SECTION 465353.01 – SEQUENCING BATCH REACTOR EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions 1 Specification sections, apply to work of this section.

B. Standard References:

1. American National Standards Institute, ANSI.
2. National Electric Code, NEC.
3. NEMA, Standards of National Electrical Manufacturers Association, NEMA.
4. Occupational Safety and Health Act, OSHA.
5. American Society for Testing and Materials, ASTM.
6. American Iron and Steel Institute, AISI.
7. American Gear Manufacturer's Association, AGMA.
8. Institute of Electrical and Electronic Engineers, IEEE.
9. Standards of the Hydraulic Institute.
10. American Institute of Steel Construction, AISC.
11. American Society of Civil Engineers, ASCE.
12. American Welding Society, AWS.
13. Steel Structures painting Council, SSPC.

1.2 SUMMARY

A. The Contractor shall furnish all labor, materials, tools and equipment complete with all accessories and appurtenances required for a complete wastewater treatment plant as shown on the Contract Drawings and as specified herein.

B. No product substitutions shall be allowed. The equipment to be furnished hereunder shall be an ICEAS®, referred as SBR Treatment System, as manufactured by Sanitaire (Xylem).

C. Furnish, deliver, and install a new and complete ICEAS® Treatment System, also referred to as the Sequencing Batch Reactor (SBR) system.

D. The Intermittent Cycle Extended Aeration System (ICEAS®) shall include furnishing and installing the necessary equipment and controls to provide an operating treatment system complete with air diffusion equipment, decant mechanisms, blower systems, air control valves, waste sludge pumps, instrumentation, control panel, and MCC. The system supplier shall provide installation and start-up assistance training, and guarantee the process performance.

E. It is the intent of these specifications that a single manufacturer-supplier, regularly engaged in the design, manufacture, assembly and production of sequential batch reactor systems of the type specified, shall have complete responsibility for the final design, furnishing, coordination, assembly, and installation supervision of all components in the Sequential Batch Reactor system.

F. Working drawings, including arrangement and erection drawings of the equipment and control equipment; schematic control diagrams, electrical connection diagrams, and complete description of the control systems; and equipment operating characteristics shall all be furnished.

1.3 DESCRIPTION

A. The system shall incorporate continuous activated sludge technology with intermittent systems operation. The system shall use a single reactor in which the activated sludge is alternately aerated and/or mixed over a number of pre-determined cycles. Solids liquid separation shall occur during a settling phase of the cycle. After the settling phase, treated effluent shall be decanted or withdrawn from the liquid surface. Flow to the vessel is not interrupted at any time.

B. The functions of flow equalization, biological oxidation, nitrification, sedimentation and aerobic sludge stabilization shall all be carried out in a single reactor. Systems that require reactor bypassing during the settle and/or decant phases shall not be acceptable.

C. Influent Wastewater Characteristics

Design Flow:		
Average Design Day Flow (ADDF)	0.250	MGD
Maximum Daily Flow (MDF)	0.500	MGD
Max. 4-Hour Cycle Flow	0.50	MGD

Max. 3-Hour Cycle Flow	1.000	MGD
BOD_5	250	mg/L
TSS	250	mg/L
NH_3-N	50	mg/L
TP	8	mg/L
Temperature Range (Water)	10-20	°C
Temperature Range (Air)	20-90	°F
Site Elevation	900	ft
pH range	6.5-8.5	SU

D. Effluent Quality Requirements:

1. The following effluent limits shall be on a 30-day arithmetic average:

BOD_5	10	mg/L
Total Suspended Solids	10	mg/L
Ammonia NH_3-N	1.0	mg/L

E. ICEAS® Process Design

1. The ICEAS® process shall be designed using the following parameters:

F/M Ratio	0.051	lb BOD/lb MLSS-day
SVI (After 60 Minutes)	150	ml/g
Cycle Time		
Normal	4	hour cycles/day
Storm-1	3	hour cycles/day
Storm-2	2	hour cycles/day
~~Storm-3~~	~~1.5~~	~~hour cycles/day~~
Decant Time		
Normal	60	min

Storm-1	45	min
Storm-2	30	min
~~Storm 3~~	~~45~~	~~min~~
Waste Sludge Produced (Approx.)	193	lb/day/basin
MLSS at Bottom Water Level	4,653	mg/L

2. The ICEAS® has been configured as follows:

Number of Basins	2	-
Width/Basin	21	ft
Length/Basin	59	ft
Water Depth at Top Water Level	18	ft
Water Depth at Bottom Water Level	14.6	ft

3. The dual tank design provides the ability to operate with one basin out of service, while maintaining F/M ratios and cell residence time within the endogenous respiratory phase of the biomass. This capability is useful for short time periods such as during basin and equipment maintenance.

4. Equally divided influent shall be continuously and simultaneously received by all basins of the system at all times, irrespective of the sequence of operation of the treatment system. The system shall be designed so that the basin configuration prevents short circuiting of the influent during the decant sequence. A portion of the ICEAS® basin reactor shall contain a discrete pre-react zone formed by a baffled wall. This zone shall have an anoxic environment during settle and decant phases.

1.4 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

B. All work performed under this section shall be in accordance with all approved trade practices and manufacturer's recommendations.

C. The equipment manufacturers listed shall have a minimum of ten (10) years of experience of producing the specified equipment and shall be able to show evidence of at least ten (10) installations in satisfactory operation for at least five (5) years in the United States.

D. The equipment furnished shall be fabricated, assembled, installed and placed in proper operation condition in full conformity with approved drawings, specifications, engineering data, and/or recommendations furnished by the equipment manufacturer. The equipment manufacturer shall, in addition to the Contractor, assume the responsibility for proper installation and functioning of the equipment.

E. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work. All equipment shall perform as specified and accessories shall be provided as required for satisfactory operation.

1.5 SUBMITTALS

A. The Contractor shall submit manufacturer’s technical data and application instruction in accordance with the General and Supplementary Conditions and Division 1 Specifications and any additional information listed herein.

B. Product Data: Submit manufacturer's technical data and application instructions.

C. Shop Drawings: Submit required copies of manufacturer’s literature, dimensional drawings, wiring diagrams, motor data, performance data, materials of construction, a description of the process design (Operational Description), a description of the control system software logic (Functional Design Specification), and any other information necessary to determine compliance of the equipment to the specification and project requirements.

1. Highlight project-specific model numbers and options in equipment data sheets.

2. Submittal drawings showing plan, elevation and cross sections of the equipment.

3. Component details of the aeration equipment showing diffusers, diffuser holders, gaskets, retainer rings, supports, threaded union and/or flanged joints and a purge system.

4. Materials and Manufacturing specifications.

D. Aeration System submittal information to include:

1. Equipment data sheets

2. Performance data including oxygen transfer calculations

3. Certified SOTE curves from previous test runs on equivalent system shop transfer testing.

4. Headloss calculations and pressure requirements.

5. Customer contact list with telephone numbers (minimum of 10 contacts from similar size facilities).

E. Operation and maintenance manual with installation instructions. Submit after approval of equipment and prior to shipment.

F. Process Performance Guarantee

1.6 WARRANTY

A. Manufacturer shall guarantee all equipment furnished to be free from defects in materials and workmanship under normal use and service for a period of twelve (12) months after the date first placed in service or eighteen (18) months after delivery whichever occurs first.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. SBR Treatment System shall be an ICEAS®, as manufactured by Sanitaire (Xylem).

2.2 POSITIVE DISPLACEMENT BLOWERS

A. Provide all labor, material and equipment to furnish and install the positive displacement blower systems as specified herein and detailed on the drawings for the SBR basins. The blower systems shall be designed for the following operating characteristics:

	Units	SBR	SHT
Quantity	EA	2	2
Air Flow[1]	scfm	230	190
Discharge Pressure	psig	8.3	8.8
Motor Shaft Power	hp	20	15
Motor Control		Variable	Variable

Supply Power	-	460 / 3 ph / 60Hz

1. Standard Conditions: Air Flow measured at 14.7 psia (1 bar), 68°F (20°C) and 36% relative humidity.
2. Site Specific Conditions: Site Elevation 900 or 14.21 psi, 100°F and 90% relative humidity.
3. Noise level: Enclosure shall reduce the sound levels by 15-20 dBa and shall be sufficient to meet the 75 dBa attenuation requirement at one (1) meter from any exterior surface of the enclosure.

B. Blower and accessories shall be furnished as a complete assembled package and must include all interconnecting piping, instrumentation and supports needed to ship the assembly as a complete unit.

1. Each blower package shall include the following main components:
   a. Positive displacement blower with sound-proof enclosure
   b. Motor with slide base
   c. V-Belt drive
   d. Drive guard
   e. Common elevated structural steel base
   f. Vibration isolator pads
   g. Spare parts
   h. Motor Over-temperature Switch
   i. The SBR and SHT blowers shall be controlled VFDs. VFDs to be provided by the Contractor.
   j. The spare unit blower shall be equipped with Variable Frequency Drive (VFD).
2. Accessories: Each blower shall be furnished with the following accessory items:
   a. Sound enclosure
   b. Inlet and outlet flexible connectors (expansion joints)
   c. Intake Filter
   d. Inlet Silencer

e. Discharge silencers

f. Pressure Relief Valves

g. Check Valve

h. Discharge Butterfly Valve

i. Vibration Isolator Pads

j. Inlet Vacuum Gauge

k. Discharge Pressure Gauge

l. Discharge Temperature gauge

m. Filter differential pressure gauge

n. High temperature shut-down switch

C. Guarantee and Warranty

1. The manufacturer shall warrant the bare blowers being supplied against all defects in workmanship and materials for a period of twenty-four (24) months from date of startup, not to exceed thirty (30) months from the date of shipment from the manufacturer of the blowers.

D. Blower Construction

1. General

a. Each blower shall be of the horizontal, rotary, positive displacement type. Each assembly shall be rugged in construction and of such design that it may be disassembled and inspected without disturbing the inlet or discharge piping.

b. Blowers shall be V-belt driven by a motor.

2. The casing shall be made of high strength, close grained, cast iron, and shall be adequately ribbed to prevent casing deflection and facilitate cooling. Casing shall be of EN GG 200 cast iron. Inlet and discharge ports shall be flanged.

3. Rotors:

a. The rotors shall be a tri-lobe design in order to minimize pulsation and noise.

b. Each rotor and shaft shall be precision machined out of a one-piece casting made of CN45 forged steel.

c. The rotor assemblies shall be statically and dynamically balanced to ISO standard Grade G 6.3.

d. The rotor must be solid or closed-end. The rotors shall operate without rubbing, liquid seals or lubrication in the air chamber.

e. The rotors shall have an integral sealing strip for improved efficiency.

4. Cover Plates

a. The gear-end and drive-end cover plates shall be high strength, close grained, cast iron made of EN GG 200 cast iron. Aluminum cover plates shall not be allowed.

b. The cover plates shall have a precision machined sealing face.

c. The drive-end cover plate shall include at least two precision machined holes to allow for the use of fitting bolts to accurately align the opening for the input shaft seal.

5. Bearings

a. The bearing maximum speeds must be at least two times the maximum recommended blower speed.

b. All bearings shall be anti-friction type rated by AFBMA standards to have a B10 life of 40,000 hours at design speed and maximum radial and thrust load conditions. Bearing life is AT LEAST 100,000hrs at design conditions

6. Timing Gears: The rotor timing gears shall be precision machined and ground from alloy steel made from case hardened 16 MnCr5 material. The timing gear set shall be taper-mounted on the rotors. Keyed, hub mounted, taper-pinned, or splined shaft timing gear mounting designs are not acceptable.

7. Lubrication:

a. Both the gear end and the drive end of the blowers shall be oil splash lubricated via a disc slinger for minimal maintenance and long service life.

b. The lubrication design shall ensure adequate lubrication of the timing gears and bearings.

c. The drive-end and gear-end oil chambers must not be interconnected and each oil chamber shall have a domed design sight glass to allow visual inspection of oil level and oil condition, viewable from the front of the blower.

d. Blower to be factory filled with a synthetic lubricating fluid that is rated for the design conditions specified.

8. Rotor Seal Assembly: Each rotor shall include one labyrinth seal assembly on each end, four assemblies in total per blower. Each seal assembly shall consist of the following:

    a. Oil splash guard ring.

    b. Shaft guide wear sleeve with vent holes located between the dual air and oil ring seals. Wear sleeve shall protect the blower casing.

    c. Four piston ring type labyrinth seals made from heat treated cast iron. Two seals located on the air side and two seals located on the oil side of the grooved rotor sleeve.

    d. Grooved rotor sleeve which will protect the rotor shaft and be used to hold the four piston ring seals.

9. Input Shaft Seal Assembly:

    a. The input drive shaft seal shall be a high temperature radial lip type seal made from Viton elastomer. The seal shall prevent oil leakage from where the input shaft goes thru the drive end cover.

    b. The seal design shall incorporate a replaceable wear sleeve on the input drive shaft. The sleeve exterior to be tungsten carbide coated to reduce friction and wear.

    c. The input shaft seal design must allow for the lip seal and the shaft sleeve to be replaced without removing the drive end cover plate.

10. Base: The blower base frame with integrated discharge silencer shall be designed for the frequency range of the blower, shall be provided to reduce the noise of the blower system as specified.

    a. The blower base shall incorporate the pivoting motor swing base and tensioning assembly to insure proper alignment of the drive assembly.

    b. Belt guards shall be provided which completely enclose the V-belts and sheaves. The guards shall be easily removable so that belts may be conveniently serviced.

    c. All required anchor bolts and sleeves shall be ASTM A 36 steel. Contractor shall supply recommended by the manufacturer anchor bolts.

    d. Baseplates shall be grouted in place as required by conditions of installation with a non-shrink grout equal to Five Star Grout, Master Builders Embeco 636 Grout, or equal. Minimum grout thickness shall be 1-1/2 in. or as recommended by the manufacturer.

11. Drive System: Each blower shall be driven by a multiple V-belt drive system assembly consisting of sheaves, quick detachable bushings, V-belts, and sliding motor base. Provide drive assembly with a 1.4 service factor based on motor nameplate horsepower. A two-part OSHA approved drive guard shall be provided for each blower.

    a. Motor: Each blower shall be equipped with an electric motor designed, manufactured, and tested in accordance with the latest revised edition of NEMA MG-1. The motor shall be a squirrel-cage induction type, single-speed, horizontally mounted motor conforming to the following:

        1) Synchronous speed: 1800 RPM

        2) Insulation: Class B with Class F insulation or better

        3) Enclosure: TEFC or ODP

        4) Service factor: 1.15

        5) Duty cycle: Continuous

        6) Ambient temperature rating: 40°C

        7) Bearing lubrication: Manufacturer's standard

        8) Bearing life: 50,000 hours rating life as defined by AFBMA Standards

        9) High efficiency design with nominal full load efficiency of 90% minimum.

        10) Motor windings shall have embedded, normally closed thermal switch that will open upon excessive temperature.

12. Oil Drains

    a. An oil drain from the blower drive-end and gear-end lubricating oil sumps shall be separately piped to the front of the blower base with flexible tubing. Common fill and drain shall not be allowed.

    b. Each oil drain shall include a drain valve installed for ease of maintenance. The drain valves shall be 90° stainless steel ball valves and include a fully retained gasketed threaded cap to prevent accidental discharge of the blower lubricant.

13. Spare Parts: The equipment supplier shall deliver the following spare parts for each blower size:

    a. Lubrication for first year of operation

b. One (1) set of V-belts of each size

c. One (1) filter element for each size air intake filter

d. All of the above parts shall be provided as spare parts and shall be packaged for potential long-term dry storage.

14. Installation, Startup and Training:

a. The blower manufacturer will furnish services of a factory-based engineer for one (1) eight (8) hour day to check the blower installation, make any field adjustments necessary to insure proper mechanical operation, and instruct plant operations personnel on equipment supplied.

b. The blower manufacturer shall submit a written report for record certifying that equipment has been satisfactorily installed and lubricated. The report shall also certify that training has been provided for operation and maintenance of the blower equipment.

c. Factory testing: Each blower stage shall be factory tested in accordance with ISO 1217, Annex B performance test to verify flow and brake horsepower at blower maximum conditions. Each blower system provided by the manufacturer shall be guaranteed to provide performance to ISO 1217.

15. Acceptable Manufacturers:

a. Aerzen PD Blower.

b. Gardner Denver PD Blower.

2.3 AIR CONTROL VALVES

A. The SBR supplier to furnish the following motor operated air flow control valves to control aeration in the SBR basins.

Valve Location	SBR
Valve Quantity	2
Valve Diameter	4
Actuator Power Supply	120/1/60
Actuator Type	Open/Close

B. Valves Construction

1. The valves shall be butterfly valves, flange body style, EPDM-seat, tight-closing type for installation between two (2) ANSI Class 125/150 standard flanges.

2. The valves shall be rated at 50 psi (345 kPa) and provide drop tight shutoff at differentials up to 50 psi.

3. Valve bodies shall be cast iron (ASTM A126, Class B). Flanged end valves shall be AWWA C504 short body design with Class 125 flanged ends face and drilled per ASME B16.1 standard for cast iron flanges.

4. Valves shall be provided with power actuators.

5. Seats shall be of EPDM suitable for use with compressed air and shall be field replaceable.

6. The disc shall be ductile iron (ASTM A536).

7. Discs shall be offset to provide an uninterrupted 360-degree seating edge.

8. The disc shall be securely attached to the valve shaft utilizing a field removable/replaceable 316 stainless steel torque screw on sizes 3-12" (80-300 mm) or a tangential pin loced in place with a set screw on sizes 14-20' (350-500 mm).

9. Valve shafts shall be ASTM A276, Type 316 stainless steel. Valve shaft seals shall be self-compensating V-type packing with a minimum of four sealing rings.

C. Electric Motor Actuators

1. All electric actuators shall conform to the requirements of AWWA Standard C-540.

2. Power actuated valves shall be furnished with electric motor actuators. The valve actuators are to be sized for design pressure with flow in reverse direction plus a 1.5 safety factor. The actuators shall include, geared travel limit switches, torque limit switches, manual handwheel, condensation heater, terminals for motor power and controls and drive nut.

3. The motor shall be specifically designed for actuator service. The motor will be of the induction type with class F insulation and protected by means of thermal switches imbedded in the motor windings. Motor enclosure will be totally enclosed, non-ventilated.

4. The entire actuator enclosure should be NEMA 4 watertight.

5. Travel limit switches will be provided to de-energize the motor control circuit when the actuator reaches the limits of travel in the open and close directions.

6. Mechanical dial position indicator will be furnished on all valves.

7. The motor shall have an operating speed adjustment.

D. Acceptable Manufacturers

1. Valves shall be Dezurik BAW Resilient Seated Butterfly or approved equal.

2. Actuators shall be AUMA model AQ, SQR, or approved equal.

2.4 FINE BUBBLE AERATION

A. Furnish all materials, equipment, services, and testing for the fine bubble aeration system.

B. Equipment Components Included

1. Stainless steel droplegs, supports, and anchors.

2. PVC manifolds, air distributors, diffuser holders, and retainer rings

3. Bolts, nuts and gaskets for aeration system flange connections.

4. Air distributor purge systems.

5. Membrane disc diffusers with integral O-ring gaskets.

C. System Design and Performance:

1. Design aeration system to transfer not less than the following pounds of oxygen per day in clean water at 14.7 PSI, 20°C and zero dissolved oxygen at the specified submergence, air rate and pressure.

Tank	Units	SBR	SHT
Std. O_2 Transfer Rate (SOTR)	lbsO_2/hr	137	1,198
Volumetric Air Rate	SCFM	230	190
Operating Pressure at Top of Dropleg	psig	8.3	8.8
Diffuser Submergence (@ AVG SWD)	ft		
#Diffusers/Tank	each	150	119

2. Design air distributors with centerline spacing not to exceed 4 feet to maximize oxygen transfer efficiency and mixing efficiency and to minimize solids deposition between air distributors.

D. Materials, Fabrication and Finishing

1. Stainless Steel – Pipe, Fittings and Supports:

a. Fabricate all welded parts and assemblies from sheets and plates of 304L stainless steel with a 2D finish conforming to ASTM A240, 554, 774, 778.

b. Fabricate non-welded parts and flanges from sheets, plates or bars of 304 stainless steel conforming to ASTM A240 or ASTM A276.

c. Welds & Welding Procedure: Weld in the factory using latest standards according to AWS. Continuously weld both sides of face rings and flanges to eliminate potential for crevice corrosion.

d. Corrosion Protection and Finishing clean all welded stainless steel surfaces and welds after fabrication by using the following procedure: Pre-clean outside and finish clean all interior and exterior welds and piping by full immersion pickling and rinse with water to remove all carbon deposits and contaminants to regenerate a uniform corrosion resistant chromium oxide film per ASTM A380 Section 6.2.11, Table A2.1 Annex A2 and Section 8.3.

2. Natural Rubber: Furnish all fixed and expansion joint O-ring gaskets of natural rubber/SBR with a Shore A durometer of 45 ± 5.

3. Polyvinyl Chloride (PVC) Pipe and Fittings:

a. Produce all PVC pipe and fittings from PVC compound with a minimum tensile strength of 7000 psi.

b. Provide lower drop pipe, manifold and air distributors as follows:

Diameter	Wall Thickness	ASTM
4 inch	SDR 33.5	D3915, 3034
6 inch & larger	Schedule 40	D1784, 1785, 2466

c. Factory solvent weld all PVC joints. Field solvent welding will NOT be permitted.

4. EPDM Membrane Diffusers and Gaskets:

a. Manufacture circular membrane diffuser discs with integral O-ring of EPDM synthetic rubber compound with precision die formed slits. Thermoplastic materials (i.e. plasticized PVC or polyurethane) are not acceptable.

b. Quality Control – Test diffuser using primary sampling criteria outlined in Military Standard 105E.

E. Fine Bubble Aeration System Components:

1. Droplegs: Provide a stainless steel dropleg from the air main connection to the dropleg connection on the manifold.

2. Manifolds: Provide PVC manifolds for connections to the air distribution headers. Fabricate manifolds with 4-inch diameter fixed threaded union positive locking anti rotational or flanged joints for connection to the air distributors.

3. Air Distributors and Diffuser Holders: Provide 4-inch diameter air distributors perpendicular to the air manifold.

    a. Fabricate distributors with single diffuser holders solvent welded to the crown of the air distributor for complete air seal and strength.

    b. Provide 4-inch diameter threaded removable end caps complete with gasket, threaded coupling and end plate for clean out at the end of each distributor.

4. Air Distributor and Manifold Connection Joints:

    a. Join air distributor sections with positive locking anti rotational fixed threaded union or flange type joints for all submerged header joints to prevent blow apart and rotation.

    b. Design flanged joints with a 125 lb drilling angle, face ring, follower flange and stainless-steel hardware.

5. Supports: Provide each section of manifold and air distributor with a minimum of two (2) supports.

    a. Limit maximum support spacing to 8 feet.

    b. Design all supports to allow for thermal expansion and contraction forces over a temperature range of 125°F.

6. Diffuser Assemblies: Furnish diffuser assemblies including diffuser, diffuser gasket, holder, retaining ring and air flow control orifice.

    a. Membrane Diffuser: Incorporate an integral check valve into the membrane diffuser.

    b. Design and test diffusers for a dynamic wet pressure (DWP) of 12 inches ± 20% water column @ 1.0 SCFM/diffuser and 2 inches submergence.

    c. Visual Uniformity – Observe diffusers for uniform air distribution across the active surface of the diffuser at 1.0 SCFM/diffuser and 2 inches submergence. Active surface is defined as the perforated horizontal projected area of the diffuser.

d. Quality Control – Test diffuser using primary sampling criteria outlined in Military Standard 105E.

7. Diffuser Holders and Retainer Rings:

a. Design holder with air flow control orifice. Holder to provide peripheral support for the diffuser.

b. Design retainer ring to seal the diffuser and O-ring in the holder to prevent air leakage around gasket.

c. Design retainer rings threads with minimum cross section of 1/8-inch and allow for one complete turn to engage threads.

8. Anchor Bolts: Provide a mechanical 304 SS expansion anchor bolts for embedment in 4000 psi concrete with a pullout safety factor of 4.

F. Liquid Purge System: Provide a liquid purge system to drain the entire submerged aeration piping system for each aeration grid including airlift purge eductor line and control valve. The purge system shall use a solenoid valve for automatic operation coordinated with the SBR operation.

G. Package spare parts in a separate container clearly marked as “Spare Parts” and provide inventory list on exterior of the container.

H. Installation Procedures: Follow equipment manufacturer's recommendations and O&M manual for of equipment installation.

I. Acceptable Manufacturers: Xylem Inc. Sanitaire Products

2.5 DECANT MECHANISM

A. The SBR supplier to furnish decanter assemblies with drive actuator for each SBR basin. The decanters shall be designed to remove clarified effluent.

Decanter Quantity	2
Decanters per Basin	1
Decanter Weir Length	7.5 ft
Decanter Material of Construction	304L SS
Actuator Quantity	2
Actuators per Basin	1

Actuator Power Supply	460 V / 3 ph / 60Hz
Actuator Power	1/4 Hp

B. Design Parameters

1. Decanter design must allow for variable speed operation and fail-safe park position above TWL.

2. The maximum decanter loading at Normal Flow Mode condition shall not exceed 20 ft^3/ft/min (1.8 m^3/m/min). The maximum decanter loading at High Flow Mode condition shall not exceed 30 ft^3/ft/min (2.8 m^3/m/min).

3. The decanter weir and trough shall always be visible from the basin side wall thereby providing the operator with a visual check of the effluent quality during the decant phase of the cycle.

4. The decanter shall be parked above the design top water level during aeration and settling phases, thereby eliminating any possibility of solids carryover during these phases. Decanters floating on the liquid surface during aeration and settling, with the weir of entry ports submerged below the surface shall not be allowed.

5. At top park position, the decanter shall provide 'fail safe' overflow protection in the event of a power failure. Settled supernatant will flow via gravity, under the scum guard, over the weir, and into the decanters. In overflow event, this will allow for the entire depth of the basin (up to TWL) to be used for settling while overflowing the weir.

6. The decanter shall be designed with a scum guard mechanism to prevent the discharge of scum and floatables during decanter or overflow operation.

7. All in-basin seals and bearings shall be maintenance free.

8. Decanter assembly components requiring routine maintenance shall be accessible from the walkway and shall not require confined space entry into the basin.

9. The drive mechanism or actuator shall be designed for a continuous duty, variable speed mode of operation thereby producing a uniform effluent flow rate throughout the decant phase.

10. Actuator limit switches and motor shall be integrated with process control system to prevent blower operation during the decant phase of the cycle.

11. The decanter assembly shall not require effluent valves, valve vaults, flex joints, throttling capabilities, or dewatering supports.

C. Equipment

1. The decanters shall be supplied with the following components:

   a. Upper collection trough with integral, overflow weir

   b. Scum guard mechanism

   c. Downcomer pipes

   d. Collector pipe (for decanters >6ft)

   e. Swivel Joint or Seals & bearings, as required

   f. Electro-mechanical actuator

2. The drive mechanism or actuator shall consist of an electro-mechanical screw jack with protective boot and end position limit switches. The actuator shall be equipped with a VFD rated motor suitable for continuous duty in an outdoor, moist environment. The motor shall be driven by a variable frequency drive allowing the controls to vertically lower the decanter at a continuous and uniform rate.

3. The decanter shall not require spring loaded valves, flexible joints, and/or throttling effluent valves to control discharge rate.

4. The decanter must be self-supporting when the basin is drained.

D. Materials

1. All in-basin welded decanter components, except seals and bearings, shall be constructed of corrosion and ultra-violet resistant stainless steel. All fasteners shall be constructed of stainless steel.

2. The decanter seals and bearings shall be constructed of maintenance free, synthetic materials for longest possible service life. All seals and bearings shall be shipped factory assembled, simplifying installation.

E. Fabrication and Finishing

1. All decanter welding must be conducted by welders certified under ASME Code 9.

2. All joints to be finish tested for integrity by either air pressure (3.0 psi) or dye penetrate methods.

3. All finished decanter units to be fee of abrasions, damage, flaws, carbon contamination and discoloration. All weld burn and discoloration shall be removed with pickle paste. All stainless-steel surfaces shall be passivated and shall have a pleasing and uniform passivated appearance. Decanters shall be power washed for final cleaning prior to shipment.

F. Acceptable Manufacturers:

1. Xylem Inc. Sanitaire Products

2.6 WASTE SLUDGE PUMPS

A. The SBR supplier to furnish submersible non-clog wastewater pump(s), in each SBR basin. Leak detectors shall be used to sense water presence in the oil and stator housings.

Pump Quantity	2
Pumps per Basin	1
Pump Model	Flygt DP-3069/473
Design Flow Rate	110 gpm
Design TDH	40 ft
Design Shut Off Head	50 ft
Submersible Cable Length	30 ft
Lifting Chain Length	25 ft
Motor Power Supply	460 V / 3 ph / 60 Hz
Drive	2.4 Hp

B. Equipment

1. Each pump shall be equipped with a submersible electric motor with submersible cable (SUBCAB) suitable for submersible pump application.
2. The power cable shall be sized according to NEC and ICEA standards.
3. The pump shall be supplied with a mating cast iron 3-inch discharge connection.
4. Each pump shall be fitted with lifting chain or stainless steel cable.
5. The working load of the lifting system shall be 50% greater than the pump unit weight.

C. Pump Design: The pump(s) shall be automatically and firmly connected to the discharge connection, guide by no less than two guide bars extending from the top of the station to discharge connection.

D. Pump Construction

1. Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities.

2. All O-rings shall be of Nitrile Rubber. The lifting handle shall be stainless steel. Cast iron impellers shall be sprayed with primer.

E. Bearings: The upper bearing shall be a single row ball bearing. The lower bearing shall be a two row angular contact ball bearing. Motor bearings shall be permanently grease lubricated.

F. Mechanical Seal: Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies.

G. Cable Entry Seal

1. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal.

2. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable.

H. Impeller: Impellers available for this pump model shall be either single-vaned, totally enclosed or multi-vaned, vortex type.

I. Wearing Rings: A wear ring system shall be used to provide efficient sealing between the volute and suction inlet for totally enclosed impellers. Each pump shall be furnished with a leaded red brass ring insert that is drive fitted to the volute inlet.

J. Volute: Pump volute(s) shall be single-piece grey cast iron, Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified.

K. Acceptable Manufactures:

1. Xylem Inc. Flygt Products

2.7 PROCESS CONTROL SYSTEM

A. General

1. The SBR supplier to furnish a complete SBR control system. This shall include a master control panel with a Graphic Operator Interface, Programmable Logic

Controller, Motor Starters, Variable Frequency Drives, Control Switches, and Pilot lights.

2. Local control stations shall be included for the Decanters

3. Motor Starters and Variable Frequency Drives shall be included in a separate Motor Control Center.

B. Control Panel

1. The control panel enclosure shall be a heavy duty, NEMA 12, enclosure with a flange mounted disconnect if three-phase power is required. The panel shall be made of 10-gauge steel and fully braced. The doors shall be heavy duty 3-point latching doors with a padlocking handle. The master circuit breaker disconnect shall be on the far right, and be interlocked with the doors.

2. Control power shall be provided by a transformer if three-phase power is required. In addition, a voltage filter and surge protective device shall be used for PLC and HMI power supply. The voltage filter will combine active tracking technology with UL listed surge protection against the full spectrum of voltage transients and surges. It must continuously track the input AC line power and respond instantly upon detecting extraneous high frequency noise and high voltage transients. The device must be UL1449 and UL1283 listed.

3. All control voltage branch feeders shall be protected by circuit breakers or fuses.

4. Control relays shall be electromechanical with touch safe screw terminals

5. Motor starters shall be UL Listed as a self-protected control device type of combination starter [rated at 18,000 AIC].

6. Terminal blocks shall be high-density type, rated for 600 VAC, 30 amp minimum. Ten percent spare terminals shall be provided. All devices shall be clearly marked and identified on the inside of the panel. All terminals and wires shall be clearly tagged in accordance with the schematic and wiring diagrams.

C. Programmable Logic Controller (PLC)

1. The Programmable Logic Controller (PLC) shall have a built in Ethernet port for network communications.

2. Acceptable Manufacturers: Rockwell Automation / Siemens.

3. Human Machine Interface (HMI)

4. A Graphic Operator Interface Terminal (HMI) shall be mounted on the front of the panel for control of the SBR as a means of controlling the system and shall provide

graphic display of the process parameters and equipment status on a color display. The HMI shall also allow for entry of setpoint changes for system control. The display shall be 15.5" widescreen touchscreen, aspect ratio 16:9. The display shall be connected to a DIN rail mounted industrial computer.

D. Human Machine Interface (HMI)

1. Graphical display of all status information available for each device in the biological treatment system in the form of a pop-up window for quick and easy access.

2. Display all smart sensor status information available from the sensors.

3. ~~Electronic O&M Manuals for all hardware provided by the SBR manufacturer shall reside on the HMI and be quickly obtained by pushing a button.~~

4. ~~Alarm screen that allows the operator to select an alarm and push a button to display troubleshooting tips for that alarm.~~

5. ~~Easy navigation set up with control mode select buttons for each basin along the left and HMI screen navigation buttons along the top.~~

6. Maintenance dashboard screen with quick read gauges of maintenance life span for all biological treatment devices requiring maintenance.

7. Historical trend screen displays 10 days of key process variables, logged once per minute, including, where applicable, each basin's DO, Temp, DO Setpoint, Level, Clock, Waste pump running and air valve opened signals.

8. VNC capability for remote access through VPN.

E. Remote connection:

1. A webport with a built in four-port Ethernet switch shall be provided to allow direct access for online technical support via a standard internet connection.

2. A customer account including a free subscription through the duration of the supplier's warranty period shall be set up by the supplier to allow operations staff access to view the plant HMI. The Owner shall be responsible for the subscription renewal starting at the expiration of the warranty period.

F. SBR Control Logic

1. The SBR controls shall operate on a time cycle basis. The process elapsed time will be displayed on the display terminal. Each pair of SBR tanks will operate on a complimentary basis, so that while one tank is in aeration the other tank is in settling or decant phase. The cycle will automatically adjust for high flow conditions to

increase the throughput capacity in high flow conditions. In automatic operation, the processor shall at all times maintain the proper sequence of operation even in the event of power failure. All phases of the process and equipment shall be interlocked so that the process cannot be upset. If an equipment failure takes place an alarm will be displayed on the operator terminal until cleared. The display will indicate the time of the alarm and status.

2. Time critical sequences and other process variables can be adjusted via the operator interface terminal as follows:

   a. SBR Sequences shall consist of [1] Aeration blower run time, [2] The waste sludge pump start time and running time, [3] The decanter lowering rate, and [4] Special process variables such as DO or SIMS control setpoints if required

3. UV Interface: Each decanter shall have a non-mercury float switch mounted from the end of the weir. The float switch will trip when the decanter weir comes in contact with the water. Through the SBR control system a PLC digital output contact will close signaling the UV system that effluent flow is occurring. When the decanter weir is removed from the water and the float is no longer tripped the PLC output contact will open. The SBR operator interface shall have a selection on the set point screen which shall enable/disable the PLC output.

4. Chemical Feed: The SBR control system shall provide a PLC output contact that shall be used to turn on a chemical feed system. From the SBR operator interface there shall be the following set point selections.

Chemical Feed:	Enable/Disable
Chemical Feed Start Time:	Minute (determined by basin clock)
Chemical Feed Run Time:	Minute, Seconds

   A PLC digital output contact that shall close when the chemical feed is enabled and the start time set point equals the basin clock. The PLC output contact will remain closed until the run time is elapsed. This process will repeat itself every basin cycle.

5. The control system will include the following controllers, as well as instruments for monitoring process parameters, as detailed subsequently in this specification:

   a. Hydraulic Controller

   b. Decanter Controller

   c. Aeration Controller

G. Acceptable Manufacturers:

1. Xylem Inc. Sanitaire Products.

2.8 MOTOR CONTROL CENTER

A. The SBR supplier to furnish a Motor Control Center shall be provided for all motors associated with the SBR equipment.

B. Equipment

1. The motor control center shall be Rockwell Automation / Siemens, or equal. The unit shall have main lugs and bus system, which shall be tin plated copper and shall be fully braced for 42,000A RMS AIC with continuous horizontal and vertical bus bracing. The bus shall be rated for a minimum of 600 amps. Molded polycarbonate isolating material will separate the main bus from the unit starters and wire way. The enclosure will have a NEMA 1 rating.

2. Motor starter disconnecting devices shall be magnetic type circuit protectors (HMCP) and rated for 100,000A RMS. Motor starters shall be NEMA rated, shall incorporate overload protection, surge suppressers, and disconnecting terminal blocks. Starters for motors 50 hp and above shall be solid state reduced voltage type. Control wiring shall be 16AWG, MTW copper and color coded by voltage. The MCC shall have a 4.3" vertical wire way separated from unit starters. The MCC shall have a full length copper ground bus. The motor control center shall be wired to NEMA Class 1, Type B standard.

C. Acceptable Manufacturers:

1. Rockwell Automation.

2.9 INSTRUMENTATION AND PROCESS CONTROL

A. The SBR supplier to furnish, configure and commission the instrumentation for the SBR system. In addition, the SBR supplier shall furnish the control algorithms detailed below to control the process with the supplied instrumentation.

	Location	No. per Zone	Total Count
Terminal/Controller	Transferable	-	1
DO	Aerated Zones	1	2

B. Terminal/Controller:

1. The analyzer shall be a digital multi-channel, multi-parameter system capable of controlling up to 20 sensors, in any combination, for the determination of water and wastewater parameters.

   a. The controller must be configurable to include the following measurements: COD, TOC, DOC, SAC, BOD, pH, ORP, NH_4, NO_3, Conductivity, DO, Turbidity, TSS, Temperature and Sludge Level Monitor.

   b. Communication between controller and sensor shall be digital, allowing cable runs up to 3,000 feet without further amplification.

   c. The system will provide up to 20 programmable analog outputs (max. load 500 ohms) and 20 programmable alarm relays (rated to 5A at 250VAC). System shall also be capable of Ethernet/IP and Profibus IP communication.

   d. 90VAC-264VAC power required.

   e. Enclosure is NEMA-4X rated.

   f. Entire system including the sensors shall have built in lightning and surge protection.

   g. Ambient operating temperature –20°C to +55°C.

   h. System diagnostics shall be standard.

   i. System shall also have a USB interface port, data storage capability, and 3 levels of security.

   j. System must have integrated lightning and overvoltage protection.

   k. Backup controller function to increase reliability.

2. The terminal controller shall be YSI/WTW model 2020 IQ Sensor Net.

3. All instruments associated with the SBR system must be connected to the terminal/controller communication network back to the main SBR control panel.

4. Universal Mounting Kits with all necessary hardware shall be provided for each sensor.

5. A sunshield and mounting bracket shall be provided for the system display/controller and each local component to be mounted outside.

C. Hydraulic Controller

1. Description of controller

a. The hydraulic controller is used to adjust the cycle time to accommodate increased flow events while maintaining treatment objectives.

b. The hydraulic controller shall automatically switch back into a normal mode of operation once the hydraulic threshold has been maintained and an additional cycle has been completed.

c. The hydraulic controller shall interface with the aeration controller to increase the settling time to minimum of 30 minutes during the high flow conditions.

d. Include an integral safety feature interlocking the aeration and mixer controllers to prevent solids carryover in the decanter.

e. Reduce energy and optimize process stability by maintaining the desired dissolved oxygen setpoint during aerobic phases of the react phase.

f. The intent of the multiple modes of operation is to protect the process operation when instrumentation has faulted or is in need of maintenance.

2. Performance metrics

a. Submit test data from a minimum of six (6) full-scale plants that demonstrates that the proposed hydraulic controller properly transitions to a high-flow cycle when operated continuously at the design peak flow rate, while meeting peak instantaneous NPDES permit levels for grab and composite samples, without water overflowing the basin walls.

b. For each set of test data submitted, the test shall start at minute 0 of the cycle in the normal cycle, at which time the influent flow rate shall be increased to the peak design flow rate and maintained at that level until the end of the cycle.

c. For each set of test data submitted, the control system must properly transition to the high-flow cycle, which shall be 75% of the normal cycle periods or less, without water overflowing into the decanter before the start of the decant cycle and without the decanter being submerged at any time.

d. For each set of test data submitted, measurements of the basin water level during the test, as well as calculations of the hydraulic retention time (HRT) and weir loading rate (CFM/ft) shall be provided.

3. Instrument specification

a. Each basin shall be equipped with a level transducer. The level transducer shall have ceramic diaphragm and polyphenylene sulfide (PPS) 40% glass reinforced body. The transducer shall be cable mounted and factory

calibrated for the basin depth. The transducer shall be a 2-wire type and produce a 4-20ma signal in direct proportion to the measured level.

b. The level transducer shall be a Xylem Inc, MJK Expert 3400.

c. Each basin shall be equipped with a high level non-mercury float switch.

d. The float shall be a Xylem Inc, Flygt Products Model ENM-10.

e. Level signals and level indication shall be used to control the high flow cycle time and to reduce the aeration time in case of extreme high flows.

D. Decanter Controller

1. Controller description

a. Decanters shall be used to remove effluent from the SBR basins during the decant phase of the system cycle.

b. The decanter controller uses an algorithm to descend the decanter weir throughout the cycle at a constant vertical rate ensuring a constant discharge flow rate.

c. The decanter controller ensures proper synchronization between process decant time and weir position prior to the next phase starting to prevent solids contamination in the decanter effluent.

d. When not at design flow the decanter idle time is at the beginning of the decant cycle to maximize settling time.

e. Decanter speed will be controlled by a Variable Frequency Drive (VFD) which controls the speed of the decanter actuator motor.

2. Performance Metrics

a. Shall ensure the decanter is above the water level prior to aeration of the tank such that solids cannot carryover the decanter 100% of the time during the transition from decant to aeration phase of the cycle.

3. System Components

a. Decanter mechanism – as described in mechanical section of this specification

b. Linear actuator – as described in mechanical section of this specification

c. Variable Frequency Drive (VFD):

1) The VFD shall be microprocessor based, all-digital, compact style, low-noise PWM type. It shall allow programming of the torque curve,

speed and voltage, over current and overload protection. It shall have protective warning and diagnosis functions. The unit shall have programmed automatic fault restarts and low power ride through. The control unit display shall be mounted in an easily accessible location. The unit shall have a NEMA 1 rating suitable for mounting in a panel, on a wall, or in an MCC. The VFD will be setup, programmed, and post commissioned supported by Sanitaire personnel. The speed is determined by the PLC in order to maintain a uniform vertical lowering of the decanter weir. The maximum decanter travel is controlled by magnetic limit switches mounted on the decanter actuator. In addition, there shall be a decanter local control station for each basin consisting of a 4-position switch enclosed in a NEMA 4X enclosure. The local station allows manual raise and lower control as well as off and automatic control. The VFD must be properly wired and programmed so that manual raise and lower control does not require any input from the PLC.

E. Aeration Controller

1. Each basin shall be equipped with a dissolved oxygen probe.

   a. Communication to controller shall be digital.

   b. Connection to IQ Sensor Net shall be through two wire shielded cable.

   c. The sensor shall be calibration free using intelligent membrane technology.

   d. Membranes shall last up to two years with replacement membranes containing calibration data chip.

   e. Sensor shall use soft green fluorescent light with calibrated optics and equal path reference system.

   f. Sensor shall have a measuring range of 0-20.00 mg/l.

   g. Sensor shall integrate temperature measurement and compensation.

   h. Temperature operating range of -5° C to + 50° C and measuring range of -5° C to + 50° C.

   i. System accuracy shall be ± 0.05 mg/l < 1.00 mg/l, ± 0.1 mg/l > 1.00 mg/l.

   j. Sensor shall include self-diagnostics.

2. The DO sensor shall be YSI/WTW model FDO 700 IQ.

3. The dissolved oxygen signal shall be displayed at the main control panel display unit and be an input to the PLC. The PLC, using a control algorithm will output a

4-20mA signal to control the air flow out of the blower. The control system will control the airflow to provide only the amount of air required to maintain the dissolved oxygen set point.

~~F. Portable Suspended Solids System~~

1. ~~The SBR supplier to furnish one (1) portable suspended solids system which shall consist of a minimum two major components, the analyzer and the sensor.~~

2. ~~The analyzer shall be housed in a glass-filled nylon enclosure with a Velcro hand strap, which can also be converted to a belt mounting strap. Calibration shall not require an immediate known value and it shall not require a saved or retained sample.~~

3. ~~The sensor shall be a single gap, optical sensor with twenty-five feet of Kevlar internally reinforced cable. The cable shall be marked in one foot increments and be constructed of polyurethane and optical grade ground glass lenses.~~

4. ~~The portable suspended solids system shall be Xylem Inc. Royce Technologies model 711, with a Model 71 sensor.~~

5. ~~The portable unit shall be used for analyzing suspended solids and blanket interfaces in the reactor.~~

PART 3 - INSTALLATION AND PERFORMANCE

3.1 TESTING

A. After completion of the installation, the equipment shall be tested by the Contractor in the presence of the Engineer under actual operating conditions. The test shall be conducted under the supervision of the manufacturer's technical representative.

3.2 BIOLOGICAL PROCESS PERFORMANCE GUARANTEE

A. Supplier shall provide a Process Performance Guarantee to the Owner, guaranteeing the SBR process shall meet effluent wastewater quality, as determined during the Performance Test.

B. The full Process Performance Guarantee language and details of the Performance Test; defining conditions of guarantee, responsibilities, testing protocol, sampling, and analysis shall be provided with the Equipment Submittal.

C. The supplier shall guarantee that the SBR process shall meet effluent wastewater quality, as determined during the Performance Test equal to or less than the effluent quality as defined in paragraph 2.03 Effluent Quality Requirements.

D. The influent wastewater to the SBR process shall be defined by paragraph 2.02 Influent Wastewater Characteristics. The influent BOD_5, TSS, TKN, and TP loadings are defined by the Maximum Month Flow and the respective concentrations as outlined in paragraph 2.02.

E. The supplier shall provide a Process Performance Guarantee for the SBR system defined by paragraph 2.04 Process Design.

3.3 OXYGEN TRANSFER TEST

A. Conduct a performance test to demonstrate capability of the aeration equipment to meet the specified oxygen transfer requirements.

B. Base all tests on the following criteria:

1. A minimum of 3 tests for each specified condition in complete accordance with ASCE Clean Water Test Procedure (1992 or latest edition)

2. Conduct tests by an independent aeration testing firm in a full scale aeration test tank (minimum of 300 sq. ft.) at the specified submergence and water depth with a diffuser density equivalent to the specified tank configuration. Diffuser density is defined as the ratio of the total tank surface area to the total active diffuser surface area.

3. Conduct shop test with air rate and mass rate of oxygen transfer directly proportional to the ratio of the shop test tank volume and the design tank volume.

4. Plot of pounds of oxygen per day per 1000 cubic feet of tank volume versus air per 1000 cubic feet of tank volume in tap water at 14.7 Asia, 20°C and zero dissolved oxygen at the specified submergence.

C. Certify and stamp all tests by a registered Professional Engineer.

D. Include all costs for testing (exclusive of witnesses' expenses) in the equipment price. All tests may be witnessed at Owner/Engineer option. Cost of travel and living expenses for Owner/Engineer to be paid by the Owner.

E. Submit all test data from oxygen transfer tests for approval by the Engineer prior to manufacturing equipment.

3.4 OPERATION AND MAINTENANCE MANUAL

A. Prior to or with the delivery of equipment, the manufacturer shall provide copies of an operation and maintenance manual including storage, installation, start-up, operating and maintenance instructions, and a complete parts list and recommended spare parts list. The O & M Manuals shall be in compliance with the General Requirements.

3.5 FIELD SERVICES START-UP AND TRAINING

A. The services of the field representative shall include minimum ten (10) days, exclusive of travel time, and two (2) travel trips. The Owner shall notify the manufacturer a minimum of ten working days prior to the time that the field services are desired.

B. The Owner shall notify Sanitaire when the installation of the SBR equipment has been completed. A representative of the supplier shall inspect the installation. The Owner shall be advised in writing of any corrections or adjustments that are required for the SBR equipment installation. After the SBR installation has been completed to the supplier's satisfaction, a letter of certification that all equipment is installed in accordance with its instructions and that the SBR equipment is ready for operation shall be furnished.

C. The field person shall do a functional check of each item furnished and start-up of the process. During this time, the field representative will provide operation training, which shall include familiarization with the SBR process, its requirement and review of the Operation and Maintenance Manuals.

END OF SECTION 465353.01