.03 | 0.26 | 5.01 | 0.58 | 23.15 |
| 14 | SW-17 | 0.09 | 0.32 | 65.4 | 0.01 | 0.012 | 0.20 | 0.99 | 1.33 | 0.74 | 0.001 | 0.03 | 0.13 | 0.05 | 2.47 |
| 15 | SW-18 | 1.94 | 0.96 | 54.7 | 0.08 | 0.011 | 11.51 | 3.38 | 1.81 | 1.87 | 0.001 | 1.28 | 1.50 | 2.68 | 4.24 |
| 16 | SW-19 | 10.84 | 3.21 | 32.9 | 0.17 | 0.046 | 2.74 | 1.31 | 1.36 | 0.93 | 0.001 | 1.01 | 27.7 | 0.31 | 31.6 |
| 17 | SW-20 | 14.65 | 1.94 | 29.3 | 0.15 | 0.049 | 3.44 | 1.45 | 1.33 | 0.87 | 0.001 | 1.46 | 30.7 | 0.45 | 35.71 |

N. B.: SW1-ETP-1 Sludge, SW2-ETP-2 Sludge, SW3-ETP-3 Sludge, SW4-CRM ETP Sludge, SW5-BOD-1 Sludge, SW8-BF-1 Flue Dust, SW9-BF-2 Flue Dust, SW10-BOF GCP Dust, SW11-DRI Cold ESP Dust, SW12-DRI Wet Scrapper Dust, SW13-SMS Slag, SW14-BF Granulated Slag, SW15-Lime Plant De-dusting Dust, SW17-Mill Scale, SW18-SMS-II FES Dust, SW19-BF-1 GCP Dust & SW20-BF-2 GCP Dust

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**Table-4(a).** Experimental variables for Toxicity Characteristic Leaching Procedure (TCLP) study of Solid Waste samples conducted as per US-EPA method 1311.

| Sl. No. | TCLP study Variables | Variable Data | | | | | |
|---|---|---|---|---|---|---|---|
| | | SW 1 | SW 2 | SW3 | SW 4 | SW 5 | SW 8 |
| 1 | TCLP study method | US-EPA Method-1311 | | | | | |
| 2 | Sample type | Dust and Gravels, Particle size < 8 mm | Dust and Gravels, Particle size < 8 mm | Dust and Gravels, Particle size < 8 mm | Dust and Gravels, Particle size < 8 mm | Dust and Gravels, Particle size < 8 mm | Dust and Gravels, Particle size < 8 mm |
| 3 | Sample particle size taken for leaching | Original sample | Original sample | Original sample | Original sample | Original sample | Original sample |
| 4 | Initial pH of samples | 7.86 | 8.07 | 8.31 | 8.45 | 6.71 | 9.08 |
| 5 | pH after HCl + heat | 3.01 | 5.69 | 6.82 | 7.15 | 4.16 | 3.67 |
| 6 | Extraction fluid used | Extraction fluid -1 | Extraction fluid -2 | Extraction fluid -2 | Extraction fluid -2 | Extraction fluid -1 | Extraction fluid -1 |
| 7 | pH of Extraction fluid | 4.91 | 2.88 | 2.88 | 2.88 | 4.91 | 4.91 |
| 8 | Sample taken for leaching, gm | 50 | | | | | |
| 9 | Volume of extraction fluid used, ml | 1000 | | | | | |
| 10 | Liquid/solid ratio | 20:1 | | | | | |
| 11 | Head space | 10 % | | | | | |
| 12 | Extraction Temperature °C | 28 | | | | | |
| 13 | Extraction Time, hour | 18 | | | | | |
| 14 | Filter | Glass micro fiber, Whatman GF/C | | | | | |
| 15 | Washing of filters | With dil. $HNO_3$and distilled water | | | | | |
| 16 | pH of recovered extraction fluid | 4.75 | 4.47 | 4.46 | 4.52 | 4.65 | 4.78 |

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CSIR - INSTITUTE OF MINERALS & MATERIALS TECHNOLOGY
(Council of Scientific & Industrial Research)
Bhubaneswar - 751013, Odisha, INDIA

# TEST REPORT

**Ref. No. IMMT/CCD/08/2021** **Date: 03.08.2021**

**Table-4(b).** Trace element analysis of TCLP or WET Procedure solutions of Solid waste samples; leaching studies conducted as per US-EPA method 1311 and Appendix II of section 66261 of Title 22 of California Code Regulations (CCR).

| Sl. No. | Component | Concentrations in TCLP or WET* leaching solutions of Solid Waste test samples (mg/L) | | | | | | Waste constituents concentration limits of TCLP or STLC. US-EPA and California Code of Regulations (mg/L) |
|---|---|---|---|---|---|---|---|---|
| | | SW1 | SW2 | SW3 | SW4 | SW5 | SW8 | |
| 1 | Hg | 0.002 | 0.004 | 0.003 | 0.002 | 0.002 | 0.004 | 0.2 |
| 2 | As | 0.019 | 0.037 | 0.032 | 0.010 | 0.015 | 0.001 | 5.0 |
| 3 | Se | 0.047 | 0.067 | 0.056 | 0.036 | 0.169 | 0.011 | 1.0 |
| 4 | Sb* | 0.044 | 0.039 | 0.045 | 1.13 | 0.001 | 0.11 | 15.0 |
| 5 | Ba | 0.37 | 1.39 | 1.16 | 0.08 | 0.13 | 0.07 | 100.0 |
| 6 | Cd | 0.002 | 0.002 | 0.008 | 0.001 | 0.001 | 0.001 | 1.0 |
| 7 | Cr | 0.019 | 0.018 | 0.026 | 0.513 | 0.023 | 0.025 | 5.0 |
| 8 | Pb | 0.021 | 0.027 | 0.126 | 0.021 | 0.025 | 0.013 | 5.0 |
| 9 | Mn | 0.29 | 5.04 | 3.66 | 1.72 | 0.57 | 2.12 | 10.0 |
| 10 | Ag | 0.001 | 0.001 | 0.001 | 0.003 | 0.002 | 0.003 | 5.0 |
| 11 | Co* | 0.21 | 0.18 | 0.15 | 0.21 | 0.19 | 0.21 | 80.0 |
| 12 | Cu* | 0.53 | 0.02 | 9.6 | 0.04 | 12.3 | 0.05 | 25.0 |
| 13 | Mo* | 0.071 | 0.074 | 0.052 | 0.175 | 0.002 | 0.008 | 350 |
| 14 | Ni* | 0.27 | 0.22 | 0.25 | 1.04 | 0.49 | 0.24 | 20.0 |
| 15 | V* | 1.07 | 1.32 | 0.46 | 0.23 | 0.001 | 0.74 | 24.0 |
| 16 | Zn* | 2.62 | 1.05 | 3.39 | 2.33 | 0.73 | 2.86 | 250 |
| 17 | F-* | 0.67 | 1.03 | 1.21 | 2.69 | 38.6 | 19.5 | 180 |

Remark: The TCLP and WET leaching solution analyses of Solid Waste samples reveal that trace element concentrations are much below the Waste constituent concentration limits.

03/08/21

(J. Das)
Principal Technical Officer
Central Characterization Dept.

सीएसआइआर - खनिज एवं पदार्थ प्रौद्योगिकी संस्थान
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Bhubaneswar - 751013, Odisha, INDIA

# TEST REPORT

**Ref. No. IMMT/CCD/08/2021** **Date: 03.08.2021**

**Table-5(a).** Experimental variables for Toxicity Characteristic Leaching Procedure (TCLP) study of Solid Waste samples conducted as per US-EPA method 1311.

| Sl. No. | TCLP study Variables | Variable Data | | | | | |
|---|---|---|---|---|---|---|---|
| | | SW9 | SW10 | SW11 | SW12 | SW13 | SW14 |
| 1 | TCLP study method | US-EPA Method-1311 | | | | | |
| 2 | Sample type | Dust and Gravels, Particle size < 8 mm | Dust and Gravels, Particle size < 8 mm | Dust and Gravels, Particle size < 8 mm | Dust and Gravels, Particle size < 8 mm | Dust and Gravels, Particle size < 8 mm | Dust and Gravels, Particle size < 8 mm |
| 3 | Sample particle size taken for leaching | Original sample | Original sample | Original sample | Original sample | Original sample | Original sample |
| 4 | Initial pH of samples | 10.3 | 11.2 | 10.9 | 9.57 | 12.2 | 9.60 |
| 5 | pH after HCl + heat | 3.34 | 5.61 | 9.64 | 8.13 | 11.9 | 3.81 |
| 6 | Extraction fluid used | Extraction fluid -1 | Extraction fluid -2 | Extraction fluid -2 | Extraction fluid -2 | Extraction fluid -2 | Extraction fluid -1 |
| 7 | pH of Extraction fluid | 4.91 | 2.88 | 2.88 | 2.88 | 2.88 | 4.91 |
| 8 | Sample taken for leaching, gm | 50 | | | | | |
| 9 | Volume of extraction fluid used, ml | 1000 | | | | | |
| 10 | Liquid/solid ratio | 20:1 | | | | | |
| 11 | Head space | 10 % | | | | | |
| 12 | Extraction Temperature °C | 28 | | | | | |
| 13 | Extraction Time, hour | 18 | | | | | |
| 14 | Filter | Glass micro fiber, Whatman GF/C | | | | | |
| 15 | Washing of filters | With dil. $HNO_3$and distilled water | | | | | |
| 16 | pH of recovered extraction fluid | 4.95 | 5.09 | 5.04 | 4.82 | 4.54 | 4.55 |

03/08/21

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# TEST REPORT

**Ref. No. IMMT/CCD/08/2021** **Date: 03.08.2021**

**Table-5(b).** Trace element analysis of TCLP or WET Procedure solutions of Solid waste samples; leaching studies conducted as per US-EPA method 1311 and Appendix II of section 66261 of Title 22 of California Code Regulations (CCR).

| Sl. No. | Component | Concentrations in TCLP or WET* leaching solutions of Solid Waste test samples (mg/L) | | | | | | Waste constituents concentration limits of TCLP or STLC. US-EPA and California Code of Regulations (mg/L) |
|---|---|---|---|---|---|---|---|---|
| | | SW9 | SW10 | SW11 | SW12 | SW13 | SW14 | |
| 1 | Hg | 0.002 | 0.004 | 0.004 | 0.003 | 0.005 | 0.001 | 0.2 |
| 2 | As | 0.002 | 0.006 | 0.002 | 0.029 | 0.003 | 0.023 | 5.0 |
| 3 | Se | 0.049 | 0.011 | 0.002 | 0.063 | 0.052 | 0.051 | 1.0 |
| 4 | Sb* | 0.10 | 0.11 | 0.07 | 0.04 | 0.04 | 0.05 | 15.0 |
| 5 | Ba | 0.38 | 0.06 | 0.88 | 1.02 | 0.05 | 0.29 | 100.0 |
| 6 | Cd | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 1.0 |
| 7 | Cr | 0.024 | 0.016 | 0.027 | 0.030 | 0.031 | 0.023 | 5.0 |
| 8 | Pb | 1.14 | 0.011 | 0.003 | 0.024 | 0.015 | 0.022 | 5.0 |
| 9 | Mn | 1.96 | 0.07 | 2.58 | 1.66 | 3.04 | 0.39 | 10.0 |
| 10 | Ag | 0.003 | 0.001 | 0.003 | 0.001 | 0.002 | 0.001 | 5.0 |
| 11 | Co* | 0.21 | 0.13 | 0.22 | 0.19 | 0.16 | 0.17 | 80.0 |
| 12 | Cu* | 0.04 | 0.03 | 0.03 | 0.16 | 0.04 | 0.02 | 25.0 |
| 13 | Mo* | 0.024 | 0.01 | 0.001 | 0.01 | 0.001 | 0.001 | 350 |
| 14 | Ni* | 0.18 | 0.06 | 0.07 | 0.21 | 0.15 | 0.18 | 20.0 |
| 15 | V* | 0.79 | 0.36 | 0.23 | 0.14 | 1.72 | 0.16 | 24.0 |
| 16 | Zn* | 4.01 | 2.54 | 0.14 | 0.42 | 0.05 | 1.38 | 250 |
| 17 | F-* | 18.0 | 0.07 | 2.07 | 1.33 | 0.16 | 7.74 | 180 |

Remark: Remark: The TCLP and WET leaching solution analyses of Solid Waste samples reveal that trace element concentrations are much below the Waste constituent concentration limits.

03/08/21

(J. Das)
Principal Technical Officer
Central Characterization Dept.

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Bhubaneswar - 751013, Odisha, INDIA

# TEST REPORT

**Ref. No. IMMT/CCD/08/2021** **Date: 03.08.2021**

**Table-6(a).** Experimental variables for Toxicity Characteristic Leaching Procedure (TCLP) study of Solid Waste samples conducted as per US-EPA method 1311.

| Sl. No. | TCLP study Variables | Variable Data | | | | |
|---|---|---|---|---|---|---|
| | | SW15 | SW17 | SW18 | SW19 | SW20 |
| 1 | TCLP study method | US-EPA Method-1311 | | | | |
| 2 | Sample type | Dust and Gravels, Particle size < 8 mm | Dust and Gravels, Particle size < 8 mm | Dust and Gravels, Particle size < 8 mm | Dust and Gravels, Particle size < 8 mm | Dust and Gravels, Particle size < 8 mm |
| 3 | Sample particle size taken for leaching | Original sample | Original sample | Original sample | Original sample | Original sample |
| 4 | Initial pH of samples | 12.5 | 8.61 | 12.5 | 9.26 | 9.47 |
| 5 | pH after HCl + heat | 12.3 | 1.71 | 12.2 | 3.02 | 6.32 |
| 6 | Extraction fluid used | Extraction fluid -2 | Extraction fluid -1 | Extraction fluid -2 | Extraction fluid -1 | Extraction fluid -2 |
| 7 | pH of Extraction fluids | 2.88 | 4.91 | 2.88 | 4.91 | 2.88 |
| 8 | Sample taken for leaching, gm | 50 | | | | |
| 9 | Volume of extraction fluid used, ml | 1000 | | | | |
| 10 | Liquid/solid ratio | 20:1 | | | | |
| 11 | Head space | 10 % | | | | |
| 12 | Extraction Temperature °C | 28 | | | | |
| 13 | Extraction Time, hour | 18 | | | | |
| 14 | Filter | Glass micro fiber, Whatman GF/C | | | | |
| 15 | Washing of filters | With dil. $HNO_3$ and distilled water | | | | |
| 16 | pH of recovered extraction fluid | 8.21 | 4.64 | 7.85 | 4.57 | 4.60 |

(J. Das)
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# TEST REPORT

**Ref. No. IMMT/CCD/08/2021** **Date: 03.08.2021**

**Table-6(b).** Trace element analysis of TCLP or WET Procedure solutions of Solid waste samples; leaching studies conducted as per US-EPA method 1311 and Appendix II of section 66261 of Title 22 of California Code Regulations (CCR).

| Sl. No. | Component | Concentrations in TCLP or WET* leaching solutions of Solid Waste test samples (mg/L) | | | | | Waste constituents concentration limits of TCLP or STLC. US-EPA and California Code of Regulations (mg/L) |
|---|---|---|---|---|---|---|---|
| | | SW15 | SW17 | SW18 | SW19 | SW20 | |
| 1 | Hg | 0.002 | 0.004 | 0.002 | 0.003 | 0.002 | 0.2 |
| 2 | As | 0.018 | 0.018 | 0.026 | 0.018 | 0.003 | 5.0 |
| 3 | Se | 0.055 | 0.054 | 0.181 | 0.057 | 0.019 | 1.0 |
| 4 | Sb* | 0.014 | 0.079 | 0.070 | 0.063 | 0.015 | 15.0 |
| 5 | Ba | 0.35 | 0.16 | 0.22 | 0.17 | 0.59 | 100.0 |
| 6 | Cd | 0.001 | 0.001 | 0.002 | 0.080 | 0.030 | 1.0 |
| 7 | Cr | 0.057 | 0.021 | 0.038 | 0.022 | 0.027 | 5.0 |
| 8 | Pb | 0.025 | 0.019 | 0.021 | 21.5 | 22.4 | 5.0 |
| 9 | Mn | 0.02 | 0.27 | 0.12 | 0.39 | 0.97 | 10.0 |
| 10 | Ag | 0.001 | 0.001 | 0.005 | 0.002 | 0.001 | 5.0 |
| 11 | Co* | 0.16 | 0.17 | 0.17 | 0.19 | 0.19 | 80.0 |
| 12 | Cu* | 0.07 | 0.02 | 0.14 | 0.19 | 0.01 | 25.0 |
| 13 | Mo* | 0.014 | 0.057 | 0.067 | 0.021 | 0.039 | 350 |
| 14 | Ni* | 0.08 | 0.27 | 0.10 | 0.18 | 0.14 | 20.0 |
| 15 | V* | 0.01 | 0.06 | 0.75 | 0.77 | 0.59 | 24.0 |
| 16 | Zn* | 0.03 | 0.18 | 2.06 | 3.87 | 4.98 | 250 |
| 17 | F-* | 19.7 | 0.61 | 18.8 | 9.57 | 17.8 | 180 |

Remark: Remark: The TCLP and WET leaching solution analyses of Solid Waste samples reveal that trace element concentrations are much below the Waste constituent concentration limits.

03/08/21

(J. Das)
Principal Technical Officer
Central Characterization Dept.

ORISSA WASTE MANAGEMENT PROJECT
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Plot No 420/648/1, Vill: Kanchichuan
Po: Mangalpur, Via- Sukinda, Dist-Jajpur
Odisha, PIN-755018
Phone No.: 9178458227/9937026836
Email: laboratoryowmp@ramky.com
Website: www.ramky.com

**To**
**Tata Steel BSL Ltd.**
**At- Narendrapur, Po- Kasupanga**
**Via- Meramandali**
**Dist- Dhenkanal**

We are here with enclosing the Comprehensive analysis report of Solid Waste Sample –: **Waste Containing Oil/ Thinner,** received on Date: **04.05.2020**. The disposal method for the above sample is **Direct Incineration.** We are also enclosing the invoice for analysis.

The disposal method is purely based on the characteristics of the sample sent to us. When the waste will be sent to us it will be analyzed and if the characteristics change the disposal method may change.

Please send us your suggestions for improving laboratory services by filling customer Feedback form attached herewith.

Thanking you for your business. Please Contact us again if we can be of any service in the future. Our fullest Co-Operation and best service assured always.

Yours faithfully
**For Orissa Waste Management Project**
**(A division of Ramky Enviro Engineers Ltd)**

RAMKY ENVIRO ENGINEERS LTD. OWMP

**Authorized Signatory**
**(Soumya Roy)**

Towards sustainable growth

ORISSA WASTE MANAGEMENT PROJECT
(A division of Ramky Enviro Engineers Ltd.)
Plot No 420/648/1, Vill: Kanchichuan
Po: Mangalpur, Via- Sukinda, Dist-Jajpur
Odisha, PIN-755018
Phone No.: 9178458227/9937026836
Email: laboratoryowmp@ramky.com
Website: www.ramky.com

Test Report No: OWMP/COM/CA-256-020-Section-1

Name and address of the client

Tata Steel BSL Ltd.
At- Narendrapur, Po- Kasupanga
Via- Meramandali
Dist- Dhenkanal

Towards sustainable growth

Report Date : 13.07.2020
Analysis Completion Date : 30.05.2020
Analysis Starting Date : 18.05.2020
Sampling Date : 02.05.2020
Sample received Date : 04.05.2020
Sub-Contracting of Tests : NA

Sample Condition : Sample received in Polythene Cover
Sampling Procedure : NA
Sample registration no : OWMP/COM/CA-256-020
Sample description/Code: Waste Containing Oil/ Thinner
Sample Collected by : REEL

Physical Observations:

| Parameter | Result |
|---|---|
| Physical State | Liquid |
| Color | Yellowish |
| Texture | Liquid |
| Odour | Oily |
| Is there any violent chemical change (in air) (Normally unstable) (Yes/No) | NO |
| Reacts violent with water (Yes/No) | NO |
| Generating of toxic fumes with water/acid/basic (Yes/No) | NO |
| Forms potentially explosive mixture with water (Yes/No) | NO |
| Explosion when subjected to a strong initiating force (Yes/No) | NO |
| Explosion at normal temperature & pressure (Yes/No) | NO |

## TEST RESULT

| S.NO | PARAMETER | Unit | Method | Result | Std. for Secure Landfill Disposal |
|---|---|---|---|---|---|
| 1 | Paint Filter Liquid Test | - | SW-846 9095A | NA | Pass |
| 2 | Bulk Density | gm/cc | ASTM D6683-19 | 1.23 | --- |
| 3 | pH at 22°C | - | USEPA 1998, SW – 846; 9045C | 4.84 | 4 to 12 |
| 4 | Flash Point | °C | USEPA 1998, SW – 846: 1020A | >60 °C | >60° C |
| 5 | Loss On Drying at 105 °C | % | APHA 23rd Edition 2017; 2540 | 33.01 | --- |

Test Report No: OWMP/COM/ CA-256-020-(Section 1)

| S.NO | PARAMETER | Unit | Method | Result | Std. for Secure Landfill Disposal |
|---|---|---|---|---|---|
| 6 | Loss on Ignition at 550°C | % | APHA 23rd Edition, 2017; 2540 | 96.34 | <= 20% Non-biodegradable<= 5%: Biodegradable |
| 7 | Calorific Value | cal/gm | IS: 1350(Part-II)-1970 | 8269 | <2500 |
| 8 | Water Soluble Inorganics (In WLT Extract) | %(w/w) | APHA 2540 E | 1.02 | <20.0 |
| 9 | Oil & Grease (AS n-Hexane extractable) | %(w/w) | Std Methods: 5520E | 58.54 | <4.0 |
| 10 | Cyanide (WLT) | mg/L | APHA 4500 CN E | 0.10 | <2.0 |
| 11 | Reactive Sulfide | mg/Kg | USEPA 1998,SW - 846 9034 | ND | <500 |
| 12 | Total Phenols(WLT) | mg/L | APHA-5530B&D | ND | <100.0 |
| 13 | Ammonia as N (WLT) | mg/L | APHA-4500$NH_3$B,C | <5.0 | <1000.0 |
| 14 | Fluoride as F-(WLT) | mg/L | APHA 23rd Edition; 4500 F-D | 1.6 | <50.0 |
| 15 | Nitrate Nitrogen as N(WLT) | mg/L | APHA 4500 $NO_3^-$ B | ND | <30.0 |
| 16 | Arsenic as As (Total) | mg/Kg | USEPA 1998, SW846; 7061 A | ND | --- |
| 17 | Arsenic as As (WLT) | mg/L | USEPA 1998,APHA-3500 As B, SW846; 7061 A | ND | <1.0 |
| 18 | Cadmium (Total) | mg/Kg | USEPA 1998, SW846 - 7130 | ND | --- |
| 19 | Cadmium (WLT) | mg/L | APHA 23rd Edition,3111 B | ND | <0.2 |
| 20 | Cadmium (TCLP) | mg/L | USEPA 1998, SW-846; 7130 | ND | <1.0 |
| 21 | Total Chromium (Total) | mg/Kg | USEPA 1998, SW846 - 7190 | 5.33 | --- |
| 22 | Total Chromium (TCLP) | mg/L | USEPA 1998, SW846 - 7190 | NA | <5.0 |
| 23 | Chromium(WLT) | mg/L | APHA 23rd Edition 2017: 3500 Cr B | NA | --- |
| 24 | Hexavalent Chromium(WLT) | mg/L | APHA 23rd Edition 2017: 3500 Cr B | NA | <0.5 |
| 25 | Lead (Total) | mg/Kg | USEPA 1998, SW846 - 7420 | 7.78 | --- |
| 26 | Lead (TCLP) | mg/L | USEPA 1998, SW846 - 7420 | NA | <5.0 |
| 27 | Lead (WLT) | mg/L | APHA 23rd Edition, 3111 B | NA | <2.0 |
| 28 | Nickel (Total) | mg/Kg | USEPA 1998, SW846 - 7520 | 2.45 | --- |
| 29 | Nickel (WLT) | mg/L | APHA 23rd Edition, 3111 B | NA | <3.0 |
| 30 | Zinc (Total) | mg/Kg | USEPA 1998, SW846 - 7950 | ND | --- |
| 31 | Zinc (WLT) | mg/L | APHA 23rd Edition, 3111 B | NA | <10 |
| 32 | Copper (Total) | mg/Kg | USEPA 1998, SW846 - 7210 | 2.02 | --- |
| 33 | Copper (WLT) | mg/L | APHA 23rd Edition, 3111 B | NA | <10 |

for. Pranab

Checked by
(Nihar Ranjan Lenka)

RAMKY ENVIRO ENGINEERS LTD.

Authorized Signatory
(Soumya Roy)



Site Address: Plot No 420/648/1, Vill: Kanchichuan, Po: Mangalpur, Via- Sukinda, Dist- Jajpur, Odisha. E-mail: laboratoryowmp@ramky.com

Test Report No: OWMP/COM/ CA-256-020-(Section 2)

| S.NO | PARAMETER | Unit | Method | Result | Std. for Secure Landfill Disposal |
|---|---|---|---|---|---|
| 1 | Mercury as Hg (Total) | mg/Kg | SW-846 7471A | NA | --- |
| 2 | Mercury as Hg (TCLP) | mg/L | SW-846 7470A | NA | <0.2 |
| 3 | Mercury as Hg (WLT) | mg/L | SW-846 7470A | NA | <0.1 |
| 4 | Total Fluoride as F- | % | SW 846 | NA | --- |
| 5 | Chlorides as Cl - in 10% Solution | mg/L | APHA (Part 4500-Cl⁻:B) | NA | --- |
| 6 | Total Nitrogen as N | % | CHNS | NA | --- |
| 7 | Total Carbon as C | % | CHNS | NA | --- |
| 8 | Total Hydrogen as H | % | CHNS | NA | --- |
| 9 | Total Sulfur as S | % | CHNS | NA | --- |
| 10 | Chloroform | mg/L | GC-MS | ND | 6.0 mg/L (TCLP) |
| 11 | Carbon tetra chloride | mg/L | GC-MS | ND | 0.5 mg/L (TCLP) |
| 12 | Benzene | mg/L | GC-MS | ND | 0.5 mg/L (TCLP) |
| 13 | Chloro Benzene | mg/L | GC-MS | ND | 100.0 g/L(TCLP) |
| 14 | Cresols | mg/L | GC-MS | ND | 200.0 g/L(TCLP) |
| 15 | 1,4 - Dichloro Benzene | mg/L | GC-MS | ND | 7.5 mg/L (TCLP) |
| 16 | 1,2 – Dichloro Ethane | mg/L | GC-MS | ND | 0.5 mg/L (TCLP) |
| 17 | Pyridine | mg/L | GC-MS | ND | 5.0 mg/L (TCLP) |
| 18 | Ethyl Methyl Ketone | mg/L | GC-MS | ND | 200.0 g/L(TCLP) |
| 19 | Nitro Benzene | mg/L | GC-MS | ND | 2.0 mg/L (TCLP) |
| 20 | Tetrachloro Ethylene | mg/L | GC-MS | ND | 0.7 mg/L (TCLP) |
| 21 | Trichloro Ethylene | mg/L | GC-MS | ND | 0.5 mg/L (TCLP) |
| 22 | 1,1 – Dichloroethylene | mg/L | GC-MS | ND | 0.7 mg/L (TCLP) |
| 23 | 2,4 – Dinitrotoluene | mg/L | GC-MS | ND | 0.1 mg/L (TCLP) |
| 24 | Endrin | mg/L | GC-MS | ND | 0.02 mg/L (TCLP) |
| 25 | Heptachlor(and its epaoxide) | mg/L | GC-MS | ND | 0.008 g/L(TCLP) |
| 26 | Hexachlorobenzene | mg/L | GC-MS | ND | 0.13 mg/L (TCLP) |
| 27 | Hexachlorobutadiene | mg/L | GC-MS | ND | 0.5 mg/L (TCLP) |
| 28 | Hexachloroethane | mg/L | GC-MS | ND | 3.0 mg/L (TCLP) |
| 29 | Lindane | mg/L | GC-MS | ND | 0.4 mg/L (TCLP) |
| 30 | Methoxychlor | mg/L | GC-MS | ND | 10.0 mg/L (TCLP) |
| 31 | Pentachlorphenol | mg/L | GC-MS | ND | 100.0 g/L(TCLP) |
| 32 | Toxaphene | mg/L | GC-MS | ND | 0.5 mg/L (TCLP) |
| 33 | 2,4,5 – Tri Chlorophenol | mg/L | GC-MS | ND | 400.0 g/L(TCLP) |
| 34 | 2,4,6 – Trichlorophenol | mg/L | GC-MS | ND | 2.0 mg/L (TCLP) |
| 35 | 2,4,5 – TP (Silvex) | mg/L | GC-MS | ND | 1.0 mg/L (TCLP) |
| 36 | Vinyl Chloride | mg/L | GC-MS | ND | 0.2 mg/L (TCLP) |
| 37 | 2,4 - D | mg/L | GC-MS | ND | 10.0 mg/L (TCLP) |
| 38 | Chlordane | mg/L | GC-MS | ND | 0.03 mg/L (TCLP) |

for. Pranab
Checked by
(Nihar Ranjan Lenka)

Authorized Signatory
(Soumya Roy)



Site Address: Plot No 420/648/1, Vill: Kanchichuan, Po: Mangalpur, Via- Sukinda, Dist- Jajpur, Odisha. E-mail: laboratoryowmp@ramky.com

Test Report No: OWMP/COM/CA-256-020

ORISSA WASTE MANAGEMENT PROJECT
(A division of Ramky Enviro Engineers Ltd.)
Plot No 420/648/1, Vill: Kanchichuan
Po: Mangalpur, Via- Sukinda, Dist-Jajpur
Odisha, PIN-755018
Phone No.: 9178458227/9937026836
Email: laboratoryowmp@ramky.com
Website: www.ramky.com

Name and address of the client:

Tata Steel BSL Ltd.
At- Narendrapur, Po- Kasupanga
Via- Meramandali
Dist- Dhenkanal

Towards sustainable growth

## ABBREVIATIONS:

| | | |
|---|---|---|
| CPCB | - | Central Pollution Control Board |
| OWMP | - | Orissa Waste Management Project |
| SW 846 | - | Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, USEPA, May 1997 |
| Std. Methods | - | Standard Methods for the Examination of Water & Wastewater, APHA 23rd Edition, 2017 |
| TCLP | - | Toxicity Characteristic Leaching Procedure |
| WLT | - | Water Leaching Testing |
| LOD | - | Loss on Drying |
| LOI | - | Loss on Ignition |
| NA | - | Not Applicable |
| ND | - | Not Detected |
| BDL | - | Below Detectable Limit |

## TERMS & CONDITIONS:

1. *Reports pertained only to the submitted sample.*
2. *Test reports shall not be reproduced except in full, without written approval of the OWMP laboratory.*
3. *In the absence of specific request from the customer, OWMP follows National/International standards specifications for conducting the tests. Alternatively, in the absence of these methods, OWMP shall follow the operating procedures developed OWMP.*
4. *The laboratory, normally will not offer any opinion/advise or recommendation with respect to the suitability or otherwise of the sample for any application or use. Conformities to a specification or Act will be mentioned as per the Act/specification, if required.*
5. *Under no circumstances OWMP accepts any liability or loss or damage caused by use or misuse of the rest report. Liability is limited to the testing fee charged, in case of proven negligence by the laboratory.*
6. *Client may visit ( if desired) our laboratory to witness the related tests.*
7. *This test report is valid for two years from the date of issue of report, if there is no change in processes, raw materials etc.*

Yours faithfully
**For Orissa Waste Management Project**
**(A division of Ramky Enviro Engineers Ltd)**

**Authorized Signatory**
**(Soumya Roy)**

National Institute of Technology
Rourkela-769008, Odisha

RIGHT TO INFORMATION

**12. Name of the sample: DRI char**

**Analysis type: Composition and trace element detection**

**Table 12(a). Compositional analysis**

| Compound name | $SiO_2$ | $Al_2O_3$ | Fe | $TiO_2$ | MnO | CaO | MgO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $SO_3$ | LOI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wt % | 40.39 | 2.56 | 9.54 | 2.38 | 0.26 | 9.23 | 2.64 | 0.54 | 0.87 | 1.67 | 0.56 | 28 |

**Table 12(b). Trace elemental analysis**

| Element name | Pb | Cd | Cu | As | Ni | Co | Cr | Zn | Ag | Sb | Mo | V | Hg | Se | B | Ba |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wt % | 0.006 | 0.008 | 0.048 | 0.024 | 0.058 | 0.037 | 0.067 | 0.075 | 0.001 | 0.027 | 0.043 | 0.027 | 0.001 | 0.064 | 0.019 | 0.027 |

**Table 12(c). Physical analysis**

| Analysis name | Value |
|---|---|
| Sieve analysis | Arithmetic mean diameter 0.227 mm |
| Bulk density | 0.42 gm/m$^3$ |
| Dry matter | - |
| Volatile matter | 16 % |
| Calorific value | 3132.95 cal/g |
| Glass properties | 63.07 % |
| pH | 9.10 |

Soumya S. Mohapatra

(Authorized Signatory)

Dr. Soumya Sanjeeb Mohapatra
Assistant Professor
18 MAR 2020
Dept. of Chemical Engineering
NIT RKL - 769008

सीएसआइआर - खनिज एवं पदार्थ प्रौद्योगिकी संस्थान
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भुवनेश्वर-751013, ओड़िशा, भारत
CSIR - INSTITUTE OF MINERALS & MATERIALS TECHNOLOGY
(Council of Scientific & Industrial Research)
Bhubaneswar - 751013, Odisha, INDIA

# TEST REPORT

**Ref. No. IMMT/CCD/07/2021** **Date: 30.07.2021**

| | |
|---|---|
| Name & Address of the Party: | Tata Steel BSL Ltd.<br>At-Narendrapur, P.O.-Kusupanga<br>Via-Meramandali, Dist-Dhenkanal |
| Sample Details: | 1. Fly ash, BFPP-1 2. Bed ash, BFPP-1<br>3. Fly ash, BFPP-2 4. Bed ash, BFPP-2 |
| Date of Receiving: | 25.06.2021 |
| Date(s) of Conducting Test: | 30.06.2021 |
| Date of Completion of Test: | 23.07.2021 |

**Method Adopted: 1.** Major element analysis of ash samples through wet chemical route by using Volumetric, gravimetric, photometric, nephelometric, AAS and ICP-OES techniques.
**2.** TCLP study of ash samples as per US-EPA method 1311 or ASTM-D5233-92. Leaching solution analysis by ICP-OES and AAS.

**Detail Report:** Following data tables are enclosed

**Table-1.** Chemical composition analysis of fly ash and bed ash samples.
**Table-2.** Experimental variables for Toxicity Characteristic Leaching Procedure (TCLP) study of Ash samples conducted as per US-EPA method 1311.
**Table-3.** Trace element analysis of TCLP or WET Procedure solutions of Ash samples; leaching studies conducted as per US-EPA method 1311 and Appendix II of section 66261 of Title 22 of California Code Regulations (CCR).

(J. Das)
Principal Technical Officer
Central Characterization Dept.

N.B.:- The samples are not drawn by CSIR-IMMT. Liability, if any, for CSIR/IMMT arising in connection with the testing shall be subject to ceiling of amount received by the institute from the client. The report should not be interpreted in part.

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# TEST REPORT

**Ref. No. IMMT/CCD/07/2021** **Date: 30.07.2021**

**Table-1.** Chemical composition analysis of fly ash and bed ash samples.

| Sl. No. | Component | Concentration in Test Samples, % | | | |
|---|---|---|---|---|---|
| | | Fly Ash, BFPP-1 | Bed Ash, BFPP-1 | Fly Ash, BFPP-2 | Bed Ash, BFPP-2 |
| 1 | $SiO_2$ | 49.85 | 52.45 | 56.4 | 54.9 |
| 2 | $Al_2O_3$ | 25.8 | 24.6 | 16.8 | 17.5 |
| 3 | $Fe_2O_3$ | 2.64 | 3.66 | 4.35 | 5.18 |
| 4 | $TiO_2$ | 1.38 | 1.41 | 0.88 | 0.79 |
| 5 | $MnO_2$ | 0.02 | 0.04 | 0.11 | 0.16 |
| 6 | CaO | 1.66 | 2.34 | 4.99 | 7.67 |
| 7 | MgO | 0.97 | 1.12 | 1.10 | 2.21 |
| 8 | $Na_2O$ | 1.39 | 1.37 | 1.21 | 1.16 |
| 9 | $K_2O$ | 1.18 | 1.29 | 1.20 | 1.14 |
| 10 | $Cr_2O_3$ | 0.018 | 0.017 | 0.031 | 0.027 |
| 11 | NiO | 0.004 | 0.005 | 0.005 | 0.003 |
| 12 | CuO | 0.009 | 0.009 | 0.007 | 0.004 |
| 13 | ZnO | 0.008 | 0.009 | 0.017 | 0.007 |
| 14 | BaO | 0.046 | 0.049 | 0.036 | 0.031 |
| 15 | $P_2O_5$ | 0.38 | 0.34 | 0.32 | 0.21 |
| 16 | $SO_3$ | 0.27 | 0.10 | 0.15 | 0.43 |
| 17 | $Cl^-$ | 0.38 | 0.64 | 0.21 | 0.42 |
| 18 | LOI | 6.56 | 2.37 | 3.34 | 3.70 |
| 19 | $F^-$, mg/L | 0.94 | 1.23 | 1.65 | 1.79 |

30/07/21

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**Ref. No. IMMT/CCD/07/2021** **Date: 30.07.2021**

**Table-2.** Experimental variables for Toxicity Characteristic Leaching Procedure (TCLP) study of Ash samples conducted as per US-EPA method 1311.

| Sl. No. | TCLP study Variables | Variable Data | | | |
|---|---|---|---|---|---|
| | | Fly Ash, BFPP-1 | Bed Ash, BFPP-1 | Fly Ash, BFPP-2 | Bed Ash, BFPP-2 |
| 1 | TCLP study method | US-EPA Method-1311 | | | |
| 2 | Sample type | Dust, Particle size < 100 µm | Dust and Gravels, Particle size < 8 mm | Dust, Particle size < 100 µm | Dust and Gravels, Particle size < 8 mm |
| 3 | Sample particle size taken for leaching | Original sample | Original sample | Original sample | Original sample |
| 4 | Initial pH of samples | 9.11 | 12.29 | 10.30 | 12.41 |
| 5 | pH after HCl + heat | 2.04 | 10.13 | 2.37 | 11.29 |
| 6 | Extraction fluid used | Extraction fluid -1 | Extraction fluid -2 | Extraction fluid -1 | Extraction fluid -2 |
| 7 | pH of Extraction fluids | 4.94 | 2.90 | 4.94 | 2.90 |
| 8 | Sample taken for leaching, gm | 50 | | | |
| 9 | Volume of extraction fluid used, ml | 1000 | | | |
| 10 | Liquid/solid ratio | 20:1 | | | |
| 11 | Head space | 10 % | | | |
| 12 | Extraction Temperature °C | 28 | | | |
| 13 | Extraction Time, hour | 18 | | | |
| 14 | Filter | Glass micro fiber, Whatman GF/C | | | |
| 15 | Washing of filters | With dil. $HNO_3$ and distilled water | | | |
| 16 | pH of recovered extraction fluid | 5.12 | 4.78 | 4.95 | 5.66 |

30/7/21

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**Ref. No. IMMT/CCD/07/2021** **Date: 30.07.2021**

**Table-3.** Trace element analysis of TCLP or WET Procedure solutions of Ash samples; leaching studies conducted as per US-EPA method 1311 and Appendix II of section 66261 of Title 22 of California Code Regulations (CCR).

| Sl. No. | Component | Concentrations in TCLP or WET* leaching solutions of Ash test samples (mg/L) | | | | Waste constituents concentration limits of TCLP or STLC. US-EPA and California Code of Regulations (mg/L) |
|---|---|---|---|---|---|---|
| | | Fly Ash, BFPP-1 | Bed Ash, BFPP-1 | Fly Ash, BFPP-2 | Bed Ash, BFPP-2 | |
| 1 | Hg | 0.005 | 0.004 | 0.004 | 0.003 | 0.2 |
| 2 | As | 0.034 | 0.054 | 0.041 | 0.025 | 5.0 |
| 3 | Se | 0.080 | 0.044 | 0.085 | 0.047 | 1.0 |
| 4 | Sb* | 0.056 | 0.049 | 0.038 | 0.021 | 15.0 |
| 5 | Ba | 0.46 | 0.20 | 0.38 | 0.27 | 100.0 |
| 6 | Cd | 0.001 | 0.002 | 0.001 | 0.002 | 1.0 |
| 7 | Cr | 0.026 | 0.021 | 0.031 | 0.025 | 5.0 |
| 8 | Cr (VI) | 0.012 | 0.009 | 0.015 | 0.010 | 5.0 |
| 9 | Pb | 0.024 | 0.028 | 0.024 | 0.016 | 5.0 |
| 10 | Mn | 0.42 | 0.31 | 0.69 | 0.27 | 10.0 |
| 11 | Ag | 0.012 | 0.009 | 0.034 | 0.008 | 5.0 |
| 12 | Co* | 0.18 | 0.14 | 0.16 | 0.13 | 80.0 |
| 13 | Cu* | 0.51 | 0.16 | 0.55 | 0.12 | 25.0 |
| 14 | Mo* | 0.19 | 0.54 | 0.29 | 0.06 | 350 |
| 15 | Ni* | 0.31 | 0.19 | 0.31 | 0.16 | 20.0 |
| 16 | V* | 1.23 | 0.39 | 1.72 | 0.31 | 24.0 |
| 17 | Zn* | 0.64 | 0.13 | 1.12 | 0.09 | 250 |

Remark: The TCLP and WET leaching solution analyses of fly ash and bed ash samples reveal that trace element concentrations are much below the Waste constituent concentration limits. Therefore, the ash samples are non-hazardous materials and their use as land filling or mine void dumping will not have any adverse effect on the ground water quality in respect of the analyzed parameters and no separate lining is required for dumping of the tested ash samples.

30/07/21

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Central Characterization Dept.