1st HELLENIC - CHINESE ENVIRONMENTAL FORUM

EYDAP S.A.

"Urban Wastewater Management and Presentation of Treatment Facilities of EYDAP S.A."

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Wastewater Treatment Centre Director
EYDAP S.A.
Athens Water Supply and Sewerage Company S.A.

- Establishment in 1980 with the merging of the Hellenic Water Company (E.E.Y.) and the Sewerage Organization of Athens (O.A.P.)
- Introduction in the Athens Stock Exchange in 1999
- Employees: 3360
EYDAP S.A.
Athens Water Supply and Sewerage Company S.A.

Water supply
4 Water treatment plants (Galatsi, Menidi, Kiourka, Aspropyrgos)
Water originating from Mornos, Evinos, Yliki, Marathon, boreholes around Viotikos Kifissos river)
8,200 km of water supply grid

Sewerage
6,000 km of sewerage grid
Separate, with the exception of the historical centre (combined)

Wastewater treatment
2 operational wastewater treatment plants:
Psittalia WWTP, Metamorphosis WWTP
1 wastewater treatment plant under construction: Thriassio WWTP
5 planned wastewater treatment plants in Eastern Attica (Paiania - Kropia WWTP, N. Makri - Marathon WWTP, N. Mesogeia WWTP, Lavreotiki WWTP& Fokaia WWTP)
URBAN WASTEWATER AND PRE-TREATED INDUSTRIAL WASTE RECEPIENTS

- EYDAP S.A. SEWERAGE GRID
- EYDAP S.A. WASTEWATER TREATMENT PLANTS

RESPONSIBLE EYDAP S.A. MANAGEMENT DIRECTORATES

- SEWERAGE GRID DIRECTORATE
- WASTEWATER TREATMENT PLANT DIRECTORATE
- QUALITY DIRECTORATE
EYDAP S.A.
ORGANISATION CHART OF URBAN WASTEWATER AND LIQUID WASTE
MANAGEMENT - TREATMENT DIRECTORATES AND SERVICES

GRID AND PLANT OPERATION GENERAL DIRECTORATE

<table>
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<th>Quality Directorate</th>
<th>Sewerage Grid Directorate</th>
<th>Wastewater Treatment Plant Directorate</th>
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<tbody>
<tr>
<td>Liquid Waste Control and Supervision Service</td>
<td>Grid Maintenance Regional Sector Services</td>
<td>Metamorphosis Wastewater Treatment Plant Service</td>
</tr>
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<td>E/M Facilities Service</td>
<td>Pre-emptive Grid Maintenance Service</td>
<td>Psittalia Wastewater Treatment Plant Service</td>
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<tr>
<td></td>
<td></td>
<td>Thriassio Wastewater Treatment Plant (Under Construction)</td>
</tr>
</tbody>
</table>
QUALITY DIRECTORATE
LIQUID WASTE CONTROL AND SUPERVISION SERVICE

SCOPE

- Design, development and application of procedures for liquid industrial waste pollution control.
- Licensing of industrial enterprises for draining pre-treated liquid waste to EYDAP’s grid
LIQUID WASTE CONTROL PROCEDURE

- Submission of a suitable design for approval on behalf of the industrial enterprise, with description, if necessary, of the pre-treatment facilities required to be constructed, according to the instructions of EYDAP S.A. so that the characteristics of drained liquid waste are within specified limits (GG B 582 - MD 179182/656/2-7-1979).
- Approval of the relevant design.
- Design and construction implementation control of potentially required pre-treatment projects.
- Series of sample checks in order to certify the effective operation of pre-treatment facilities and acceptable quality of pre-treated liquid waste before their disposal to EYDAP's grid.
LIQUID WASTE CONTROL PROCEDURE (continued)

- Granting of drainage license to EYDAP’s grid for a time period depending, among others, on the pollutant loads and the size of the industrial business.
- Regular monitoring of liquid waste quality through sample checks.
SEWERAGE GRID

EYDAP S.A. is exclusively responsible for the design, construction, operation, maintenance and expansion of wastewater sewerage pipes in its areas of jurisdiction. Until 1999 EYDAP S.A. was also responsible for the rainwater drainage grid in its area of jurisdiction, but by Law 2744/99 this responsibility was transferred to the MEPPW. Furthermore, the construction of sewerage pipes less than 350 mm in diameter has been transferred to the local authorities.

Rainwater pipes discharge surface runoff rainwater via gravity flow to the sea, while sewage pipes collect urban wastewater and transport them to the wastewater treatment plants.

The sewerage system is combined in certain areas in downtown Athens and Piraeus and separate in the rest of Athens Metropolitan Area, with a total length of approximately 6,000 km, covering 92% of the area's sewerage needs.
Part of the grid operates by gravity (gravity flow), while other parts, mainly low altitude and coastal areas, require pumping stations and discharge pipes.

Wastewater collection - Main collectors:

Gravity flow
- Parakifissios Collector (29 km)
- Parailissihi Collectors (Southern 11 km, Northern 5.2 km)
- Collector by Proph. Daniel Torrent (9.4 km)
- KTH Collector (4.6 km)
- AKTH Collector (6 km)

Main Sewerage Pipes (ending in the Psittalia WWTP)
- MAP, 16 km
- Complementary, CMAP, 7.5 km

Pumping
- 23 pumping stations in line (3.3 km discharge pipes)
  - Main Coastal Collector (14.5 km)
  - 21 local pumping stations
  - Discharge to gravity flow pipes
Wastewater Treatment Plants

Psittalia Wastewater Treatment Plant

Equivalent population: 5,600,000

Design supply (mean): 1,000,000 m³/d

Peak supply: 27 m³/s
Mean variance of incoming mean daily supplies (m^3/d) in the Psittalia WWTP
**Treated outflow disposal applications**

based on the approved environmental terms, according to Directive 91/271/EEC:

**Treated outflow concentration limits (mg/l)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD₅</td>
<td>25</td>
</tr>
<tr>
<td>COD</td>
<td>125</td>
</tr>
<tr>
<td>Suspended solids (≥ 93% of samples)</td>
<td>35</td>
</tr>
<tr>
<td>Total Nitrogen Removal (%)</td>
<td>70 - 80 on an annual basis</td>
</tr>
</tbody>
</table>
Construction phases

The facilities in Psittalia WWTP were constructed by the MEPPW with part-financing from the European Union in 3 phases:

- **1994**: Phase A completion (sewage & sludge treatment facilities, including underwater siphons and disposal pipes)
- **2004**: Phase B completion (biological sewage & sludge treatment facilities)
- **2007**: Phase C completion (thermal sludge dehydration plant construction)

Furthermore, the following facilities were also constructed in Psittalia WWTP by EYDAP S.A. with part-financing from the European Union:

- 2 Combined Heat and Power (CHP) Stations burning biogas (2001 and 2009) and
- 1 CHP station burning Natural Gas (2009)
Psittalia Wastewater Treatment Plant
Akrokeramos facilities
Sewage pre-treatment

Screening
Degridding
Heavy solids removal
Deodorisation

Twin inverted siphon
Degridding   Screening

Inflow pumping station
Psittalia WWTP CHP STATIONS

Construction by EYDAP S.A. with part-financing from the EU.

Usage of biogas produced in the Psittalia WWTP (80,000 - 90,000 m³/d)
7.14 MWe Station (commissioned 2001)
4.25 MWe Station (commissioned 2009)
Coverage of the plant's power needs (mainly during Phase A)
Sale of excess power to the HTSO
Coverage of thermal needs for sludge digestion

Use of natural gas for thermal support of thermal sludge dehydration
12.9 MWe station (commissioned 2009)
Coverage of thermal needs for sludge digestion (65%)
Coverage of the plant's power needs (Phase B)
Financial and Environmental Benefit from Combined Heat and Power Generation using Biogas

- Autonomy of Psittalia WWTP facilities in energy during Phase A
- Profit from the non-purchase of power
- Income from the sale of excess power
- Fuel economy
- Reduced pollutant emission in the atmosphere
- Acquisition of know-how
- Opening of new jobs
Psittalia Wastewater Treatment Plant
Thermal Sludge Dehydration Plant

Dehydrated product silo

Final product
Conformity with US EPA 503 Class A specifications for sanitised sludge

Particle size 1 - 5 mm

Maximum temperature 45°C

Dry solids content (%) 90 - 95
Thermal dehydration - dry product usage capabilities

- **Fuel**
  The product resulting from thermal sludge dehydration in Psittalia has a calorific value comparable to that of lignite. It can be used as secondary fuel in thermal power plants or as an alternative fuel in cement industries.

- **Soil application**
  The product resulting from thermal sludge dehydration in Psittalia is sanitised and meets the requirements of Directive 86/278/EEC concerning heavy metal content for soil application. Since it contains nitrogen, phosphorus, potassium and organic matter it can be used as ameliorant.
Metamorphosis WWTP

Plant Characteristics

- The Metamorphosis Wastewater Treatment Plant is the first Biological Treatment plant constructed in Greece. It operates since 1984 and constitutes the only domestic cesspool waste collection and treatment plant in the Prefecture of Attica.

- It has been designed for simultaneous treatment of urban wastewater and cesspool waste in two separate pre-treatment and primary settling lines. Subsequently, both waste types are treated in an aerobic biological reactor with an active sludge system. Treated wastewater is then disinfected with sodium hypochlorite before disposal to the recipient.
Metamorphosis WWTP

Design Parameters

Equivalent population: 500,000

Design hydraulic load:
- Q urban wastewater 20,000 m$^3$/d
- Q cesspool wastewater 24,000 m$^3$/d
ANNUAL INCOMING WASTEWATER SUPPLY
Treated outflow disposal applications

(according to the approved environmental terms)

Treated outflow concentration limits (mg/l)

- BOD < 20 mg/l
- COD < 100 mg/l
- SS < 35 mg/l
Metamorphosis WWTP
Simultaneous treatment of cesspool waste and urban wastewater
Flow chart
Metamorphosis WWTP sludge waste line

- Tank truck unloading area
- Degridding, Screening, Degreasing
- Cesspool waste flocculation
- Deodourisation system with a 3 stage chemical scrubber
- Two rectangular urban wastewater primary settling tanks
- Two circular cesspool waste primary settling tanks
- Urban wastewater primary settling sludge pumping station
- Cesspool waste primary settling sludge pumping station
- Biological stage
- Two circular final settling tanks
- Recirculation and excess sludge pumping station
- Decontamination
- Industrial water facility (single layer sand filters)
- Anaerobic sludge digestion
- Sludge dehydration (filter belt press)
- Dehydration building deodorisation system with chemical scrubber
- Dehydrated sludge transport to the Psittalia WWTP for thermal dehydration.
THRIASSIO WASTEWATER TREATMENT PLANT

Tendering within the framework of a wider project, including the construction of the following individual projects:

1) Thriassio Field Western Sector Basic Wastewater Sewerage Collectors Areas: Mandra, Elefsina and Magoula

2) Thriassio Field Eastern Sector Basic Wastewater Sewerage Collectors Area: Aspropyrgos

3) Thriassio Field Wastewater Treatment and Disposal Facilities Development in two phases: Phase A and Phase B
THRIASSIO WASTEWATER TREATMENT PLANT

Urban wastewater and liquid waste treatment from industries and other facilities (after pre-treatment, if possible).

Design data

Daily wastewater supply (m$^3$/d)
Mean: 21,000 (Phase A), 42,000 (Phase B)
Maximum: 27,650 (Phase A), 55,300 (Phase B)

Treated flow recipient: Elefsina Gulf
   Disposal by means of a 1.56 km disposal pipe at 14 m depth

Final outflow quality, after filtering and decontamination (mg/l):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD$_5$</td>
<td>15</td>
</tr>
<tr>
<td>COD</td>
<td>100</td>
</tr>
<tr>
<td>Suspended solids</td>
<td>10</td>
</tr>
<tr>
<td>Total phosphorus</td>
<td>1</td>
</tr>
<tr>
<td>Total nitrogen</td>
<td>10</td>
</tr>
<tr>
<td>E. Coli</td>
<td>100 FC/100 ml</td>
</tr>
</tbody>
</table>
Wastewater treatment stages

- Pre-treatment: Degridding, screening - degreasing
- Primary settling
- Biological treatment (active sludge method with nitrification and biological nitrogen and phosphorus removal, as well as chemical phosphorus removal capability)
- Filtering
- Decontamination (using ultraviolet radiation)

Sludge treatment stages:

- Thickening
- Anaerobic digestion
- Dehydration
- Transport to Psittalia WWTP for thermal dehydration
Final settling  Dehydration
Bioreactors  Digestion tanks
Decontamination  Gasholder
Phase B Facilities  Primary Settling  Pre-treatment Building
In conclusion, the need for sustainable development combines environmental protection and coverage of energy needs and, in this framework, full exploitation of available renewable energy sources, including biogas, dry matter and treated outflow of Wastewater Treatment Plants, constitutes a constant need and one of the main targets of EYDAP S.A.

Thank you for your attention