SOLID WASTE CHARACTERIZATION REPORT

FOR

Environmental Baseline Study of Municipal Solid Waste Dumpsite Haridwar, Uttarakhand.

Location: Haridwar Dumpsite at Sarai Road.

SUBMITTED TO

TATA CONSULTING ENGINEERS LIMITED. Mumbai- 400083

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SUBMITTED BY

ECON LABORATORY AND CONSULTANCY

(ISO 9001, ISO 14001 Certified & NABL Accredited Laboratory)

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1.0 INTRODUCTION

Solid waste is the useless, unwanted and discarded material resulting from day to day activities in the community. Solid waste management may be defined as the discipline associated with the control of generation, storage, collection, transfer, processing, and disposal of solid waste.

The term 'Municipal Solid Waste (MSW)' is commonly referred to as the rejected or unwanted material generated by the daily activities from residential, institutional, commercial, and other areas excluding the bio-medical and hazardous wastes. MSW is classified into three main categories:

(1) Organic materials including kitchen waste, vegetable waste, agricultural waste and yard waste.

(2) Inert materials like sand, dust, gravels etc.

(3) Recyclable waste like glass, metals, paper, plastics and tin cans.

In the year 2016, the Government of India enacted "Solid Waste Management Rules, 2016" stipulating compliance criteria for, segregation, collection, storage, transportation, processing and disposal of municipal wastes. The Ministry of Environmental Forest and climate change (MOEFCC) Government of India, vide their Notification dated 8th April 2016 made it effective from the date of its publication in the Gazette of India. These rules are therefore applicable throughout the country. The Solid Waste Management Rules, 2016, were updated based on the Municipal Solid Wastes (Management and Handling) Rules, 2000.

Haridwar, considered to be among the seven holiest cities in India, is an ancient city located on the banks of River Ganga in the Garhwal region of Uttarakhand. As per provisional reports of Census India, population of Haridwar in 2011 was 18, 90,422.

According to Haridwar Municipality, an average of 150-200 MT of waste is collected daily. During fairs and fests like ongoing Ardh Kumbh Mela, due to increase in floating population, this quantity rises to nearly 300 metric tonnes. Source of waste generation includes Residential areas, Commercial areas and others. Table1.1 shows classification of the municipal solid waste.

Table 1.1: Classification of MSW in Haridwar City.

S No	Source	Area covered	Typical waste generators	Type of solid waste
1.	Residential	All 60 wards	Single and multifamily dwellings	Food or yard wastes, paper, cloths, glass, metals, wood, plastics, E-wastes, household hazardous wastes etc.
2.	Commercial	Upper and lower clock tower	Hotels or Restaurants, sabzi mandi, markets, offices	Food wastes, paper and cardboards, glass, metals, wood, plastics etc.
3.	Others	Schools, colleges, institutes, hospitals, club etc.	ITBP, UPCL, Doon Hospital, Indresh Hospital, Sai Temple, Doon club	General wastes, medical wastes, food waste, hazardous wastes etc.
4.	Municipal services	Recreational areas, parks, gardens etc.	Street sweeping, Doon express park, Gandhi park	Dust, park or garden waste, waste from recreational areas.

TATA CONSULTING ENGINEERS Ltd, Mumbai has awarded the Legacy Waste Characterization work to **ECON Laboratory & Consultancy** to know the qualitative and quantitative analysis of waste at different region of Uttarakhand. ECON team has been completed proposed project at given location to known the various parameters of waste.

Present report summarizes the results of the Physico-chemical parameters of Legacy Solid Waste, Ground Water Quality, Leachate, Ambient Noise Monitoring, and Ambient Air Quality Monitoring

1.1AIMS AND OBJECTIVES:

The overall objectives for the waste management assessment are summarized below:

- Collection of solid waste
- Characterization of the collected Solid Waste from given dumpsites.
- Physico-chemical analysis of Solid Waste
- Leachate Analysis, Ambient Air Quality Monitoring, Ambient Noise Monitoring and Ground Water Quality assessment.

2.0 MATERIALS AND METHODOLOGY:

Following Materials and Methodology used for collection of samples. Include the following:

- Description of study area.
- Collection of sample.

2.1 Description of Study area:

This study was conducted in Haridwar, is an ancient City of Uttarakhand, a state in India. Dumpsite in Haridwar is located at Sarai Road (Latitude: 29.9008 and Longitude: 78.092943)

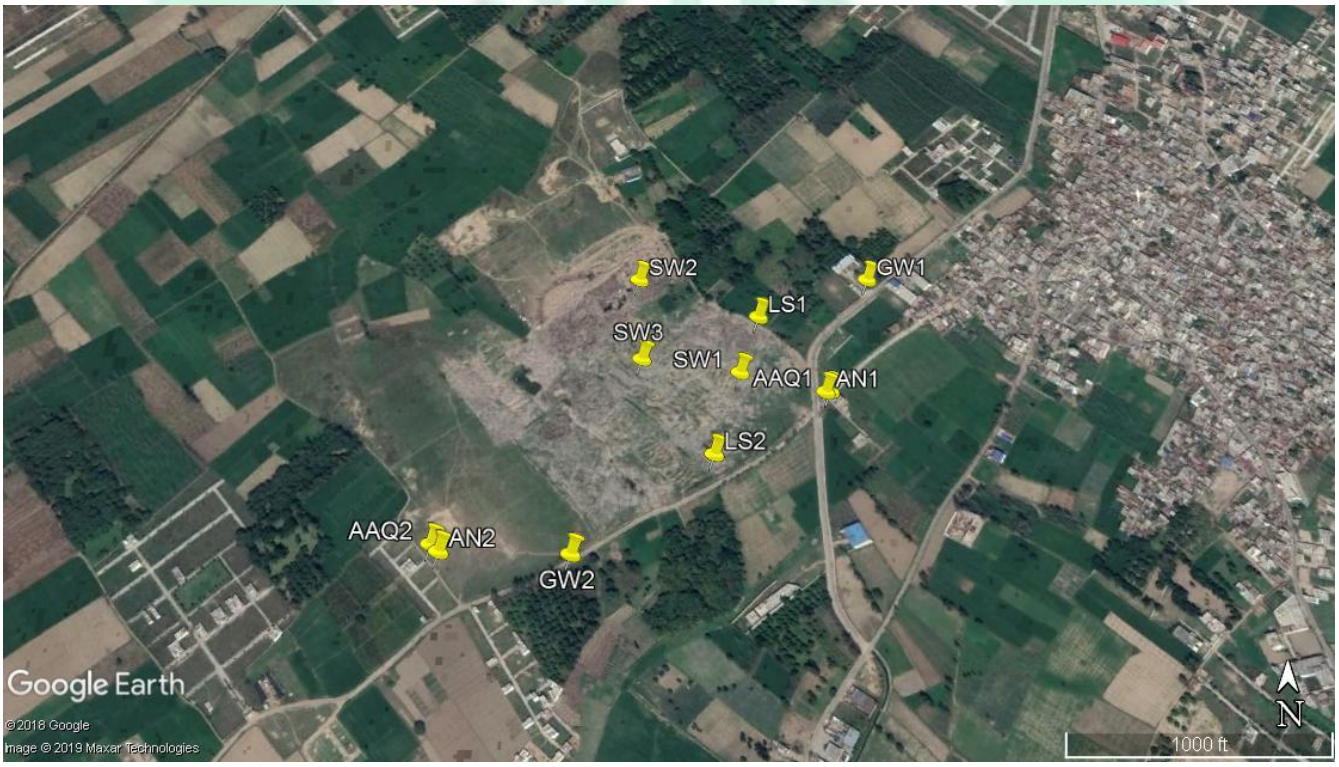


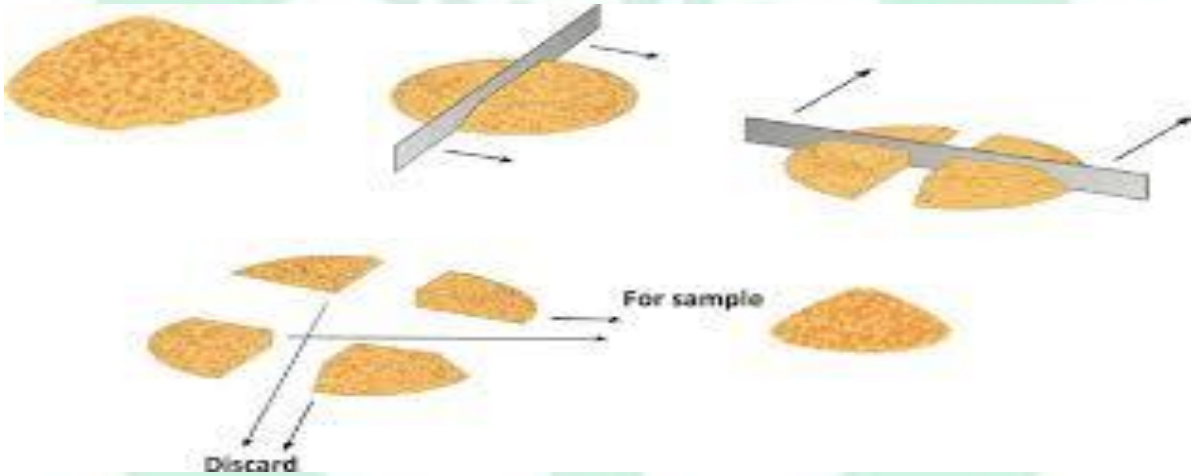
Figure 1: Satellite map showing study area.

2.2 Collection of sample:

Sampling Methodology was carried out according to Municipal Solid Waste (Management & Handling) Rules, 2016 and SWM Manual.

Sampling Procedure: Proper method are used to collect the samples of solid waste, ground water, leachate, ambient air and ambient noise.

1. **Solid waste:** Coning and quartering method is used to collect the samples of solid waste. This method used by analytical chemists to reduce the sample size of a powder without creating a systematic bias. The technique involves pouring the sample so that it takes on a conical shape, and then flattening it out into a cake. The cake is then divided into quarters; the two quarters which sit opposite one another are discarded, while the other two are combined and constitute the reduced sample. The same process is continued until an appropriate sample size remains. Analyses are made with respect to the sample left behind.



2. **Ground water:** Grab sampling method is used to collect the ground water samples. A grab sample is a sampling technique in which is a single sample or measurement is taken at a specific time or over as short a period as is feasible. Grab samples provide an immediate sample, and are thus preferred for some tests. This is the most common type of sample and is the sampling technique used for most labs.
3. **Ambient Air:** Respirable Dust Sampler are used to take the ambient air sample. The Respirable Dust Sampler is meant for monitoring the Total Suspended Particles (TSP) in ambient air conditions. It also simultaneously used for sampling the pollutant gases like SO2, NOX, NH3, CH4 and CO ... The fine dust with a diameter of less than 10 microns will pass through the filter paper.

4. **Ambient Noise:** Digital sound level meter are used to take samples of noise. A sound level meter is used for acoustic (sound that travels through air) measurements. It is commonly a hand-held instrument with a microphone. The diaphragm of the microphone responds to changes in air pressure caused by sound waves.

2.2.1<u>Quantification of Legacy Waste Sample:</u> This comprise of following activities:

a) Two samples were collected in cross-gradient of the site. One sample is collected from Up-

gradient and another one from Down-gradient (2 meter depth).

b) The samples were taken at 3 different locations in the dumping ground at various depths

Coordinates for First Location: 29°54' 0.26 ''N, Longitude- 78°5 '32.07''E
Coordinates for Second Location: 29°54' 4.69''N, Longitude- 78°5 '27.14''E
Coordinates for Third Location: 29°54' 0.89''N, Longitude. - 78°5 '27.30''E

c) Total 6 samples were collected from this dumping site,

d) The quantity of each sample was about 10kg. As per Municipal Solid Waste (Management & Handling) Rules, 2016 and SWM Manual.

2.2.2 Qualitative Assessment of Legacy Waste Sample: The qualitative analysis of the solid waste sample mainly divided into physical and chemical parameters.

- **Leachate Sample Collection and Analysis.**

a) The leachate samples were collected from the site as per direction of engineer incharge.

b) Minimum 2 no. of samples were collected from different location as per the site condition.

Location: 1 (Sample-01): 29°54'2.89''N, 78°05 '33.07''E
Location: 2 (Sample-02): 29°53' 56.59''N, 78°05 '30.75'' E

2.2.3 Baseline Ambient Air, Ambient Noise and Ground Water Sample Collection and Analysis

a) For baseline ambient air, noise & ground water quality monitoring 2 no. of samples were collected from site.

Sampling Location: Ambient Air Quality: AAQ-1: 29°53'59.42"N, 78°05 '36.39'' E UPWIND

Sampling Location: Ambient Air Quality: AAQ-2: 29°53' 52.80''N, 78°05 '17.78''E DOWN WIND

Sampling Location: Ambient Noise: AN-1: 29°53' 59.37''N, 78°05 '36.18'' E UPWIND

Sampling Location: Ambient Noise AN-2: 29°53' 52.51''N, 78°05 '18.17''E DOWNWIND

b) For ambient air monitoring and noise monitoring one sample was taken from upwind direction and second sample was taken at the downwind direction as per wind rose within a radial distance of 2.0 km from the dumping ground for 24 hour.

c) Noise constraint levels were measure for 24 hours continuous monitoring in dB (A) Leq

3.0 PHOTOPLATES

Figure 2: Photo plate Showing Collection of solid waste from Up-gradient at location 1.

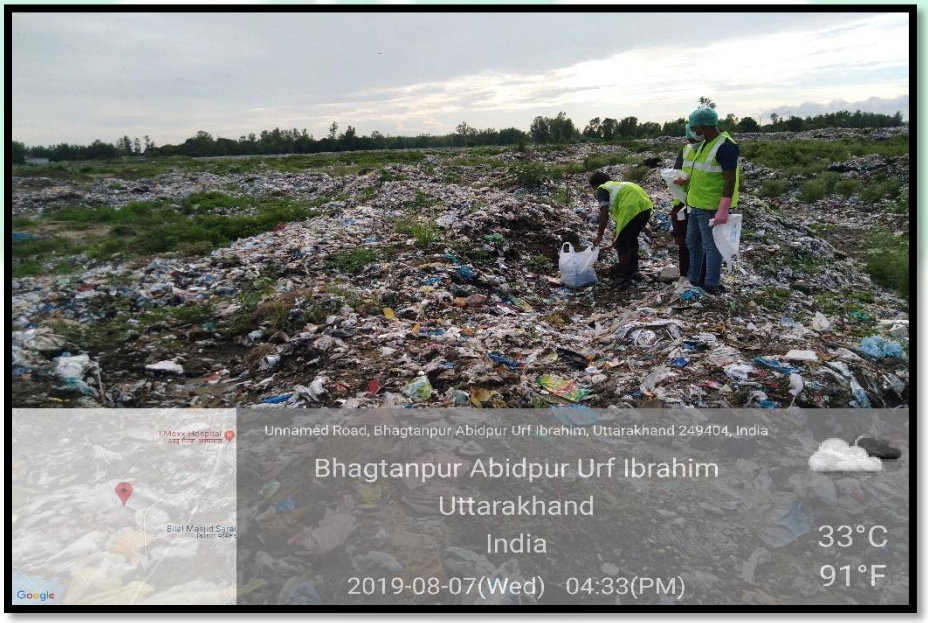


Figure 3: Photo plate Showing Collection of solid waste from Down-gradient (2 meter depth) at location 1.

Figure4: Photo plate Showing Collection of solid waste from Up-gradient at location 2.

Figure 5: Photo plate Showing Collection of solid waste from Down-gradient (2 meter depth) at location 2.

Figure 6: Photo plate Showing Collection of solid waste from Up-gradient at location 3.

Figure 7: Photo plate Showing Collection of solid waste from Down-gradient (2 meter depth) at location 3.

Figure 8: Showing Leachate Sampling at location 1.

Figure 9: Showing Leachate Sampling at location 2.

Figure 10: Photo plate Showing Ambient Air Monitoring at location 1.

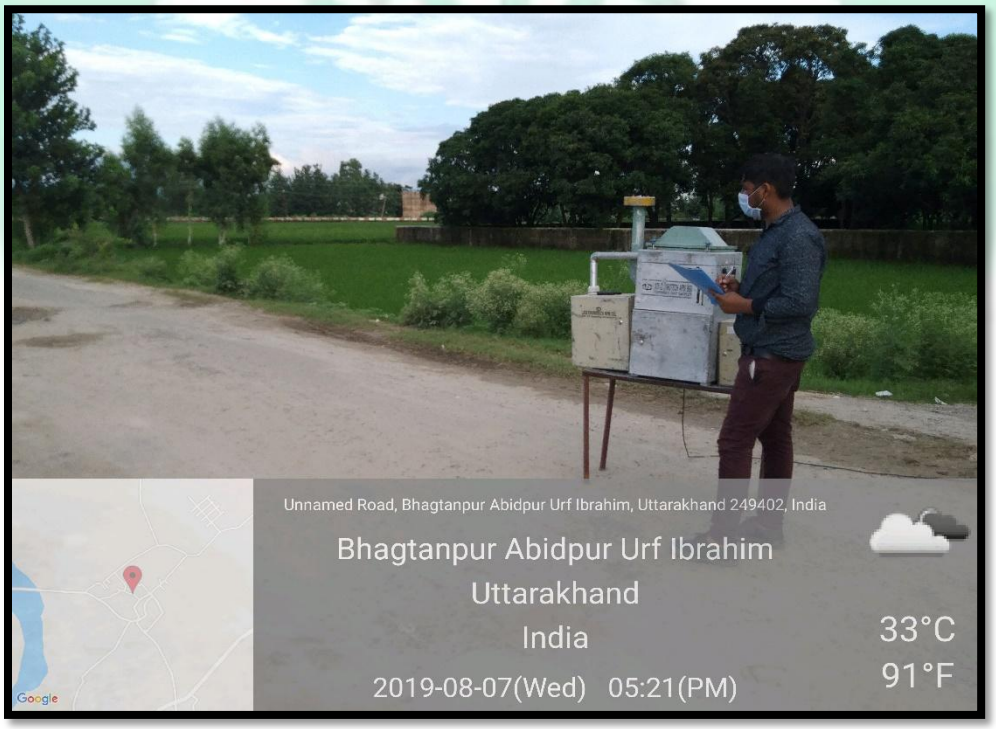


Figure 11: Showing Ambient Air Monitoring at location 2.

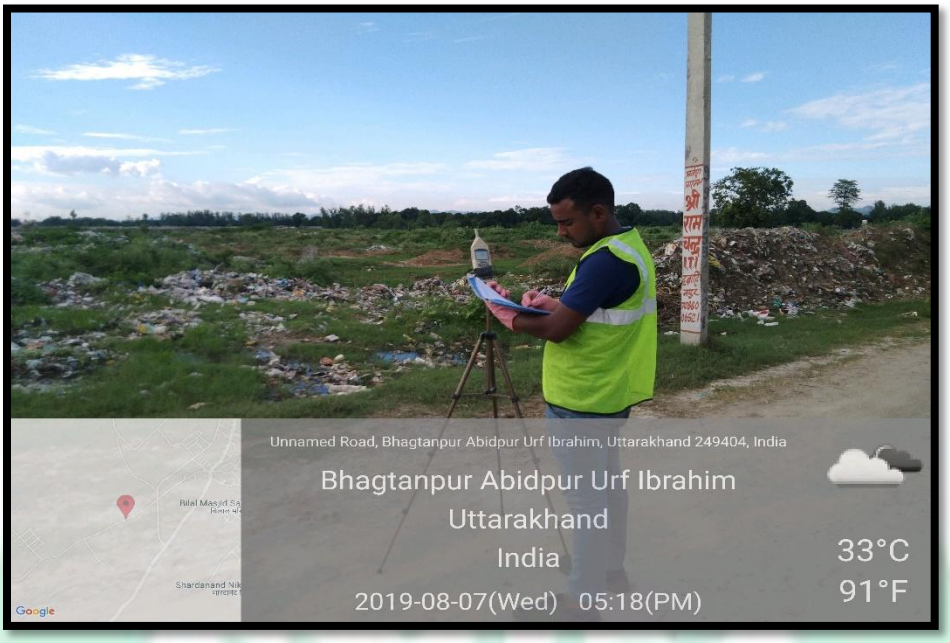


Figure 12: Photo plate Showing Ambient Noise Monitoring at location 1:

Figure 13: Photo plate Showing Ambient Noise Monitoring at location 2.

Figure 14: Photo plate Showing Ground Water sampling at location 1.

Figure14: Photo Showing Ground Water sampling at location 2.

Figure 15– Showing Component separation of solid waste.

Figure 18: Showing Quantification of solid waste.

4.0RESULTS AND DISCUSSION

4.1 Physical Analysis of Solid Waste

Location: 01
UP-GRADIENT

TOTAL WEIGHT OF SAMPLE= 10.343 KG

S.No.	Parameters	Results	Units
1.	Bulk Density	120	Kg/m^3
2.	Calorific Value	102.9	Kcal/kg
3.	Moisture	38.04	%
4.	Conductivity	1184.2	µmh/cm

4.2 Particle Size and Composition Analysis

S.No.	Parameters	Results	Units
1.	Plastic	30.22	%
2.	Paper	0.94	%
3.	Cardboard	0.54	%
4.	Thermocol	0.21	%
5.	Glass	0.40	%
6.	Metals	0.62	%
7.	Leather	0.22	%
8.	Rubber & Synthetics	0.32	%
9.	Clothes and Rags	26.88	%
10.	Sand/Silt	NIL	%
11.	Stone	2.65	%
12.	Brick	0.90	%

13.	Horticulture waste/wood	NIL	%
14.	Decomposed/insert Waste	36.16	%

4.3 Chemical Analysis of Solid Waste:

S.No.	Parameters	Results	Units	Limits
1.	pH	8.19	-	6.5-7.5
2.	Total Volatile Solids (% By mass)	45.47	%	_
3.	Total Organic Carbon (% By mass)	15.20	%	12.00
4.	C/N Ratio	47.50	-	< 2.0
5.	Total Nitrogen (% By mass)	0.32	%	0.8
6.	Total Phosphate as P_2O_5,(% By mass)	0.67	%	0.4
7.	Total Potassium as K_2O, (% By mass)	0.21	%	0.4
8.	Arsenic, (As)	2.21	mg/kg	10.00
9.	Nickel, (Ni)	0.11	mg/kg	50.00
10.	Zinc, (Zn)	25.72	mg/kg	1000.00
11.	Cadmium, (Cd)	0.280	mg/kg	5.00
12.	Copper, (Cu)	24.28	mg/kg	50.00
13.	Chromium, (Cr^{6+})	17.23	mg/kg	50.00
14.	Lead, (Pb)	48.96	mg/kg	100.00
15.	Mercury, (Hg)	BDL	mg/kg	0.15
16.	Chloride, (Cl) (% By mass)	118.2	%	_
17.	Sulphur, (% By mass)	BDL	%	_
18.	Iron, (Fe)	1408.50	mg/kg	_
19.	Manganese, (Mn)	117.21	mg/kg	_

4.4 Physical Analysis of Solid Waste

Location: 01
DOWN-GRADIENT (2 METER DEPTH)
TOTAL WEIGHT OF SAMPLE= 10.268 KG

S.No.	Parameters	Results	Units Limits as per SWM 2016
1.	Bulk Density	124	Kg/m^3
2.	Calorific Value	1510.2	Kcal/kg
3.	Moisture	1072.6	%
4.	Conductivity	20.46	µmh/cm

4.5 Particle Size and Composition Analysis

S. No.	Parameters	Results	Units
1.	Plastic	26.62	%
2.	Paper	NIL	%
3.	Cardboard	0.22	%
4.	Thermocol	0.17	%
5.	Glass	0.10	%
6.	Metals	0.27	%
7.	Leather	0.09	%
8.	Rubber & Synthetics	0.14	%
9.	Clothes and Rags	18.50	%
10.	Sand/Silt	3.19	%
11.	Stone	2.63	%
12.	Brick	0.74	%
13.	Horticulture waste/wood	NIL	%
14.	Decomposed/insert Waste	47.33	%

4.6 Chemical Analysis of Solid Waste

S.No.	Parameters	Results	Units	Limits as per SWM 2016
1.	pH	8.24	-	6.5-7.5
2.	Total Volatile Solids (% By mass)	48.32	%	_
3.	Total Organic Carbon (% By mass)	10.24	%	12.00
4.	C/N Ratio	36.57	-	< 2.0
5.	Total Nitrogen (% By mass)	0.28	%	0.8
6.	Total Phosphate as P_2O_5,(% By mass)	0.54	%	0.4
7.	Total Potassium as K_2O, (% By mass)	0.19	%	0.4
8.	Arsenic, (As)	4.97	mg/kg	10.00
9.	Nickel, (Ni)	0.07	mg/kg	50.00
10.	Zinc, (Zn)	7.60	mg/kg	1000.00
11.	Cadmium, (Cd)	BDL	mg/kg	5.00
12.	Copper, (Cu)	7.53	mg/kg	50.00
13.	Chromium, (Cr^{6+})	1.36	mg/kg	50.00
14.	Lead, (Pb)	21.82	mg/kg	100.00
15.	Mercury, (Hg)	BDL	mg/kg	0.15
16.	Chloride, (Cl) (% By mass)	132.6	%	_
17.	Sulphur, (% By mass)	BDL	%	_
18.	Iron, (Fe)	307.64	mg/kg	_
19.	Manganese, (Mn)	92.36	mg/kg	_

4.7 Location: 02
UP-GRADIENT
TOTAL WEIGHT OF SAMPLE= 11.586 KG

4.8 Physical Analysis of Solid Waste

S.No.	Parameters	Results	Units
1.	Bulk Density	129	Kg/m^3
2.	Calorific Value	1420.7	Kcal/kg
3.	Moisture	1204.1	%
4.	Conductivity	25.58	µmh/cm

4.9 Particle Size and Composition Analysis

S. No.	Parameters	Results	Units Limits as per SWM 2016
1.	Plastic	40.58	%
2.	Paper	1.20	%
3.	Cardboard	0.68	%
4.	Thermocol	0.54	%
5.	Glass	5.60	%
6.	Metals	0.58	%
7.	Leather	0.18	%
8.	Rubber & Synthetics	0.92	%
9.	Clothes and Rags	6.64	%
10.	Sand/Silt	NIL	%
11.	Stone	2.99	%
12.	Brick	2.24	%
13.	Horticulture waste/wood	2.97	%
14.	Decomposed/insert Waste	34.88	%

4.10 Chemical Analysis of Solid Waste

S. No.	Parameters	Results	Units	Limits
1.	pH	8.21	-	6.5-7.5
2.	Total Volatile Solids (% By mass)	38.90	%	_
3.	Total Organic Carbon (% By mass)	19.71	%	12.00
4.	C/N Ratio	65.7	-	< 2.0
5.	Total Nitrogen (% By mass)	0.30	%	0.8
6.	Total Phosphate as P_2O_5,(% By mass)	0.58	%	0.4
7.	Total Potassium as K_2O, (% By mass)	0.18	%	0.4
8.	Arsenic, (As)	1.92	mg/kg	10.00
9.	Nickel, (Ni)	BDL	mg/kg	50.00
10.	Zinc, (Zn)	29.97	mg/kg	1000.00
11.	Cadmium, (Cd)	0.19	mg/kg	5.00
12.	Copper, (Cu)	28.46	mg/kg	50.00
13.	Chromium, (Cr^{6+})	14.57	mg/kg	50.00
14.	Lead, (Pb)	52.90	mg/kg	100.00
15.	Mercury, (Hg)	BDL	mg/kg	0.15
16.	Chloride, (Cl) (% By mass)	106.8	%	_
17.	Sulphur, (% By mass)	BDL	%	_
18.	Iron, (Fe)	1132.52	mg/kg	_
19.	Manganese, (Mn)	123.06	mg/kg	_

4.11: Location: 02
DOWN-GRADIENT (2 METER DEPTH)
TOTAL WEIGHT OF SAMPLE= 7.346 KG

4.12 Physical Analysis of Solid Waste

S. No.	Parameters	Results	Units
1.	Bulk Density	134	Kg/m^3
2.	Calorific Value	909.7	Kcal/kg
3.	Moisture	46.79	%
4.	Conductivity	934.6	µmh/cm

4.17 Chemical Analysis of Solid waste

S. No.	Parameters	Results	Units	Limits
1.	pH	8.62	-	6.5-7.5
2.	Total Volatile Solids (% By mass)	42.19	%	_
3.	Total Organic Carbon (% By mass)	13.84	%	12.00
4.	C/N Ratio	53.23	-	< 2.0
5.	Total Nitrogen (% By mass)	0.26	%	0.8
6.	Total Phosphate as P_2O_5,(% By mass)	0.49	%	0.4
7.	Total Potassium as K_2O, (% By mass)	0.15	%	0.4
8.	Arsenic, (As)	5.40	mg/kg	10.00
9.	Nickel, (Ni)	0.18	mg/kg	50.00
10.	Zinc, (Zn)	9.13	mg/kg	1000.00
11.	Cadmium, (Cd)	BDL	mg/kg	5.00
12.	Copper, (Cu)	9.19	mg/kg	50.00
13.	Chromium, (Cr^{6+})	1.01	mg/kg	50.00
14.	Lead, (Pb)	17.31	mg/kg	100.00
15.	Mercury, (Hg)	BDL	mg/kg	0.15
16.	Chloride, (Cl) (% By mass)	125.40	%	_
17.	Sulphur, (% By mass)	BDL	%	_
18.	Iron, (Fe)	198.64	mg/kg	_
19.	Manganese, (Mn)	97.34	mg/kg	_

4.13 Particle Size and Composition Analysis:

S. No.	Parameters	Results	Units
1.	Plastic	51.78	%
2.	Paper	2.64	%
3.	Cardboard	1.02	%
4.	Thermocol	0.67	%
5.	Glass	2.11	%
6.	Metals	0.10	%
7.	Leather	0.15	%
8.	Rubber & Synthetics	0.20	%
9.	Clothes and Rags	14.29	%
10.	Sand/Silt	NIL	%
11.	Stone	2.58	%
12.	Brick	1.22	%
13.	Horticulture waste/wood	0.40	%
14.	Decomposed/insert Waste	22.84	%

4.14 Location: 03
UP-GRADIENT

TOTAL WEIGHT OF SAMPLE= 11.444 KG

4.15Physical Analysis of Solid Waste:

S. No.	Parameters	Results	Units
1.	Bulk Density	122	Kg/m^3
2.	Calorific Value	1468.1	Kcal/kg
3.	Moisture	22.22	%
4.	Conductivity	1034.2	µmh/cm

4.16 Particle Size and Composition Analysis:

S. No.	Parameters	Results	Units
1.	Plastic	29.78	%
2.	Paper	3.84	%
3.	Cardboard	1.54	%
4.	Thermocol	0.92	%
5.	Glass	3.90	%
6.	Metals	1.20	%
7.	Leather	0.94	%
8.	Rubber & Synthetics	0.63	%
9.	Clothes and Rags	1.46	%
10.	Sand/Silt	NIL	%
11.	Stone	3.41	%
12.	Brick	0.87	%
13.	Horticulture waste/wood	4.60	%
14.	Decomposed/insert Waste	46.91	%

4.17 Chemical Analysis of Solid waste

S. No.	Parameters	Results	Units	Limits
1.	pH	8.39	-	6.5-7.5
2.	Total Volatile Solids (% By mass)	29.80	%	_
3.	Total Organic Carbon (% By mass)	14.14	%	12.00
4.	C/N Ratio	61.48	-	< 2.0
5.	Total Nitrogen (% By mass)	0.23	%	0.8
6.	Total Phosphate as $P_2O_{5,}$(% By mass)	0.45	%	0.4

7.	Total Potassium as K_2O, (% By mass)	0.20	%	0.4
8.	Arsenic, (As)	2.28	mg/kg	10.00
9.	Nickel, (Ni)	0.15	mg/kg	50.00
10.	Zinc, (Zn)	36.40	mg/kg	1000.00
11.	Cadmium, (Cd)	0.11	mg/kg	5.00
12.	Copper, (Cu)	27.03	mg/kg	50.00
13.	Chromium, (Cr^{6+})	11.98	mg/kg	50.00
14.	Lead, (Pb)	43.10	mg/kg	100.00
15.	Mercury, (Hg)	BDL	mg/kg	0.15
16.	Chloride, (Cl) (% By mass)	137.87	%	_
17.	Sulphur, (% By mass)	BDL	%	_
18.	Iron, (Fe)	1092.32	mg/kg	_
19.	Manganese, (Mn)	101.24	mg/kg	_

4.18Location: 03
TOTAL WEIGHT OF SAMPLE= 11.117 KG
DOWN-GRADIENT (2 METER DEPTH)

S. No.	Parameters	Results	Units
1.	Bulk Density	129	Kg/m^3
2.	Calorific Value	134.03	Kcal/kg
3.	Moisture	24.29	%
4.	Conductivity	819.90	µmh/cm

4.19 Particle Size and Composition Analysis

S. No.	Parameters	Results	Units
1.	Plastic	26.98	%
2.	Paper	0.11	%

3.	Cardboard	0.14	%
4.	Thermocol	0.22	%
5.	Glass	0.30	%
6.	Metals	0.15	%
7.	Leather	NIL	%
8.	Rubber & Synthetics	0.10	%
9.	Clothes and Rags	9.61	%
10.	Sand/Silt	NIL	%
11.	Stone	2.70	%
12.	Brick	0.22	%
13.	Horticulture Waste/wood	0.05	%
14.	Decomposed/insert Waste	59.42	%

4.20Chemical Parameters of Solid Waste

S. No.	Parameters	Results	Units	Limits
1.	PH	8.57	-	6.5-7.5
2.	Total Volatile Solids (% By mass)	35.41	%	_
3.	Total Organic Carbon (% By mass)	13.11	%	12.00
4.	C/N Ratio	69.00	-	< 2.0
5.	Total Nitrogen (% By mass)	0.19	%	0.8
6.	Total Phosphate as P_2O_5,(% By mass)	0.39	%	0.4
7.	Total Potassium as K_2O, (% By mass)	0.14	%	0.4
8.	Arsenic, (As)	6.40	mg/kg	10.00
9.	Nickel, (Ni)	0.11	mg/kg	50.00
10.	Zinc, (Zn)	24.36	mg/kg	1000.00
11.	Cadmium, (Cd)	0.13	mg/kg	5.00
12.	Copper, (Cu)	10.41	mg/kg	50.00
13.	Chromium, (Cr^{6+})	0.93	mg/kg	50.00

14.	Lead, (Pb)	18.46	mg/kg	100.00
15.	Mercury, (Hg)	BDL	mg/kg	0.15
16.	Chloride, (Cl) (% By mass)	142.28	%	_
17.	Sulphur, (% By mass)	BDL	%	_
18.	Iron, (Fe)	172.96	mg/kg	_
19.	Manganese, (Mn)	87.06	mg/kg	_

4.21Leachate Sample -01

S. No.	Parameters	Results	Units	Limits
1.	pH	8.72	-	5.5-9.0
2.	Suspended Solids	1124	mg/l	200
3.	Dissolved Solids	3087.3	mg/l	2100
4.	Ammonical Nitrogen as N	42.20	mg/l	_
5.	Total Kjeldhal Nitrogen as N	98.33	mg/l	_
6.	Chemical Oxygen Demand	2498.92	mg/l	_
7.	Biochemical Oxygen Demand (3 days at 27^0C)	1239.02	mg/l	100
8.	Arsenic, (As)	BDL	mg/l	0.2
9.	Nickel, (Ni)	0.19	mg/l	_
10.	Zinc, (Zn)	3.98	mg/l	_
11.	Cadmium, (Cd)	0.23	mg/l	_
12.	Copper, (Cu)	0.22	mg/l	_
13.	Total Chromium	6.13	mg/l	_
14.	Lead, (Pb)	0.62	mg/l	_
15.	Mercury, (Hg)	0.19	mg/l	_
16.	Cyanide as CN	0.011	mg/l	0.2
17.	Chloride, (Cl) (% By mass)	142.26	mg/l	600
18.	Fluoride as F	8.98	mg/l	_
19.	Phenolic Compound as C_6H_5OH	0.19	mg/l	_

4.22 Leachate Sample -02

S. No.	Parameters	Results	Units	Limits
1.	pH	8.94	-	5.5-9.0
2.	Suspended Solids	1349	mg/l	200
3.	Dissolved Solids	3285.1	mg/l	2100
4.	Ammonical Nitrogen as N	47.94	mg/l	_
5.	Total Kjeldhal Nitrogen as N	111.70	mg/l	_
6.	Chemical Oxygen Demand	3241.64	mg/l	_
7.	Biochemical Oxygen Demand (3 days at 27^0C)	1564.09	mg/l	100
8.	Arsenic, (As)	BDL	mg/l	0.2
9.	Nickel, (Ni)	0.31	mg/l	_
10.	Zinc, (Zn)	1.21	mg/l	_
11.	Cadmium, (Cd)	1.02	mg/l	_
12.	Copper, (Cu)	0.63	mg/l	_
13.	Total Chromium	1.09	mg/l	_
14.	Lead, (Pb)	0.41	mg/l	_
15.	Mercury, (Hg)	0.11	mg/l	_
16.	Cyanide as CN	BDL	mg/l	0.2
17.	Chloride, (Cl) (% By mass)	158.40	mg/l	600
18.	Fluoride as F	32.61	mg/l	_
19.	Phenolic Compound as C_6H_5OH	0.14	mg/l	_

4.23Ground Water Sample Analysis -01

S. No.	Parameters	Results	Units	Limit of IS:10500-2012	
				Desirable Limits (Max.)	Permissible Limits the Absence of source (Max.)
1.	pH	7.13	-	6.5 to 8.5	No relaxation
2.	Total Hardness as $CaCO_3$	272.94	mg/l	200	600
3.	Total Dissolved Solids	381.6	mg/l	500	2000
4.	Total Kjeldhal Nitrogen as N	BDL	mg/l	-	-
5.	Nitrate as NO_3	2.57	mg/l	45	No relaxation
6.	Iron as Fe	BDL	mg/l	0.3	No relaxation
7.	Cyanide as CN	BDL	mg/l	0.05	No relaxation
8.	Arsenic, (As)	BDL	mg/l	0.01	0.05
9.	Nickel, (Ni)	BDL	mg/l	_	_
10.	Zinc, (Zn)	BDL	mg/l	5.0	15
11.	Cadmium, (Cd)	BDL	mg/l	0.003	No Relaxation
12.	Copper, (Cu)	BDL	mg/l	0.05	1.5
13.	Chromium (Cr^{6+})	BDL	mg/l	0.05	No relaxation
14.	Lead, (Pb)	BDL	mg/l	0.01	No Relaxation
15.	Mercury, (Hg)	BDL	mg/l	0.001	No Relaxation
16.	Chloride as Cl	54.06	mg/l	250	1000
17.	Sulphate as SO_4	48.14	mg/l	200	400
18.	Phenolic Compound as C_6H_5OH	BDL	mg/l	0.001	0.002

4. 24Ground Water Sample Analysis -02

S. No.	Parameters	Results	Units	Limit of IS:10500-2012	
				Desirable Limits (Max.)	Permissible Limits the Absence of source (Max.)
1.	pH	7.20	-	6.5 to 8.5	No relaxation
2.	Total Hardness as $CaCO_3$	285.18	mg/l	200	600
3.	Total Dissolved Solids	398.1	mg/l	500	2000
4.	Total Kjeldhal Nitrogen as N	BDL	mg/l	-	-
5.	Nitrate as NO_3	2.70	mg/l	45	No relaxation
6.	Iron as Fe	BDL	mg/l	0.3	No relaxation
7.	Cyanide as CN	BDL	mg/l	0.05	No relaxation
8.	Arsenic, (As)	BDL	mg/l	0.01	0.05
9.	Nickel, (Ni)	BDL	mg/l	_	_
10.	Zinc, (Zn)	BDL	mg/l	5.0	15
11.	Cadmium, (Cd)	BDL	mg/l	0.003	No Relaxation
12.	Copper, (Cu)	BDL	mg/l	0.05	1.5
13.	Chromium (Cr^{6+})	BDL	mg/l	0.05	No relaxation
14.	Lead, (Pb)	BDL	mg/l	0.01	No Relaxation
15.	Mercury, (Hg)	BDL	mg/l	0.001	No Relaxation
16.	Chloride as Cl	57.32	mg/l	250	1000
17.	Sulphate as SO_4	51.43	mg/l	200	400
18.	Phenolic Compound as C_6H_5OH	BDL	mg/l	0.001	0.002

4.26 Ambient Air Quality -01

S. No.	Parameters	Results	Units	NAAQS#
1.	Particulate Matter (PM_{10})	92.46	$\mu g/m^3$	100
2.	Particulate Matter ($PM_{2.5}$)	57.04	$\mu g/m^3$	60
3.	Sulphur Dioxide (SO_2)	10.24	$\mu g/m^3$	80
4.	Nitrogen Dioxide (NO_2)	18.19	$\mu g/m^3$	80
5.	Carbon Monoxide (CO)	0.72	mg/m^3	4.0
6.	Ammonia as NH_3	169.09	$\mu g/m^3$	400
7.	Methane as CH_4	245.87	$\mu g/m^3$	_

NAAQS-National Ambient Air Quality Standard: Schedule-VII, [Rule 3 (3B)], [Part-II-Sec.-3(i) 16.

4.27 Ambient Noise Monitoring: 01

S. No.	Parameters	Results	Units	Requirements (as per CPCB Guidelines)
1.	EQUVALENT NOISE LEVEL (Day Time)	51.8	dB	65
2.	EQUVALENT NOISE LEVEL (Night Time)	42.5	dB	55

4.28Ambient Air Monitoring: -02

S. No.	Parameters	Results	Units	NAAQS#
1.	Particulate Matter (PM_{10})	132.90	$\mu g/m^3$	100
2.	Particulate Matter ($PM_{2.5}$)	68.14	$\mu g/m^3$	60
3.	Sulphur Dioxide (SO_2)	12.80	$\mu g/m^3$	80
4.	Nitrogen Dioxide (NO_2)	25.72	$\mu g/m^3$	80
5.	Carbon Monoxide (CO)	0.86	mg/m^3	4
6.	Ammonia as NH_3	181.12	$\mu g/m^3$	400
7.	Methane as CH_4	267.45	$\mu g/m^3$	–

NAAQS-National Ambient Air Quality Standard: Schedule-VII, [Rule 3 (3B)], [Part-II-Sec.-3(i) 16.

4.29Ambient Noise Monitoring: 02

S. No.	Parameters	Results	Units	Requirements (as per CPCB Guidelines)
1.	EQUVALENT NOISE LEVEL (Day Time)	52.2	dB	65
2.	EQUVALENT NOISE LEVEL (Night Time)	53.9	dB	55

5.0 Discussion:

In the present study, following parameters results discussion are given below:

Arsenic: According to Municipal Solid Waste (Management & Handling) Rules, 2016 and SWM Manual desirable limit of Arsenic is 10mg/kg. Main source of Arsenic is from timber treatment, waste from agriculture chemicals, pharmaceuticals and metallic alloy waste. At Up-gradient waste Arsenic was ranges from 1.92 mg/kg to 2.21 mg/kg**.** And down gradient waste was ranges from 6.40 mg/kg to 5.40 mg/kg. And in

Nickel: According to Municipal Solid Waste (Management & Handling) Rules, 2016 and SWM Manual desirable limit of Nickel is 50mg/kg. Most nickel waste from within manufacturing processes, such as battery production. At Up-gradient waste nickel was ranges from 0.15 mg/kg to BDL. And in down gradient waste nickel ranges from 0.07 mg/kg to 0.11 mg/kg.

Zinc: According to Municipal Solid Waste (Management & Handling) Rules, 2016 and SWM Manual desirable limit of Zinc is 1000mg/kg. Many foodstuffs contain certain concentration of zinc. Zinc is added during industrial waste, mining and steel processing. At Up-gradient waste zinc was ranges from 36.40 mg/kg to 29.97 mg/kg. And in down gradient waste zinc ranges from 24.36 mg/kg to 7.60 mg/kg.

Cadmium: According to Municipal Solid Waste (Management & Handling) Rules, 2016 and SWM Manual desirable limit of Cadmium is 5mg/kg. There are various sources of cadmium in waste such as use of phosphate fertilizers, presence in sewage sludge, Cd batteries plating and plastics. At Up-gradient waste cadmium was ranges from 0.280 mg/kg to 0.19 mg/kg. And in down gradient waste cadmium ranges from 0.13 mg/kg to BDL.

Copper: According to Municipal Solid Waste (Management & Handling) Rules, 2016 and SWM Manual desirable limit of copper is 50mg/kg. Copper may be introduced in waste from electronic plating, wire drawing, copper polishing, paint manufacturing. At Down-gradient waste copper was ranges from 10.41 mg/kg to 7.53 mg/kg. And in Up-gradient waste copper ranges from 28.46 mg/kg to 27.03 mg/kg.

Chromium: According to Municipal Solid Waste (Management & Handling) Rules, 2016 and SWM Manual desirable limit of Chromium is 50mg/kg. Waste like electroplates, leather tanning waste, leaching from topsoil and rocks are some of the main source of chromium. At Up-gradient waste chromium was ranges from 17.23 mg/kg to 14.57mg/kg. And in down gradient waste chromium ranges from 1.36 mg/kg to 0.93 mg/kg.

Lead: According to Municipal Solid Waste (Management & Handling) Rules, 2016 and SWM Manual desirable limit of lead is 100mg/kg. Source of lead are wastes like paints, gasoline, solder and consumer product. At Up-gradient waste lead was ranges from 52.90 mg/kg to 48.96 mg/kg. And in down gradient waste chromium ranges from 17.31 mg/kgto 21.82 mg/kg.

Mercury: According to Municipal Solid Waste (Management & Handling) Rules, 2016 and SWM Manual desirable limit of Mercury is 0.15mg/kg. Mercury sources in waste are electric utilities, municipal waste combustors, industrial boilers, medical waste, cement and manufacturing waste. In all samples Mercury ranges is Below Desirable Limit.

6.0Preventive Measures:

Proper methods of waste dumping have to be undertaken to confirm that it does not affect the environment around the area or cause health hazards to the people living there.

At the house-hold proper segregation of waste has to be done and it should be ensured that all organic matter is kept aside for composting. Which is undoubtedly the best method for the correct disposal of this segment of the waste. In fact, the organic part of the waste that is generated decomposes more easily, attracts insects and cause disease. Organic waste can be composted and then used as a fertilizer.

7.0 References:

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