



An Alternative Water Generation Plant

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Introduction

BTG, a specialty pharmaceutical company, needed to replace their obsolete purified water generation plant (the Quattro) to continue to expand their manufacturing operations.

Problem Statement

There was not enough purified water (PW) being generated to meet the demands of production. Table 1 and Table 2 illustrate the increase in demand following utility upgrades and how this exceeds the Quattro's output of ~2000l/h. Furthermore, the Quattro required regular chemical sanitisation which was time consuming and harmful to the environment.

Table 1: PW usage prior to utility upgrades		
Utility	PW usage (l/h)	Output
Water for Injection	500	420 l/h
Steam Generator	270	250 kg/h
Clean in Place	350	500 l/h
Points of Use	850	1,000 l/h
PW usage	~1,970l/h @ max demand	

Table 2: PW usage after utility upgrades		
Utility	PW usage (l/h)	Output
Water for Injection	1,023	900 l/h
Steam Generator	270	250 kg/h
Clean in Place	500	500 l/h
Points of Use	1,500	1,500 l/h
PW usage	~3,293l/h @ max demand	

Aims and Objectives

Project Aims

1. Meet current and future water demand.
2. Alternative method of sanitisation.
3. Comply with regulations and industry standards.
4. Automatic control and continuous monitoring of new system.

Project Objectives

1. Upgrade critical utilities to support new water generation plant.
2. Improve the infrastructure.

Timing Plan

Seven-week maintenance window was planned from the 07th of February 2023 – 31st of March 2023

Difficulties Encountered

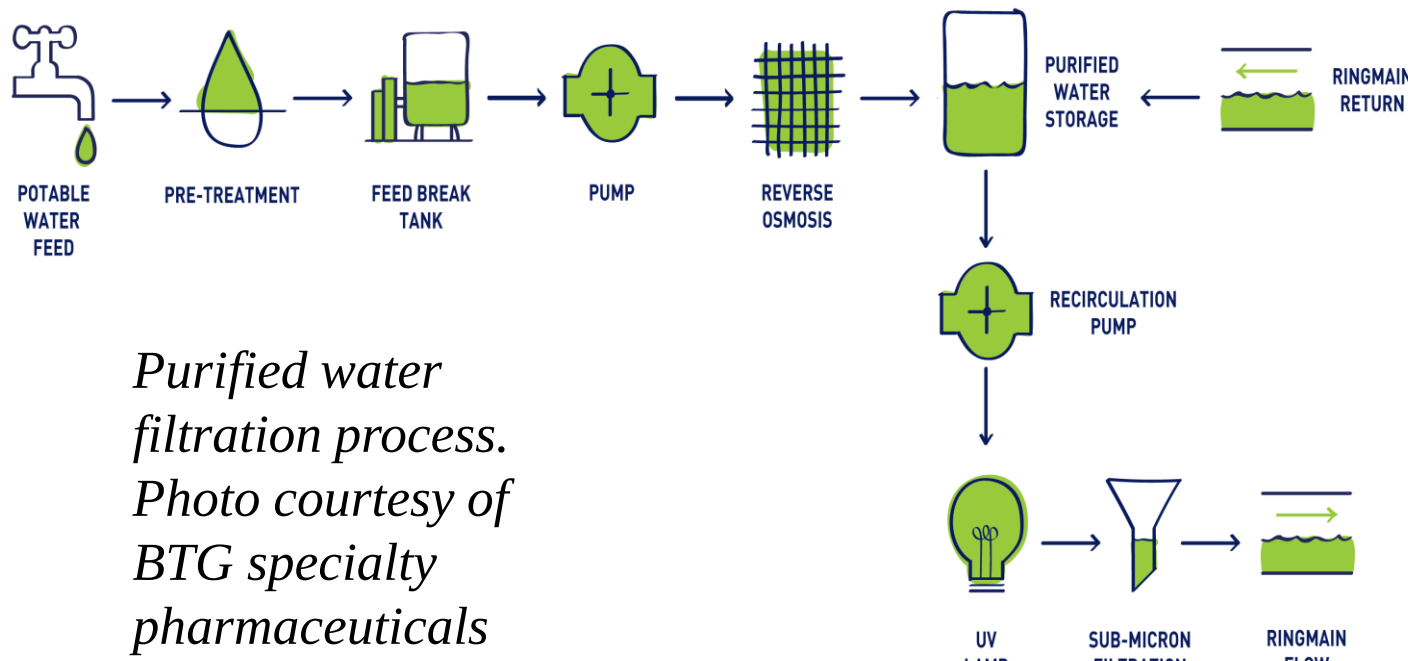
- Global shortage of microchips
- Urgent processing of ricin antidote
- Key members of staff leaving.

Milestones Achieved

- Procurement during the pandemic
- Unique sample and validation plan
- A successful first week

Research

PW is water that has been mechanically filtered and is free of impurities and microorganisms.



Three alternative purified water generation technologies were researched:

- Ultrafiltration (UF)
- Distillation
- Reverse Osmosis (RO)

- ❌ UF did not meet the project aims
- ❌ Distillation was too high an initial and operating cost

- ✓ RO met all the project aims. The Orion, a PW generation plant capable of producing 4m³/h, exceeded expectations with sustainability features such as recovery and recycle modes and thermal sanitization. It was manufactured from stainless steel in line with regulations.

Orion Purified Water Generation Plant. Photo courtesy of Veolia Water Technologies



Work Carried out

Budget

Option	Technology	Supplier	Cost
1	Ultrafiltration	Meco	£298,000
2	Reverse Osmosis	Veolia	£365,506
3	Distillation	Steris	£455,000

Support Upgrade	Cost	Total
Utilities	£24,865	£430,000 ±5%
Infrastructure	£39,629	

Installation

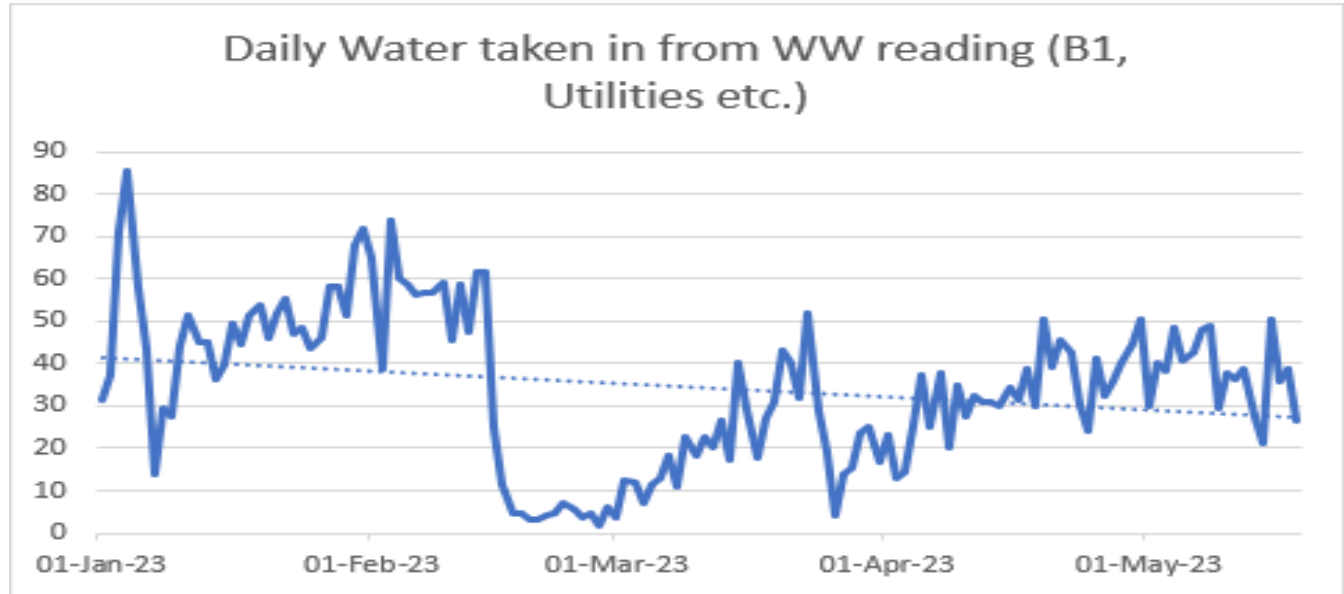
Infrastructure, utilities and Orion installation



Results and Conclusion

Measured against the project aims

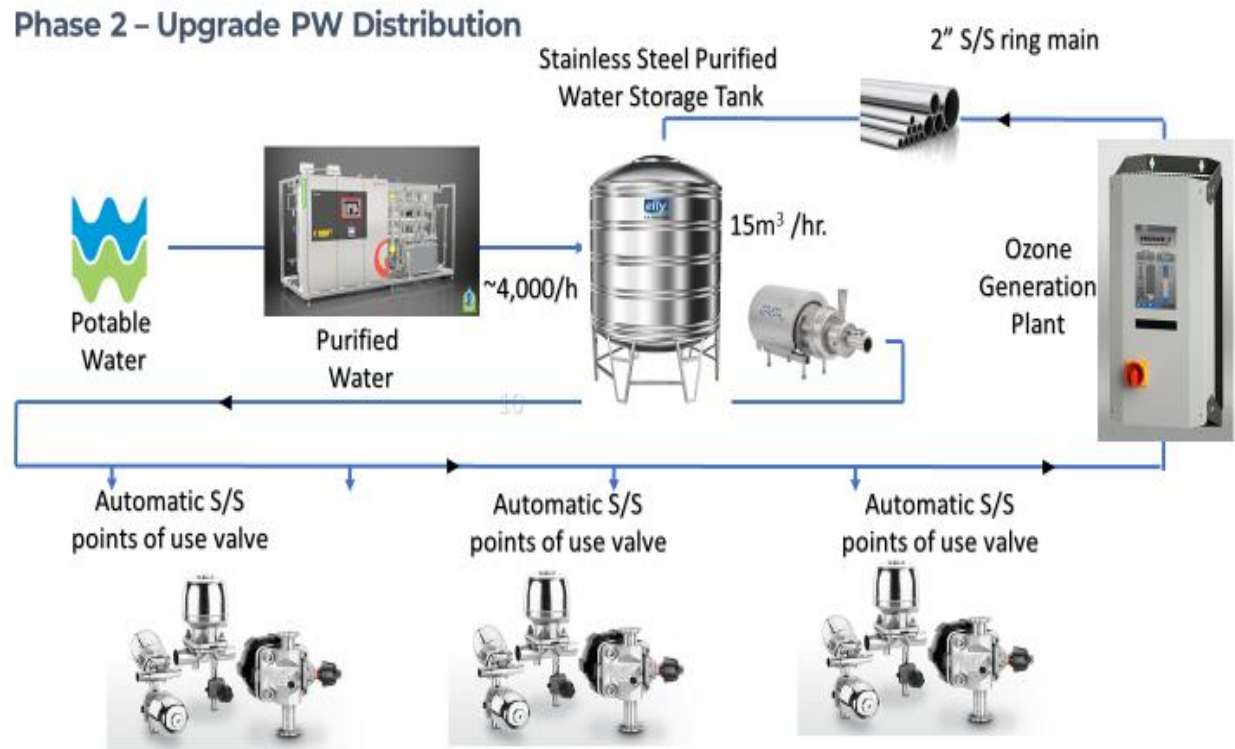
- ✓ Orion Output 4,000 l/h
- ✓ Thermal Sanitisation @ 85°C
- ✓ Manufactured from Stainless Steel
- ✓ Fully Automatic Process



Average water consumption drops post Orion installation

Good communication, thorough research and robust timing plan all helped to successfully install the Orion at BTG.

Further Work



Phase 2 to upgrade the purified water distribution system

Following phase 1, upgrading the generation system, phase 2 is to upgrade the distribution system to include, stainless steel tank, automatic valves and ozone sanitisation which will begin in November 2023.

Acknowledgements

My wife for her encouragement and support throughout my studies.

References

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Veolia. (2020). *PHARMACEUTICAL Pure Water Guide*.