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REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
OFFICE OF THE SECRETARY
MANILA

16 MAR 2018

DEPARTMENT ORDER NO. 41 Series of 2018 03.20.18

SUBJECT: DPWH Standard Specification for Item 1729 – Sewage Treatment Plant (STP) - Dynamic Sequential Batch Reactor (SBR) Process

It has been the thrust of the Department to provide effective standard specifications in the implementation of various infrastructure projects. As such, there is a need to set a standard specification for Dynamic Sequential Batch Reactor Process for sewage treatment plant. The attached **DPWH Standard Specification for Sewage Treatment Plant (STP) - Dynamic Sequential Batch Reactor (SBR) Process, Item 1729** *is hereby prescribed* for the guidance and compliance of all concerned.

This specification shall form part of the on-going revision of the DPWH Standard Specifications for Public Work Structures – Buildings, Ports and Harbors, Flood Control and Drainage Structure and Water Supply Systems, Volume III, 1995 Edition.

This Order shall take effect immediately.

MARK A. VILLAR
Secretary

14.1.2 FET/RGT

Department of Public Works and Highways
Office of the Secretary
WIN8U01587

DPWH Standard Specification for
ITEM 1729 - Sewage Treatment Plant (STP) -
Dynamic Sequential Batch Reactor (SBR) Process

1729.1 Description

This Item covers the provision and installation of a complete modular Sewage Treatment Plant (STP) using Sequential Batch Reactor (SBR) Treatment System.

The proposed treatment is the Sequential Batch Reactor (SBR) aerobic biological system, an established activated sludge biological cleaning system for all types of Sewage. This treatment option adapts well to changing and increasing sewage load by changing the cycle periods and characteristics without the necessity of any new constructions. Ongoing discharge does not interfere with the settlement of sludge during the liquid/sludge separation process. As a result, the separation of sludge from cleansed liquid can be achieved at a faster rate, and more efficiently compared to a settlement tank in a continuous flow system. Treatment system includes (1) Combined Pre-treatment Process, (2) Secondary Dynamic (SBR) Treatment Process, (3) Disinfection Process, (4) Aerobic Sludge Digestion Process, (5) Sludge Dewatering Process.

Minimum performance standards required for (SBR) aerobic biological System are:

(1) Minimum of six (6) hours hydraulic retention time;
(2) Design MLSS of at least 2000 ppm;
(3) Systems using enzymes / bioactive substances by themselves are not acceptable;
(4) Provide proper treatment for sludge management, odor control and disinfection before discharge

The proposed treatment required with effluent complying with DENR Standards (DAO 2016-08) for SB (Sec. 1-Fishery Water Class 11, Sec. 2-Tourism Zones, Sec.3-Recreational Water Class I) for Marine Waters. Also, RA 9275 otherwise known as the Philippine Clean Water Act.

1729.2 Material Requirements

1729.2.1 Combined Pre-Treatment Process

The objective of combined preliminary treatment is the removal of coarse solids, grit, grease and other large materials often found in raw Sewage. Removal of these materials is necessary to enhance the operation and maintenance of subsequent treatment units.

Equipment to use shall include: (1) Combined Pre-Treatment Unit with degreasing and grit removal process, (2) Manual Bar Fine Screen, (3) Influent Non-contact Doppler Flowmeter, (4) Equalization Submersible Non-Clog Channel Type Transfer Pump with Cutter, (5) Equalization Wide Band Coarse Bubble Diffusers.

Table 1729.1 - Combined Pre-Treatment Process

No.	Name of Equipment	Thickness/ Sizes	Valid Values		Conforming Standard / Design Code
			Class	Others	
1	Combined Pre-Treatment Unit with degreasing and grit removal process	Min. 60 l/s Output; with 2mm mesh	Stainless Steel AISI 304 or 316	2 kW, 220V, 1Ph, 60 Hz	This unit shall conform to the following: Carpentry: Stainless Steel AISI 304 or 316; Bolts: A2 or A4; Screws: Micro alloy steel; Liners: Bars in Stainless Steel AISI 304 or 316; Greasy matter separation system: Stainless Steel AISI 304 or 316; Flange: Fixing flange in aluminum, parts in contact with the effluent in Stainless Steel AISI 304 or 316; Surface Treatment: pickled and passivated.
2	Manual Bar Fine Screen	3.6 m^3/min, 2mm slit size	Mesh Steel Wire	PNS	SS AISI 304 or 316.
3	Influent Non-contact Doppler Flowmeter	As per flow requirements	Stainless Steel AISI 304 or 316	0.01 kW, 220V, 1Ph, 60Hz	Certified nonincendive for Class I Division 2, Groups A, B, C, D hazardous locations
4	Equalization Submersible Non-Clog Channel Type Transfer Pump with Cutter	Min. 76.2 mm Dia or as per flow design requirements	Body Cast Iron FC250, Motor Shaft Stainless Steel SUS420J2	3.7 kW, 440V, 3Ph, 60Hz	Cable: VCT; Motor Shaft: Stainless Steel (SUS 420J2); Pump Housing and Impeller: Cast iron (FC250); Electric Motor Insulation Class: Class F; Enclosure: IP68
5	Equalization Wide Band Coarse Bubble Diffusers	Min. 24 Holes or as per flow design requirements	Stainless Steel AISI 304 or 316	10 X 5mm Dia. Holes	US Patents 7,674,514; 7,398,499 and 6,811,148

1729.2.2 Secondary Treatment – Dynamic SBR Process

The objective of secondary treatment process is the further treatment of the effluent from primary treatment to remove the residual organics and suspended solids. In most cases, secondary treatment follows primary treatment and involves the removal of biodegradable dissolved and colloidal organic matter using aerobic biological treatment system. Activated Sludge System is the biological treatment system employed in the existing sewage treatment plant.

This process includes Dynamic Sequential Batch Reactor (SBR) Process, the pre-treated Sewage will now be treated in a biological treatment process called Dynamic SBR. Dynamic SBR incorporates two (2) hydraulic cycle control features that allow you to operate the system in two (2) basic process modes: Nitrification and De-nitrification. The simple cycle provides half the cycle for aeration and treatment of the sewage and total of two (2) hours for settle and decant. The cycles are staggered so one (1) blower can provide air to a pair of basins while ensuring that only one (1) basin is aerated at any time. If nutrient removal is required, the cycle time is extended to provide time for anoxic periods to allow de-nitrification and Biochemical Oxygen Demand (BOD) removal. The continual feed provides BOD at all times to provide good de-nitrification rates at all points in the cycles and optimize nitrogen removal.

This process requires the use of (1) SBR Air Motorized Valve, (2) SBR Turbo Air Blower, (3) SBR Waste Sludge Non-Clog Submersible Pump, (4) SBR Fine Bubble Diffusers, (5) Floating Decanter w/ motorized valve, (6) Decanter Motorized Valve, (7) Decanter Air Solenoid Valve and (8) Dissolve Oxygen (DO) Meter.

Table 1729.2 - Secondary Treatment – Dynamic SBR Process

No.	Name of Equipment	Thickness/ Sizes	Valid Values		Conforming Standard / Design Code
			Class	Others	
1	SBR Air Motorized Valve	Min. 152.4 mm Dia., DN600,10 bar	Ductile Iron A536-65-42-15 Epoxy Painted	0.024 kW, 220V, 1P, 60Hz	ISO 12238, Pneumatic fluid power-Directional Control Valves – Measurement of shifting time
2	SBR Turbo Air Blowers	21.29 m3/min @ 500mbar	Casing Aluminum AL 365, Impeller AL 7075 Shaft Ti Alloy, Bearing Ni Alloy	22.4 kW, 440V, 3P, 60Hz	ISO 1940, Mechanical vibration – Balance quality requirements for rotors in a constant state
3	SBR Waste Sludge Non-Clog Submersible Pump	Min. 76.2 mm Dia Bore or as per design capacity	Body Cast Iron FC250, Motor Shaft Stainless Steel SUS420J2	2.2 kW, 440V,3P,60Hz	National Electric Code (NEC) or National Fire Protection Association (NFPA) 70
4	SBR Fine Bubble Diffusers	Min. 304.8 mm DISC or as per design capacity	Polytetrafluoro-ethylene (PTFE) Coated Membrane	--	US Patents 7,674,514; 7,398,499 and 6,811,148
5	Floating Decanter w/ motorized valve	As per design requirements	Stainless Steel AISI 304 or 316	--	SS AISI 304 or 316
6	Decanter Motorized Valve	Min. 355.6 mm Dia. or as per design requirements	Ductile Iron A536-65-42-15 Epoxy Painted	0.024kW, 220V, 1P, 60Hz	ISO 12238, Pneumatic fluid power-Directional Control Valves – Measurement of shifting time
7	Decanter Air Solenoid Valve	Min 25.4 mm Dia. as per design requirements	Brass for Body, Stainless for Core Tube	0.008kW, 220V,1P,60Hz	Underwriters Laboratories Inc., NEMA, IEEE, and other industrial standards ASCO Class B, F and H insulation systems are UL listed in the Recognized Component Index (yellow book) under Guide No. OBJY2
8	Dissolve Oxygen (DO) Meter	0-20 mg/L (1pc/tank)	PVC	0.01kW, 220V,1P,60Hz	IEC 61298-2 – Process measurement and control devices-General methods and procedures for evaluating performance – Part 2 at nominal operating conditions

1729.2.3 Disinfection Process

The decanted Sewage from the SBR basins will be disinfected using Ultraviolet (UV) Disinfection Process. This process will instantaneously neutralize microorganisms as they pass through ultraviolet lamps submerged in the effluent. Treated effluent from the system will be discharged to the storm drainage or nearest body by gravity. UV Sterilizer and Effluent Flow meter will be required on this process.

Use Ultraviolet (UV) Disinfection Process or Chlorination Disinfection Process

Table 1729.3 - Disinfection Process

No.	Name of Equipment	Thickness/ Sizes	Valid Values		Conforming Standard / Design Code
			Class	Others	
1	Ultraviolet (UV) Sterilizer	Min. 195 m3/h @ 254nm, 1cm or as per design requirements	Stainless Steel AISI 304 or 316 or High-Density Polyethylene (HDPE)	2.5 Kw, 440V,3P, 60Hz	International Standard against NSF/ANSI Standard 61
2	Effluent Electro Magnetic Flowmeter	Min. 406.4 mm Dia. or as per design requirements	Carbon Steel ASTM A 105 for Housing & Flanges, Stainless Steel AISI 304/1 4301	0.01kW, 220V,1P, 60Hz	With type approval after OIML R 49 and verified according to MI-001 - 0D inlet/0D outlet installation; conform to ISO 4064, Water meter for cold potable water and hot water and EN 14154, Water meter for mechanical flowmeters; Built-in length according to ISO 13359, Measurement of conductive liquid flow in closed conduits

1729.2.4 Aerobic Sludge Digestion Process

The excess sludge requires treatment to reduce its water and organic content and to obtain a stabilized product suitable for end-use or final disposal. Waste sludge generated from the SBR tank shall be stored and treated by means of biological process called Aerobic Digestion. Aerobic digestion is a method of sludge stabilization wherein biodegradable organic matter decomposed at about 50 percent – 80 percent reduction into a relative stable compound and oxidized some cellular material into CO_2, H_2O, and NO_3. This process is possible by continuous mixing and oxygenation/aeration using a blower and stainless-steel bubble diffusers.

Process requires the use of (1) Aerobic Sludge Digester (ASD) Wide Band Coarse Bubble Diffusers, (2) ASD Non-Clog Submersible Transfer Pump/Screw Press Feed Pump, (3) ASD Air Blower.

Table 1729.4 - Aerobic Sludge Digester (ASD) Process

No.	Name of Equipment	Thickness/ Sizes	Valid Values		Conforming Standard / Design Code
			Class	Class	
1	Aerobic Sludge Digester (ASD) Wide Band Coarse Bubble Diffusers	Min. 24 Holes, L=24" or as per design requirements	Stainless Steel AISI 304 or 316	10 X 5mm Dia. Holes	US Patents 7,674,514; 7,398,499 and 6,811,148
2	ASD Non-Clog Submersible Transfer Pump/Screw Press Feed Pump	Min. 76.2 mm Dia Bore or as per design requirements	Body Cast Iron FC250, Motor Shaft Stainless Steel SUS420J2	1.5 Kw, 440V, 3P, 60Hz	National Electric Code (NEC) or National Fire Protection Association (NFPA) 70

Table 1729.4 - Aerobic Sludge Digester (ASD) Process

No.	Name of Equipment	Thickness/ Sizes	Valid Values		Conforming Standard / Design Code
			Class	Class	
3	ASD Air Blower	Min. 26.33 m3/min or as per design requirements	Casing Aluminum AL 365, Impeller AL 7075 Shaft Ti Alloy, Bearing Ni Alloy	30kW, 440V, 3P, 60Hz	ISO 1940, Mechanical vibration – Balance quality requirements for rotors in a constant state

1729.2.5 Sludge Dewatering Process

The stabilized and digested sludge from the aerobic sludge digester will be pumped to the proposed dewatering facility. The dewatering press to be used is combination of thickener and dewatering press which is known as Volute Screw Press. Volute Dewatering Press eliminates the need for a thickener, sludge storage, or separate dosing facilities. One (1) duty unit of Volute Dewatering Press will be provided. The existing Sludge Drying Bed will serve as standby unit in case the Volute dewatering press is out for maintenance. 2.5 g – 3.0 g polymer/kg of dry solids will be injected prior to the dewatering press using automatic polymer preparation unit to aid in the dewatering process. The dewatered sludge cake shall have a dryness of 20 percent -25 percent. The dewatered sludge can be used as an organic fertilizer or for landfill used. This process requires (1) Sludge reaction Loop, (2) Volute Dewatering Press, (3) Polymer Dosing Pump, (4) Polymer Stock Solution Tank and (5) Polymer Stock Solution Tank Air Mixing.

Table 1729.5 - Sludge Dewatering Process

No.	Name of Equipment	Thickness/ Sizes	Valid Values		Conforming Standard / Design Code
			Class	Others	
1	Sludge Reaction Loop	--	Stainless Steel AISI 304 or 316 Ti (1.4571) or HDPE	--	ISO 9001, Quality Management System
2	Volute Dewatering Press	Min. 15-20 kg/hr Vol. Cap or as per design requirements	Stainless Steel AISI 304 or 316 Ti (1.4571)	0.55kW, 440V,3P,60Hz	ISO 9001, Quality Management System
3	Polymer Dosing Pump	Min. V6, 31.2 L/hr @ 2 bar or as per design requirements	Body Aluminum Die Cast molded reinforced by GFRPP (Polypropylene)	0.048kW, 220V, 1P, 60Hz	EN 31201 (ISO 11201), Acoustics
4	Polymer Stock Solution Tank	As per design requirements	Polyethylene	--	Republic Act 9003 or the "Ecological Solid Waste Management Act of 2000
5	Polymer Solution Tank Air Mixing	Min. 304.8 mm DISC or as per design requirements	Polytetrafluoroethylene (PTFE) Coated Membrane	--	US Patents 7,674,514; 7,398,499 and 6,811,148

1729.2.6 Odor Control Process

The anticipated odor management will comply with government regulations. The facility will comply with ISO (International) and DIN (German) standards acceptable to even areas in

close proximity to residential areas, where odor emissions standards are stricter. Principals of odor management are: (1) No odor is emitted from operations with natural ventilation; malodorous Sewage is encapsulated in airtight operations. (2) Reliable equipment and back-up equipment are provided.

All manufacturing of equipment process, spare parts and related fittings on this Odor Control process must conform to the specification & standard of ISO 9001:2008 Quality System: ISO 7005-2, 10631, 185, 1083, 5922, 5752. International standard NSF/ANSI 61 (NSF-61).

1729.2.7 SBR Process Mechanical Piping, Valve, Fittings & Supports

For every process of the Sewage treatment plant, there is a corresponding mechanical piping, valves and fitting & structural/mechanical supports to insure the proper process flow of the system. All piping materials associated with the pumping unit with its fittings shall flange to PN 10 or greater in accordance with ISO 7005-2. Disconnection of the major items of plant shall use sufficient flanges and unions in order not to disturb the main piping works. Adequate pipe support must be installed to allow for the removal of any section of pipework during maintenance. Adequate clamping and guides shall be always being designed and available during construction.

All manufacturing of equipment process, spare parts and related fittings on this SBR mechanical piping, valves, fittings and supports process must conform to the specification & standard of ISO 9001:2008 Quality System: ISO 7005-2, 10631, 185, 1083, 5922, 5752. International standard NSF/ANSI 61 (NSF-61), Standard Specification of ASTM: A-48, A-536, A-36, A-27, A-153, A-234, B-62, D2751, D2661-08, F409-02. Standard Specification of AWWA: C203, C504.

1729.2.8 SBR Electrical, Programmable Logic Controller (PLC) Programming & Instrumentation

SBR sewage treatment control system based on PLC is introduced to put forward the technological process and control requirements, the system introduces the composition principle of the system and the PLC selection and allocation of resources, but also gives a flow chart of PLC program composition and related settings, demonstrates the SBR sewage treatment method of PLC control advantages compared with the traditional sewage treatment method。

The SBR manufacturer creates a plant-specific PLC to operate the SBR within specific parameters for a specific treatment plant. The PLC operates all flows, aeration, valves, timers, lights, in fact, the entire process. The PLC computer tells the SBR when to switch from one treatment stage to the next. Once the PLC is on-line and properly programmed, the process requires little outside input.

All manufacturing of equipment process, spare parts and related fittings on this SBR Electrical, PLC Programming & Instrumentation must conform to the specification & standard of ISO 9001:2008 Quality System: ISO 7005-2, 10631, 185, 1083, 5922, 5752.

1729.3 Construction Requirements

1729.3.1 Installation Requirements

All components of the sewage treatment system such as tanks, pumps, valves, motors/controls and other similar equipment and appurtenances shall be located and so installed to meet the requirements for sanitary protection of water quality, hydraulics of the system and protection against interruption of service by fire, flood or any other hazard. In this case, all equipment shall be elevated at least 16 cm above finished grade and all floors shall drain in such manner that the quality of the treated water will not be endangered. Electrical controls shall be located above grade.

Plug-and-play of individual parts shall be done in good workmanship. Installation shall be watertight.

Supervision by a representative of the manufacturer shall be provided as to the assembly of all mechanical equipment/ appurtenances at the time of installation and initial operation.

All its construction & installations shall be in accordance complying with the specification & standard set of by ISO 9001:2008 Quality System, National Building Code of the Philippines (NBCP PD 1096) and its IRR, House Bill 3565-2016.

1729.3.2 Water Quality Output Testing Requirements

The Sewage treatment system shall deliver the required treated sewage quality based on RA 9275 otherwise known as the Philippine Clean Water Act as described in Water Quality Guidelines (WQG) and General Effluent Standards (GES) for Water Environment standard parameters set forth standards devised by the Philippine National Standards (PNS) prescribed by the Department of Environment and Natural Resources (DENR) regulations.

Table 1729.6 - Water Quality Guidelines for Primary Parameters

Parameter	Unit	Water Body Classification								
		AA	A	B	C	D	SA	SB	SC	SD
Biochemical Oxygen Demand (BOD)	mg/L	1	3	5	7	15	n/a	n/a	n/a	n/a
Chloride	mg/L	250	250	250	350	400	n/a	n/a	n/a	n/a
Color	TCU	5	50	50	75	150	5	50	75	150
Dissolved Oxygen [a]	mg/L	5	5	5	5	2	6	6	5	2
(Minimum)										
Fecal Coliform	MPN/100mL	<1.1	<1.1	100	200	400	<1.1	100	200	400
Nitrate as NO_3-N	mg/L	7	7	7	7	15	10	10	10	15
pH (Range)		6.5-8.5	6.5-8.5	6.5-8.5	6.5-9.0	6.0-9.0	7.0-8.5	7.0-8.5	6.5-8.5	6.0-9.0
Phosphate	mg/L	<0.003	0.5	0.5	0.5	5	0.1	0.5	0.5	5
Temperature [b]	°C	26-30	26-30	26-30	25-31	25-32	26-30	26.3	25-31	25-32
Total Suspended Solids	mg/L	25	50	65	80	110	25	50	80	110

Note: **MPN/100mL** - Most Probable Number per 100 milliliters
n/a – Not Applicable
TCU - True Color Unit

(a) Samples shall be taken from 9:00 AM to 4:00 PM
(b) The natural background temperature as determined by Environment Management Bureau (EMB) shall prevail if the temperature is lower or higher than the WQG; provided that the maximum increase is only up to 10 percent and that it will not cause any risk to human health and the environment.

Table 1729.7 - Water Quality Guidelines for Secondary Parameters-Inorganics

Parameter	Unit	Water Body Classification								
		AA	A	B	C	D	SA	SB	SC	SD
Ammonia as NH_3-N	mg/L	0.05	0.05	0.05	0.05	0.75	0.04	0.05	0.05	0.75
Boron	mg/L	0.5	0.5	0.5	0.75	3	0.5	0.5	5	20
Fluoride	mg/L	1	1	1	1	2	1.5	1.5	1.5	3
Selenium	mg/L	0.01	0.01	0.01	0.02	0.04	0.01	0.01	0.1	0.2
Sulfate	mg/L	250	250	250	275	500	250	250	275	500

Table 1729.8 Water Quality Guidelines for Secondary Parameters-Metals (c)

Parameter	Unit	Water Body Classification								
		AA	A	B	C	D	SA	SB	SC	SD
Arsenic	mg/L	0.01	0.01	0.01	0.02	0.04	0.01	0.01	0.02	0.04
Barium	mg/L	0.7	0.7	0.7	3	4	0.1	0.7	1	4
Cadmium	mg/L	0.003	0.003	0.003	0.005	0.01	0.003	0.003	0.005	0.01
Chromium as	mg/L	0.01	0.01	0.01	0.01	0.02	0.05	0.05	0.05	0.1
Hexavalent										
Chromium (Cr^{6+})										
Copper as Dissolved	mg/L	0.02	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.04
Copper										
Iron	mg/L	1	1	1	1.5	7.5	1.5	1.5	1.5	7.5
Lead	mg/L	0.01	0.01	0.01	0.05	0.1	0.01	0.01	0.05	0.1
Manganese	mg/L	0.2	0.2	0.2	0.2	2	0.4	0.4	0.4	4
Mercury	mg/L	0.001	0.001	0.001	0.002	0.004	0.001	0.001	0.002	0.004
Nickel	mg/L	0.02	0.02	0.04	0.2	1	0.02	0.04	0.06	0.3
Zinc	mg/L	2	2	2	2	4	0.04	0.05	0.8	1.5

Note: **(c)** Unless otherwise specified, the above parameters are expressed as total metals.

Table 1729.9 - Water Quality Guidelines for Secondary Parameters-Organics

Parameter	Unit									
		AA	A	B	C	D	SA	SB	SC	SD
Benzo(a)pyrene	mg/L	0.7	0.7	0.7	1.5	3	0.7	0.7	1.5	3
ETEX										
Benzene	mg/L	0.01	0.01	0.01	0.05	0.5	0.01	0.01	0.05	0.5
Toluene	mg/L	0.7	0.7	1	4	5	1	1	4	5
Ethylbenzene	mg/L	0.3	0.3	0.3	1.5	2	0.2	0.2	1.5	2
Xylenes	mg/L	0.5	0.5	0.5	1.5	1.8	0.5	0.5	1.5	1.8
Cyanide as Free Cyanide	mg/L	0.07	0.07	0.07	0.1	0.2	0.02	0.02	0.1	0.2
Organophosphate as Malathion	mg/L	1	1	1	3	6	1	1	3	6
Oil and Grease	mg/L	<1	1	1	2	5	1	2	3	5
Polychlorinated Biphenyls (d)	mg/L	<0.1	<0.1	0.2	0.5	1	0.3	0.3	0.5	1
Phenol & Phenolic Substances (e)	mg/L	<0.001	<0.001	<0.001	0.05	0.5	<0.001	<0.001	0.05	0.5
Surfactants (MBAS)	mg/L	<0.025	0.2	0.3	1.5	3	0.3	0.3	1.5	3

Table 1729.9 - Water Quality Guidelines for Secondary Parameters-Organics

Parameter	Unit	AA	A	B	C	D	SA	SB	SC	SD
Trichloroethylene	mg/L	0.07	0.07	0.07	0.9	2	0.07	0.07	0.9	2
Total Organochlorine Pesticides (f)	mg/L	n/a	n/a	50	50	50	50	50	50	50
Aldrin	mg/L	0.03	0.03	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Chlordane	mg/L	0.2	0.2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Dichlorodiphenyltrichloroethane	mg/L	1	1	n/a	n/a	n/a	n/a	n/a	n/a	n/a
(DDT)										
Dieldrin	mg/L	0.03	0.03	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Endrin	mg/L	0.6	0.6	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Heptachlor	mg/L	0.03	0.03	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Lindane	mg/L	2	2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Methoxychlor	mg/L	50	50	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Toxaphene	mg/L	4	4	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Notes:

CAS - Chemical Abstracts Service
IUPAC - International Union of Pure and Applied Chemistry
MBAS - Methylene Blue Active Substances
mg/L - microgram per liter
(d) Polychlorinated Biphenyls (PCBs) include nine Aroclors and 19 individual PCB congeners described below:
(e) Phenols include 2-chlorophenol, 2,4-dichlorophenol, and 2,4,6 trichlorophenol
(f) When monitoring for Class AA and A waters, the individual organochlorine pesticides shall be monitored. For Class B, C, D, SA, SB, SC and SD; Total Organochlorine Pesticides shall be monitored, which refers to the organochlorine pesticides listed in Table 0.6 plus Benzene Hexachloride (BHC) (a,B,8,y), 4,4' Dichlorodipheyldichloroethane (DDD), 4,4' Dichlorodiphenyldichloroethylene (DDE), Endosulfan (I,) I, and sulfate).

1729.4 Method of Measurement

The quantity to be paid for will be measured as per individual process detailed below in tabulation for the complete Sewage Treatment Plant (STP) system as furnished on site and in accordance with these design standard, specifications and as accepted by the Engineer.

1729.5 Basis of Payment

The accepted quantity, measured as prescribed in Section 1729.4 shall be paid for at the Contract Unit Price/set/process for Sewage Treatment Plant System which price and payment shall be full compensation for furnishing all materials, including all labor, equipment, tools and incidentals necessary to complete the work prescribed in this Item.

Payment shall be made under:

Pay Item Number	Description	Unit of Measurement
1729 (1)	Sewage Treatment Plant (STP) – Dynamic Sequential Batch Reactor (SBR) Process	Lump Sum

References:

In accordance with DENR AO 34 as revised in DENR AO 35, and DENR AO 2016-08 Water Quality Guidelines (WQG) and General Effluent Standards (GES) of 2016 all criteria should meet prescription for Sec. 68 (b) Coastal and Marine Waters, SB classification, based on below qualification:

1. *Presidential Proclamation 1801, dated November 10, 1978; Presidential Decree 354, dated December 23, 1873;*
2. *Presidential Decree 705, Revising Presidential Decree No. 389, Otherwise known as the Forestry Code*

of the Philippines, dated May 19, 1975, as amended by Presidential Decree 1159;

3. *Executive Order No. 578, dated December 18, 2006, establishing the National Policy on Biological Diversity, prescribing its Implementation throughout the Country, covering the Verde Island Passage Marine Corridor and the President declared the Verde Island Passage Marine Corridor as a marine sanctuary and a national protected area.*
4. *Philippine Standards prescribed Department of Environment and Natural Resources (DENR) regulations (DAO 35), DAO 2016-08;*
5. *Sanitary Engineering Law (Republic Act No 1364);*
6. *Philippine Mechanical Engineering Code as adopted by the Board of Mechanical Engineering pursuant to the Mechanical Engineering Law (RA 8495 as amended.);*
7. *Philippine Electrical Code Part 1 (PEC-1) and Part 2 (PEC-2), as adopted by the Board of Electrical Engineering pursuant to the Philippine Electrical Engineering Law (RA 7920.);*
8. *Republic Act 9003 or the "Ecological Solid Waste Management Act of 2000*
9. *ISO (international standards);*
    - *ISO 9001, ISO 1940, ISO 12238, ISO 11201, ISO 13359*
10. *American Iron and Steel Institute (AISI) standards;*
    - *AISI 304, AISI 316*
11. *United States Patent and Trademark Office (USPTO)*
    - *US Patents 7,674,514; 7,398,499; 6,811,148*