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To Study the Contract Management on Sewage Treatment Plant (STP)

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ABSTRACT

A study on domestic waste water characterization has been performed followed by the design of sewage treatment plant. The present study involves the analysis of pH value, total solids, total suspended solids, hardness, acidity, alkalinity, chloride, chlorine, BOD, DO and heavy metals such as Iron, Copper, Zinc, Magnesium, Nickel, Chromium, Lead, Calcium, Aluminium, Silicon, Potassium. A sewage treatment plant is quite necessary to receive the domestic and commercial waste and removes the materials which pose harm for general public. Its objective is to produce an environmentally-safe fluid waste stream (or treated effluent) and a solid waste (or treated sludge) suitable for disposal or reuse (usually as farm fertilizer).

The samplings of the domestic waste from hostels have been done in different times of the day to have an average data of the measured parameters. The average values of pH, Turbidity, Acidity, Chloride, Residual Chlorine, Hardness, Total Solid, BOD, DO, Alkalinity, Total Iron Content, Zinc Content, Potassium, Copper, Magnesium, Nickel, Chromium, Lead, Calcium, Aluminum and Silicon are found out.

The study examined the use of contract management practices on performance of the Sewage Treatment Plant construction projects, implemented under different contract modes. The objectives of this presentation are to examine the role of monitoring intensity in enhancing performance of the Sewage Treatment Plant construction projects under contract modes Item Rate, BOT, EPC, HAM, TOT etc. to analyze the relationship between risk management and performance of the Sewage Treatment Plant construction projects and to assess the role of evaluation in enhancing performance at different parts of the country.

Good contract management and administration has the capacity to increase revenue opportunities, decrease costs and enhance service delivery. Importantly, as competencies of managers and resources at their disposal increases, it is essential that they strengthen their efforts to make compliance central to strategic objectives.

Many findings including and indicated that there was a significant positive relationship between monitoring intensity, risk management, evaluation and performance of STP construction projects. The performance of the STP construction projects in India was more related to the availability and use of resources which include funding, human resources and the basic raw materials used in the construction process which results into delays, cost overruns and poor quality service. Based on these study findings it is therefore recommended that India should commit more resources to evaluation and risk management to realize higher level of service delivery in Sewerage construction/ STP. My above presentation covers briefly number of risks encountered from different contract modes of Sewer projects.

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INTRODUCTION

Pollution in its broadest sense includes all changes that curtail natural utility and exert deleterious effect on life. The crisis triggered by the rapidly growing population and industrialization with the resultant degradation of the environment causes a grave threat to the quality of life. Degradation of water quality is the unfavorable alteration of the physical, chemical and biological properties of water that prevents domestic, commercial, industrial, agricultural, recreational and other beneficial uses of water. Sewage and sewage effluents are the major sources of water pollution. Sewage is mainly composed of human fecal material, domestic wastes including wash-water and industrial wastes.

The growing environmental pollution needs for decontaminating waste water result in the study of characterization of waste water, especially domestic sewage.

In the past, domestic waste water treatment was mainly confined to organic carbon removal. Recently, increasing pollution in the waste water leads to developing and implementing new treatment techniques to control nitrogen and other priority pollutants.

Sewage Treatment Plant is a facility designed to receive the waste from domestic, commercial and industrial sources and to remove materials that damage water quality and compromise public health and safety when discharged into water receiving systems. It includes physical, chemical, and biological processes to remove various contaminants depending on its constituents. Using advanced technology it is now possible to re-use sewage effluent for drinking water.

The present study comprises the study on quality of domestic waste water that is discharged from the HB Hall of National Institute of Technology, Rourkela, through the kitchen outlets and bathroom effluents. The study includes characterization tests for pH value, acidity, alkalinity, chloride, residual chlorine, turbidity & DO.

SEWAGE TREATMENT PLANT

Sewage treatment is the process of removing contaminants from municipal wastewater, containing mainly household sewage plus some industrial wastewater. Physical, chemical, and biological processes are used to remove contaminants and produce treated wastewater that is safe enough for release into the environment. It includes physical, biological and sometimes chemical processes to remove pollutants. Its aim is to produce an environmentally safe sewage water, called effluent, and a solid waste, called sludge or biosolids, suitable for disposal or reuse. Reuse is often for agricultural purposes, but more recently, sludge is being used as a fuel source.

Water from the mains, used by manufacturing, farming, houses (toilets, baths, showers, kitchens, sinks), hospitals, commercial and industrial sites, is reduced in quality as a result of the introduction of contaminating constituents. Organic wastes, suspended solids, bacteria, nitrates, and phosphates are pollutants that must be removed.

Sewage can be treated close to where it is created (in septic tanks and their associated drainfields or sewage treatment plants), or collected and transported via a network of pipes and pump stations to a municipal treatment plant. The former system is gaining popularity for many new ECO towns, as 60% of the cost of mains sewerage is in the pipework to transport it to a central location and it is not sustainable. It is called 'Decentralisation' of sewage treatment systems.

The job of designing and constructing sewage works falls to environmental engineers. They use a variety of engineered and natural systems to meet the required treatment level, using physical, chemical, biological, and sludge treatment methods. The result is cleaned sewage water and sludge, both of which should be suitable for discharge or reuse back into the environment. Sludge, however, is often inadvertently contaminated with many toxic organic and inorganic compounds and diseases and the debate is raging over the safety issues. Some pathogens, for example, 'Prion' diseases (CJD or 'Mad Cow Disease is a Prion disease) cannot be destroyed by the treatment process.

The features of wastewater treatment systems are determined by:

1. The nature of the municipal and industrial wastes that are conveyed to them by the sewers.
2. The amount of treatment required to keep the quality of the receiving streams and rivers.

Discharges from treatment plants are usually diluted in rivers, lakes, or estuaries. They also may, after sterilisation, be used for certain types of irrigation (such as golf courses), transported to lagoons where they are evaporated, or discharged through underground outfalls into the sea. However, sewage water outflows from treatment works must meet effluent standards set by the Environment Agency to avoid polluting the waters that receive them.

Sewage treatment plant

Processes fall into two basic types:

Anaerobic Sewage Treatment

Sewage is partly decomposed by anerobic bacteria in a tank without the introduction of air, containing oxygen. This leads to a reduction of Organic Matter into Methane, Hydrogen Sulphide, Carbon Dioxide etc. It is widely used to treat wastewater sludge and organic waste because it provides volume and mass reduction of the input material to a large extent.. The methane produced by large-scale municipal anerobic sludge treatment is currently being examined for use in homes and industry, for heating purposes. Septic tanks are an example of an anerobic process, but the amount of methane produced by a septic tank (it is only the SLUDGE at the bottom that produces methane) serving less than 100 people is miniscule. In addition to this, septic tank effluent still contains about 70% of the original pollutants and the process smells very badly, due to the Hydrogen Sulphide, if not vented correctly. The effluent produced by this process is highly polluting and cannot be discharged to any watercourse. It must be discharged into the Aerobic layer of the soil (within the top metre of the ground) for the aerobic soil bacteria to continue the sewage treatment via the aerobic process below.

Aerobic Sewage Treatment

In this process, aerobic bacteria digest the pollutants. To establish an aerobic bacterial colony you must provide air for the bacteria to breathe. In a sewage treatment plant, air is continuously supplied to the Biozone either by direct Surface Aeration using Impellers propelled by pumps which whisk the surface of the liquid with air, or by Submerged Diffused Aeration using blowers for air supply through bubble diffusers at the bottom of the tank. (The most modern aerobic sewage systems use natural air currents and do not require electricity, though these are only used for small scale sewage systems at the moment. Once again, the general public leads the way!) Aerobic conditions lead to an aerobic bacterial colony being established. These achieve almost complete oxidation and digestion of organic matter and organic pollutants to Carbon Dioxide, Water and Nitrogen, thus eliminating the odour and pollution problem above. The effluent produced by this process is non-polluting and can be discharged to a watercourse

Conventional sewage water treatment involves either two or three stages, called primary, secondary and tertiary treatment. Before these treatments, preliminary removal of rags, cloths, sanitary items, etc. is also carried out at municipal sewage works.

Primary Treatment
This is usually Anerobic. First, the solids are separated from the sewage. They settle out at the base of a primary settlement tank. The sludge is continuously being reduced in volume by the anerobic process, resulting in a vastly reduced total mass when compared to the original volume entering the system.

Secondary Treatment
This is Aerobic. The liquid from the Primary treatment contains dissolved and particulate biological matter. This is progressively converted into clean water by using indigenous, water-borne aerobic micro-organisms and bacteria which digest the pollutants. In most cases, this effluent is clean enough for discharge directly to rivers.

Tertiary Treatment
In some cases, the effluent resulting from secondary treatment is not clean enough for discharge. This may be because the stream it is being discharged into is very sensitive, has rare plants and animals or is already polluted by someone's septic tank. The Environment Agency may then require a very high standard of treatment with a view to the new discharge being CLEANER than the water in the stream and to, in effect, 'Clean it up a bit'. It is usually either Phosphorous or Ammoniacal Nitrogen or both that the E.A. want reduced. Tertiary treatment involves this process. If Phosphorous is the culprit, then a

Future Scope
The future scope of waste water management as per guidelines of Hon'ble National Green Tribunal (NGT) New Delhi, Central Pollution Control Board, Ministry of Environment and Forest, Ministry of Water Resources now renamed as Jal Shakti Ministry, National Mission for Clean Ganga (NMCG), Ganga Action Plan, Yamuna Action Plan, River Yamuna Monitoring Committee , National River Conservation Plan (NRCP), Planning Commission now renamed as " Niti Auyog" and other governing body defined some guidelines regarding to reduce pollution in various rivers water, by planning waste water management with meant of construction of Sewage Treatment Plants.

The various Public Interest litigation have been filed in the Hon'ble High Court, Supreme Court etc. regarding reduction of pollution in rivers water by planning scheduling, constructing STPs to stop waste water/ sewage water flow into rivers. The future scope of waste water management to achieve the desired parameters of BOD, COD, $P^{H,}$ TSS and coliform as per norms fixed.

Sr. No.	Parameter	Prescribed Limit	Future Scope
1	BOD_5	< 30 mg/litre	≤ 20 mg/litre to 10mg/litre
2	COD	< 100 mg/litre	< 100 mg/litre
3	TSS	50 mg/litre	≤ 40 mg/litre
4	P^H	7-8.50 mg/litre	7-8.50 mg/litre
5	Fecal Coliform	<1000 MPN/100 ml (desirable)	----
6	Oil and Grease	<1000/100 ml (maximum)	----

Resources required are large, but not daunting. A rough cost estimate indicate that NRCP projects all over India are estimated to cost about Rs. 11,250 crore to 33,000 crore to create 8250 MLD of additional capacity to meet present shortfall above can be between Rs. 2080 crores to Rs. 7180 crores to meet the projected requirement for 2020. The I and D works should be looked upon as a short term solution. In the long run, the possibility of providing every household with sewage connection should be explored these cost.

The study can be extended on waste water management with contract management intensity in following directions.
1. Adoption of latest technology of waste water management.
2. Implementation of Hon'ble Supreme Court and High Court Decision by bounding to concerned authority in legal proceeding i.e. undertaking in shape of affidavit must be got filed to achieve desired target within stipulated time frame.
3. Forefit of performance guarantee deposited by various departments if violation is occured.

EXPERIMENTAL WORK
Biochemical Oxygen Demand (BOD):-
It is one of the most important parameters and is a measure of organic matter present in waste water. BOD is determined by measuring the amount of oxygen absorbed by a sample of waste water in the presence of micro-organisms during a specific period. Generally taken as five days, at a specific temperature, generally 20º C expressed as BOD. It is an internationally accepted standard.

Dissolved oxygen deficiency indicates the amount of oxygen consumed or lost from the quantity of water while BOD gives the future loss of dissolved oxygen that would take place due to the decomposition of organic matter present in it.

The BOD is primary measure of the strength of waste water and is also an indication of the effects that they can be expected to have on receiving streams by reducing their oxygen content. Generally the treatment of waste water is selected in such a way that it reduces the BOD of the effluent to the desired acceptable limits either prescribed by the regulatory body or as suggested by various Indian Standards discussed above or it is governed by the specific purpose for which the sewage effluent is intended to be used. Greater reliance is placed on the BOD test as compared to the determination of Volatile Solids when putrescibility of sewage is to be determined.

As for the principle of BOD reaction, within a period of about 10 days approximately 90% of biological oxygen demand is satisfied. After that period rate is very slow. As discussed above usually a 5 days BOD is all that is tested. To carry out this test, the sewage or the effluent is diluted usually in the ratio of 1:100 i.e. one part of sewage mixed with 99 parts of fresh water saturated with oxygen is kept for 5 days test at 20º C. for example if the BOD of the diluted sample is 11 PPM in the beginning and 8 PPM at the end of 5 days, then the BOD of the sample is:

5 days BOD = (11-8) x dilution ratio

= 3 x 100 = 300 PPM.

Approximate value of BOD:-

For different types of sewages and tank effluents, approximate BOD value mg/1 are:

TABLE Type of Sewage and its approximate BOD value

Types of Sewage	BOD, mg/1
Strong sewage	400
Average sewage	220
Weak sewage	110
Strong septic tank effluent	240
Average septic tank effluent	150
Average effluent from primary sedimentation tanks	100
Average filter effluent	25
Effluent from aerated tank	20
Very good well treated effluent	10

DETAILED REPORT OF LABORATORY SAMPLES

SAMPLE TESTED AT ALL LABS

Circle Name: Jhajjar Circle

Division Name: Jhajjar PHED No. 3

Sr. No.	Dates	Lab Name	Division Name	STP Name	Sampling Point	Results				Remarks
	Sample Received, Sample Tested					**BOD (mg/Litr)**	**COD (mg/Litr)**	**TSS (mg/Litr)**	**pH**	
						Permissble Limit				
						30 mg/Ltr.	**250mg/Ltr.**	**100 mg/Ltr.**	**5.5 - 9.0**	
	Jhajjar Circle									
	Jhajjar PHED No. 3									
	Badli PHESD									
	,		Jhajjar PHED No. 3							
	Bahadurgarh PHESD No. 4									
	,		Jhajjar PHED No. 3							
	Jhajjar PHESD No. 5									
1.	01/06/2019, 04/06/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	14	126	24	7.9	Within Permissible Limit
2.	03/06/2019, 06/06/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	20	140	12	7.8	Within Permissible Limit
3.	05/06/2019, 08/06/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	22	152	24	7.32	Within Permissible Limit
4.	07/06/2019, 10/06/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	24	164	22	7.8	Within Permissible Limit
5.	10/06/2019, 13/06/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	20	154	20	7.24	Within Permissible Limit
6.	12/06/2019, 15/06/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	16	136	14	7.6	Within Permissible Limit
7.	14/06/2019, 17/06/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	14.8	112	18	7.32	Within Permissible Limit

8.	17/06/2019, 20/06/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	22	134	18	7.20	Within Permissible Limit
9.	19/06/2019, 22/06/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	16	142	16	7.28	Within Permissible Limit
10.	21/06/2019, 24/06/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	16	98	62	7.40	Within Permissible Limit
11.	23/06/2019, 26/06/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	14	96	90	7.7	Within Permissible Limit
12.	28/06/2019, 30/06/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	18	118	27	7.8	Within Permissible Limit
13.	01/07/2019, 04/07/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	15	125	29	7.5	Within Permissible Limit
14.	03/07/2019, 06/07/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	17	135	20	7.4	Within Permissible Limit
15.	05/07/2019, 08/07/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	10	122	25	7.36	Within Permissible Limit
16.	08/07/2019, 10/07/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	14	118	28	7.8	Within Permissible Limit
17.	10/07/2019, 13/07/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	12.8	142	17	7.8	Within Permissible Limit
18.	12/07/2019, 15/07/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	12	116	20	78	Not Within Permissible Limit
19.	14/07/2019, 17/07/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	18	148	39	7.40	Within Permissible Limit
20.	16/07/2019, 19/07/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	18	152	16	7.8	Within Permissible Limit
21.	18/07/2019, 21/07/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	18	154	20	7.68	Within Permissible Limit
22.	22/07/2019, 25/07/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	12.8	124	16	7.38	Within Permissible Limit
23.	24/07/2019, 27/07/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	18	148	16	7.6	Within Permissible Limit
24.	26/07/2019, 29/07/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	18.4	162	32	7.8	Within Permissible Limit
25.	29/07/2019, 01/08/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	12	108	18	7.8	Within Permissible Limit

26.	30/07/2019, 02/08/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	12	142	14	7.24	Within Permissible Limit
27.	31/07/2019, 03/08/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	14	124	20	7.9	Within Permissible Limit
28.	02/08/2019, 05/08/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	18	152	20	7.14	Within Permissible Limit
29.	06/08/2019, 09/08/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	16.4	162	32	7.8	Within Permissible Limit
30.	08/08/2019, 11/08/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	12	135	18.10	7.42	Within Permissible Limit
31.	10/08/2019, 13/08/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	16	134	18	7.10	Within Permissible Limit
32.	12/08/2019, 15/08/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	11	104	16	7.36	Within Permissible Limit
33.	14/08/2019, 17/08/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	11.40	112	18	7.36	Within Permissible Limit
34.	16/08/2019, 19/08/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	12	98	19	7.40	Within Permissible Limit
35.	18/08/2019, 21/08/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	11.50	116	18	7.30	Within Permissible Limit
36.	20/08/2019, 23/08/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	14	118	18	7.8	Within Permissible Limit
37.	22/08/2019, 25/08/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	16	120	16.94	7.20	Within Permissible Limit
38.	24/08/2019, 27/08/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	12.4	126	18	7.50	Within Permissible Limit
39.	27/08/2019, 30/08/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	14	132	20	7.38	Within Permissible Limit
40.	29/08/2019, 01/09/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	16	124	20	7.50	Within Permissible Limit
41.	31/08/2019, 03/09/2019	Site Lab	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5 MLD	Effluent	12	98	16	7.7	Within Permissible Limit
42.	19/11/2014, 24/11/2014	Regional Laboratory, HSPCB, E-II, Hissar	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5.5 MLD	Effluent	36	139.8	40	8.5	Not Within Permissible Limit

43.	19/11/2014,	JHAJJAR	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5.5 MLD		36	139.8	40	8.5	
44.	10/01/2015, 14/01/2015	M/S Avon Food Lab(P) Ltd., Delhi	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5.5 MLD	Effluent	34	264	96	7.19	Not Within Permissible Limit
45.	10/01/2015, 14/01/2015	M/S Avon Food Lab(P) Ltd., Delhi	Jhajjar PHED No. 3	STP-JJR-Jhajjar-5.5 MLD	Influent	80	360	118.4	6.97	Within Permissible Limit

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