Napier-Reid’s Bio-Batch™ SBR is an effective aerobic biological system to remove pollutants i.e. BOD, COD, Suspended Solids, Nitrogen and Phosphorous from municipal sewage and industrial wastewater in a batch process of Fill, Aerate, Settle and Decant.
NAPIER - REID Bio-Batch™ SBR is an aerobic biological system that has been successfully used to treat both municipal sewage and industrial wastewater. The SBR process has been extensively used worldwide over the past decades, by collecting the raw wastewater in a batch reactor and decanting the treated wastewater after eliminating pollutants i.e. BOD, COD, TSS, nitrogen and phosphorous. The process is conducted in an alternating aerobic / anoxic / aerobic conditions by a batch process of filling (introduction of raw wastewater), aeration (for bacteria respiration), settling (solids separation) and decanting (final effluent evacuation and removal).
Bio-Batch™ is a true interrupted batch feed process, in which, continuous inflow is accommodated through an alternating fill and draw by feeding two or more reactors. For continuous inflow operations, at least two reactors are used in alternating mode.

A unique feature of the Bio-Batch™ is that there is no return activated sludge (RAS) or secondary clarifier required for solids separation. Because both aeration and settling occurs in the same reactor, no sludge is lost from the reaction step and none has to be returned to maintain the solids content in the aeration chamber. A portion of the sludge is removed from the reactor at a predetermined interval in each cycle to maintain a constant and calculated inventory of activated sludge solids.

In a typical SBR process for municipal sewage or industrial wastewater, the influent first passes through a screen, and degritter prior to entry into the SBR tank.

The Bio-Batch process is a five-step operation that is carried out through the following sequence in a typical 4 hour cycle.

3-D model of Napier Reid’s Bio-Batch Sequencing Batch Reactors
SBR Process

Fill/Aerate Sequence

During this sequence, raw wastewater is introduced into the reactor where it is mixed and aerated to satisfy the design oxygen demand. To increase biological performance and eliminate the conditions encouraging filamentous bacteria proliferations, the inlet end of the reactor has a selector zone. This is a baffle arrangement, which is hydraulically connected to the main reactors. During this sequence the BOD removal and nitrification takes place.

Settle Sequence

Following aeration, the air is shut off and flow is diverted to other reactor(s). A tranquil condition is created in the main aeration zone for efficient sludge settling. During this period anoxic/anaerobic conditions are created for denitrification and biological phosphorous removal.

Decant

Following settling, the clarified supernatant water is decanted as the final effluent. A swing type or telescopic type decanter is used to remove the clarified supernatant from the tank.

Fill/Idle Sequence

At reduced loadings an idle sequence can be introduced and added to the treatment cycle. When the system is designed for nutrient removal, idle time can also be used during the aeration sequence to create an anoxic/anaerobic condition for denitrification and biological phosphorus removal.
Main Components of Bio-Batch™

Tankage can be either steel or reinforced concrete, depending on the plant size and design.

To optimize oxygen transfer efficiency and mixing a fine bubble membrane aeration system is used.

The decanter is the key component in a good SBR system. It withdraws the treated effluent from below the surface without disturbing the quiescent settled sludge layer and without withdrawing scum, foam and settled sludge.

Napier-Reid’s swing decanter provides a longitudinal weir with a scum baffle that is driven through a series of linkages using a gear motor and screw actuator. Napier-Reid also manufactures a telescopic type decanter (Uniflo), which has a longitudinal weir that moves in a vertical direction on a telescoping pipe it is also driven by a gear motor and screw actuator.

Typically, swing decanters are manufactured up to 12 m in weir length and telescopic units up to 4m in weir length.

Either centrifugal or positive displacement type air blowers are used for the SBR process to meet oxygen requirements.
Main Components of Bio-Batch™

Nutrients

Nutrients such as nitrogen and phosphorus may be required for industrial wastewater treatment and is supplemented in the form of urea and di-ammonium phosphate to optimize the microbial activity in the process. Normally, municipal sewage is enriched with nitrogen and phosphorus, hence the addition of nutrients is not required.

Waste Sludge Pumping System

To maintain a proper biomass concentration in the SBR reactor, excessive biosolids must be removed from the reactor by submersible pumps, which are preset to operate automatically according to the requirements of the process.

Aerobic Sludge Digester

In many applications aerobic sludge digesters are provided for sludge storage and stabilization. A fine bubble aeration system is used in the digester to maintain aerobic conditions.

Control System

A customized programmable logic controller is employed to command all the sequences of the Bio-Batch process. PC based SCADA control system can be provided if required.
Advantages of Napier-Reid’s Bio-Batch SBR

Process:
- Equalization, biological treatment, secondary clarification, settling and decanting can be achieved in the same reactor tank.
- Cycles within the system can be programmed for nutrient removal.
- Flexibility in operation and control can handle a variable wastewater flow.
- Exhibits linear scale-up.
- Options for anoxic/anaerobic conditions in the same tank.
- High nutrient removal capabilities.
- Filamentous growth elimination.
- Odor free process.
- The combined experience of Napier Reid’s process designers is over 300 years.

Design & Equipment:
- Custom engineered SBR plants from package level to large scale (20 m3/day to 150,000 m3/day and higher)
- Modular design allows for a simple expansion and upgrade.
- Retrofitting and upgrade of existing tanks is possible.
- All components of “Bio-Batch” SBR systems consist of high quality equipment for years of smooth operation.
- Operator friendly decanter design with drive unit accessible from the platform.

Instrumentation and Automation:
- SBR system can be supplied from semiautomatic to completely automatic as per client’s requirements.
- Advanced control system and programming results in minimum operator attention.
- Computer interface technologies for ease of operation.

Space and O&M Cost:
- Only 60% footprint area is required compared to a conventional extended aeration system.
- Common wall construction translates to civil construction cost savings.
- Minimum operating and maintenance cost e.g. no return activated sludge requirements.
- Production of tertiary quality effluent at secondary treatment costs.
## Application of Napier-Reid's Bio-Batch SBR

### Industrial
- Chemical and Petrochemical Industry
- Dairy, Food and Beverage Industries
- Pharmaceutical Industry
- Pulp and Paper Industry
- Textile Industry

### Domestic
- Municipalities
- Mobile Home parks
- Institution/Hotels

## About Napier - Reid

**Napier-Reid** is located in the greater Toronto area in the Province of Ontario, Canada. We supply engineering services and process equipment for water and wastewater treatment.

We have the technology, resources and experience to design, manufacture and implement innovative water and wastewater treatment solutions worldwide. We have completed over 3000 projects since our inception in 1950. This stands as a testament of our ongoing commitment of providing the highest quality service, products and after sales support in the industry. Our capabilities include engineering, manufacturing, installation and field support. We have in-house personnel for complete mechanical, electrical and instrumentation process and control system design. As a manufacturer, our designs focus on cost-effective solutions, simplicity of installation and ease of maintenance.

**Napier-Reid** has developed an excellent team with many years of experience. We have a well-deserved reputation for innovation, service and integrity. A significant portion of Napier-Reid’s revenue comes from export to regions such as the Caribbean, Central America, South America, Middle East, Eastern Europe, Africa, and Asia. Some of these projects are financed by Canadian government or International financing institutes. As a Canadian manufacturer, we are eligible for Canadian governmental funding and EDC export credit. We have the capability to handle a large range of projects, from engineering, equipment supply, installation, start-up, to turnkey projects. Let Napier-Reid be your solution for water and wastewater purification.

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