# St. Lawrence TECHNOLOGIES

WASTEWATERS

## JUGGLER™ TECHNOLOGY: ECO-EFFICIENT MOBILE UNIT FOR EMPTYING SEPTIC TANKS

## ABSTRACT


The company Groupe SNS Inc. has developed and demonstrated a unique and efficient process to facilitate the emptying, transport, disposal and treatment of biosolids (sludge, scum and liquids) from septic tanks, while reducing costs.

The Juggler™ technology is a patented process that combines a dual-chamber tank, an innovative suction method and a physical and mechanical treatment unit for septic wastewater.

The Juggler™ truck removes all septic tank contents and returns a filtered supernatant that is on average 98% free of organic matter to the septic tank in less than twenty minutes. Because it carries only sludge and scum, one Juggler truck can service up to five times more septic tanks than a conventional pumper truck in one run.


## HIGHLIGHTS

**Technology**

- Truck equipped with dual-chamber tank, vacuum pump, suction nozzle, innovative filtration system and control system.
- Process entirely automated and chemical-free; quantity and quality of liquids returned to septic tank entirely independent of operator.

**Environment**

- Removes all septic contents and returns a filtrate that is on average 98% free of organic matter to the tank, as well as the bacterial flora necessary for its proper functioning.
- Encourages the practical application of 4Rs-D (reduce, reuse, recycle, reclamation and disposal)

**Cost-Effectiveness**

- Reasonable purchase price and quick, one-year return on investment.
- Reduced operating, transport and maintenance costs as well as lower costs for sludge disposal at treatment plant.

Saint-Laurent Vision 2000


Environment Canada Protection Québec Region
Environnement Canada Protection Région du Québec
Juggler™
Volet Environnemental du FPGST-E
Québec Ministère de l'Environnement
Québec Industrie et Commerce
Canada Economic Development
Développement économique Canada
National Research Council Canada
Conseil national de recherches Canada

## PROJET OBJECTIVES/ PHASE

**The aim of the project was to develop a new system for collecting septic waste and returning a treated liquid to the tank.**

**Throughout its development, the technology was validated in partnership with the Institut national de la recherche scientifique (INRS-ETE), and carried out in three phases:**

**I Pilot study of the developed process (1999)**
**II Performance study of conventional double-chambered trucks (2000)**
**III Environmental efficiency study of the Juggler™ system (2001).**

**During phase III, the work of INRS-ETE consisted mainly of:**
**• monitoring the truck for three days, sampling and characterizing ten septic tanks**
**• evaluating the physical and chemical quality of various samples taken before, during and after tank emptying**
**• measuring the level of sludge before and after emptying the tanks**
**• performing sedimentation tests to check the quality and speed of decantation of suspended particulate matter in the residual water that was returned to the tanks after emptying.**

## BACKGROUND

The usual method of servicing septic tanks consists of emptying the tank completely and disposing of the biosolids (sludge, scum and liquids) at a municipal treatment plant or treatment unit. Various technologies, including a dual-chamber truck, have been developed to withdraw only the sludge and return the liquid to the septic tank. Most of these technologies involve mechanical dewatering processes which are relatively complex or, in the case of dual-chamber trucks, return untreated liquids containing up to 50% residue to the septic tank.

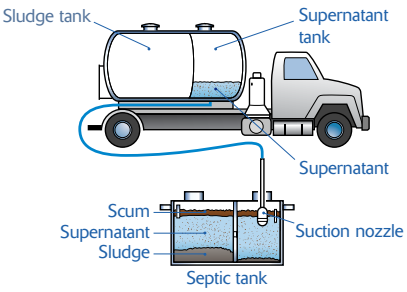
## TECHNOLOGY

The Juggler™ technology is a mobile septage treatment unit that returns a purified liquid to the septic tank. Its distinguishing feature is its suction nozzle, a device equipped with a floater through which the supernatant is pumped laterally rather than vertically. This helps prevent the resuspension of solids that have settled at the bottom of the tank. The supernatant is pumped to one of the truck's two chambers according to its solids content (Step 1). A density meter connected to an indicator light in the truck redirects liquids with an excessively high solids content into the sludge tank. Once the sludge and scum have been vacuumed up (Step 2), the liquids in the front section of the truck are screened through an innovative USSU™ (Ultrasonic Solid Separating Unit). Specially designed for this application, it has a filtration porosity of 60 µm. The filtrate is then returned to the septic tank (Step 3). The nozzle allows for a less direct inflow, thus lessening resuspension of the solid matter remaining in the septic tank. The truck's filter is cleaned automatically.
These three steps take less than 20 minutes and no chemicals are involved.

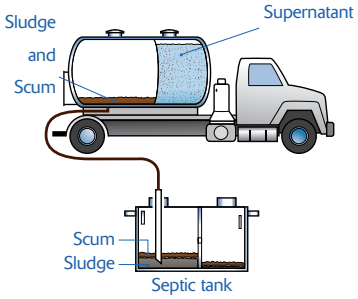
### The environmentally-sound way to empty your septic tank

**Here's how the Juggler™ unit functions:**

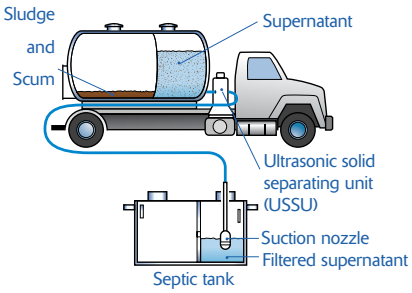
**Step 1: Supernatant is drawn up from the septic tank**




**Step 2 : Sludge and scum are drawn up**




**Step 3 : Supernatant is treated and returned to septic tank**




**FEATURES OF THE JUGGLER™ TRUCK**

| Pump type ($m^3$/min) | Pumping rate used (litre/min) | Sludge tank volume ($m^3$) | Liquid tank volume ($m^3$) | Number of septic tanks serviced in a day | Number of septic tanks serviced before truck has to be emptied |
|---|---|---|---|---|---|
| 11.3 (400 cfm) | 680 (150 gpm) | 8.17 (1800 imperial gallons) | 3.18 (700 imperial gallons) | Over 15 | 12 to 15 |

# RESULTS

The approach chosen by INRS-ETE was to monitor Groupe SNS Inc. during the process of emptying septic tanks using the Juggler™ truck. Over a three-day period, ten septic tanks were sampled and characterized. The tanks were all standard concrete septic tanks with volumes of 750 or 850 gallons (3.41 and 3.86 $m^3$) made up of two adjoining sections, along with a drainfield.

Technologically speaking, the studies conducted by INRS-ETE showed that the Juggler™ truck, when supernatant is vacuumed, pumps fewer solid particles of sludge than do conventional dual-chamber trucks. The overall $BOD^5$, COD, TSS, VSS and TKN removal efficiency of the Juggler™ process was also evaluated by comparing it to characteristic sludge composition during a complete septic tank emptying. Average removal rates of 95%, 98% and 92%, respectively, were measured for $BOD^5$/COD, TSS/VSS and TKN. These rates demonstrate the excellent ability of the process to separate biosolids from liquids, without resorting to chemicals and in only a few minutes more than the conventional pumping trucks.

Moreover, there was no significant sludge accumulation in either of the two sections of the septic tanks 24 hours after emptying. Blockage of the drainfield is not a concern due to the quality of the liquids being returned to the septic tank. The practice of returning liquids and bacteria to the septic tank is recommended by the Quebec Environment Ministry, because the system can more rapidly recover and regain its efficiency.

Finally, unlike conventional trucks which have to refill empty septic tanks with clean water to prevent their sides from buckling and/or keep tanks from rising, the hydrostatic pressure inside the empty septic tank is kept in balance by recycling the treated water.

**OVERALL $BOD^5$, COD, TSS, VSS AND TKN REMOVAL EFFICIENCY (%) OF JUGGLER™ TECHNOLOGY**

| Septic tank | $BOD_5$ | COD | TSS | VSS | TKN |
|---|---|---|---|---|---|
| 1 | 979 | 97.4 | 99.3 | 99.1 | 95.3 |
| 2 | 94.0 | 93.6 | 97.5 | 97.5 | 91.6 |
| 3 | 93.1 | 92.8 | 98.0 | 97.8 | 92.1 |
| 4 | 95.4 | 95.6 | 98.0 | 98.1 | 92.5 |
| 5 | 96.6 | 96.0 | 99.1 | 99.2 | 94.2 |
| 6 | 96.3 | 96.0 | 98.9 | 98.7 | 93.9 |
| 7 | 96.3 | 95.2 | 98.2 | 97.7 | 94.9 |
| 8 | 94.9 | 94.2 | 98.3 | 98.0 | 90.9 |
| 9 | 92.9 | 92.9 | 98.1 | 97.8 | 85.0 |
| 10 | 95.3 | 94.5 | 98.5 | 98.3 | 87.5 |
| **Average** | **95.3** | **94.8** | **98.4** | **98.2** | **91.8** |
| **Standard deviation** | **1.6** | **1.5** | **0.6** | **0.6** | **3.3** |

**$BOD^5$** Biochemical oxygen demand
**COD** Chemical oxygen demand
**TSS** Total suspended solid
**VSS** Volatile suspended solids
**TKN** Total Kjeldahl nitrogen

# POTENTIAL AND LIMITATIONS

**Potential**

The Juggler™ technology fosters the 4Rs-D principle and sustainable development:

- At-source reduction of residual matter, lower hydrocarbon consumption and thus greenhouse gas emissions.
- Recycling of treated water.
- Reuse of bacterial flora.
- Reclamation of biosolids made easier.
- Disposal at source and at the treatment centre with no need for chemicals.

In Quebec alone, Juggler™ trucks could service the septic systems of more than 400 000 main residences once every two years and over 200 000 secondary residences once every four years. The technology could also be adapted for other applications, including the emptying of grease traps and lagoons in agri-food plants (e.g. starch removal) and the treatment of certain industrial wastewaters.

**Limitations**

For the time being, the treatment capacity of the mobile unit is limited to 75 gallons per minute (285 L/min) and to a solids concentration of 10 000 mg/L of suspended particulate matter in the liquid requiring treatment.

**Awards**

- Concours québécois en entrepreneurship 1999
- Grands Prix québécois de l'invention 2000
- Prix de l'Innovation du Carrefour des nouveautés at the Salon des technologies environnementales du Québec 2002.

# INFORMATION

This data sheet is based on the results of studies conducted by l'Institut national de la recherche scientifique du Québec.

The project received technical and financial support from several federal and provincial government departments and, locally, from other financial partners both public and private. Additional technological partners were Pépinière d'entreprises innovantes de Chaudière-Appalaches, Services d'innovation et de transfert technologiques pour l'entreprise (SITTE) and Matiss Inc..

For additional information, please contact:

**Environment Canada**
Technology Innovation and Industrial Sectors
Jean-René Michaud, ing., M.Sc.A.
Program Coordinator
105 McGill Street, 4th Floor
Montreal, Quebec H2Y 2E7
Tel: (514) 283-9207
Fax: (514) 496-2901
E-mail:
jean-rene.michaud@ec.gc.ca

**Goupe SNS (Service Nettoyage Sanitaire) Inc.**
Érick Vachon, President
Tel: (418) 227-9411
E-mail:
info@jugglersystem,com

**Ministère de l'Environnement du Québec**
Georges Gabra, Dr.Sc.
Program Coordinator
Direction de l'information et de la coordination de la recherche
Tel: (418) 521-3824
E-mail:
georges.gabra@menv.gouv.qc.ca

Natural Resources Canada | Ressources naturelles Canada

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St. Lawrence TECHNOLOGIES

St. Lawrence Technologies data sheets are intended for all companies, industries, organizations and individuals interested in new environmental technologies. They are produced by Environment Canada, as part of St. Lawrence Vision 2000. They serve to disseminate the results of technology development and demonstration projects conducted in the following five sectors: wastewaters; contaminated soil; hazardous wastes; contaminated sediment and innovative tool.

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Environment Canada
Technology Innovation and Industrial Sectors Section
105, McGill Street, 4th floor
Montreal, Quebec H2Y 2E7
Tel.: (514) 496-6851
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Dianne Ouellet

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Jean-René Michaud

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Jean-Francois Blais

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Patricia Potvin

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