

NORAM's patented VERTREAT™ system is a high-rate activated sludge treatment process which uses an in-ground vertical shaft to provide aerobic biological treatment.

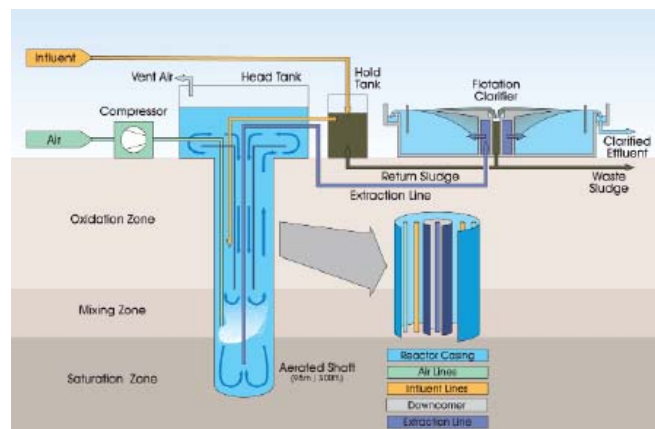
Vertical treatment processes have been proven to be effective in the treatment of municipal and industrial wastewater for more than 25 years, with over 200 facilities in operation worldwide.

The high oxygen transfer in VERTREAT™ enables rapid treatment of high-strength waste streams. The VERTREAT™ process is not limited by oxygen availability, even at high BOD loads. Primary clarification is not typically required ahead of VERTREAT™, and the system has very few moving parts.

VERTREAT™ has the following advantages over alternative technologies:

SMALL FOOTPRINT

VERTREAT™ typically uses only 10-30% of the total land required for conventional activated sludge plants of equivalent capacity. The reduced land requirements provide savings in capital costs and allow smaller footprint sites to be considered for new plants. This flexibility also means that retrofits to existing plants become feasible where the land available would otherwise limit expansion.



The VERTREAT™ Process

- Wastewater is treated in a sub-surface aerobic reactor, typically 250-300 ft deep.
- Air is injected at the bottom of the reactor under pressure.
- The air provides oxygen for BOD reduction, promotes mixing in the reactor, and achieves solids separation through flotation clarification.
- Solids separation is carried out in a flotation clarifier. Gas dissolved at depth comes out of solution as the treated effluent is returned to atmospheric pressure.
- Off-gas from the shaft is collected in a sealed head tank and can be treated separately if necessary.

MINIMAL VISUAL IMPACT

The low visual impact of VERTREAT™, self-contained and largely hidden from view underground, gives it a significant advantage over the large surface tanks of a conventional plant. In some cases, the entire treatment plant can be housed in a building.

VERY LOW VOC AND ODOUR EMISSIONS

The absence of large open aeration tanks reduces the potential for fugitive odour emissions. Off-gas from the in-ground reactor is collected in a sealed head tank. High oxygen transfer efficiency also reduces the volume of off-gas by approximately 80%.

HIGH OXYGEN TRANSFER EFFICIENCY

Increased oxygen solubility at depth and a long bubble retention time result in high oxygen transfer efficiencies, in excess of 65%. Oxygen transfer efficiencies in a conventional system are typically 10-15%. This enhanced oxygen transfer reduces energy costs by about 50% compared to conventional systems.

EFFECTIVE TREATMENT OF DIFFICULT WASTE STREAMS

Due to the high dissolved oxygen concentrations and high mixing energy, VERTREAT™ is capable of treating problematic waste streams including streams prone to foaming and streams with widely fluctuating loads.

COMPETITIVE CAPITAL AND OPERATING COSTS

The VERTREAT™ system does not require primary clarification and has a smaller footprint than a conventional wastewater treatment system. The result is a very competitive capital cost. Operational cost savings come from reduced energy requirements for aeration and low maintenance costs.



VERTREAT™ aeration shaft placement

NORAM Engineering and Constructors Ltd.



COMPANY PROFILE

NORAM is an engineering and technology development firm based in Vancouver, Canada. Founded in 1988, NORAM employs a highly qualified technical staff of approximately one hundred. NORAM has a global client base and has successfully completed projects on five continents.

Today NORAM is the world's leading supplier of mononitrobenzene (MNB) plants, a key intermediate in the production of polyurethane. In addition, NORAM offers sulfuric acid equipment, biological treatment facilities, energy systems, and technologies for the chemical, minerals processing, environmental, and pulp & paper industries.

NORAM offers proprietary technology to customers through engineered equipment and complete chemical plants. NORAM's core competencies include:

- Biological Treatment Technologies
- Electrochemical Systems
- Energy Systems
- Environmental Technologies
- Feasibility Studies
- Fluid Dynamics & Finite Element Analysis
- Heat Transfer Systems Design
- Nitration Technology
- Project Management
- Pulp & Paper Technologiess
- Sulfuric Acid Manufacture

PARTNERING WITH INNOVATION AND EXPERIENCE

NORAM is focused on the development, commercialization and supply of established and novel processes. With its entrepreneurial culture, NORAM has a demonstrated track record of thinking outside the box to provide innovative solutions. Technologies can be evaluated and integrated into an advanced engineering solution based on first principles.

NORAM has made its mark internationally by supplying proprietary systems to various industries world-wide. NORAM can bring this expertise and innovative ideas to your projects.

NORAM has established strategic relationships with the following organizations:

- ◆ Bateman Engineering BV
- ◆ Canadian Hydrogen and Fuel Cell Association
- ◆ Eco-Tec
- ◆ First Chemical Corporation (A DuPont Company)
- ◆ FP Innovations
- ◆ Kemetco Research Inc.
- ◆ Membrane Reactor Technologies
- ◆ Ostaro Nutrient Recovery Technologies Inc.
- ◆ Radient Technologies
- ◆ Siloxy Limited
- ◆ Simon Carves Limited (Punj Lloyd Group)
- ◆ The Electrosynthesis Company

NORAM Engineering and Constructors Ltd.
Suite 1800 - 200 Granville Street
Vancouver British Columbia Canada V6C 1S4
Telephone: +1 604.681.2030
Fax: +1 604.683.9164

Visit us on the internet at
www.noram-eng.com