

**BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL,
PRINCIPAL BENCH, NEW DELHI**

ORIGINAL APPLICATION NO. 606 OF 2018

IN THE MATTER OF:-

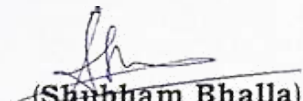
COMPLIANCE OF MUNICIPAL SOLID WASTE MANAGEMENT
RULES, 2016 AND OTHER ENVIRONMENTAL ISSUES.

NDOH: 12.12.2024

INDEX

S.No.	Particulars	Page No.
1.	AFFIDAVIT ON BEHALF OF UT CHANDIGARH.	1 - 2
2.	ANNEXURE R-1 A true copy of the Compliance report of UT Chandigarh	3-53

THROUGH COUNSEL


(Shubham Bhalla)
(SHUBHAM BHALLA)
Advocate

Office: D-52, Panchsheel Enclave, New Delhi-110017.
Mob. No. 9654427273; Email: shubhambhalla@hotmail.com

PLACE: NEW DELHI
DATE: 04.12.2024

**BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL,
PRINCIPAL BENCH, NEW DELHI**

ORIGINAL APPLICATION NO. 606 OF 2018


IN THE MATTER OF:-

COMPLIANCE OF MUNICIPAL SOLID WASTE MANAGEMENT
RULES, 2016 AND OTHER ENVIRONMENTAL ISSUES

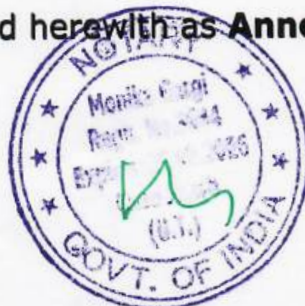
AFFIDAVIT ON BEHALF OF UT CHANDIGARH

I, Saurabh Kumar, IFS, Director, Department of Environment,
Paryavaran Bhawan, Madhya Marg, Sector 19-B, UT Chandigarh,
well conversant with the facts of the case in my official capacity
and being competent to swear this affidavit on behalf of
Respondent UT Chandigarh:-

1. That I am the Director, Department of Environment,
Chandigarh Administration. I am filing this affidavit in
terms of order of this Hon'ble Tribunal to file regular
status reports.
2. That the Compliance Report is being with the present
affidavit in compliance of the order of this Hon'ble Tribunal
regarding UT Chandigarh.


Director Environment
Chandigarh Administration

A true copy of the Compliance Report of UT Chandigarh is
annexed herewith as **Annexure R-1**.



3. That the contents of the affidavit and the compliance report are based on the record made available to the Deponent and are true to the knowledge of the Deponent.

Saurabh Kumar

DEPONENT
Director Environment
Chandigarh Administration

VERIFICATION:

I, Saurabh Kumar, IFS, the deponent above named do hereby verify and declare that the facts stated in the above paras are true to my knowledge.

Verified at _____ on this _____ day of December, 2024.

Saurabh Kumar

DEPONENT
Director Environment
Chandigarh Administration

The contents of this Affidavit/Document has been explained to the deponent/registrants. He/She has admitted the same to be correct. The deponent/registrant has signed Register at Sr. No. 1065 P. No. 84 Date 4/12/2024



Attested As Identified
Monika Gargi
MONIKA GARGI
Notary, Chandigarh (U.T.)

4 DEC 2024

4 DEC 2024

ANNEXURE R-1

COMPLIANCE REPORT

O.A. No. 606/ 2018

**(Compliance of Municipal Solid Waste Management
Rules, 2016 and other Environmental Issues)**

SUBMITTED BY

CHANDIGARH ADMINISTRATION

On 04.12.2024

INDEX

S.No.	Description	Page No.
I	Status on Compliance of Directions of Hon'ble National Green Tribunal.	1-6
	1. Separate ring-fenced account	1
	2. Status of Liquid Waste Management (LWM)	1-3
	3. Status of Solid Waste Management (SWM)	4-6
II	Annexures	


Director Environment
Chandigarh Administration

STATUS ON COMPLIANCE OF DIRECTIONS OF
HON'BLE NATIONAL GREEN TRIBUNAL ORDER DATED 30.05.2024

The status of compliance of the orders of Hon'ble NGT w.r.t. Liquid Waste Management and Solid Waste Management in U.T. Chandigarh is given below.

1. To open a separate ring-fenced account to be operated as per directions of the Adviser to the Administrator.

Status:

1.1 As per the directions of Hon'ble NGT, the Adviser to the Administrator, U.T. Chandigarh accorded approval for opening of a separate ring-fenced account which will be operated as per direction of the Adviser to the Administrator and will be utilized for restoration measures related to solid and liquid waste management.

1.2 Subsequent to the order of the Hon'ble NGT dated 18.05.2023 availability of Rs. 282 Cr. was ensured out of which an amount of Rs. 189.07 Cr. has already been spent to bridge the gap of solid and liquid waste management and other related restoration measures (detail annexed as **Annexure 'A1'**). Remaining amount of Rs. 92.93 Cr. has been kept in the separate ring-fenced account for incurring expenditure on restoration measures related to solid and liquid waste management. A Standard Operating Procedure (SOP) has been formulated for operating the account. SOP is attached as **Annexure 'A2'**.

2. Liquid Waste Management

Status:

2.1 Chandigarh has more than 100% treatment capacity. The treatment capacity of 253.5 MLD is available against the sewage water generation of 232 MLD.


Director Environment
Chandigarh Administration

Status of Liquid Waste Management:

Quantity of sewage generation (MLD)	Treatment capacity of STPs (MLD)	Present Utilization in STPs (MLD)
232	253.5	228.3

- 2.2 At present eight (8) Sewage Treatment Plants (STPs) are operational (photographs of all STPs are attached as **Annexure 'B'**). All the 8 STPs are meeting with latest norms of BOD<10 mg/l and F. Coli<100 MPN/100 ml. Data of STPs from June - November, 2024 is attached as **Annexure 'C'**.

STATUS OF SEWAGE TREATMENT PLANTS

Location	Capacity (MLD)	Present Utilization (MLD)	BOD(mg/l) November, 2024	Fecal Coliform (MPN/100 ml) November, 2024
Diggian	135	129.5	5.7	<1.8
3 BRD	50	46.0	BDL*	<1.8
Maloya	22.5	18.4	7.3	<1.8
Dhanas	7.5	4.3	BDL	<1.8
Raipur Kalan-I	22.5	20.1	3.5	<1.8
Raipur Khurd	9.0	8.0	4.4	<1.8
Raipur Kalan-II	5	1.0	BDL	<1.8
Kishangarh	2	1.0	3.1	<1.8

* BDL – Below Detection Limit (Method Detection Limit = 2 mg/l)

- 2.3 As per the directions of Hon'ble NGT, all efforts are being made expeditiously to bridge the gap in liquid waste generation and treatment including the sewage generation at Faidan village. The possibility of installation of modular STP for treatment of sewage generated at Faidan village is being explored. Further, to ensure 100% treatment of sewage, regular monitoring is being done to check if there is any discharge/leakage of untreated waste water into drains. The same is resolved by tapping the identified discharge points and channelizing the waste water to the nearest STP.


 Director Environment
 Chandigarh Administration

- 2.4 With regard to performance of Raipur Kalan –II STP, it is informed that 100 % sewage received at the STP is treated. There are two streams of 2.5 MLD each and at present one stream is operational which is treating 1 MLD of sewage. The data of last 06 months is attached as **Annexure ‘D’**.
- 2.5 The parameters of treated effluent from STPs are being tested as per the procedures given in the Standard Methods for Examination of Water and Wastewater, American Public Health Association (APHA) 24nd edition. For Fecal Coliform, the procedure for estimation of Total Most Probable Number (MPN) & Fecal Coliform-9221 is being followed as given in the Standard Methods for Examination of Water and Wastewater. The procedure is attached as **Annexure ‘E’**.
- 2.6 The disinfection at STPs is being carried out regularly through Chlorination wherein Gas chlorination is being used to disinfect the final treated effluent in sewage treatment plants. The process involves the use of chlorine gas to eliminate pathogenic microorganisms, ensuring that the treated water is safe for discharge into natural water bodies or for reuse in various applications. The methodology followed is attached as **Annexure ‘F’**.
- 2.7 For utilizing Tertiary Treated (TT) water, distribution lines are being laid including in industrial areas so that TT water can be used upto maximum possible extent. Provision of TT water to parks/gardens/green belts will be further enhanced and approximately 1911 such green landscapes will be supplied through TT water distribution lines. The work of laying of 165 km TT water distribution network will be completed by 30.04.2025. For the purpose, 3 Underground Reservoirs (UGRs) at STPs at Raipur Kalan, Maloya and 3BRD are under construction. Till date 35% of work (UGRs and allied works) has been completed.


Director Environment
Chandigarh Administration

3. Solid Waste Management

Status:

- 3.1 Chandigarh has more than 100% treatment capacity. The treatment capacity of 787 TPD is available against the municipal solid waste (MSW) generation of approx. 500 TPD. The relevant photographs of all facilities are attached as **Annexure 'G'**.

<u>Facilities</u>	<u>Capacities</u>
Material Recovery Facilities (MRFs)	: 03 Nos. (75 tonnes per shift each)
<u>Processing Facility</u>	
RDF	: 200 TPD
Compost	: (120 + 300) TPD
Horticulture	: (30+32+90) TPD
Bio-Methanation	: 5 TPD
Coconut Shell	: 10 TPD

- 3.2 100% waste is collected door to door from households in four categories viz Dry, Wet, Sanitary and Domestic Hazardous waste.
- 3.3 100% collected dry waste (approx. 116TPD including recyclables and coconut shell waste), sanitary waste (approx. 0.5 – 1 TPD) and domestic hazardous waste (approx. 0.1 TPD) at Material Recovery Facilities is sent for processing.
- 3.4 Approximately 168 TPD of wet waste is being collected. There are two compost facilities of capacities 120 TPD and 300 TPD respectively. Since, the generation of wet waste is only 168 TPD, therefore, at present; the compost facility of 300 TPD is operational which is equipped with a Leachate Treatment Plant (LTP) of 120 KLD capacity. The compost produced is being utilized by MCC.
- 3.5 Dried horticulture waste is shredded and mixed with dry waste to generate RDF. Pruned horticulture waste is processed at Horticulture Processing Plant of capacity 30

TPD to manufacture Bio-Briquettes. Horticulture waste produced in parks and green belts is processed in-situ including at 104 aerobic compost pits.

- 3.6 The sanitary waste (comprising of used diapers, sanitary towels or napkins etc.) is being collected from MRFs for processing by the authorized Biomedical Waste Treatment Facility i.e. M/s Alliance Envirocare Company Pvt. Ltd.
- 3.7 The domestic hazardous waste (comprising of discarded paint drums, pesticide cans, CFL bulbs, tube lights, etc.) is being collected by M/s RE-Sustainability Ltd. from MRFs for its proper disposal at Nimbua Greenfield (Punjab) Ltd., Derabassi.
- 3.8 Coconut shell waste is separately processed and shredded to mix with RDF for use as fuel.
- 3.9 All the C&D waste generated is being processed at C&D Waste Processing Plant of capacity 150 TPD.

3.10 Status of Solid Waste Management:

Quantity of waste generation(in TPD)	Waste Processed(in TPD)	Gap in generation & Processing(in TPD)	Quantity of waste being disposed in landfills(in TPD)
500(Approx.)	495(Approx.)	5 (Approx.)	36 (Approx.) (inerts/rejects)

Mass balance diagram of municipal solid waste generated, transferred, processed and disposed of is attached as **Annexure 'H'**. To fill the gap of 5 TPD (approx.) of dry waste (comprising of seat covers, sofas, mattress, bedsheets, etc.) MCC is in the process of installation of dedicated shredder for further processing.

- 3.11 Presently, there is no gap between generation and processing of municipal solid waste. As per the orders of Hon'ble NGT, new machine has been installed to segregate and process mixed waste and is functional from 04.12.2024 (relevant photographs are attached as **Annexure 'I'**). Recent observation of leachate generation has been

expeditiously attended and required corrective measures including lifting and treatment of leachate at LTP has been ensured. Also, since, machine for processing of mixed waste has already been made operational and there is no dumping of mixed waste now; hence, there will be no generation of leachate because of mixed waste.

- 3.12** Out of 168 TPD of wet waste generated post processing 7.5 TPD (approx.) of compost and 28 TPD (approx.) inerts are produced. The compost produced is being utilized by MCC in various parks and gardens. Further, out of 120 TPD of dry waste generated post processing 95 TPD (approx.) of RDF and 8 TPD (approx.) of inerts are generated. RDF produced is being supplied to cement manufacturing unit namely M/s Ambuja Cement, Darlaghat, Distt. Solan, HP.

3.13 Bioremediation of Legacy Waste

Bio-remediation of old dumpsite of 20 acres having legacy waste of 5 LMT has already been remediated. Out of 8 LMT legacy waste at 8.28 acres landfill, 7.80 LMT waste has already been remediated. Remaining will be completed by 31.12.2024. The photographs of bio-remediated legacy waste site are attached as **Annexure 'J'**.

Mass Balance of Legacy Waste processed:


Legacy waste bio- remediated (LMT)	Moisture 15%(LMT)	C and D Waste 1% (LMT)	RDF 14%(LMT)	Bio-soil 66%(LMT)	Rejects/ Inerts 4%(LMT)
12.80 out of 13	1.92	0.13	1.79	8.45	0.51

After testing bio-soil is used for filling low lying places in Chandigarh. A copy of test report is at **Annexure 'K'**. The C & D waste is processed at the C & D Waste Processing Plant. The RDF is supplied to M/S JBM Environment Management Pvt Ltd, Sonipat Haryana. The inerts are being disposed at landfill site.


ANNEXURE A1

Details of expenditure already incurred to bridge the gap of solid and liquid waste management and other related restoration measures are given below:

S.No.	Head	Provision	Expenditure
Funds by Chandigarh Smart City Limited (CSCL)			
1.	Rehabilitation of STPs	82.21Cr	70.66 Cr (i)
	Material Recovery Facilities 3 Nos		
	Sanitary Land Fill Site		
Funds by MCC			
1.	Tertiary Treated (T.T.) water Network & Sewerage Network	33.00 Cr	11.80 Cr
2.	NCAP (Shredder)	----	1.36 Cr
3.	Capital Head (Sheds, Legacy waste Bio-mining)	26.00 Cr	26.33Cr
4.	SBM (Legacy Waste Bio-mining)	11.00 Cr	6.45 Cr
5.	Cow Cess (ETPs)	39.79 Cr	1.50 Cr
6.	Urban Development Fund (UDF)	28.00 Cr	-----
7.	Electricity Expenditure for period July, 2023 to August, 2024 (STP Diggian, STP 3BRD, STP Dhanas, STP Raipur Khurd)	-	11.40 Cr
8.	Electricity Expenditure for period June, 2023 to August, 2024 (STP Maloya and Raipur Kalan)	-	1.57 Cr
9.	STP Maloya from September, 2023 to September, 2024 (Repair and Maintenance of Online Continuous Effluent Monitoring System	-	1.51 Cr
10.	Sewerage Network in various parts of City July, 2023 to August, 2024	-	9.79 Cr
11.	Wages to Staff for maintenance of Sewerage Network July, 2023 to August, 2024	-	4.46 Cr
12.	STP repair and Maintenance July, 2023 to August, 2024	-	13.68 Cr
	Total	137.79 Cr	89.85 Cr (ii)
Funds by Engineering Department, Chandigarh Administration			
1.	STP, T.T. water network and rain water harvesting	28.56 Cr	28.56 Cr (iii)
	Net Expenditure (i)+(ii)+(iii)		189.07 Cr


 Director Environment
 Chandigarh Administration


 CE (MCC)


 MOI


 VSC (M)

A



No.C-467479-FII(9)-2024/ 15955
CHANDIGARH ADMINISTRATION
LOCAL GOVT. & URBAN DEVELOPMENT BRANCH
 2nd Floor, Chandigarh Secretariat, Sector 9-D, Chandigarh-160009

Dated: 16-10-24

To

The Commissioner,
Municipal Corporation,
Chandigarh.

Subject: Meeting regarding opening of ring fenced account as per the order of Hon'ble National Green Tribunal in O.A. No. 606/2018.

Reference your note dated 01.10.2024, on the subject noted above.

2. In pursuance of the Hon'ble National Green Tribunal orders dated 18.05.2023, the Adviser to the Administrator is pleased to accord approval for opening of a separate account for the Ring-fenced amount to the tune of Rs. 282.00 Crores out of which the unspent balance amount of Rs.92.93 Crores should be kept in this account for incurring expenditure on Solid and Liquid Waste Management activities.

3. The SOPs for incurring expenditure out of the above mentioned account are as given below:-

Operative part of Orders of Hon'ble NGT for U.T. Chandigarh	Suggested SOP for operation of the ring-fenced account
<p><u>Order dated 18.05.2023</u> <u>Para 7</u> - During the hearing, it is submitted that compensation need not be levied on Chandigarh as it has already allocated requisite funds are readily available and works are in progress. To bridge the above gaps, estimated amount of Rs. 282 Crores may be kept in a separate account as we are informed that adequate funds are available with the Administration for the purpose and is to be utilized during the year 2023-24. <u>Para 10</u> - With regard to the issue of compensation for past violations beyond laid down timelines, we accept the prayer of Advisor to Administrator that instead of levying compensation, the Administration itself may ensure availability of funds at least to the extent of Rs. 282 Crores by transferring the amount in a separate ring-fenced account, to be operated as per directions of the Advisor to Administrator. This will not debar incurring expenditure over and above the said amount of Rs. 282 Crores, if found necessary for solid and liquid waste management. <u>Order dated 30.05.2024</u> <u>Para 5 (A)</u> - The report dated 28.05.2024 does not reflect that a sum of Rs. 282 crores has been transferred in a separate ring-fenced account. On the contrary, it is stated</p>	<p>1. The Commissioner, Municipal Corporation Chandigarh may operate the ring-fenced account on behalf of the worthy Adviser to the Administrator, Chandigarh Administration. 2. Any proposal (project/works) for utilization of fund from the said ring-fenced account will be put up through the Secretary, Local Government for the approval of the worthy Adviser to the Administrator. 3. Any transaction from the ring-fenced account will be done only after the approval of the worthy Adviser to the Administrator. 4. The funds shall be used for restoration measures w.r.t. solid and liquid waste management. 5. The restoration measures w.r.t. liquid waste management would include setting up of sewage management, treatment and utilization facilities; upgrading systems/operation of existing sewage treatment facilities to ensure compliance of standards etc. 6. The restoration measures w.r.t. solid waste management would include setting up of solid waste management facilities, operation, upgradation and maintenance of new/existing facilities</p>

Sms
 Director Environment
 Chandigarh Administration

in para 1.1 of the report that a sum of Rs. 302.26 crores has been earmarked in four separate projects under liquid and solid waste management.	and bio-mining of legacy waste etc.
---	-------------------------------------

4. Joint Commissioner-I and Joint Commissioner-II of Municipal Corporation, Chandigarh will be authorized authorities to operate the above mentioned ring-fenced account.

[Signature]
Superintendent (LG & UD),
For Secretary (LG & UD),
Chandigarh Administration.

Endst. No. No.C-467479-FII(9)-2024/15956

Dated: 16-10-24

A copy is forwarded to the following for information and necessary action:-

1. P.A/Adviser to the Administrator, UT, Chandigarh.
2. P.A/Secretary LG & UD, Chandigarh Administration.
3. P.A/Secretary Forest & Environment, Chandigarh Administration.
4. P.A/Finance Secretary, Chandigarh Administration.
5. P.A/Joint Secretary LG & UD, Chandigarh Administration.

[Signature]
Superintendent (LG & UD),
For Secretary (LG & UD),
Chandigarh Administration.

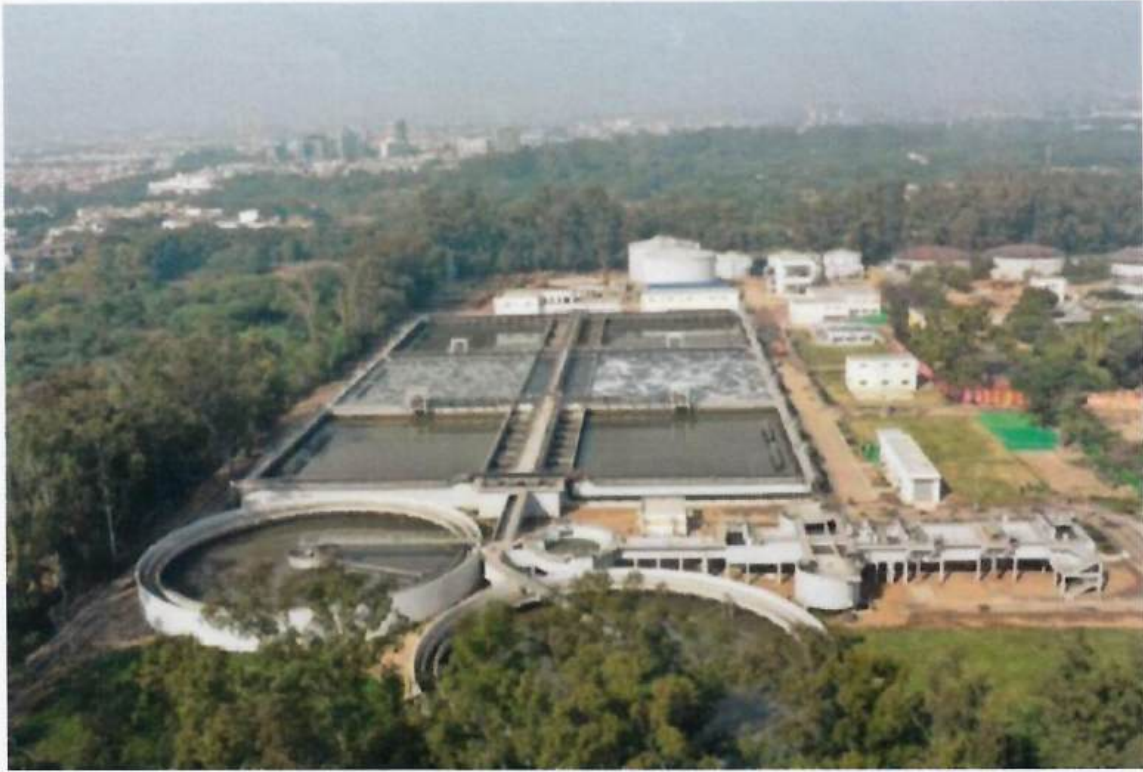
SEWAGE TREATMENT PLANTS



STP DHANAS



STP MALOYA



STP DIGGIAN



STP RAIPUR KALAN - I


Director Environment
Chandigarh Administration



STP KISHANGARH



STP RAIPUR KHURD


Director Environment
Chandigarh Administration



STP RAIPUR KALAN – II



STP 3BRD


Director Environment
Chandigarh Administration

STP DIGGIAN OUTLET - 2024

Sr.No.	Parameters	Unit	Permissible Limit	June	July	Aug.	Sept.	Oct.	Nov.
1	pH	-	6.5 to 9.0	7.6	7.2	7.2	7.1	7.0	7.0
2	COD	mg/l	50	47	21	35	27	30	42
3	BOD	mg/l	10	8.8	3.8	7.5	6.7	5.6	5.7
4	TSS	mg/l	10	9	BDL	8.0	5.3	7.5	BDL
5	NH ₃ -N	mg/l	5	2.8	0.21	0.42	2.9	0.56	2.2
6	PO ₄ -P	mg/l	1.0	0.91	0.74	0.35	0.46	0.65	0.63
7	Fecal Coliform	MPN/100ml	<100	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8

BDL-Below Detection Limit
MDL-Method Detection Limit

For TSS: MDL- 5.0 mg/l


Director Environment
Chandigarh Administration

STP 3BRD OUTLET - 2024

Sr.No.	Parameters	Unit	Permissible Limit	June	July	Aug.	Sept.	Oct.	Nov.
1	pH	-	6.5 to9.0	7.2	7.3	7.6	7.6	7.8	6.5
2	COD	mg/l	50	16	40	8	9	12	13
3	BOD	mg/l	10	3.4	5.8	BDL	BDL	BDL	BDL
4	TSS	mg/l	10	10	BDL	5.6	5.5	BDL	BDL
5	NH ₃ -N	mg/l	5	0.42	0.35	0.35	0.28	0.42	0.56
6	PO ₄ -P	mg/l	1	0.29	0.26	0.21	0.05	0.05	0.01
7	Fecal Coliform	MPN/100ml	<100	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8

BDL-Below Detection Limit
MDL-Method Detection Limit

For BOD: MDL- 2.0 mg/l
For TSS: MDL- 5.0 mg/l


Director Environment
Chandigarh Administration

STP MALOYA OUTLET - 2024

Sr.No.	Parameters	Unit	Permissible Limit	June	July	Aug.	Sept	Oct.	Nov.
1	pH	-	6.5 to 9.0	7.4	6.7	7.4	7.4	7.1	6.7
2	COD	mg/l	50	16	13	8	28	20	47
3	BOD	mg/l	10	BDL	2	BDL	2.3	BDL	7.3
4	TSS	mg/l	10	7	5	BDL	7.3	BDL	7.5
5	NH ₃ -N	mg/l	5	0.35	0.21	0.21	0.42	0.35	0.21
6	PO ₄ -P	mg/l	1.0	0.82	0.60	0.51	0.90	0.96	0.02
7	Fecal Coliform	MPN/100ml	<100	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8

BDL-Below Detection Limit
MDL-Method Detection Limit

For BOD: MDL- 2.0 mg/l
For TSS: MDL- 5.0 mg/l


Director Environment
Chandigarh Administration

STP DHANAS OUTLET - 2024

Sr.No.	Parameters	Unit	Permissible Limit	June	July	Aug.	Sept	Oct.	Nov.
1	pH	-	6.5 to 9.0	7.2	7.8	7.6	7.9	7.6	7.2
2	COD	mg/l	50	30	27	20	11	28	20
3	BOD	mg/l	10	4.3	3.6	BDL	BDL	2.5	BDL
4	TSS	mg/l	10	8	7	6	BDL	BDL	BDL
5	NH ₃ -N	mg/l	5	0.25	0.56	0.35	3.6	0.49	2.0
6	PO ₄ -P	mg/l	1	0.32	0.60	0.60	0.19	0.22	0.41
7	Fecal Coliform	MPN/100ml	<100	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8

BDL-Below Detection Limit
MDL-Method Detection Limit

For BOD: MDL- 2.0 mg/l
For TSS: MDL- 5.0 mg/l


Director Environment
Chandigarh Administration

STP RAIPUR KALAN-I OUTLET - 2024

Sr.No.	Parameters	Unit	Permissible Limit	June	July	Aug.	Sept.	Oct.	Nov.
1	pH	-	6.5 to 9.0	7.4	7.4	8.0	7.4	7.4	7.3
2	COD	mg/l	50	24	46	14	37	28	30
3	BOD	mg/l	10	3.0	6.1	3.3	6.3	4.6	3.5
4	TSS	mg/l	10	9	10	6	6.9	6.5	8.5
5	NH ₃ -N	mg/l	5	0.28	0.49	0.35	0.42	0.56	3.5
6	PO ₄ -P	mg/l	1.0	0.90	0.99	0.72	0.87	0.74	0.78
7	Fecal Coliform	MPN/100ml	<100	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8


 Director Environment
 Chandigarh Administration

STP RAIPUR KHURD OUTLET - 2024

Sr.No.	Parameters	Unit	Permissible Limit	June	July	Aug.	Sept	Oct.	Nov.
1	pH	-	6.5 to 9.0	7.3	7.4	8.2	7.6	7.6	7.8
2	COD	mg/l	50	17	15	8	14	25	47
3	BOD	mg/l	10	3.9	3.9	3.2	3.3	2.8	4.4
4	TSS	mg/l	10	8	8	BDL	5.6	7.5	8.5
5	NH ₃ -N	mg/l	5	0.35	0.28	0.42	0.35	0.42	3.5
6	PO ₄ -P	mg/l	1.0	0.42	1.0	0.21	0.98	0.84	0.81
7	Fecal Coliform	MPN/100ml	<100	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8

BDL-Below Detection Limit
MDL-Method Detection Limit

For TSS: MDL- 5.0 mg/l


Director Environment
Chandigarh Administration

STP RAIPUR KALAN -II OUTLET - 2024

Sr.No.	Parameters	Unit	Permissible Limit	June	July	Aug.	Sept.	Oct.	Nov.
1	pH	-	6.5 to 9.0	7.3	7.2	7.9	7.7	7.7	7.3
2	COD	mg/l	50	10	44	12	26	12	23
3	BOD	mg/l	10	BDL	8	3.9	3.7	BDL	BDL
4	TSS	mg/l	10	9	5	BDL	3.8	BDL	BDL
5	NH ₃ -N	mg/l	5	0.49	2.1	0.49	0.21	0.49	0.21
6	PO ₄ -P	mg/l	1.0	0.76	0.62	0.54	0.74	0.72	0.80
7	Faecal Coliform	MPN/100ml	<100	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8

BDL-Below Detection Limit
MDL-Method Detection Limit

For BOD: MDL- 2.0 mg/l
For TSS: MDL- 5.0 mg/l


Director Environment
Chandigarh Administration

STP KISHANGARH OUTLET - 2024

Sr.No.	Parameters	Unit	Permissible Limit	June	July	Aug	Sept.	Oct.	Nov.
1	pH	-	--	7.3	7.2	8.2	7.8	7.8	7.7
2	COD	mg/l	-	20	14	16	18	14	29
3	BOD	mg/l	50	BDL	BDL	BDL	BDL	BDL	3.1
4	TSS	mg/l	10	8	7	BDL	BDL	BDL	BDL
5	NH ₃ -N	mg/l	10	0.28	0.56	0.56	0.21	0.35	3.8
6	PO ₄ -P	mg/l	5	0.28	0.06	0.37	0.41	0.29	0.18
7	Fecal Coliform	MPN/100ml	<100	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8

BDL-Below Detection Limit
MDL-Method Detection Limit

For BOD: MDL- 2.0 mg/l
For TSS: MDL- 5.0 mg/l


Director Environment
Chandigarh Administration

Date	Time	Initial reading	Final Reading	Flow (m) ³
01.07.2024	9.30	878873	879393	520
02.07.2024	9.30	879393	879393	0
03.07.2024	9.30	879393	879393	0
04.07.2024	9.30	879393	880005	612
05.07.2024	9.30	880005	880746	741
06.07.2024	9.30	880746	881374	628
07.07.2024	9.30	881374	882329	955
08.07.2024	9.30	882329	882813	484
09.07.2024	9.30	882813	883509	696
10.07.2024	9.30	883509	884173	664
11.07.2024	9.30	884173	884973	800
12.07.2024	9.30	884973	885679	706
13.07.2024	9.30	885679	886322	643
14.07.2024	9.30	886322	886833	511
15.07.2024	9.30	886833	887623	790
16.07.2024	9.30	887623	888424	801
17.07.2024	9.30	888424	889304	880
18.07.2024	9.30	889304	889769	465
19.07.2024	9.30	889769	890369	600
20.07.2024	9.30	890369	891061	692
21.07.2024	9.30	891061	891482	421
22.07.2024	9.30	891482	892324	842
23.07.2024	9.30	892324	893013	689
24.07.2024	9.30	893013	893646	633
25.07.2024	9.30	893646	894290	644
26.07.2024	9.30	894290	894902	612
27.07.2024	9.30	894902	895618	716
28.07.2024	9.30	895618	896189	571
29.07.2024	9.30	896189	896920	731
30.07.2024	9.30	896920	897320	400
31.07.2024	9.30	897320	897893	573

01.08.2024	9.30	897893	898394	501
02.08.2024	9.30	898394	898888	494
03.08.2024	9.30	898888	899191	303
04.08.2024	9.30	899191	899691	500
05.08.2024	9.30	899691	899991	300
06.08.2024	9.30	899991	900351	360
07.08.2024	9.30	900351	900760	409
08.08.2024	9.30	900760	901125	365
09.08.2024	9.30	901125	901525	400
10.08.2024	9.30	901525	901980	455
11.08.2024	9.30	901980	902380	400
12.08.2024	9.30	902380	902890	510
13.08.2024	9.30	902890	903423	533
14.08.2024	9.30	903423	903934	511
15.08.2024	9.30	903934	904534	600
16.08.2024	9.30	904534	905162	628
17.08.2024	9.30	905162	905678	516
18.08.2024	9.30	905678	906191	513
19.08.2024	9.30	906191	906723	532
20.08.2024	9.30	906723	907315	592
21.08.2024	9.30	907315	907815	500
22.08.2024	9.30	907815	908577	762
23.08.2024	9.30	908577	908881	304
24.08.2024	9.30	908881	909381	500
25.08.2024	9.30	909381	909964	583
26.08.2024	9.30	909964	910397	433
27.08.2024	9.30	910397	910964	567
28.08.2024	9.30	910964	911483	519
29.08.2024	9.30	911483	911773	290
30.08.2024	9.30	911773	912079	306
31.08.2024	9.30	912079		
01.09.2024	9.30	912079	912401	322
02.09.2024	9.30	912401	912601	200

03.09.2024	9.30	912601	912815	214
04.09.2024	9.30	912815	913033	218
05.09.2024	9.30	913033	913501	468
06.09.2024	9.30	913501	914017	516
07.09.2024	9.30	914017	914735	718
08.09.2024	9.30	914735	915413	678
09.09.2024	9.30	915413	915713	300
10.09.2024	9.30	915713	916416	703
11.09.2024	9.30	916416	916878	462
12.09.2024	9.30	916878	917414	536
13.09.2024	9.30	917414	917930	516
14.09.2024	9.30	917930	918237	307
15.09.2024	9.30	918237	918749	512
16.09.2024	9.30	918749	919304	555
17.09.2024	9.30	919304	919807	503
18.09.2024	9.30	919807	920511	704
19.09.2024	9.30	920511	921500	989
20.09.2024	9.30	921500	922016	516
21.09.2024	9.30	922016	922518	502
22.09.2024	9.30	922518	923247	729
23.09.2024	9.30	923247	923690	443
24.09.2024	9.30	923690	924398	708
25.09.2024	9.30	924398	924708	310
26.09.2024	9.30	924708	925124	416
27.09.2024	9.30	925124	925833	709
28.09.2024	9.30	925833	926259	426
29.09.2024	9.30	926259	926972	713
30.09.2024	9.30	926972	927355	383
01.10.2024	9.30	927355	927697	342
02.10.2024	9.30	927697	928039	342
03.10.2024	9.30	928039	928381	342
04.10.2024	9.30	928381	928800	419
05.10.2024	9.30	928800	929355	555


Director Environment
Chandigarh Administration

06.10.2024	9.30	929355	929855	500
07.10.2024	9.30	929855	930344	489
08.10.2024	9.30	930344	930944	600
09.10.2024	9.30	930944	931539	595
10.10.2024	9.30	931539	932398	859
11.10.2024	9.30	932398	933188	790
12.10.2024	9.30	933188	934093	905
13.10.2024	9.30	934093	935343	1250
14.10.2024	9.30	935343	936663	1320
15.10.2024	9.30	936663	937767	1104
16.10.2024	9.30	937767	938814	1047
17.10.2024	9.30	938814	940166	1352
18.10.2024	9.30	940166	941579	1413
19.10.2024	9.30	941579	942832	1253
20.10.2024	9.30	942832	944257	1425
21.10.2024	9.30	944257	945457	1200
22.10.2024	9.30	945457	946557	1100
23.10.2024	9.30	946557	947817	1260
24.10.2024	9.30	947817	949101	1284
25.10.2024	9.30	949101	951172	2071
26.10.2024	9.30	951172	952624	1452
27.10.2024	9.30	952624	953557	933
28.10.2024	9.30	953557	954699	1142
29.10.2024	9.30	954699	956263	1564
30.10.2024	9.30	956263	957248	985
31.10.2024	9.30	957248	958138	890
01.11.2024	9.30	958138	958906	768
02.11.2024	9.30	958906	959406	500
03.11.2024	9.30	959406	959862	456
04.11.2024	9.30	959862	960608	746
05.11.2024	9.30	960608	961404	796
06.11.2024	9.30	961404	962424	1020
07.11.2024	9.30	962424	963137	713



08.11.2024	9.30	963137	964311	1174
09.11.2024	9.30	964311	965124	813
10.11.2024	9.30	965124	966269	1145
11.11.2024	9.30	966269	967236	967
12.11.2024	9.30	967236	968184	948
13.11.2024	9.30	968184	969173	989
14.11.2024	9.30	969173	970100	927
15.11.2024	9.30	970100	971230	1130
16.11.2024	9.30	971230	972154	924
17.11.2024	9.30	972154	973215	1061
18.11.2024	9.30	973215	974272	1057
19.11.2024	9.30	974272	975307	1035
20.11.2024	9.30	975307	976310	1003
21.11.2024	9.30	976310	977387	1077
22.11.2024	9.30	977387	978352	965
23.11.2024	9.30	978352	979208	856
24.11.2024	9.30	979208	980041	833
25.11.2024	9.30	980041	980922	881
26.11.2024	9.30	980922	981362	440
27.11.2024	9.30	981362	982387	1025
28.11.2024	9.30	982387	983362	975
29.11.2024	9.30	983362	984403	1041
30.11.2024	9.30	984403	985825	1422


Director Environment
Chandigarh Administration

9221 C. Estimation of Bacterial Density

Seidler RJ, Evans TM, Kaufman JR, Waarvick CE, LeChevallier MW. 1981. Limitations of standard coliform enumeration techniques. *J Amer Water Works Assoc.* 1981;73(10):538-542.

U.S. Environmental Protection Agency. National primary drinking water regulations. 40 CFR Parts 141, and 142. Fed Reg. 2000;65(8):1950-2015.

Garrity GM, ed. Part B: The gammaproteobacteria. In: *Bergey's manual of systematic bacteriology*, 2nd ed.; Volume 2: The Proteobacteria. New York (NY): Springer; 2005.

Manual for the certification of laboratories analyzing drinking water (EPA 815-R-05-004). Cincinnati (OH): Office of Ground Water and Drinking Water, U.S. Environmental Protection Agency; 2005.

U.S. Environmental Protection Agency. Guidelines for establishing test procedures for the analysis of pollutants under the Clean Water Act; Analysis and sampling procedures: Final Rule. 40 CFR Parts 136, 260, et al. Fed Reg. 2012;77(97):29797.

9221 C. ESTIMATION OF BACTERIAL DENSITY

1. Precision of the Multiple-Tube Fermentation Test

The multiple-tube fermentation test is not very precise unless many sample portions are examined, so use caution when interpreting the sanitary significance of any single coliform result. Precision improves greatly when several samples from a given sampling point are estimated separately and their geometric mean is calculated.

Although most probable number (MPN) tables and calculations are described for use in the coliform test, they also can be used to determine the MPN of any organism so long as suitable test media are available. Online MPN calculators are available, but until a calculator's accuracy has been verified, confirm its results using an MPN table in this section.

2. Use of Tables to Determine MPN

Record the coliform concentration as MPN/100 mL. The MPN values for a variety of positive and negative tube combinations are given in Table 9221:2, Table 9221:3 and Table 9221:4. The sample volumes indicated in Tables 9221:2 and 3 are chosen especially for drinking water examinations. Table 9221:4 illustrates MPN values for combinations of positive and negative results when five 10-mL, five 1.0-mL, and five 0.1-mL sample-portion volumes of nonpotable water are tested. If the sample-portion volumes tested are identical to those found in the tables, then report the value corresponding to the appropriate combination of positive and negative results as the MPN/100 mL. However, if the series of decimal dilutions is different, then select the MPN value in Table 9221:4 that corresponds to the combination of positive results and calculate the actual MPN using the following formula:

$$\text{MPN/100 mL} = (\text{Table MPN/100 mL}) \times 10/V$$

where:

V = volume of sample portion at the lowest selected dilution.

If the decimal series¹ includes more than 3 dilutions, use the following guidelines to select the 3 most appropriate dilutions and then use Table 9221:4 and the equation above to calculate the MPN. See Table 9221:5, which provides several examples (A-G) of combinations of positives. First, remove the highest dilution (smallest sample volume) if it has all negative tubes and at least one remaining dilution has a negative tube. Next, remove the lowest dilution (largest sample volume) if it has all positive tubes and at least one remaining dilution has a positive tube. According to these

guidelines, the 3 dilutions in Example A are selected by removal of the highest (0.001-mL) and the lowest (10-mL) dilutions.

If the lowest dilution does not have all positive tubes, and several of the highest dilutions have all negative tubes, then remove the highest negative dilutions (Example B).

More than 3 dilutions may remain after removal of the lowest dilution with all positive tubes and high dilutions with all negative tubes. In this case, if the highest dilution with *all* positive tubes is within 2 dilutions of the highest dilution with *any* positive tubes, then use the highest dilution with *any* positive tubes and the 2 immediately lower dilutions. In Example C, the highest dilution with all positive tubes is 0.1 mL, which is within 2 dilutions of 0.001 mL, which has 1 positive tube. In Example D, the highest

Table 9221:2. MPN Index and 95% Confidence Limits for All Combinations of Positive and Negative Results When Five 20-mL Portions Are Used

No. of Tubes Giving Positive Reaction Out of 5 (20 mL Each)	MPN Index/100 mL	95% Confidence Limits (Exact)	
		Lower	Upper
0	<1.1	—	3.5
1	1.1	0.051	5.4
2	2.6	0.40	8.4
3	4.6	1.0	13
4	8.0	2.1	23
5	>8.0	3.4	—

Table 9221:3. MPN Index and 95% Confidence Limits for All Combinations of Positive and Negative Results When Ten 10-mL Portions Are Used

No. of Tubes Giving Positive Reaction Out of 10 (10 mL Each)	MPN index/100 mL	95% Confidence Limits (Exact)	
		Lower	Upper
0	<1.1	—	3.4
1	1.1	0.051	5.9
2	2.2	0.37	8.2
3	3.6	0.91	9.7
4	5.1	1.6	13
5	6.9	2.5	15
6	9.2	3.3	19
7	12	4.8	24
8	16	5.8	34
9	23	8.1	53
10	>23	13	—

Part 9000 • 1137

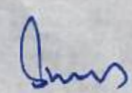

Director Environment
Chandigarh Administration

Table 9221:4. MPN Index and 95% Confidence Limits for Various Combinations of Positive Results When Five Tubes Are Used per Dilution (10 mL, 1.0 mL, 0.1 mL)^a

Combination of Positives	MPN Index/ 100 mL	Confidence Limits		Combination of Positives	MPN Index/ 100 mL	Confidence Limits	
		Low	High			Low	High
0-0-0	<1.8	—	6.8	4-0-3	25	9.8	70
0-0-1	1.8	0.090	6.8	4-1-0	17	6.0	40
0-1-0	1.8	0.090	6.9	4-1-1	21	6.8	42
0-1-1	3.6	0.70	10	4-1-2	26	9.8	70
0-2-0	3.7	0.70	10	4-1-3	31	10	70
0-2-1	5.5	1.8	15	4-2-0	22	6.8	50
0-3-0	5.6	1.8	15	4-2-1	26	9.8	70
1-0-0	2.0	0.10	10	4-2-2	32	10	70
1-0-1	4.0	0.70	10	4-2-3	38	14	100
1-0-2	6.0	1.8	15	4-3-0	27	9.9	70
1-1-0	4.0	0.71	12	4-3-1	33	10	70
1-1-1	6.1	1.8	15	4-3-2	39	14	100
1-1-2	8.1	3.4	22	4-4-0	34	14	100
1-2-0	6.1	1.8	15	4-4-1	40	14	100
1-2-1	8.2	3.4	22	4-4-2	47	15	120
1-3-0	8.3	3.4	22	4-5-0	41	14	100
1-3-1	10	3.5	22	4-5-1	48	15	120
1-4-0	11	3.5	22	5-0-0	23	6.8	70
2-0-0	4.5	0.79	15	5-0-1	31	10	70
2-0-1	6.8	1.8	15	5-0-2	43	14	100
2-0-2	9.1	3.4	22	5-0-3	58	22	150
2-1-0	6.8	1.8	17	5-1-0	33	10	100
2-1-1	9.2	3.4	22	5-1-1	46	14	120
2-1-2	12	4.1	26	5-1-2	63	22	150
2-2-0	9.3	3.4	22	5-1-3	84	34	220
2-2-1	12	4.1	26	5-2-0	49	15	150
2-2-2	14	5.9	36	5-2-1	70	22	170
2-3-0	12	4.1	26	5-2-2	94	34	230
2-3-1	14	5.9	36	5-2-3	120	36	250
2-4-0	15	5.9	36	5-2-4	150	58	400
3-0-0	7.8	2.1	22	5-3-0	79	22	220
3-0-1	11	3.5	23	5-3-1	110	34	250
3-0-2	13	5.6	35	5-3-2	140	52	400
3-1-0	11	3.5	26	5-3-3	170	70	400
3-1-1	14	5.6	36	5-3-4	210	70	400
3-1-2	17	6.0	36	5-4-0	130	36	400
3-2-0	14	5.7	36	5-4-1	170	58	400
3-2-1	17	6.8	40	5-4-2	220	70	440
3-2-2	20	6.8	40	5-4-3	280	100	710
3-3-0	17	6.8	40	5-4-4	350	100	710
3-3-1	21	6.8	40	5-4-5	430	150	1100
3-3-2	24	9.8	70	5-5-0	240	70	710
3-4-0	21	6.8	40	5-5-1	350	100	1100
3-4-1	24	9.8	70	5-5-2	540	150	1700
3-5-0	25	9.8	70	5-5-3	920	220	2600
4-0-0	13	4.1	35	5-5-4	1600	400	4600
4-0-1	17	5.9	36	5-5-5	>1600	700	—
4-0-2	21	6.8	40				

^a Results to 2 significant figures.

dilution with all positive tubes is 0.01 mL, which is within 2 decimal dilutions of 0.001 mL, to yield a combination of 4-5-1.

If, after removal of the lowest dilution with all positive tubes, no dilution with all positive reactions remains, then select the lowest 2 dilutions and assign the sum of any remaining dilutions to the third dilution. In Example E, the highest dilution with all positive

tubes contains 10 mL; this dilution was removed in the second step. Four dilutions, none of which have all positive tubes, remain. Under these circumstances, select the 2 lowest remaining dilutions corresponding to 1 and 0.1 mL of sample. For the third dilution, add the number of positive tubes in all higher dilutions (0.01 and 0.001 mL of sample), to yield a final combination of 4-4-1.

If no dilution has all positive tubes (Example F), select the lowest 2 dilutions, corresponding to 10 and 1 mL of sample. For the third dilution, add the number of positive tubes in the remaining dilutions (0.1, 0.01, and 0.001 mL of sample), to yield a final combination of 4-3-2. If the third dilution is assigned more than 5 positive tubes, then the selected combination will not be in Table 9221:4.

If the 3 dilutions selected are not found in Table 9221:4, then something in the serial dilution was unusual. In this case, the usual methods for calculating the MPN, presented here, may not apply. If a new sample cannot be collected and an MPN value is still desired, use the highest dilution with at least 1 positive tube and the 2 dilutions immediately lower as the 3 selected dilutions. In Example G, the first selection, 4-3-6 (the outcome from the highest 3 dilutions), is not in Table 9221:4 because 6 is greater than 5. The second selection, according to the above guidelines, would be 3-2-1. If this second set of selected dilutions is not in Table 9221:4, then use the following formula to calculate the MPN:

$$\frac{230.3}{z_s} \log_{10} \left(1 + \frac{x_s z_s}{\sum_{j=k}^K n_j z_j} \right)$$

where:

- z_s = the amount of the original sample inoculated into each tube of the s th dilution,
- x_s = the number of positive tubes in the s th dilution,
- K = the number of dilutions,
- j = a dilution,
- s = the highest dilution with at least one positive tube,
- n_j = the number of tubes in the j th dilution, and
- z_j = the amount of the original sample inoculated into each tube in the j th dilution.

For example, in the series x-x-3-0-0, where the third dilution level (z_s) equals 0.1 mL, $x_s z_s = 0.3$, and $\sum n_j z_j = 0.555$. Thus, the calculated MPN = 780/100 mL.

This formula also applies to serial dilutions having all positive tubes in a single dilution, and can serve as an approximation for outcomes like 5-5-5-0-0-0, where 5 tubes are used per dilution, by using just the last 4 dilutions.

Table 9221:4 shows all but the improbable positive tube combinations for a 3-dilution series. In testing 10 samples, there is a 99% chance of finding all the results among these 95 outcomes. If untabulated combinations occur with a frequency greater than

1%, it indicates that the technique is faulty or that the statistical assumptions underlying the MPN estimate are not being fulfilled (e.g., growth inhibition at low dilutions).

The MPN for combinations not appearing in the table, or for other combinations of tubes or dilutions, may be *estimated* as follows: First, select the lowest dilution that does not have all positive results. Second, select the highest dilution with at least 1 positive result. Finally, select all the dilutions between them. For example, from (10/10, 10/10, 4/10, 1/10, 0/10) use only (-, -, 4/10, 1/10, -), corresponding to 4/10 at 0.1 mL sample/tube and 1/10 at 0.01 mL sample/tube. Likewise, from (10/10, 10/10, 10/10, 0/10, 0/10), select only (-, -, 10/10, 0/10, -), corresponding to 10/10 at 0.1 mL sample/tube and 0/10 at 0.01 mL sample/tube. Use only the selected dilutions in the following formula of Thomas:¹

$$\text{MPN/100 mL (approx.)} = 100 \times P / (N \times T)^{1/2}$$

where:

- P = number of positive results,
- N = volume of sample in all the negative portions combined (mL), and
- T = total volume of sample in the selected dilutions (mL).

That is, $N = \sum (n_j - x_j) z_j$, $P = \sum x_j$, and $T = \sum n_j z_j$, where the summations are over the dilutions selected, and x_j = the number of positive tubes in the j th dilution.

In the first example above,

$$\begin{aligned} \text{MPN/100 mL (approx.)} &= 100 \times 5 / (0.69 \times 1.1)^{1/2} \\ &= 500 / 0.87 = 570 / 100 \text{ mL} \end{aligned}$$

In the second example above,

$$\begin{aligned} \text{MPN/100 mL (approx.)} &= 100 \times 10 / (0.1 \times 1.1)^{1/2} \\ &= 1000 / 0.332 = 3000 / 100 \text{ mL} \end{aligned}$$

The 2 examples compare well with the true MPNs, 590/100 mL and 2400/100 mL, respectively. The second example is a special case for which an exact solution can be calculated directly for the 2 selected dilutions.

When summarizing the results from several samples with a single MPN value, use the geometric mean or the median. The geometric mean is calculated by averaging the logarithmic values; for example, the geometric mean of A, B, and C is 10^t where:

Table 9221:5. Examples for Choice of 3 Combinations of Positives from 5 Dilutions

Example	Volume (mL)					Combination of Positives	MPN Index (No./100 mL)
	10	1	0.1	0.01	0.001		
A	5	5	1	0	0	x-5-1-0-x	330
B	4	5	1	0	0	4-5-1-x-x	48
C	5	2	5	2	1	x-x-5-2-1	7000
D	4	5	4	5	1	x-x-4-5-1	4800
E	5	4	4	0	1	x-4-4-1-x	400
F	4	3	0	1	1	4-3-2-x-x	39
G	4	3	3	2	1	x-x-3-2-1	1700

$$L = (\log_{10} A + \log_{10} B + \log_{10} C)/3$$

Mean values are reported as the antilog of L .

Reference

1. Thomas HA Jr. Bacterial densities from fermentation tube tests. *J Amer Water Works Assoc.* 1942;34(4):572-576.

Bibliography

- McCrary MH. The numerical interpretation of fermentation tube results. *J Infect Dis.* 1915;17(1):183-212.
- McCrary MH. Tables for rapid interpretation of fermentation-tube results. *Pub Health J.* 1918;9(5):201-220.
- Halvorson HO, Ziegler NR. Application of statistics to problems in bacteriology. *J Bacteriol.* 1933;25(2):101; 1933;26(4):331-339; 1935;29(6):609-634.
- Hoskins JK. The most probable numbers of *B. coli* in water analysis. *J Amer Water Works Assoc.* 1933;25(6):867-877.
- Hoskins JK. Most probable numbers for evaluation of *coli-aerogenes* tests by fermentation tube method. *Pub Health Rep.* 1934;49(12):393-405.

- Eisenhart C, Wilson PW. Statistical methods and control in bacteriology. *Bacteriol Rev.* 1943;7(2):57-137.
- Cochran WG. Estimation of bacterial densities by means of the "most probable number." *Biometrics.* 1950;6(2):105-116.
- Woodward RL. How probable is the most probable number? *J Amer Water Works Assoc.* 1957;49(8):1060-1068.
- DeMan JC. MPN tables, corrected. *Eur J Appl Biotechnol.* 1983;17:301-305.
- Blodgett RJ, Garthright WE. Several MPN models for serial dilutions with suppressed growth at low dilutions. *Food Microbiol.* 1998;15(1):91-99.
- Garthright WE. Appendix 2: Most probable number from serial dilutions. *FDA Bacteriological Analytical Manual*, 8th ed., Rev. A. Gaithersburg (MD): AOAC International; 1998.
- Blodgett RJ. Measuring improbability of outcomes from a serial dilution test. *Commun Statist Theory Meth.* 2002;31(22):2209-2223.
- Garthright WE, Blodgett RJ. FDA's preferred MPN methods for standard, large or unusual tests, with a spreadsheet. *Food Microbiol.* 2003;20(4):439-445.
- Blodgett RJ. Appendix 2: most probable number from serial dilutions. *FDA Bacteriological Analytical Manual*; 2010 [revised 2020 Oct; accessed 2021 Dec]. Available at: <http://www.fda.gov/food/food-science-research/laboratory-methods/ucm109656.htm>.

9221 D. PRESENCE-ABSENCE (P-A) COLIFORM TEST

The presence-absence (P-A) test for the coliform group is a simple modification of the multiple-tube procedure that is intended for use on routine samples collected from distribution systems or water treatment plants. This simplification using one large test portion (100 mL) in a single culture bottle to determine qualitatively whether coliforms are present or absent is justified on the theory that no coliforms are present in 100 mL of a drinking water sample. Also, it enables analysts to examine more samples in a given time period compared to quantitative methods. Comparative studies with the membrane-filter procedure indicate that the P-A test may maximize coliform detection in samples containing many organisms that could overgrow coliform colonies and cause detection problems.

The P-A broth contains lactose and a pH indicator to detect the presence of acid production. Analysts observe the culture bottles for gas and acid production—the metabolic end products of lactose fermentation. Presumptive positive coliform results obtained from P-A broth must be confirmed using BGLB broth.

1. Samples

Collect samples as directed in Section 9060, using sample containers specified in Section 9030 B.19. Follow the QC guidelines for sample bottles described in Section 9020 B.5d. Ensure that samples meet laboratory acceptance criteria upon receipt.

2. Presumptive Phase

a. Culture medium:

P-A broth: Follow QC guidelines cited in 9221 B.2.

Beef extract	3.0 g
Peptone	5.0 g
Lactose	7.46 g
Tryptose	9.83 g
Dipotassium hydrogen phosphate (K_2HPO_4)	1.35 g
Potassium dihydrogen phosphate (KH_2PO_4)	1.35 g
Sodium chloride (NaCl)	2.46 g
Sodium lauryl sulfate	0.05 g
Bromocresol purple	0.0085 g
Reagent-grade water	1 L

Make this formulation triple strength (3×) when examining 100-mL samples. Dissolve P-A medium in water by stirring (do not use heat). Dispense 50 mL prepared medium into screw-capped 250-mL milk dilution bottles or equivalent containers. A fermentation vial insert is unnecessary. Autoclave for 12 min at 121 °C; limit the total time in the autoclave to 30 min or less. Medium pH must be 6.8 ± 0.2 after sterilization.

If sterilized via filtration, a 6× strength P-A medium may be used. Aseptically dispense 20 mL of the 6× medium into a sterile 250-mL dilution bottle or equivalent container.

b. Procedure: Shake sample vigorously for 5 s (approximately 25 times) and inoculate 100 mL into a P-A culture bottle. Mix thoroughly by inverting the bottle once or twice to evenly distribute the sample throughout the medium. Incubate at 35 ± 0.5 °C and inspect after 24 ± 2 h and 48 ± 3 h for acid reactions.

c. Interpretation: If acidic conditions exist after lactose fermentation, a distinct yellow color forms in the medium. If gas also is being produced, then foaming will occur when the bottle is gently shaken. Any amount of gas or acid constitutes a presumptive positive test that requires confirmation.

Methodology for Chlorination at STPs

Introduction

The treated effluent from STPs contains bacteria such as fecal coliform, pathogens, and other residual organics, which are harmful to aquatic life and human health. To address this, disinfection of these bacteria is required, primarily through chlorination.

Gas chlorination is a common and effective method used to disinfect the final treated effluent in sewage treatment plants. This process involves using chlorine gas (Cl_2) to eliminate pathogenic microorganisms, ensuring that the treated water is safe for discharge into natural water bodies or reuse in various applications. By employing gas chlorination, sewage treatment plants can achieve high levels of disinfection, safeguarding public health and the environment. Regular monitoring and optimization of the chlorination process are vital to ensure its effectiveness and safety.

In STPs, chlorine contact tank structures, along with chlorinator and tonner rooms, have been specifically constructed for the disinfection of treated sewage.

Example:

At STP Diggian, the chlorination system is designed for a flow rate of 136 MLD (average 5677 m^3/hr) with a 30-minute hydraulic retention time for chlorine to attack bacteria and other pathogenic microorganisms in the wastewater. The treated filtered sewage from the disc filter(s) is transferred into the chlorine contact tank via gravity. Baffle arrangements are provided to ensure proper mixing for effective disinfection within the tank.

The chlorine dosage system is designed for a peak capacity of 8 ppm (45 kg/hr) to account for peak chlorine demand. However, the average chlorine dosage is typically in the range of 3 to 5 ppm. Chlorine dosage is adjusted based on the Free Residual Chlorine (FRC), which is maintained between 0.1 and 0.2 ppm at the outlet of the CCT.

For Diggian STP, chlorine tonners are supplied by PRIMO Chemicals Limited (formerly known as Punjab Alkalies and Chemicals Limited). Chlorine is supplied through pressurized tonners in liquid form, which converts to gaseous form during chlorination.

Components of Chlorination:

1. **Chlorine Contact Tank (CCT):** This tank provides a controlled environment for chlorine to effectively contact and inactivate pathogens within the treated sewage effluent. Baffle arrangements ensure proper mixing throughout the designated contact time (e.g., 30 minutes).
2. **Chlorine Tonner Room:** This secure room houses pressurized chlorine tonners containing chlorine in liquid form, which converts to gas during use. The room incorporates essential safety features, including a chlorine leak detection system and a dedicated caustic neutralizing pit for emergency response.
3. **Chlorinator Room:** This room houses the essential equipment for chlorine dosing,

including booster pumps, chlorinators, and control panels for system operation and monitoring.

4. **Automated Chlorine Leak Detection & Absorption System:** This critical safety system safeguards against potential chlorine leaks. Sensors detect leaks, triggering the activation of the absorption system. The system utilizes a caustic solution, circulated by a pump, to neutralize the leaked chlorine gas within an absorption tower. This ensures the safe containment and neutralization of leaks.

Operational Process:

- Chlorine gas is drawn from the tonners, undergoes pressure regulation, and is mixed with water to form a chlorine solution.
- The precisely controlled chlorine solution is then dosed into the CCT to achieve effective disinfection of the treated sewage effluent.
- The level of Free Residual Chlorine (FRC) is continuously monitored within the effluent. Chlorine dosage is meticulously adjusted to maintain a safe and effective level of FRC (e.g., 0.1-0.2 ppm) throughout the disinfection process.
- A system of pressure switches automates the changeover of chlorine tonners, ensuring uninterrupted operation.

Leak Management and Safety Protocols:

- Chlorine tonner rooms are equipped with emergency chlorine neutralizing pits to address potential leaks.
- If a chlorine leak is detected in the tonner room, the leak detection system activates the caustic circulation pump and centrifugal blower. The system is designed to neutralize the entire leaked tonner if the chlorine concentration exceeds 3 ppm. The leaked chlorine gas is sucked into the absorption tower, where it is mixed with caustic solution and neutralized. The neutralized solution is then collected in the caustic storage tank.
- The automated chlorine leak detection and absorption system plays a vital role in mitigating the risks associated with leaks.
- The concentration and level of the caustic solution used for chlorine neutralization are continuously monitored to ensure system effectiveness.



Chlorine Tonner with Manifold



Chlorine Absorption System



Neutralization Pits



Alarm for Chlorine Leak Detection



Chlorination Building



Chlorinators


Director Environment
Chandigarh Administration



Booster Pumps



Chlorinator Panels



Chlorine Dosing Points in Chlorine Contact Tank

C&D WASTE PROCESSING PLANT




Director Environment
Chandigarh Administration

HORTICULTURE WASTE PROCESSING PLANT

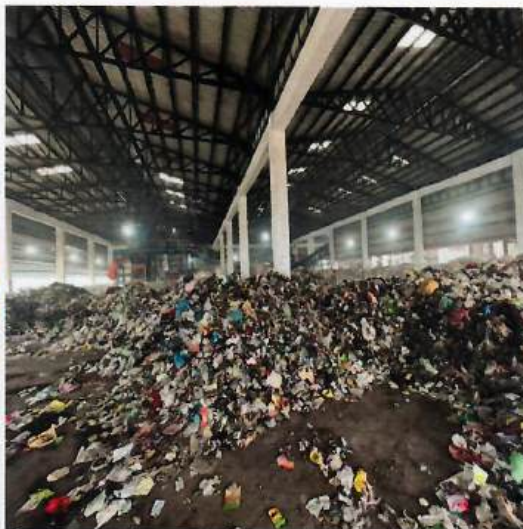


WET WASTE PROCESSING PLANT / COMPOST PLANT



S. Kumar
Director Environment
Chandigarh Administration

DRY WASTE PROCESSING PLANT/RDF PLANT




Director Environment
Chandigarh Administration

BIOMETHANATION PLANT




Director Environment
Chandigarh Administration

COCONUT SHREDDER




Director Environment
Chandigarh Administration

MATERIAL RECOVERY FACILITIES

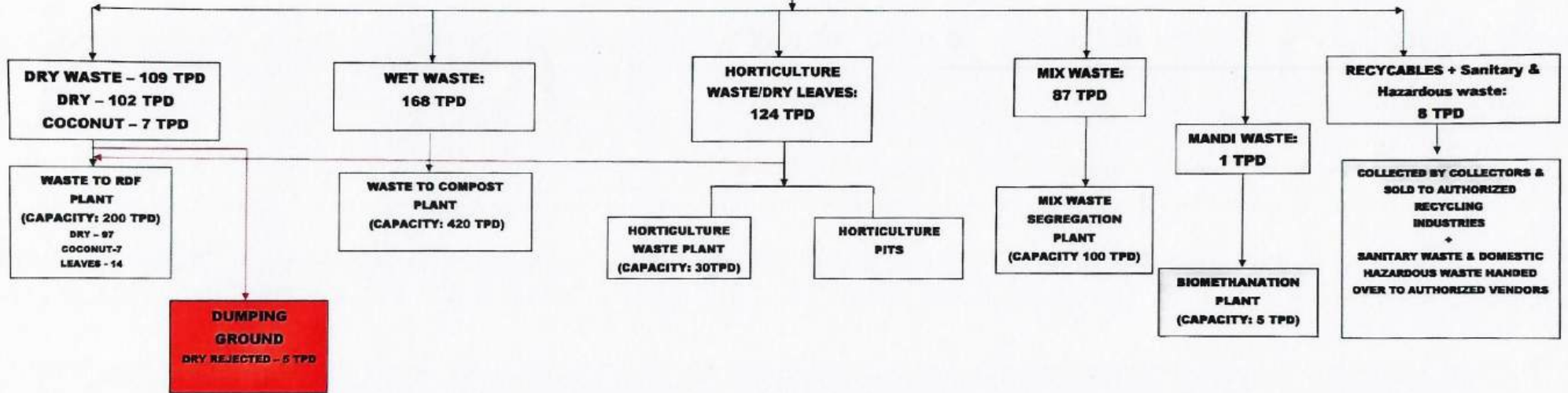



Director Environment
Chandigarh Administration



SOLID WASTE MASS BALANCE DIAGRAM

TOTAL MSW GENERATION= 497 TPD (Avg. FY 24 - 25)



CS(MCC)

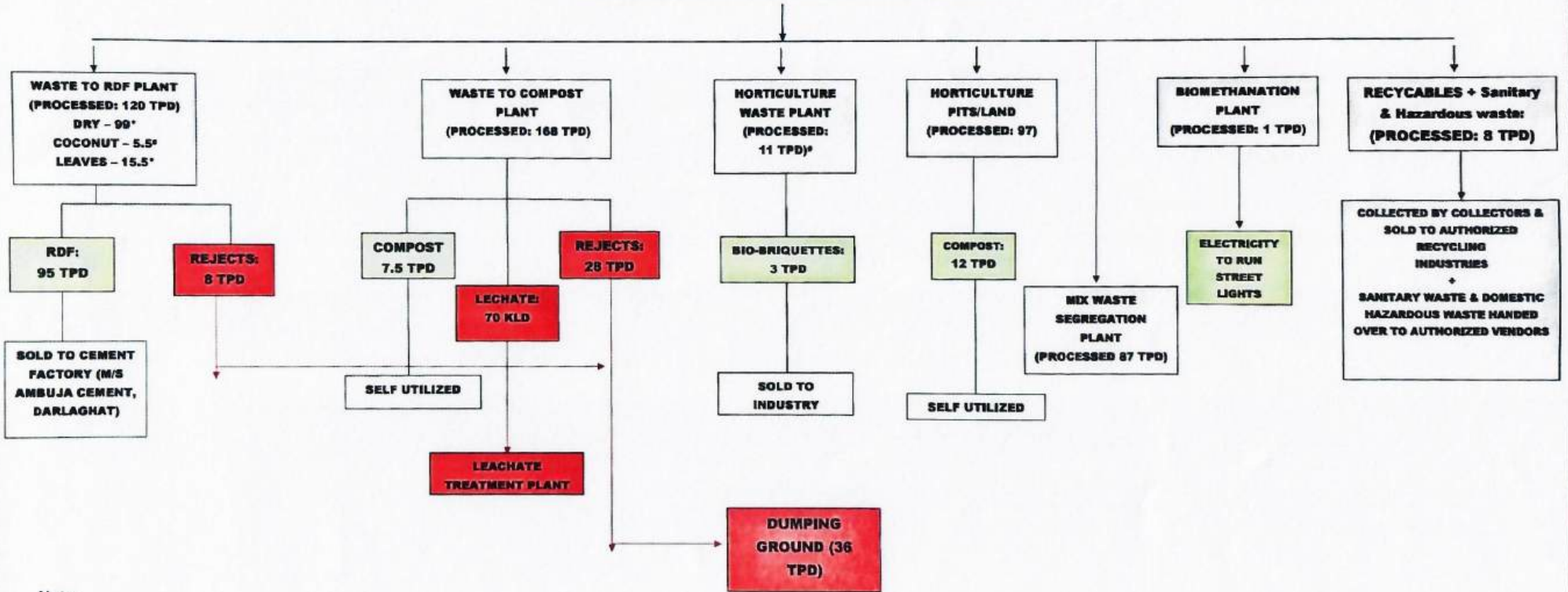
MCH

Director Environment Chandigarh Administration



SOLID WASTE MASS BALANCE DIAGRAM

TOTAL MSW PROCESSED = 492 TPD (Avg. FY 24 - 25)



Note:
*Backlog processed
Backlog remains

Handwritten signature
CE (Incc)

Handwritten signature
MCH

Handwritten signature
Director Environment
Chandigarh Administration

NEW MACHINE FOR PROCESSING OF MIXED-WASTE



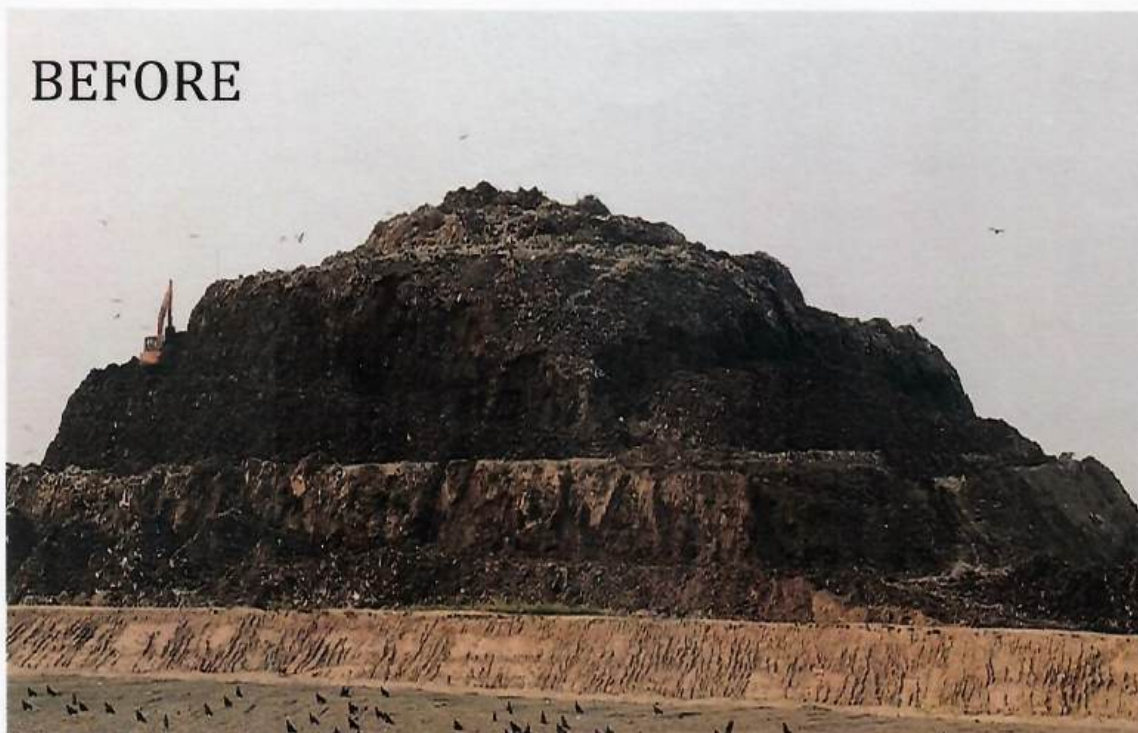



Director Environment
Chandigarh Administration




Director Environment
Chandigarh Administration

BIO-REMEDIATION AT CURRENT LANDFILL SITE




Director Environment
Chandigarh Administration

SGS

Test Report



TC-5006

SAMPLE DRAWN BY SGS INDIA PVT. LTD.

Report No : CE20-001860.001

Print Date : 07/09/2020

ULR No : TC500620100007953F

JOE No : CE20-001860

Report Control No : CER0000322349

Sample Described by Customer as : BIO SOIL

Client Name : SMS LIMITED
 Client Address : Bio Mining Chandigarh
 : Daddu Majra Dumping Ground
 Postal Code : 160014
 State : Chandigarh
 Country : INDIA
 Sample Type : BIO SOIL
 Received : 02/09/2020
 Sample Qty. : 1KG
 Recd. :
 Sampling Location : DADDU MAJRA DUMPING GROUND BIO REMEDIATION SITE
 Sampling Date : 31.08.2020
 Sampling Time : 14.15Hrs
 Test Start/End Date : 02/09/2020 - 07/09/2020
 NABL Group : Pollution & Environment
 NABL Sub Group : Wastes (Liquid/Slurry/Sludge/Solid/Semi-Solid)

NABL Accredited Tests

Analysis	Method	Result	Unit	Requirement/Limit As per USEPA Chapter 7 for Toxicity	
				Min	Max
DISCIPLINE: CHEMICAL					
Arsenic as As	USEPA 1311 & 200.8 (by ICP-MS / ICP-OES)	<0.1	mg/L	-	5.0
Total chromium as Cr	USEPA 1311 & 200.8 (by ICP-MS / ICP-OES)	<0.1	mg/L	-	5.0
Lead as Pb	USEPA 1311 & 200.8 (by ICP-MS / ICP-OES)	<0.1	mg/L	-	5.0
Zinc as Zn	USEPA 1311 & 200.8 (by ICP-MS / ICP-OES)	0.8	mg/L	-	-
Copper as Cu	USEPA 1311 & 200.8 (by ICP-MS / ICP-OES)	<0.1	mg/L	-	-
Nickel as Ni	USEPA 1311 & 200.8 (by ICP-MS / ICP-OES)	<0.1	mg/L	-	-

Remark : All parameters were analysed in TCLP leachate
 TCLP leachate prepared as per USEPA 1311 method

[Signature]
 Director Environment
 Chandigarh Administration

Page 1 of 2

This document is issued by the Company under its General Conditions of Service printed overleaf or available on request and accessible at http://www.sgs.com/terms_and_conditions.htm and Terms and Conditions for electronic documents www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 7 days (in case of perishable items) and 30 days for all other samples. The samples from regulatory bodies are to be retained as specified. This document cannot be reproduced except in full, without prior written approval of the Company.

For any feedback or complaint please write to us at info.sgsindia@sgs.com / <https://sgs.in/customerkey.com/r2JCBYP>

SGS India Pvt. Ltd.

Multi Laboratory, 28 B/1 (SP), 28 B/2 (SP), Hind Mah Road, Opposite to State Bank of India, Ambattur Industrial Estate, Chennai - 600 058, Tel: 91-44-66081800

Read & Care, Of: SGS House, 4B, A.S. Marg, Vikhroli (West), Mumbai-400083. Tel: (022) 25798421 to 28 Fax: (022) 25798431 to 35 www.sgs.com

Member of the SGS Group (SGS SA)

SGSTest Report

TC-5006

SAMPLE DRAWN BY SGS INDIA PVT. LTD.

Report No : CE20-001860.001

Print Date : 07/09/2020

ULR No : TC500620100007953F

JOE No : CE20-001860

Report Control No : CER0000322349

Per pro SGS India Private Ltd

M_ELLAPPAN

Authorized Signatory

****End of Report****

Page 2 of 2

Director Environment
Chandigarh Administration

This document is issued by the Company under its General Conditions of Service printed overleaf or available on request and accessible at http://www.sgs.com/terms_and_conditions.htm and Terms and Conditions for electronic documents www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 7 days (in case of perishable items) and 30 days for all other samples. The samples from regulatory bodies are to be retained as specified. This document cannot be reproduced except in full without prior written approval of the Company.

For any feedback or complaint please write to us at sgs@sgs.com / <http://sgs-surveyservices.com/24x7CBYP>

SGS India Pvt. Ltd.

Multi Laboratory, 28 B/1 (SP), 28 B/2 (SP), 11nd Main Road, Opposite to State Bank of India, Ambattur Industrial Estate, Chennai - 600 058, Tel: 91-44-66081600
 Road & Corp. Off.: SGS House, 4B, A.S. Marg, Vikhroli (West), Mumbai-400083. Tel: (022) 26786421 to 28 Fax: (022) 26796431 to 35 www.sgs.com

Member of the SGS Group (SGS SA)