ENVIRONMENTAL VISITATION CENTER
ALEGRIA WWTP
The new CEDAE, offering to the public the Environmental Visitation Center at Alegria WWTP, seals its commitment with the environment and environmental education highlighting the importance of spreading its knowledge and services with absolute transparency in the field of sanitary sewerage.
The Environmental Visitation Center at Alegria WWTP presents the technology applied in the plant and its beneficial achievements to the environment, reflecting positively in the population’s quality of life.

The Center is prepared to receive researchers, university professors and students interested in environmental issues, especially in improving the water quality conditions of Guanabara Bay.
Narrowing the relationship with universities, the Center promotes technical and scientific exchange with the educational institutions and the application of researches. Those are important factors to promote development, innovation and a quality leap of the services provided by the new CEDAE, ensuring sustainability of its main product: good quality water for current and future generations.
• ACTUAL CAPACITY: 2 500 L/s;

• BASIN POPULATION: 1 500 000 INHABITANTS;

• DESIGN CAPACITY: 5 000 L/s.
SANITARY BASINS COLLECTED

• CENTRO-MANGUE-CATUMBI;
• ALEGRIA;
• FARIA- TIMBÓ;
• SÃO CRISTÓVÃO.
SANITARY BASINS COLLECTED
MAIN ("TRUNK") SEWERS

Sanitary Basin
3 million inhabitants
Generated sanitary sewer flow: 600 000 m³/day (7 m³/s)

Main Existing Sewer Trunks

New (designed) Sewer Trunks
Manguinhos Trunk
Faria-Timbó Trunk

Collected Sanitary Sewer flow (2010)
140 000 m³/day (1.6 m³/s)

Sanitary sewer flow to be collected:
360 000 m³/day (4.2 m³/s)
MAIN ("TRUNK") SEWERS
MAIN ("TRUNK") SEWERS

- TRUNK CENTRO (D=900>1500>2000 mm);
- TRUNK ALEGRIA (D=900>1500>2000 mm);
- TRUNK TIJUCA (D=800>900>1000 mm);
- TRUNK SÃO CRISTÓVÃO (1500 mm);
- TRUNK FARIA-TIMBÓ (D=600>1000>1500 mm).
2000 mm PIPE
INFLUENT CHARACTERISTICS

• AVERAGE FLOW: 2 500 L/s (9 000 m$^3$/h);

• BOD$_5$ = 283 mg/L;

• TSS = 350 mg/L.
TREATMENT STAGES

PRELIMINARY TREATMENT

PRIMARY TREATMENT

SECONDARY (BIOLOGICAL) TREATMENT
TREATAMENT X SUSTAINABILITY

RAW SEWAGE -> WWTP

GAS (METHANE) -> TREATED EFFLUENT (REUSE)

SCUM (GREASE) -> TREATED EFFLUENT (REUSE)

SCREENINGS -> SLUDGE (FERTILIZER / ENERGY)

GRIT -> SLUDGE (FERTILIZER / ENERGY)
SECONDARY TREATMENT SCHEMATIC FLOW DIAGRAM

ALEGRIA WASTEWATER TREATMENT PLANT
SECONDARY TREATMENT SCHEMATIC FLOW DIAGRAM

PRIMARY EFFLUENT

Primary effluent pumping station → Aeration tank → Final settler → Parshall flume

FINAL EFFLUENT

Actived sludge pumping station

Activated sludge

RETURN (CENTRATE)

EXCESS ACTIVATED SLUDGE

Decanter centrifuge (thickening)

THICKENED SLUDGE

TO THICKENED SLUDGE PUMPING STATION

ACTIVATED SLUDGE (RETURN)

SCUM (FLOATABLES)
1. – MECHANICALLY CLEANED BAR RACKS (COARSE SOLIDS REMOVAL)

PROTECTION OF THE PUMPS FROM THE RAW SEWAGE PUMPING STATION;

• REMOVAL OF COARSE MATERIAL (PLASTIC BOTTLES, DRIFT WOOD, ETC...);

• THREE UNITS; CLEAR SPACING BETWEEN BARS: 10 cm.
2. - RAW SEWAGE PUMPING STATION

RAISES THE SEWAGE FROM AN ELEVATION OF -17 m TO AN ELEVATION OF +8 m BY CENTRIFUGAL PUMPING (TOTAL PUMPING HEIGHT = 25 m)

- FIVE PUMPS OF 700 HP EACH;
- DESIGN FLOW (EACH PUMP) = 1 850 L/s;
- TOTAL PUMPING CAPACITY = 9 250 L/s;
- TWO FREQUENCY INVERTERS (VARIABLE FLOW).
RAW SEWAGE PUMPING STATION
PRELIMINARY TREATMENT

3. – FINE SOLIDS SCREENING

REMOVAL OF FINE SOLIDS TO PROTECT TREATMENT PROCESS EQUIPMENT

• FOUR MECHANICALLY CLEANED UNITS;

• CLEAR SPACING BETWEEN BARS: 1,3 cm;

• REMOVAL OF CA. 1,5 m³/day OF SCREENINGS.
PRELIMINARY TREATMENT

4. – GRIT REMOVAL (GRIT CHAMBERS)

REMOVAL OF GRIT AND SAND TO AVOID SILTATION OF TANKS AND PREVENT OPERATIONAL PROBLEMS.

• FIVE UNITS;

• CAPACITY: 1 000 L/s EACH;

• REMOVAL: 3,4 ton/day OF GRIT.
GRIT CHAMBERS
5. – PRIMARY SETTLERS

SEPARATION OF WATER, SETTLEABLE AND FLOATABLE SOLIDS AND REMOVAL OF SLUDGE AND SCUM

- RECTANGULAR TANKS; WATER SURFACE: 7 560 m³ EACH; SCUM AND SLUDGE REMOVAL BY CHAIN AND FLIGHT COLLECTOR;
- 5 UNITS WITH CAPACITY OF 1 000 L/s EACH;
- TOTAL SUSPENDED SOLIDS IN THE INFLUENT: 200 mg/L; SOLIDS CONTENT OF THE SLUDGE: 1% (10 000 mg/L);
- HYDRAULIC DETENTION TIME: 2 h;
- SUSPENDED SOLIDS REMOVAL: 50%;
- BOD REMOVAL: 35%;
6. – SLUDGE THICKENERS

INCREASES THE SOLIDS CONTENT OF THE SLUDGE REMOVED FROM PRIMARY SETTLERS FROM 1% TO 5%

- 5 UNITS; EFFICIENCY: 90%;
- EACH UNIT RECEIVES 1 663 m³/day;
- PRODUCTION OF THICKENED SLUDGE: 294 m³/day (EACH UNIT);
- THE THICKENED SLUDGE IS TRANSFERRED TO DIGESTERS BY THE THICKENED SLUDGE PUMPING STATION.
7. - THICKENED SLUDGE PUMPING STATION

TRANSFERS TO DIGESTERS: THICKENED SLUDGE, SCUM COLLECTED IN THE PRIMARY SETTLERS AND EXCESS ACTIVATED SLUDGE FROM THE BIOLOGICAL TREATMENT

- 2 POSITIVE DISPLACEMENT PUMPS;
- CAPACITY: 17 L/s;
- PUMPING HEIGHT: 32 m.
PRIMARY TREATMENT

8. – ANAEROBIC DIGESTERS

DIGESTS RAW SLUDGE ANAEROBICALLY, GENERATING STABILIZED SLUDGE, GAS AND WATER

• 5 UNITS;

• SLUDGE CAPACITY: 7 400 m³ EACH;

• HYDRAULIC DETENTION TIME: 25 days;

• ORGANIC (VOLATILE) SOLIDS REMOVAL: 50%;

• MIXING BY EXTERNAL SLUDGE RECIRCULATION THROUGH CENTRIFUGAL PUMPS.
ANAEROBIC DIGESTERS
9. - CENTRIFUGES

INCREASES THE SOLIDS CONTENT OF DIGESTED SLUDGE FROM 5% TO 30% BY CENTRIFUGATION

• 3 UNITS;

• EACH UNIT RECEIVES 15 m³/h OF DIGESTED SLUDGE AND PRODUCES 3 000 kg/h OF SLUDGE CAKE WITH 70% OF WATER;

• WHEN THE WWTP RECEIVES AN INFLUENT FLOW OF 2 500 L/s OF RAW SEWAGE, 78 ton/day OF CAKE ARE PRODUCED;

• THE CAKE IS TRANSFERRED TO A SANITARY LANDFILL; SOON WILL BE PROCESSED IN THE THERMAL DRYER INSTEAD.
THICKENING
10. – THERMAL DRYER

INCREASES THE SLUDGE CAKE SOLIDS CONTENT FROM 30% TO 80% USING AS ENERGY SOURCE THE GAS GENERATED IN THE ANAEROBIC DIGESTERS

• THE UNIT HAS A CAPACITY OF PROCESSING UP TO 206,64 ton/day OF CAKE, PRODUCING 62 ton/day OF DRIED SLUDGE;
• THE DRYING PROCESS REDUCES 65% OF THE CAKE MASS;
• THE DRYING PROCESS PROMOTES A DRASTIC REDUCTION OF THE CONTAMINATION POTENTIAL OF THE SLUDGE;
• GAS CONSUMPTION: 989 Nm³/h.
THERMAL DRYER
THERMAL DRYER
SECONDARY TREATMENT

11. – PRIMARY EFFLUENT PUMPING STATION

TRANSFERS THE EFFLUENT FROM PRIMARY TREATMENT TO THE AERATION TANKS

• 4 PUMPS; 197 HP EACH;

• CAPACITY: 4 450 m³/h EACH.
SECONDARY TREATMENT

12. – AERATION TANKS

PROMOTES AERATION OF THE PRIMARY EFFLUENT BY MEANS OF AIR BUBBLES ORIGINATED FROM DIFFUSERS LOCATED AT THE BOTTOM OF THE TANKS

• 4 TANKS; VOLUME: 11 500 m³ EACH;
• TREATMENT CAPACITY: 2 250 m³/h EACH;
• DETENTION TIME: 5 h;
• SLUDGE AGE: 8 days;
• 4 ADDITIONAL TANKS FOR FUTURE OPERATION.
AERATION TANK
BLOWERS

PRODUCES THE AIR FLOW TO SUPPLY THE OXYGEN NEEDS OF THE AERATION TANKS

- 6 UNITS OF 800 HP EACH;
- FLOW CAPACITY: 21 800 Nm³/h OF AIR EACH.
SECONDARY TREATMENT

13. – FINAL SETTLERS

RECEIVES THE MIXED LIQUOR FROM THE AERATION TANKS AND PROMOTES THE SETTLING OF THE ACTIVATED SLUDGE, RELEASING AN EFFLUENT THAT COMPLIES WITH THE DISCHARGE STANDARDS SET TO THE RECEIVING WATERS

- 04 UNITS;
- DIAMETER: 50 m;
- VOLUME: 8 830 m$^3$ EACH;
- DETENTION TIME: 3:50 h;
- 4 ADDITIONAL TANKS FOR FUTURE OPERATION.
SECONDARY TREATMENT

14. – ACTIVATED SLUDGE PUMPING STATION

PROMOTES THE RETURN TO THE AERATION TANKS OF THE ACTIVATED SLUDGE SETTLED IN THE FINAL SETTLERS

- 4 PUMPS OF 49 HP EACH;
- FLOW CAPACITY: 1575 m³/h EACH;
- RECIRCULATION RATE: 0,6;
- THE EXCESS ACTIVATED SLUDGE IS TRANSFERRED TO MECHANICAL THICKENERS FROM WHICH THE THICKENED SLUDGE IS SENT TO THE DIGESTERS.
**FINAL EFFLUENT**

The final effluent is discharged in the receiving waters with the following characteristics:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Influent (mg/L)</th>
<th>Effluent (mg/L)</th>
<th>Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD&lt;sub&gt;5&lt;/sub&gt;</td>
<td>283</td>
<td>≤ 8</td>
<td>98.0</td>
</tr>
<tr>
<td>TSS</td>
<td>350</td>
<td>≤ 10</td>
<td>98.0</td>
</tr>
<tr>
<td>COD</td>
<td>500</td>
<td>≤ 30</td>
<td>94.0</td>
</tr>
</tbody>
</table>
CONTROL

The operation of the plant is totally monitored and controlled to meet the design process parameters and environmental standards through:

• Operational Control Center;

• Systematic analysis in laboratory units.
To demonstrate the quality of the treatment, the Center keeps an aquarium of 18,000 liters fed with WWTP treated effluent (water reuse).
Processing and utilization of the gas generated in the WWTP processes to be used in the sludge thermal dryer and as fuel in part of the fleet of vehicles of CEDAE;

- This project, which could generate carbon credits, will reduce the generation of greenhouse effect gas, collaborating in the worldwide effort to minimize the causes of global warming;

- **Biodiesel** production from the scum removed from the primary settling tanks, with prospects for implementation on industrial scale;

- **Pyrodiesel** production from the pyrolysis of the sludge generated in the WWTP.

- Production of **organic compost** from the sludge, to be used on agriculture, complying with the standards set by the environmental control agencies.
To minimize the causes of water bodies pollution, CEDAE keeps in the Center the "Incubator of the Atlantic Forest Seedling Arthur Sendas", with capacity to produce 35,000 seedlings per year. The seedlings are used by CEDAE in the reforestation of public areas and riparian vegetation of rivers that flows to Guanabara Bay.

The work at the incubator is made by inmates of the open and semi-open prison schemes from the prisional system of the State of Rio de Janeiro, aiming at their rehabilitation according to the Social Responsibility Program of the Company.