



2022 MELISSA CONFERENCE
8-9-10 NOVEMBER 2022

CREATING
A CIRCULAR
FUTURE



FIRMUS[®]
FRANCE



FGWRS

Grey Water Recycling : From Space to Earth

Pierre MAGNES

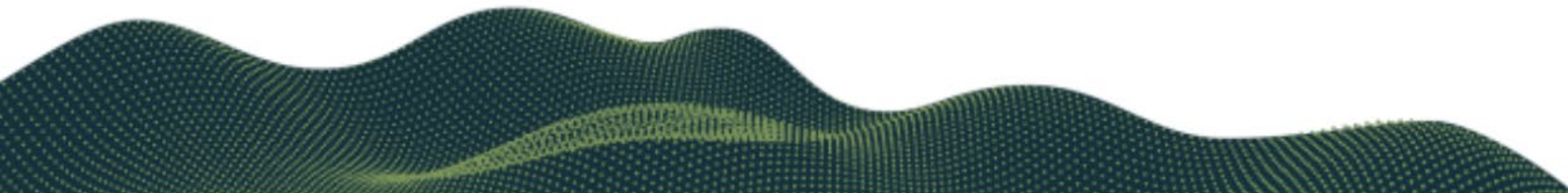




treating, purifying, separating and recycling water and wastewater

FIRMUS France treats and recycles grey water and effluents using membrane techniques.

Thanks to our technical manager, Jean-Christophe LASSERRE, we have been in touch with ESA since 1997 and been involved in several research programs and output publications.
All were focused on grey water recycling for long-span spaceflights.





First application of this ESA technology on Earth

The link between Space and the Earth ...The Antarctic Treaty

Appendix III of the Antarctic Treaty Protocol relating to the protection of the environment: Waste Disposal and Management signed in 1991 in Madrid.

ARTICLE 1

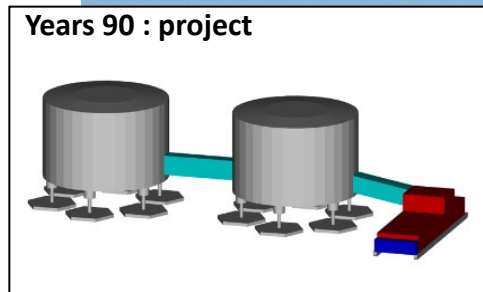
GENERAL OBLIGATIONS

- This appendix applies to activities carried out in the Antarctic treaty Zone which relate to the scientific research programmes, to tourism and to all other governmental and non-governmental activities in the Antarctic Treaty Zone for which prior notification is required in terms of Article VII, paragraph 5 of the Antarctic Treaty, including associated logistical support activities.
- The amount of waste produced or disposed of in the Antarctic Treaty Zone is to be reduced as much as possible in order to lessen its impact on the Antarctic environment and its repercussions on the Antarctic in terms of the natural environment, scientific research and other uses of the Antarctic which are compatible with the Antarctic treaty.
- The storage, disposal and removal of waste from the Antarctic Treaty Zone, as well as the recycling of this waste and its reduction at source are essential elements to be taken into consideration in organising and carrying out activities in the Antarctic Treaty Zone.



Concordia Research Station

- Altitude: 3200 m (equivalent to 3800 m)
- Nearest station: Vostok (Russia) at 600 km
- Summer period (3 months from November to early February)
60 to 80 people. Temperature between -20°C and -50°C
- Winter (9 months: from February to the beginning of November)
13 to 15 people. Temp. down to -80°C, average at -65°C
Permanent night from May to early August





Chronology of the operation

➤ **2000: ESA mock-up validation test**

- Duration: 6 month
- Shower and condensation water
- With microbial accident simulations



➤ **Spring 2002:** Characterisation of Concordia Grey Water

- Tests on the various membranes

➤ **Summer 2002:** 100 hour test of the ESA mock-up using grey water similar to that of Concordia

➤ **Spring 2003:** Design dimensions, assembly, integration and testing of the GWTU*

➤ **Spring 2004:** Long-duration test at the "*Lycée de La Canourgue*" college site

- Duration: 3 months
- Water from kitchen and student residences



➤ **Since 2005:** Treatment of Concordia Grey Water





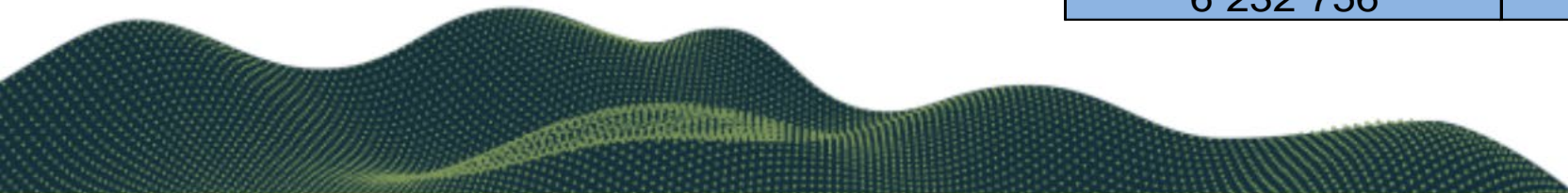
Perfect results

This process has been working since 2005 and has been used by more than 1,300 people without any health incident or technical issue.

No technical shutdown since it was put into service.

Parameters	Unit	Grey Water Average 2005-2021	Treated Water Average 2005-2021	ESA standard hygiene water	Drinking Water standards
COT	mg/l	216	3,20	10	2
Chlorure	mg/l	65	1,08	200	250
Nitrate	mg/l	0.71	0,12	25	50
Phosphate	mg/l	32	0,18	5.0	5.0
Sulfate	mg/l	25	0,43	250	250
Sodium	mg/l	115	5,90	150	200
Potassium	mg/l	19	2,30	12	12
Ammonium	mg/l	15	0,60	0.5	0.1

Grey Water Treated (liters)	Treated Water (liters)	Recycling rate (%)
6 232 756	4 985 854	80





Always an active presence



The training of future overwinterers
(technical staff and ESA doctor)



Technical Intervention
on the Station
in 2010/2011



Detachment of a
technician
to the Station
(summer 2016 2017)

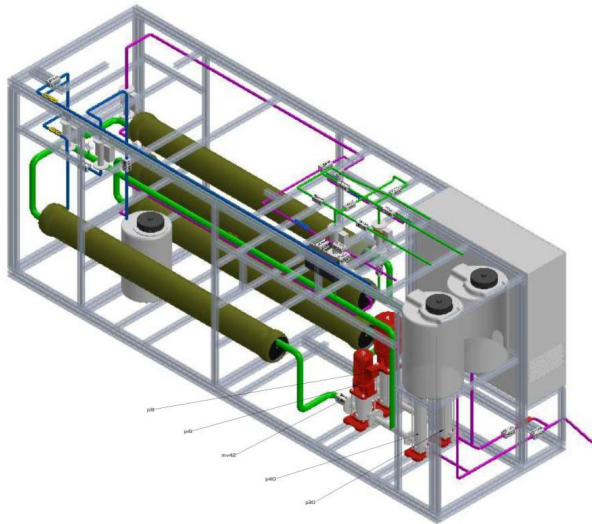




Revamping the unit

2018: realization/expedition of the electrical cabinet and modification of the 3D layout

2019 : on-site intervention in November and December to carry out the work and update the automation system.





Now, we think that time has come to transfer this knowledge, inherited from our collaboration with ESA, to more practical application on earth.

Our process shows that this technology is perfectly handled and without any health hazard.

It cannot be denied that using drinking water for toilet flush, laundry, floor cleaning and even showers, is pointless, all the more, as it becomes increasingly urgent to save water"



Firmus Grey Water Recycling System

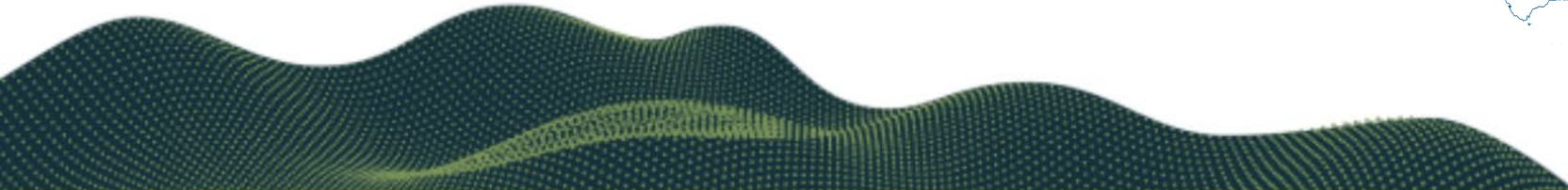


Photo - Caroline Hernandez / Unsplash



wash water > save water



*Preserve drinkable water
ressources for future
generations*





Set up tools to demonstrate the benefits of the process



1 - Unique simulation software

- › Sizing and simulation of the FGWRS process coupled with energy recovery according to your project
- › Real-time display of water and energy savings
- › **Developed in collaboration with Sherpa Engineering**



Set up tools to demonstrate the benefits of the process

2 - A mobile station: Demonstrator





FGWRS

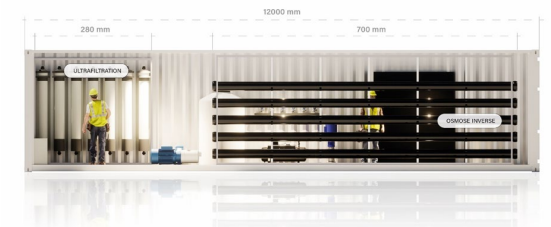
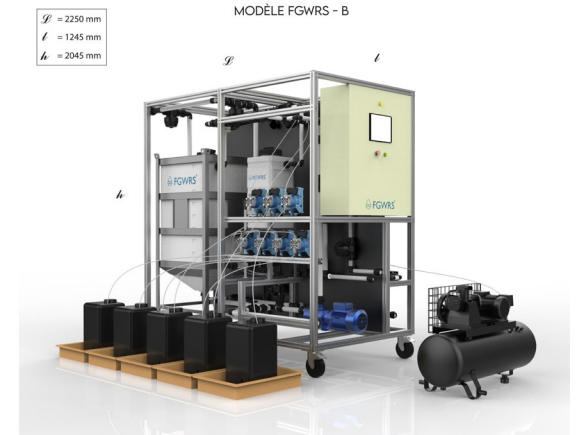
Define a complete range



home station
wash water › savewater



collective station
wash water › savewater



PROJET 10 m³.H
Station de recyclage des eaux grises 10m³.H - Container 40 pieds
Esquisse 29.08.2022



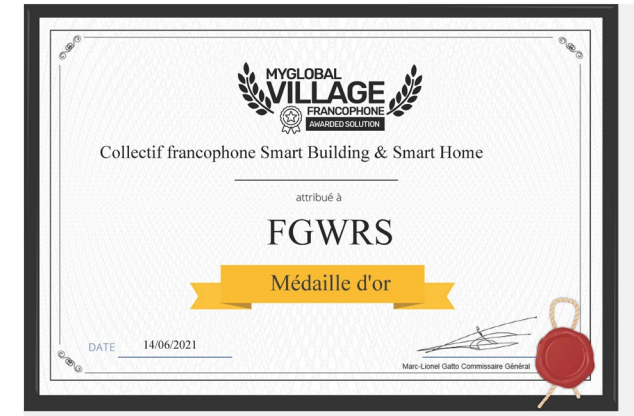
Communicating and obtaining labels

› The **Solar Impulse Efficient Solution label** seeks to bridge the gap between ecology and economy, bringing together protection of the environment and financial viability to show that these solutions are not expensive fixes to problems, but rather opportunities for clean economic growth.



› **New project in Antarctica with the Prince Albert II of Monaco Foundation in collaboration with ESA.**

Departure of Justin SARGENTI in December 2022 for two months.



› **Gold medal for French-speaking group Smart Building and Smart Home**

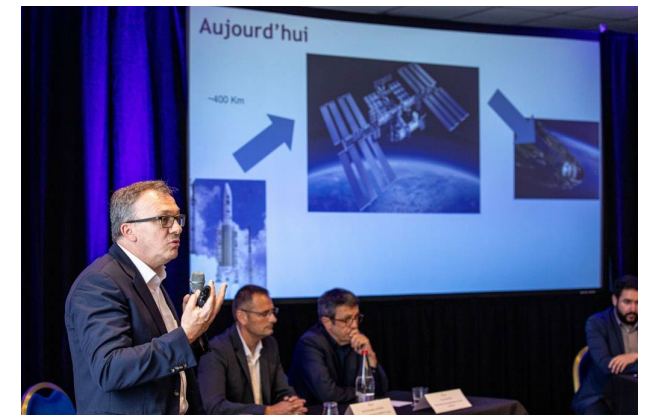


Presenting results to convince

(FAIRMONT MONTE CARLO)

- 4 "connected" rooms
- Parameter readings every 30 s
(Pressure, flow rate, temperature, turbidity, conductivity)
- Sending data every 6 hours for analysis
- Remote monitoring and intervention
- 21.11 m³ of treated water produced for 24.93 m³ of grey water collected :
85% efficiency !
- Average electricity consumption : 1kWh/m³ of treated water
- Average temperature of treated water: 25,8°C
- Water analyses by Independent and accredited laboratory: Drinking Water quality
- Energy recovery potential *: 51 176 kWh/year
- Carbon footprint *: -11,7 tCO₂/year

*based on 100 rooms, 1 pers/room, 70l/d of grey water collected, T_{moy}= 25.8°C, Recycling rate 85%





Demonstrate in real life situations

› **Roland GARROS Tennis Tournament**

- Tournament 2020,2021, 2022
- Get a exemption from the ARS

- **2020 : 23 m³ of drinking water saved**
- **2021 : 30 m³ of drinking water saved**

- **Recovery of 50% of the thermal energy**
from grey water for preheating domestic hot water



› **Monaco Pavilion Expo Dubaï 2020**

- From October 1, 2021 to March 31 2022

- **More than 37 653 liters of drinking water saved as today**

› **Océanographic Museum of Monaco**

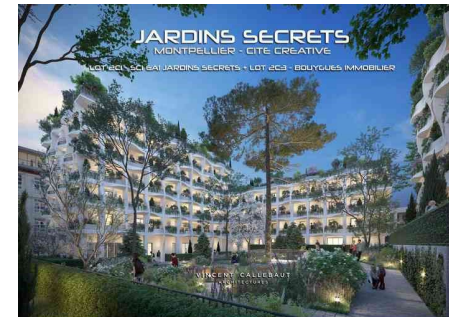
- **14,480 Liters of drinking water saved between June 26 and October 31, 2022 with 4 sinks**





Working on new projects

- Renovation public Building Bel Air Monaco (collective Station)
- Villa Belgica Monaco (Home Station)
- Villa Henri Monaco (Home Station)
- Dance School Liège (Blegium) (Collective Station)
- Laundries (Mobile Station in test with the laundry of the Montpellier Hospital)
- Renovation Private Building Schuykill Monaco (Collective Station)
- Renovation Private Building Bahia Monaco (Collective Station)
- New Buliding : Les Jardins Secrets Montpellier.





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www.melissafoundation.org

Follow us



THANK YOU.

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