Welcome

WEDECO - The Environmentally Friendly UV Technology

Presenter: **Faarish Fareed**

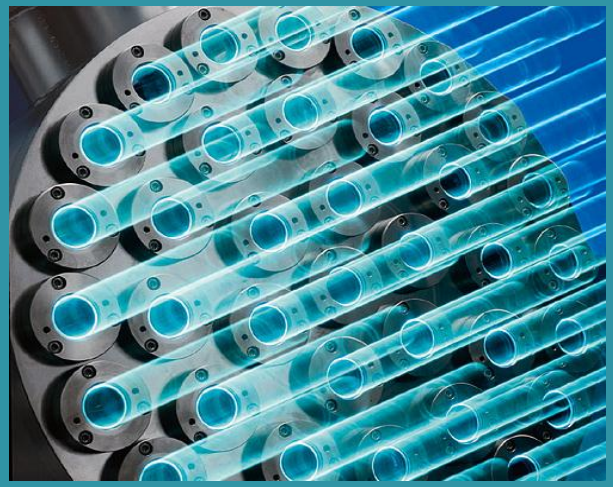
WEDECO

a xylem brand

General about WEDECO

WEDECO concentrates on chemical free water/wastewater treatment with:

UV-Disinfection



OZONE-Oxidation

More Than 250,000 installations worldwide

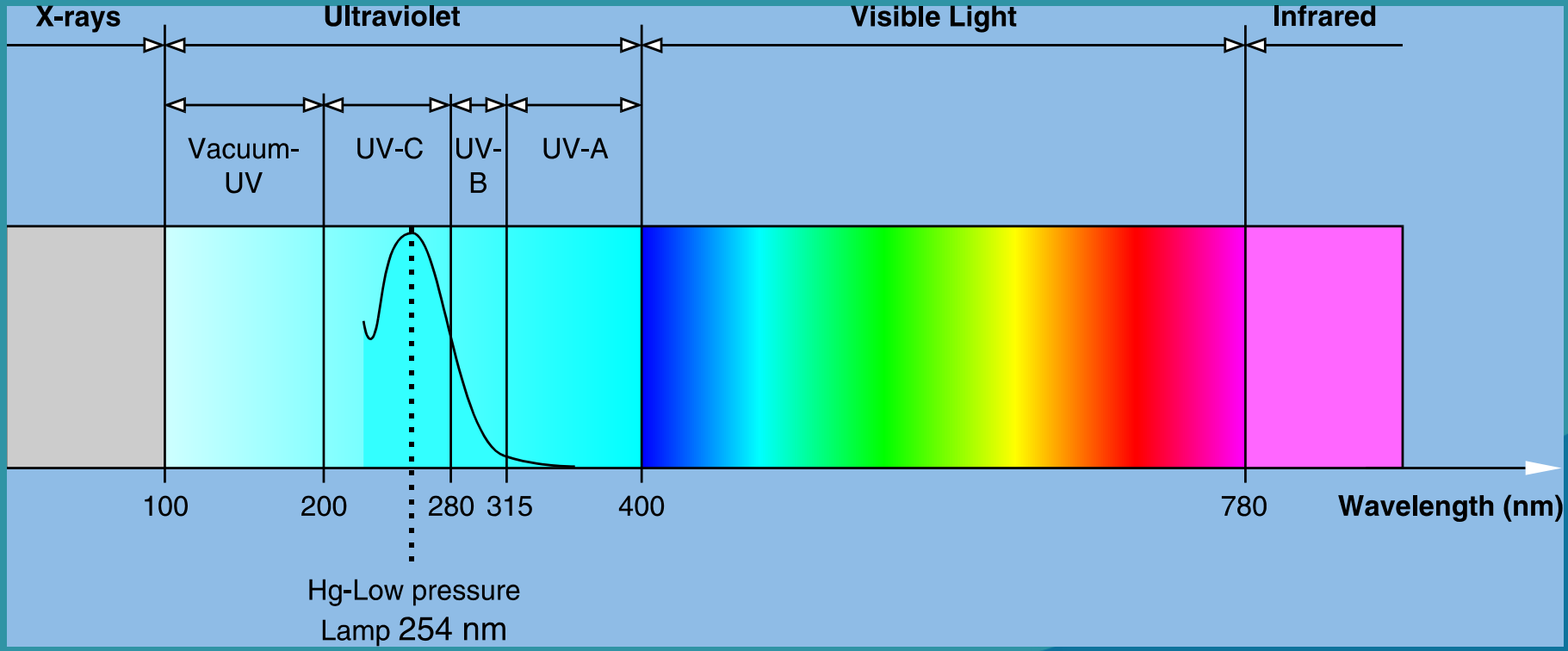
WEDECO

a xylem brand

Ultraviolet light (UV) – everybody needs it.

WEDECO
a xylem brand

The Principle of UV Technology



WEDECO
a xylem brand

The Principle of UV Technology

Ultra-violet (UV) light can be commonly divided into the following sections;-

- UVA: 315 - 400 nm (skin pigmentation – sun tan)
- UVB: 280 - 315 nm (vitamin D synthesis etc)
- UVC: **200 – 280 nm** (germicidal; max absorb of DNA)
- Vacuum UV: 100 – 200 nm (reaction with oxygen to ozone; ozone producing lamps – 185 nm)

WEDECO
a xylem brand

The Challenge – Removal of Pathogens

The common pathogens in drinking and waste water

Group	Type	Disease
BACTERIA	Coliforms	Fever, intestinal disease
	Salmonella	Typhoid fever
	Vibrio	Cholera
	Legionella	Pneumonia
	E.coli	Fever, gastro-intestinal disease
VIRUSES	Hep A	Hepatitis
	Polio	Polio
PARASITES	Cryptosporidia	Intestinal disease
	Amoeba	Amebiasis

WEDECO
a xylem brand

Disinfection Methods

Method	Target Organism	Comments
Chlorine	Bacteria & Viruses	THM formation, overdose
Chloro-dioxide	Bacteria & Viruses	Chlorite formation, overdose
Ozone	Bacteria, Viruses, Parasites	add. Biodegradability
Other chemicals	Bacteria, Viruses, Parasites	mostly prohibited
Ultra-violet Radiation	Bacteria, Viruses, Parasites	no by-products, no residual
Filtration	Bacteria & Parasites	cost intensive

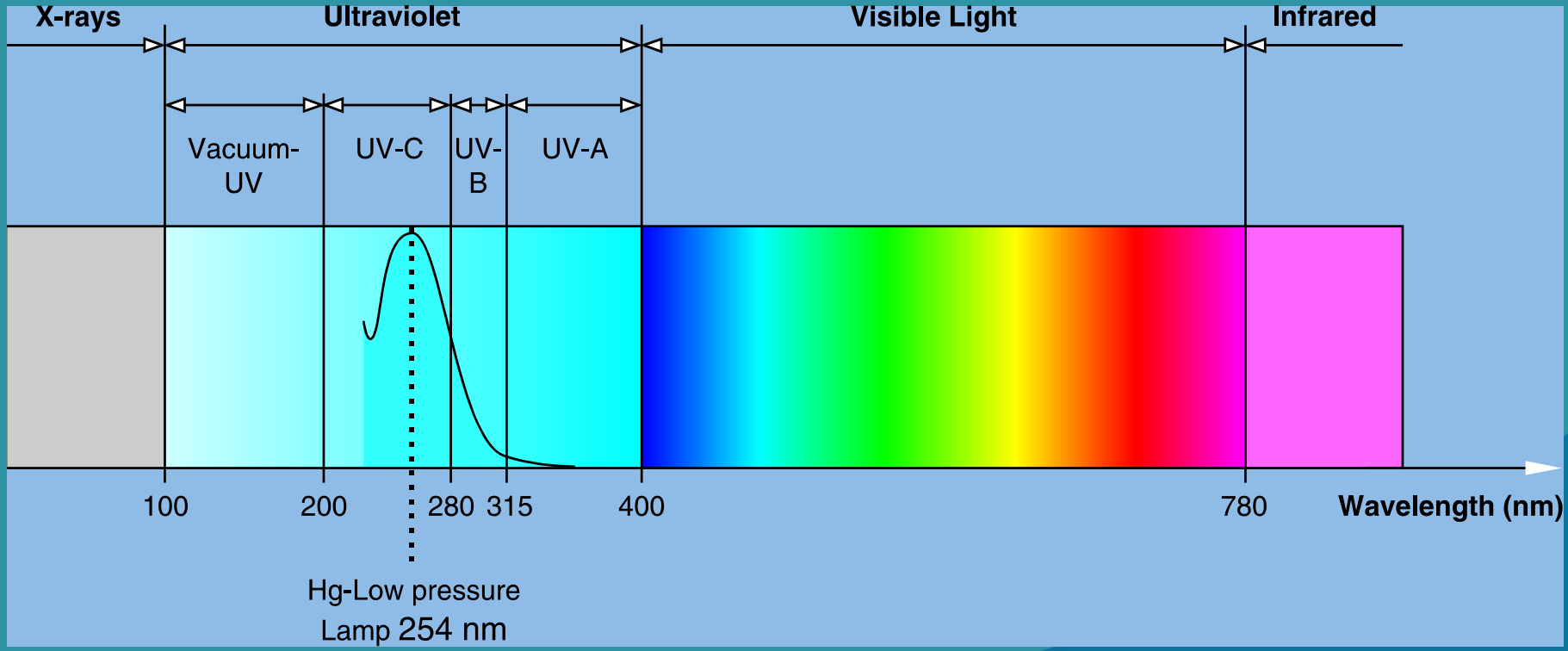
WEDECO
a xylem brand

Goal of UV Disinfection

- **Meeting drinking water disinfection requirements**
- **Product and process water disinfection**
- **Disinfection of waste water to comply with bathing water or irrigation water standards**
- **Act as part of multi-barier disinfection technology**

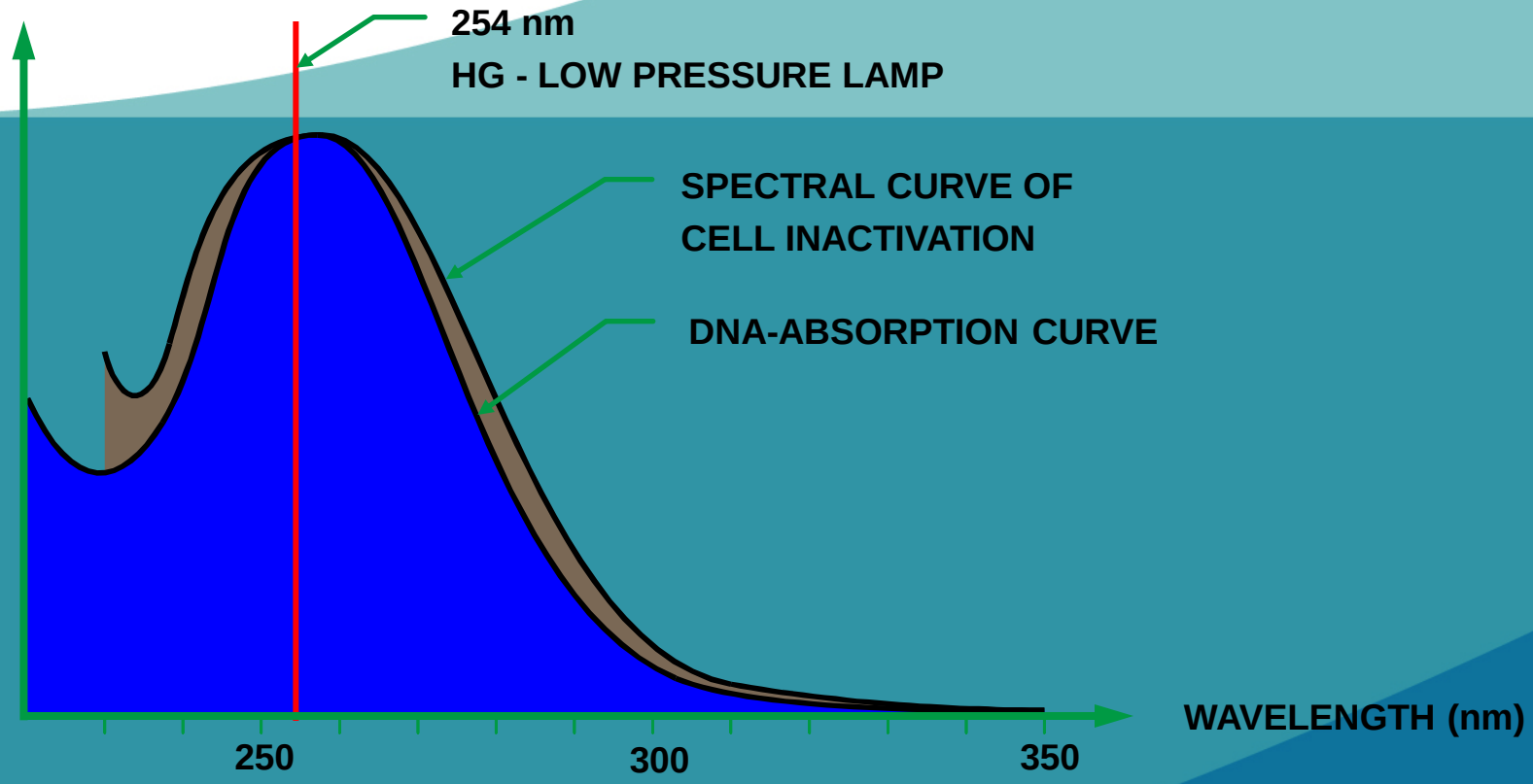
WEDECO
a xylem brand

The Principle of UV Technology



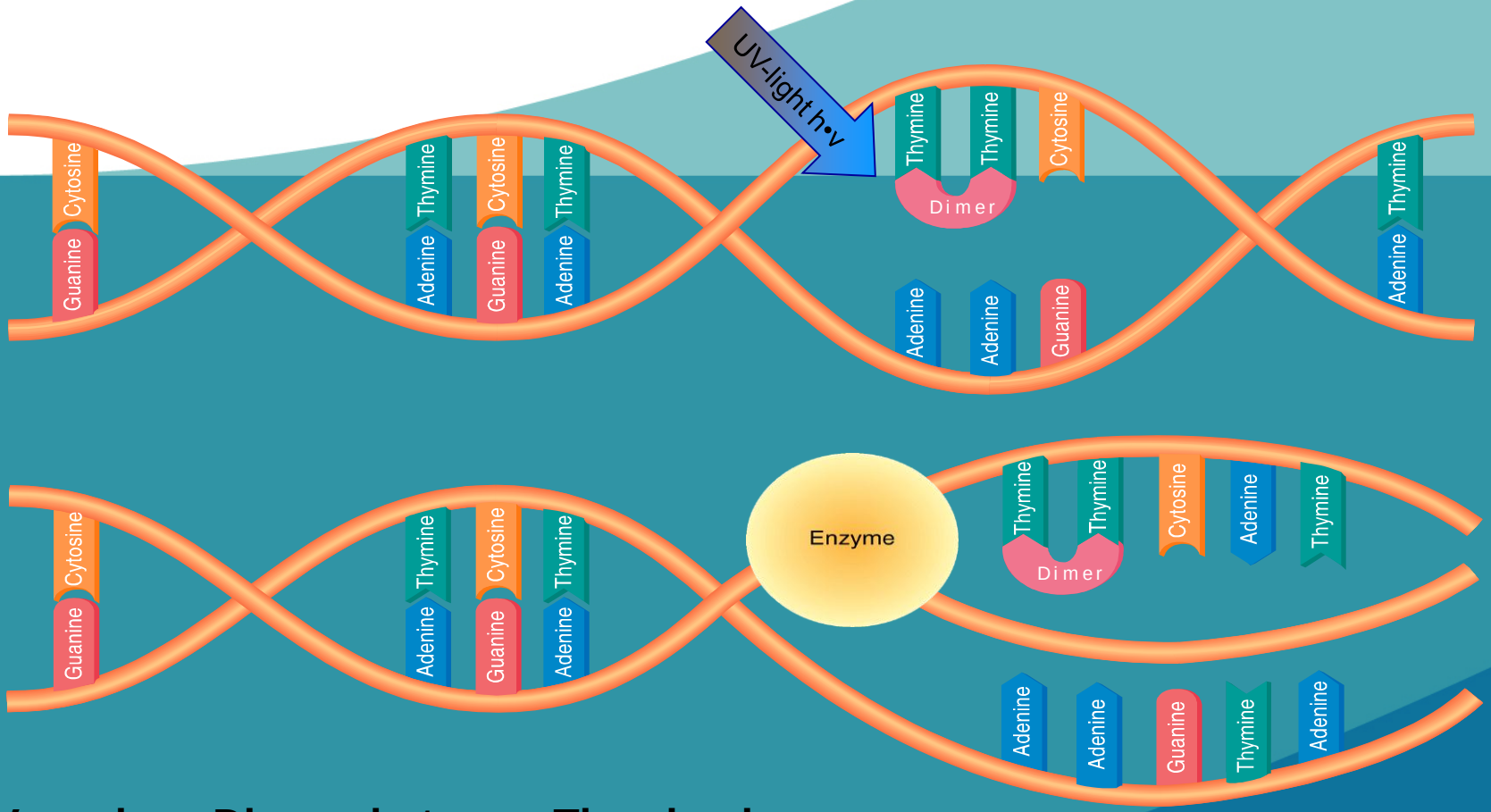
WEDECO
a xylem brand

Inactivation Curve – Cellular Level



WEDECO
a xylem brand

Inactivation of pathogenic microorganisms due to photo-oxidation of DNA

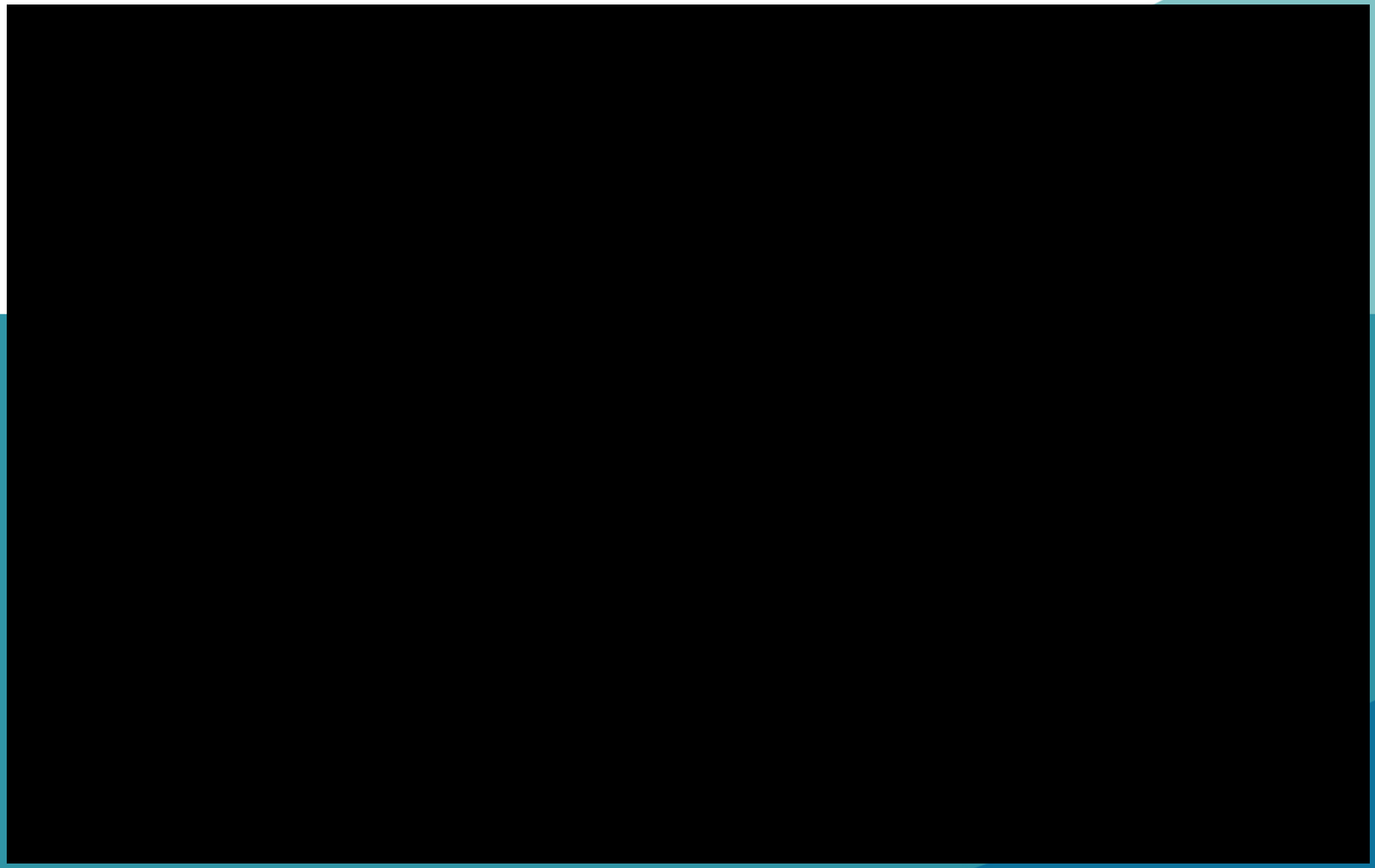


UV produce Dimers between Thymine bases;

Enzymes do not work anymore

WEDECO

a xylem brand



WEDECO

a xylem brand

The Benefits of UV

Easy and reliable to apply

No change of water chemistry

Disinfection within seconds

No need of contact tank

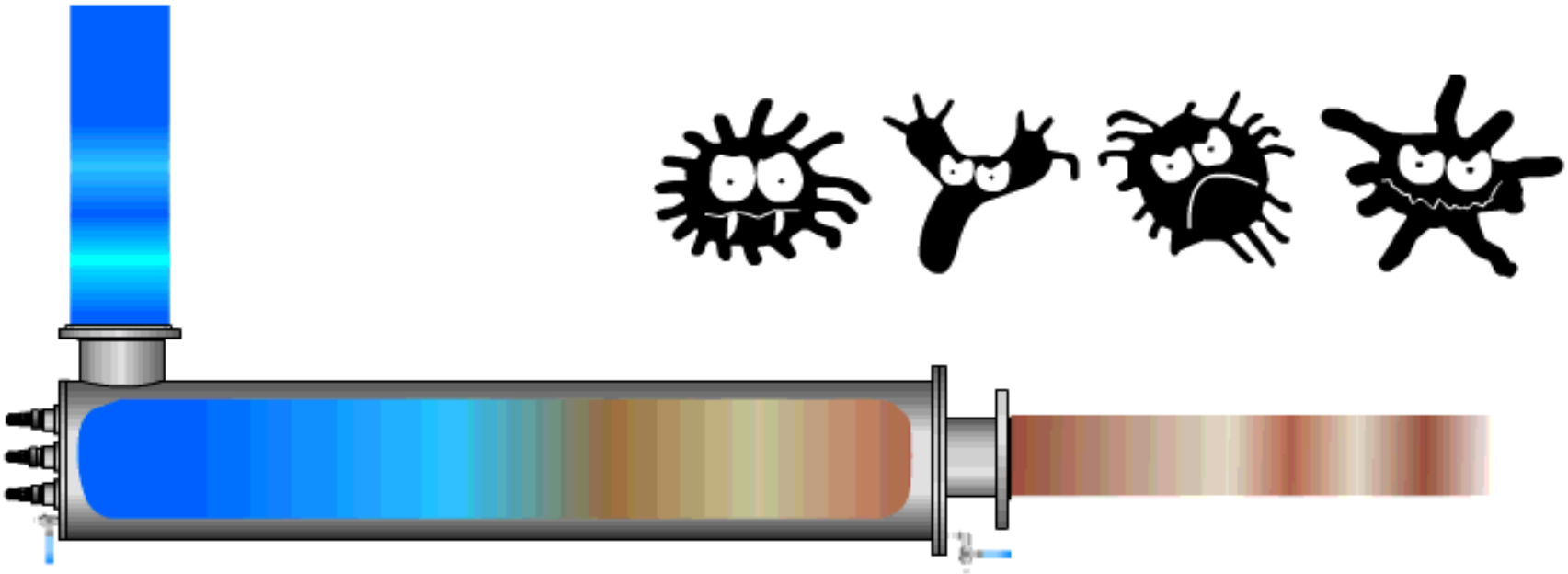
- No by products or residuals
- No effect on odour and taste
- No regrowth of viruses, bacteria and parasites
- No corrosion
- No hazardous chemicals handling, transport & storage
- No resistance as with chlorine
- Less space requirement
- On site disinfectant production

Strong movement from chemical disinfection to physical biotechnology

WEDECO

a xylem brand

Simple Concept “BUT” Effective



WEDECO

a xylem brand

Key Parameters in the UV Design

Average Retention Time:

flow rate / reactor volume

min. velocity

max. velocity

headloss

Average Intensity:

lamp output

lamp age

quartz sleeve transmittance (coating)

water quality (UV transmittance)

UV Dose = Retention Time x UV Intensity

[mJ/cm²] = [s] x [mW/cm²]

WEDECO

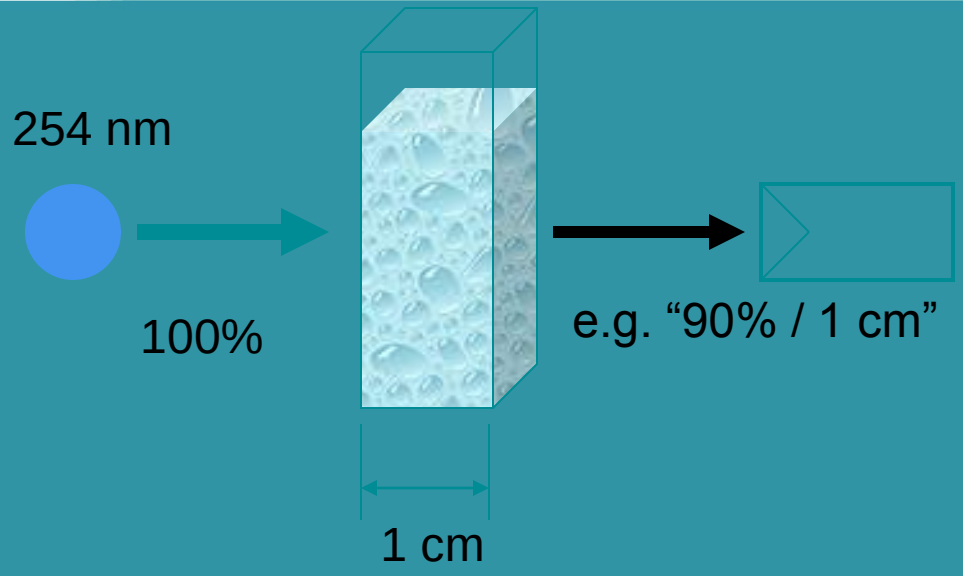
a xylem brand

UV Transmittance (UVT)

- **UVT = percentage (%) of UV light passing through material (e.g. a water sample or quartz) over a specified distance.**
- The lower the UVT value, the lesser UV light is available for disinfection.
- In consequence, a lower UVT will require a higher UV power to be applied to receive the same UV dose.

WEDECO
a xylem brand

UV Transmittance (UVT)



Typical drinking water UVT: ~ 85 – 95% / 1 cm @ 254 nm

Filtered wastewater UVT: ~ 60 – 70% / 1 cm @ 254 nm

WEDECO

a xylem brand

Peak Flow Conditions

- UV systems should always be designed on peak flow conditions
- For normal or average flows, the UV lamps can ramp down in power to match conditions and allow for power savings
- Optidose (variable power) very similar in concept to VSD operation

WEDECO
a xylem brand

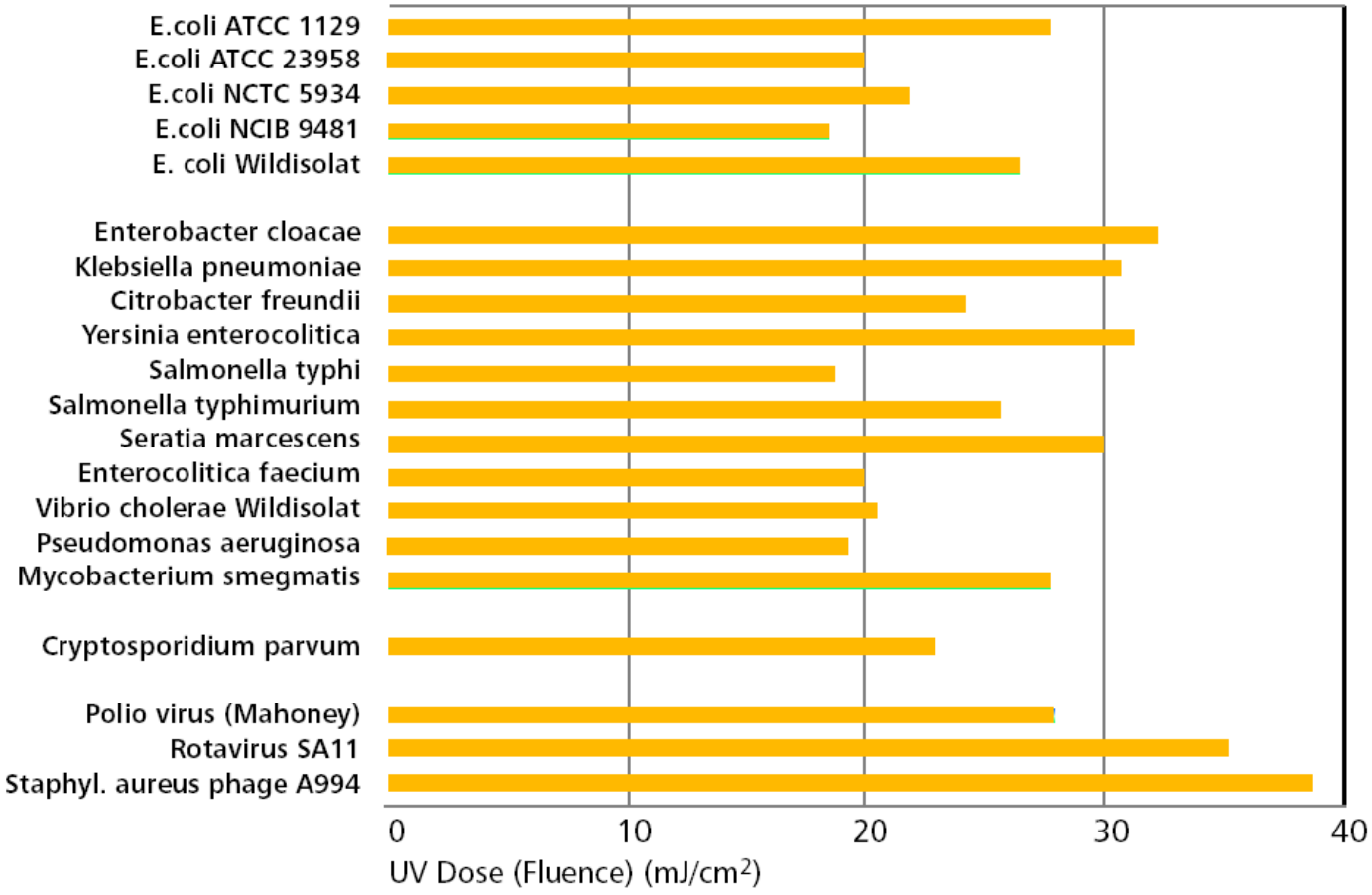
UV Dose Requirements

UV Dose for

3 log

(99.9%)

Inactivation



UV dose requirements include effects of photoreactivation

Source: University of Bonn

Typical UV Tender Specification for Tertiary Treated Sewage Effluent for re-use in KSA

Peak flow	=	e.g.100,000 m^3/day (site specific)
UV transmission	=	> 60%
Suspended Solids	=	5 mg/L average, 10 mg/L @ maximum
UV dose	=	80 mJ/cm^2 (UViDIS Dose)
Fecal Coliform target	=	2.2 CFU/100 ml (30 day geomean)

WEDECO
a xylem brand

UV Applications Overview

☞ Drinking water

-Raw water disinfection
-Chlorine removal
-Protection of ion exchanger and membranes

☞ Recycling + Waste Water

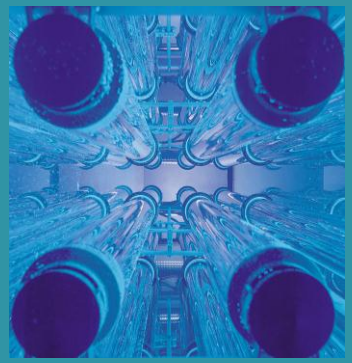
- Disinfection of waste water
- Disinfection of recycling water

☞ Food & Beverage

- Disinfection of product and brewing water
- Disinfection of CIP water
-Table water disinfection
- Disinfection of liquid sugar
- Head space disinfection of tanks
- Cap disinfection

☞ Bio–Pharma, Cosmetic

- Protection of ion exchange + membranes
- Disinfection of Purified or DI water
- Ozone destruction below detection level
- Disinfection of liquid sugar
- Disinfection of blood serum
- DI water for dialysis machines
- TOC reduction in RO water



☞ Swimming Pools

- Chloramine destruction
- Disinfection

☞ Micro-electronic

- TOC reduction
- Disinfection

☞ Process water

- Deionised water disinfection
- Water recycling -automotive industry
- Hot water loop disinfection (legionella)
- Cooling water disinfection

☞ Ships and Trains

- Drinking water and waste water
- Ballast water disinfection

☞ Aqua Culture / Zoos

- Fresh water disinfection
- Recycling water disinfection
- Waste water disinfection

WEDECO
a xylem brand

BX Series

WEDECO UV systems acc. to international drinking water regulations

- Wedeco **BX** series
- 400 J/m² biodosimetric dose
- optional automatic wiping system
- 12 - 2,120 m³/h flow capacity

WEDECO
a xylem brand

A/B - PE Series

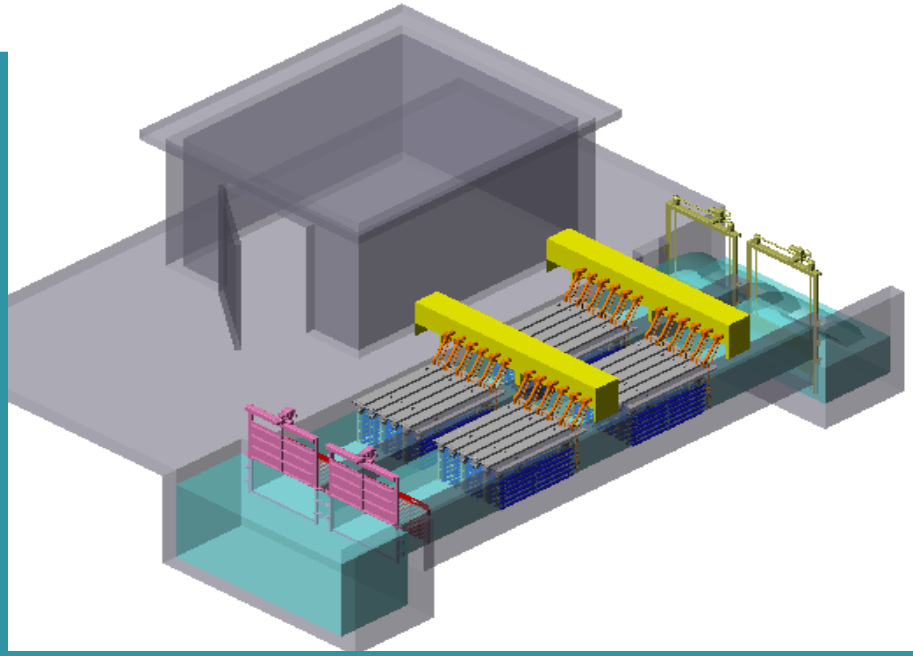
WEDECO UV systems
for corrosive mediums

- Wedeco **A/B-PE** series
- Polyethylene reactor
- 1 - 390 m³/h flow capacity

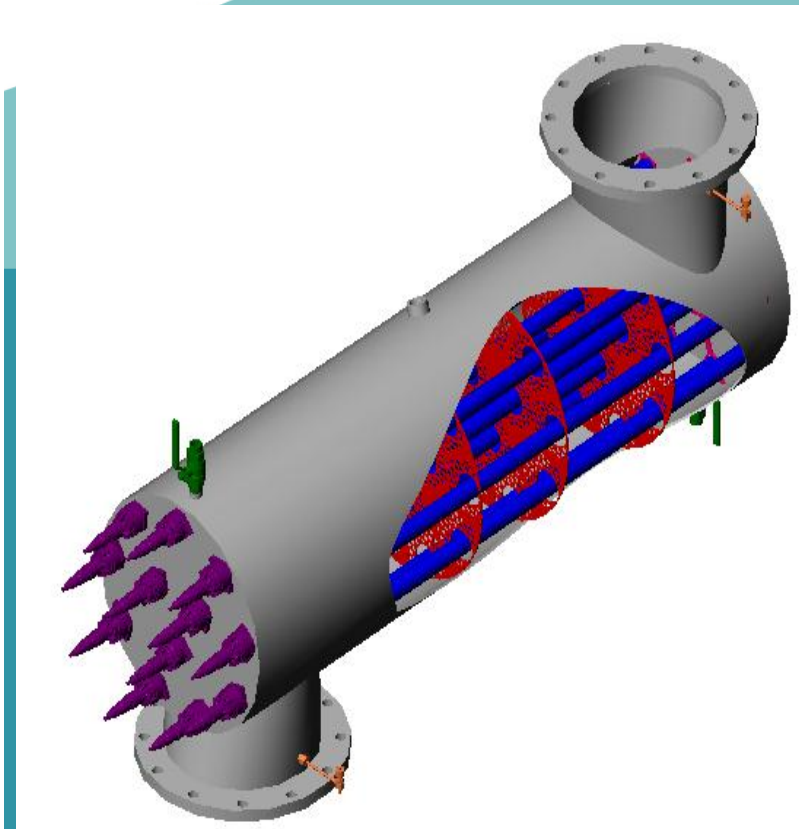
WEDECO
a xylem brand

06/02/13

UV systems used in Wastewater Disinfection



Open channel



Closed Vessel

WEDECO

a xylem brand

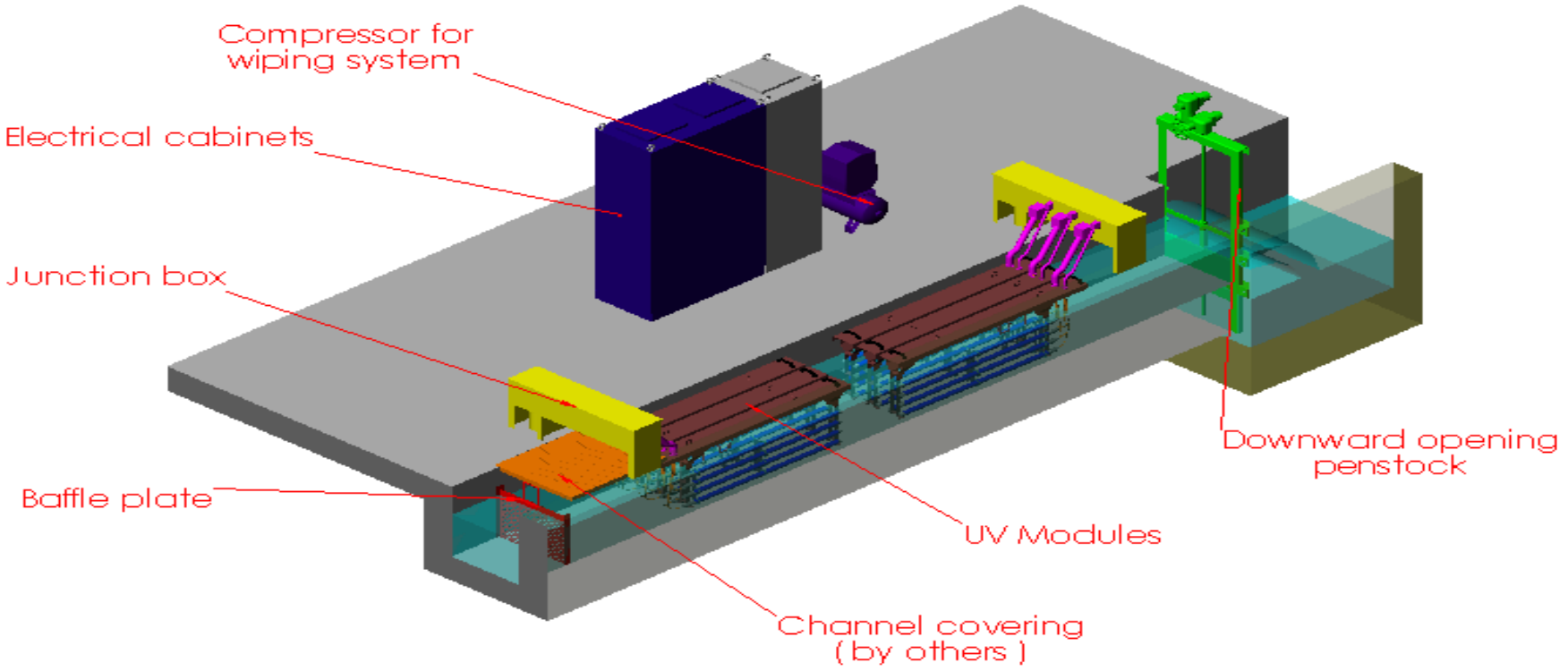
LBX Series

WEDECO UV systems acc. to international wastewater regulations

- Wedeco **LBX** series
- optional automatic wiping system
- 3 - 1,500 m³/h flow capacity

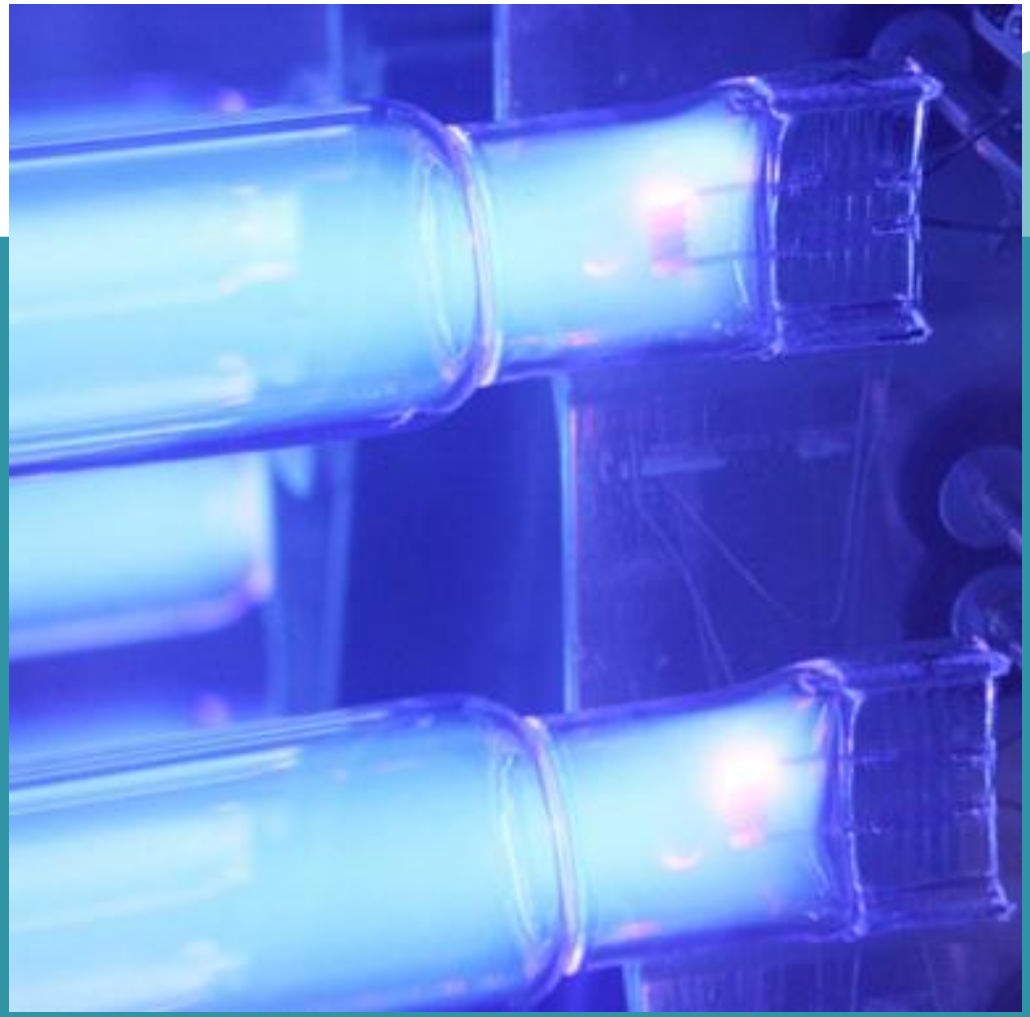
WEDECO
a xylem brand

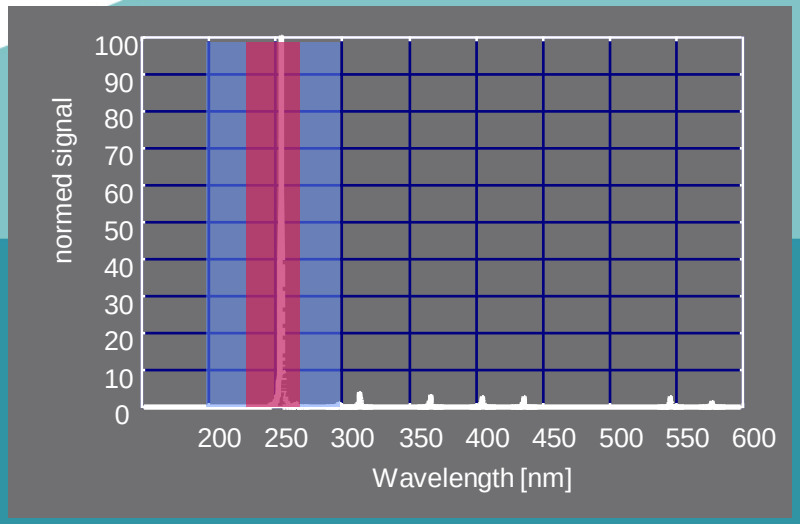
Traditional WEDECO TAK 55 Open Channel System (+30 years operational history)



WEDECO
a xylem brand

Lamp Type ECORAY ELR 30





ECORAY Lamp Specification

Lamp No# **ELR 30**

Input watts: **315**

Output watts (254 nm): **150**

Lamp life rating: **14,000 hrs**

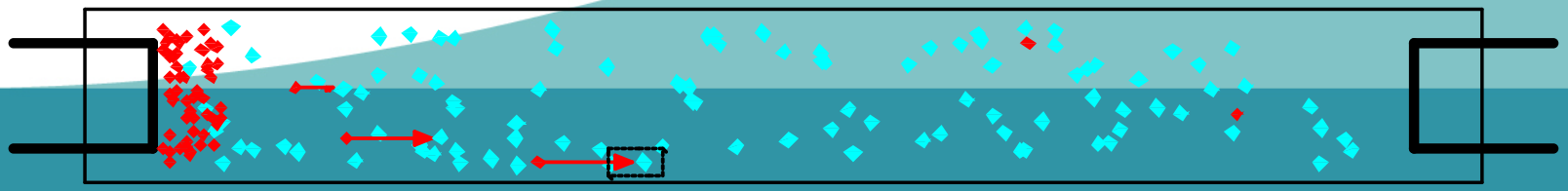
Turndown: **Linear turndown 50-100%**

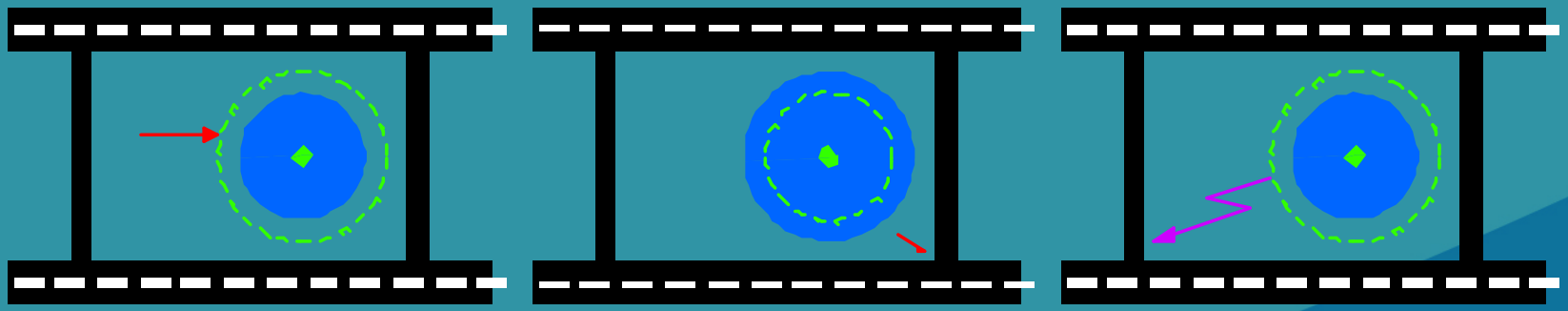
Lamp type: **Amalgam / Low Pressure**

WEDECO

a xylem brand

Mercury Gas Discharge Lamps

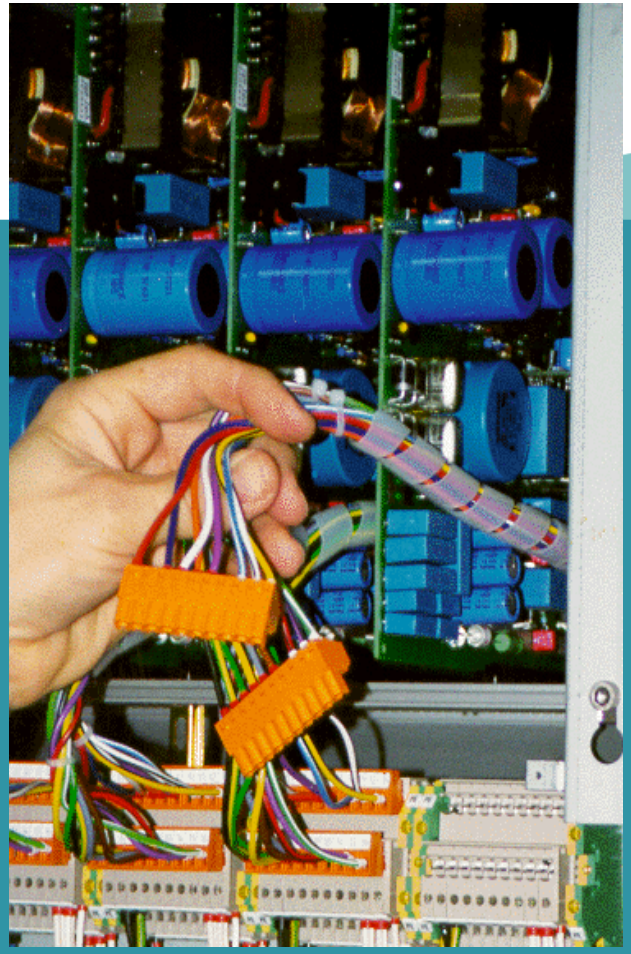


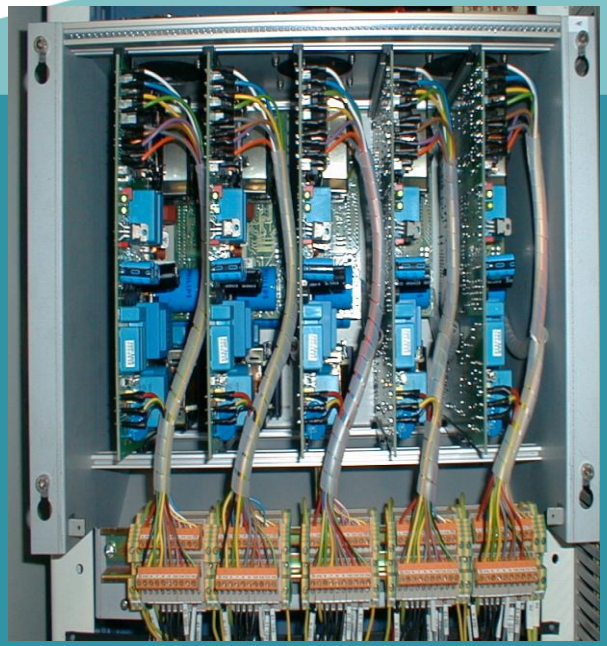


WEDECO

a xylem brand

Ease of Maintenance: Electronic Ballast Card

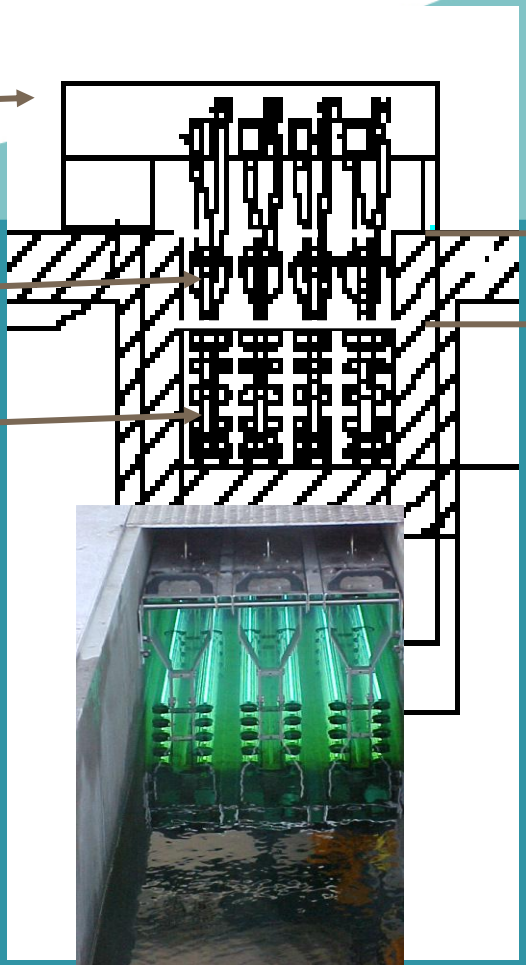




WEDECO

a xylem brand

Location of Ballast



WEDECO
a xylem brand

TAK Series 55: Module Arrangement in Banks

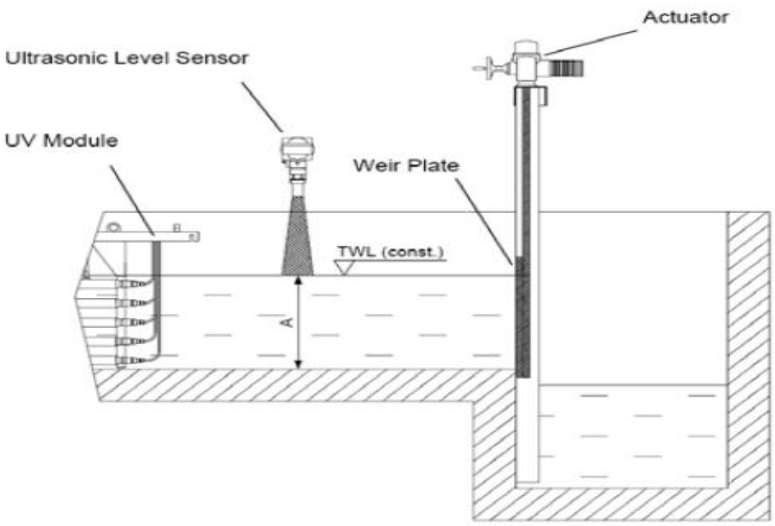
12 Modules wide

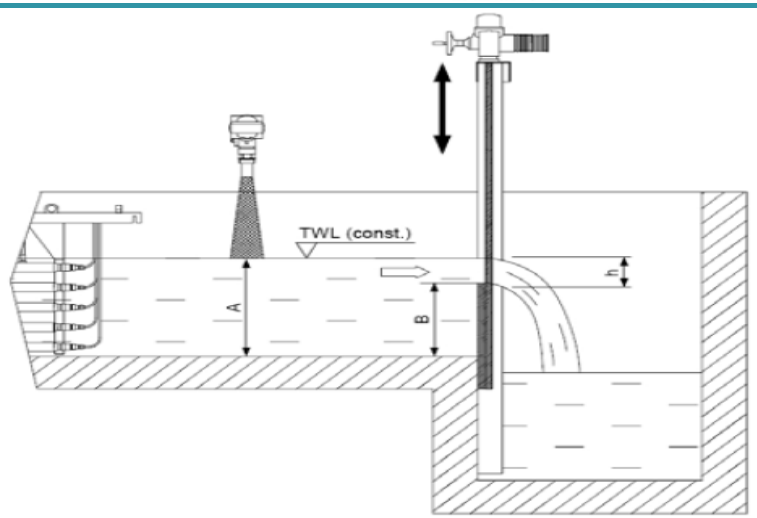
8 Modules wide

WEDECO

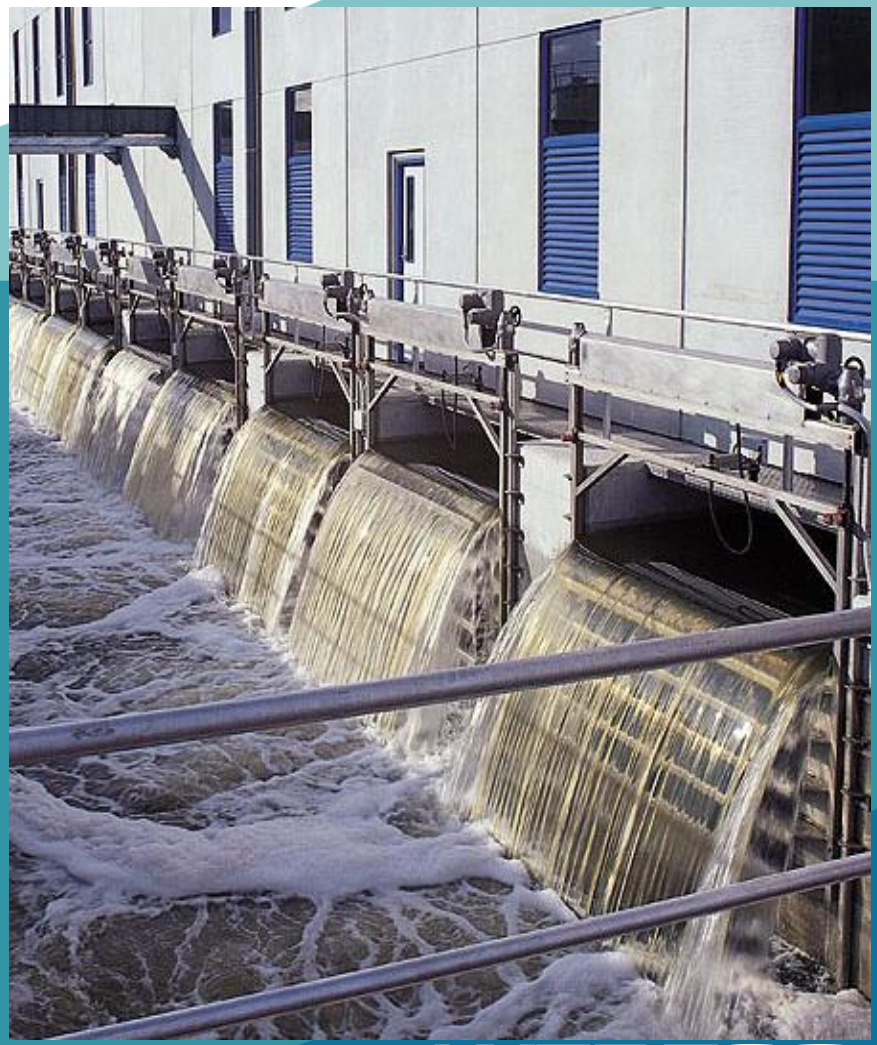
a xylem brand

Downward Opening Penstock





$$H = (Q / [2/3 * \mu * b * (2 * g)^{1/2}])^{2/3}$$



WEDECO

a xylem brand

UV Dose Pacing

UV Dose = Retention Time x Average Intensity

Intensity is a function of:

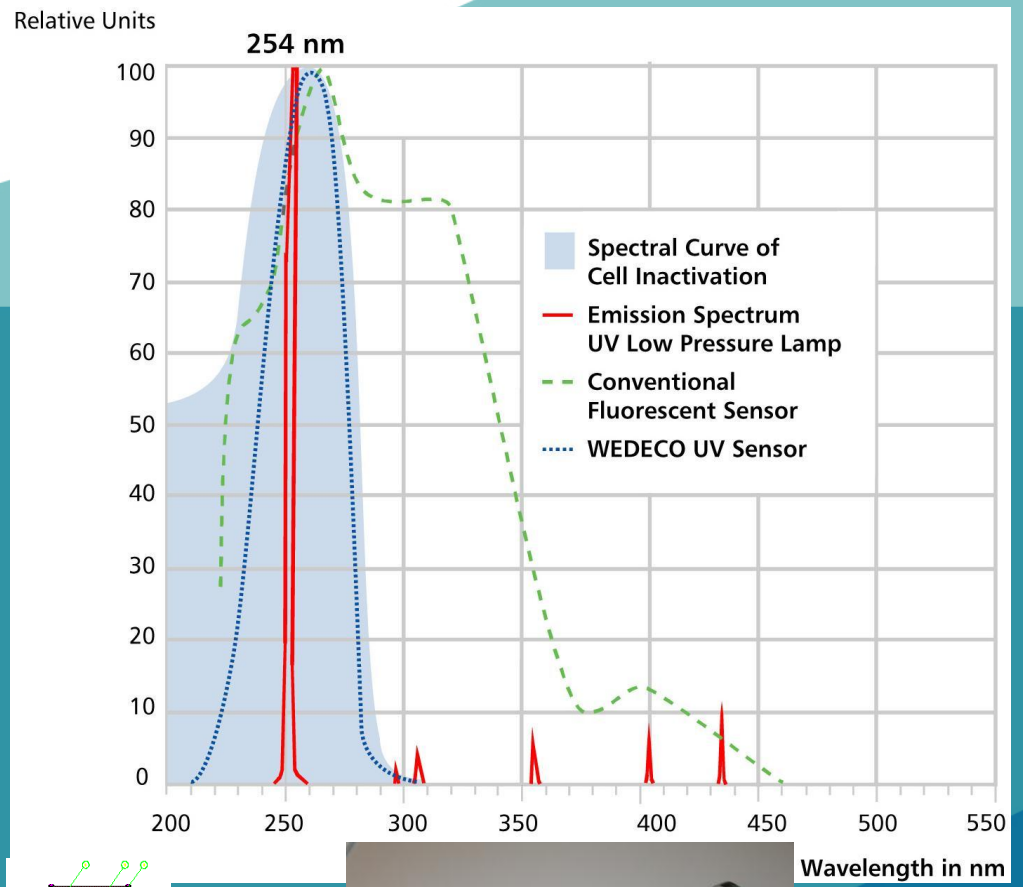
- lamp output
- lamp age
- quartz sleeve transmissivity (coating)
- water quality (UV transmittance)

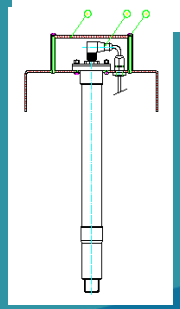
WEDECO

a xylem brand

UV Intensity Sensor

- Excellent selectivity @ 254nm to control UV-C Output: > 99%
- High accuracy ± 3%
- Factory calibration – no field adjustment necessary
- Perfect simulation of the spectral curve of cell inactivation
- (Similar Sensitivity than micro-organisms)
- 100% day-light blind
- Aging < 3% / 10,000 h
- Quick replacement / counter-check with reference sensor





a xylem brand

Reference list UV-disinfection

Waste Water disinfection with Type TAK for high flow rates (> 5.000 m³/h)

Project / Customer	Type	Flow rate, UVT	Contract award
South Mekkah SAUDIARABIA	TAK 55 with automatic wiping system	15.625 m³/h, 70%	12/2004
West Mekkah SAUDIARABIA	TAK 55 with automatic wiping system	7.813 m³/h, 70%	09/2005
North Jeddah SAUDIARABIA	TAK 55 with automatic wiping system	15.625 m³/h, 70 %	01/2006
Sharjah Phase 7 / Besix Sanotec NV U.A.E.	TAK 55 with automatic wiping system	5.314 m³/h, 65 %	10/2007
Sharjah Phase 4&5 / Besix Sanotec NV U.A.E.	TAK 55 with automatic wiping system	5.314 m³/h, 65 %	10/2007
Sharjah Phase 2&3 / Besix Sanotec NV U.A.E.	TAK 55 with automatic wiping system	3.543 m³/h, 65 %	10/2007
Jebel Ali U.A.E.	TAK 55 with automatic wiping system	22.643 m³/h, 65 %	05/2008
South Amghara & South New Jahra KUWAIT	TAK 55 with automatic wiping system	7.500 m³/h, 60 %	01/2009
South Jeddah STW Phase 4 SAUDI ARABIA	TAK 55 with automatic wiping system	15.625 m³/h, 65 %	02/2009

Mangere STP UV Installation Auckland NZ - World's Largest Open Channel by WEDECO > 7,700 UV lamps

WEDECO

a xylem brand

TAK World-Wide

> 1000 TAK Series
Global Wastewater Installations

WEDECO
a xylem brand

06/02/13

Customer Feedback after years of successful TAK 55 operation

- **UV is achieving disinfection target goal !!!**
- **Can number of UV lamps be reduced if a similar system was designed today?**
- **Can electricity consumption be optimised?**
- **Can replacement of UV lamps be made any easier than lifting out the modules ?**
- **What has WEDECO done in terms of R&D for the open channel UV system lately?**

WEDECO
a xylem brand

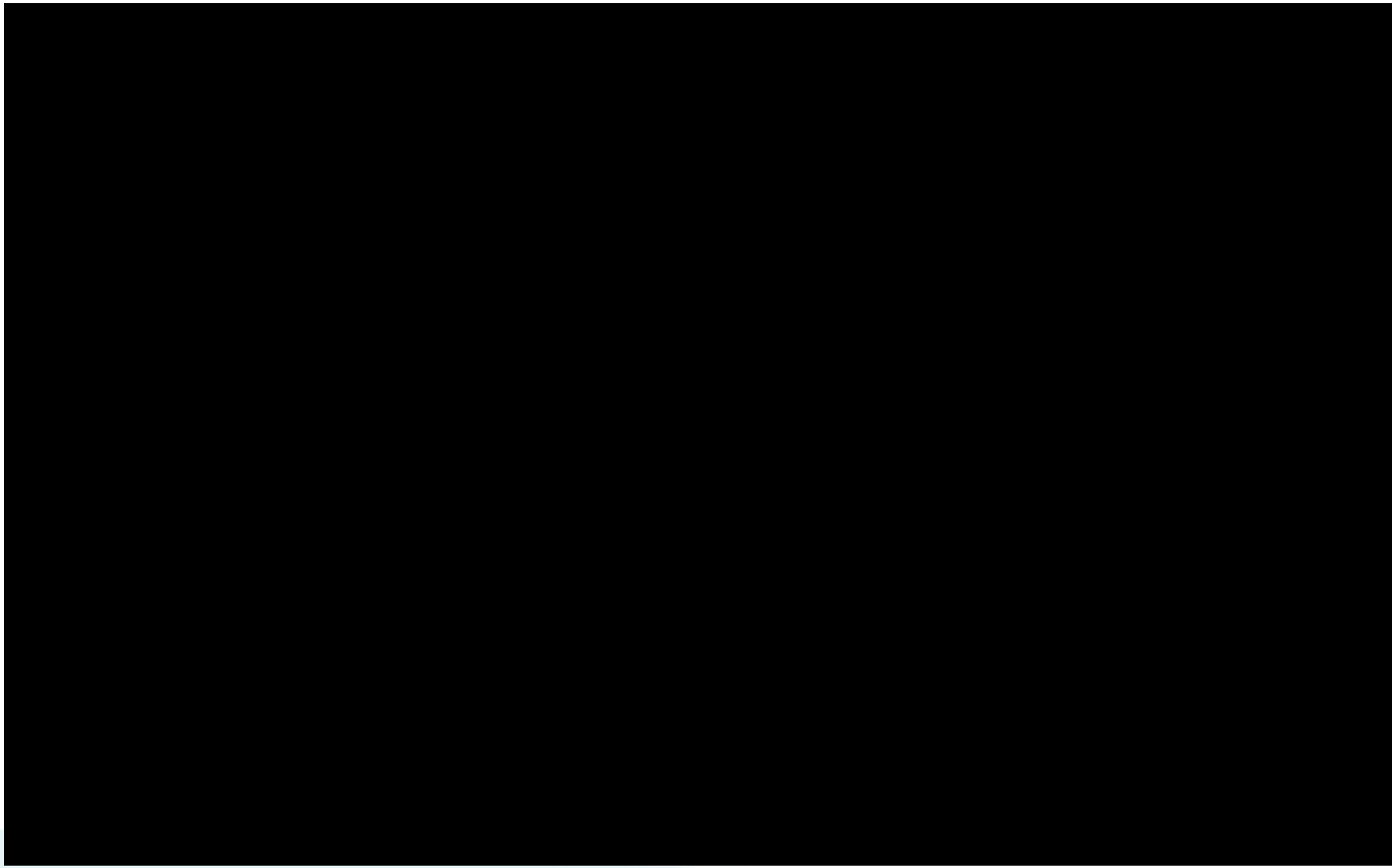
WEDECO DURON

Greener, more efficient simply better

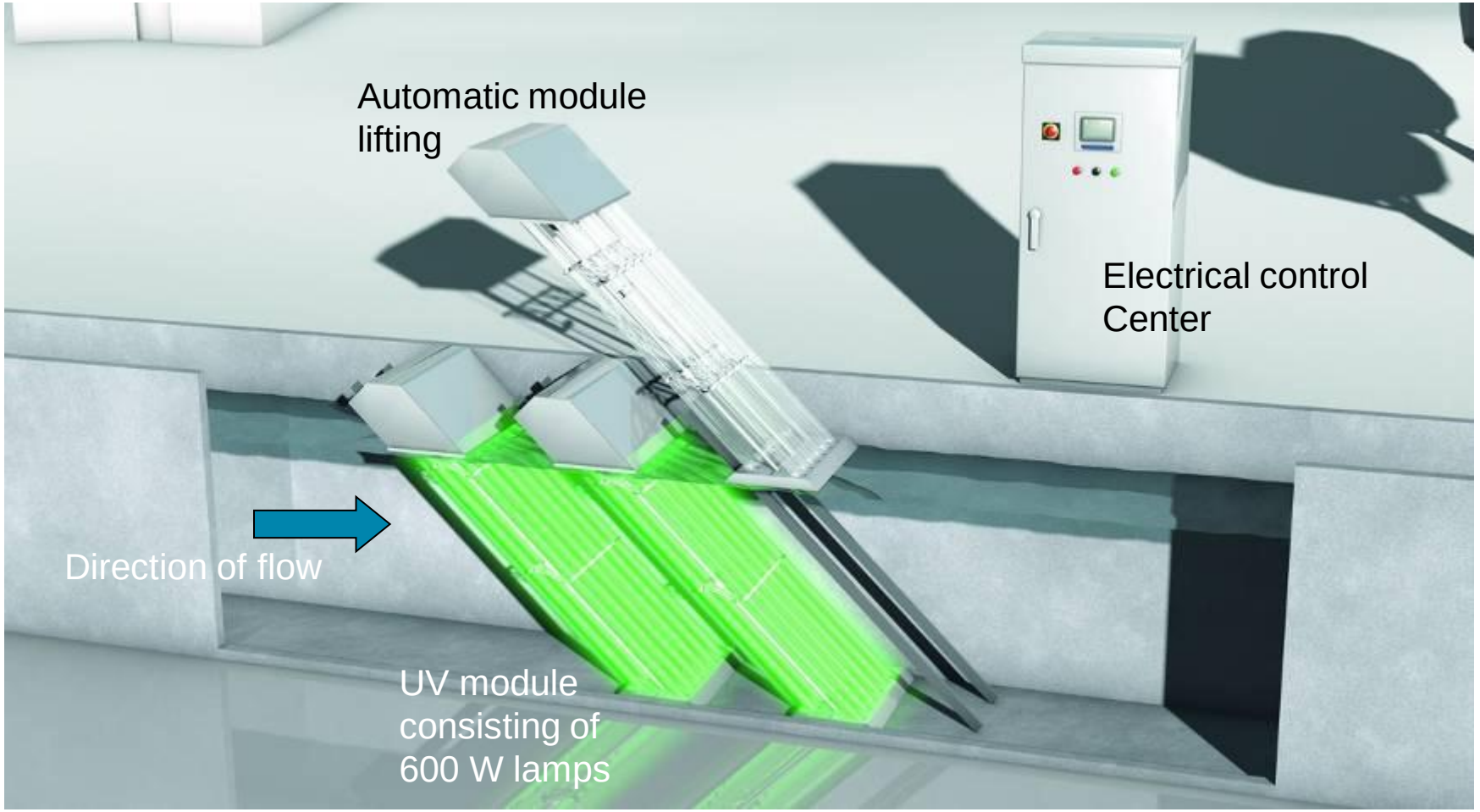
WEDECO

a xylem brand

Introduction



System overview



Enhanced ECORAY® Technology DURON

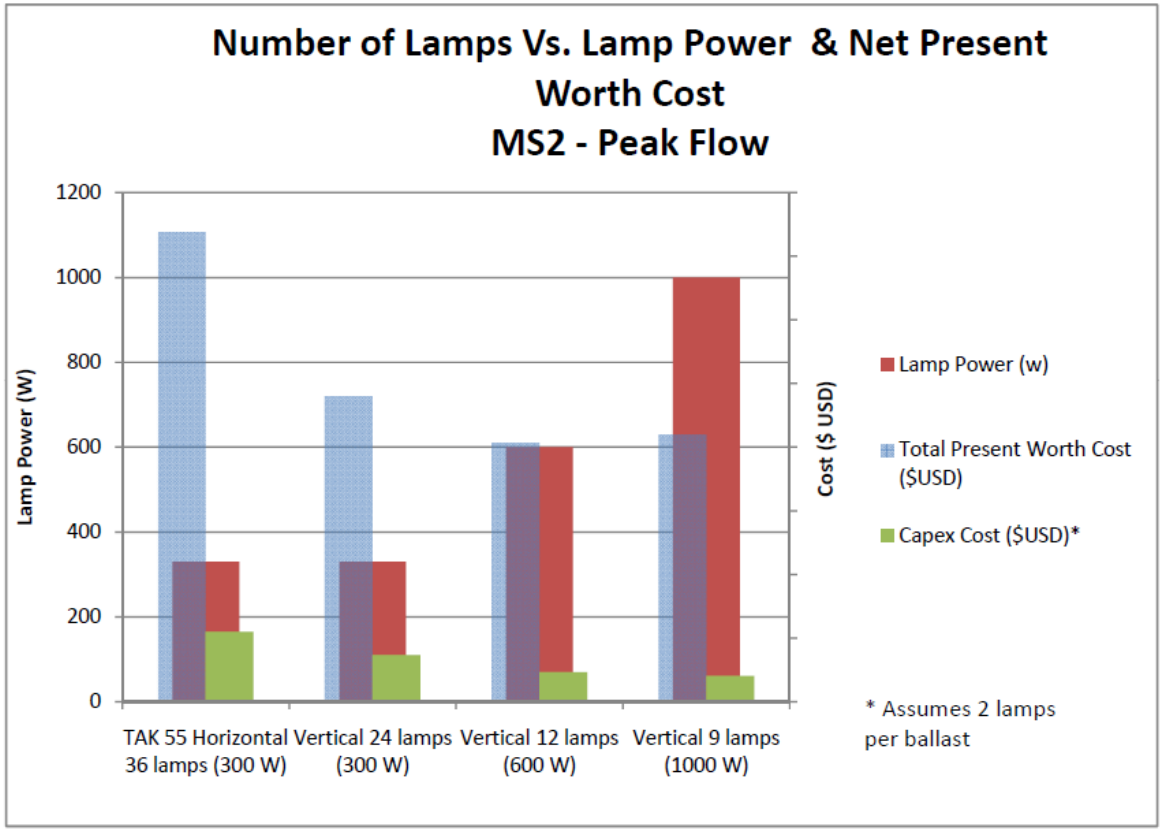
Greener, more efficient, simply better

- Minimizes your operational expenditures due to
  - Low UV lamp count
  - High UV lamp efficiency
  - Excellent lamp dimming behaviour
  - Long lamp life
  - Easy lamp handling and replacement

Enhanced ECORAY® Technology

Designed for Life Cycle cost optimisation:

Greener, more efficient, simply better



Unique 600 W lamp offering best balance between lamp efficiency and lamp count

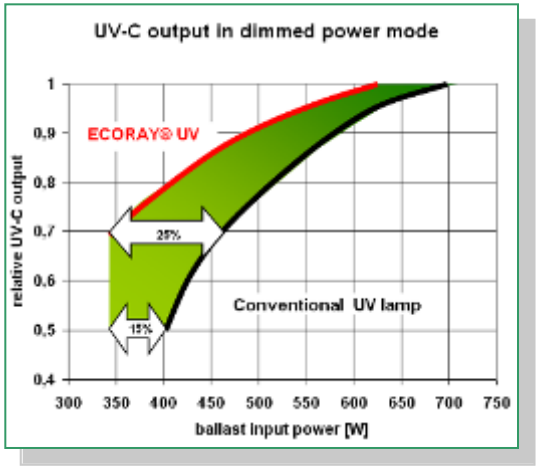
Enhanced ECORAY® Technology

ECORAY® lamp ELR60

600 W per lamp

Electronic ballast

2 lamps per ballast



- Proprietary lamp & ballast development with > 15 years of in-house expertise
- Perfectly matched lamp & ballast for highest efficiency
- 50 % ballast power input -> 70 % of UV-C output
- Up to 20 % energy savings in dimmed mode

New 45° inclined vertical design DURON

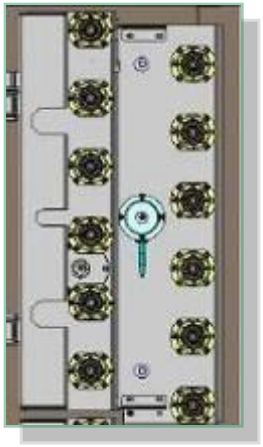
“Shining new lights on our original ideas"

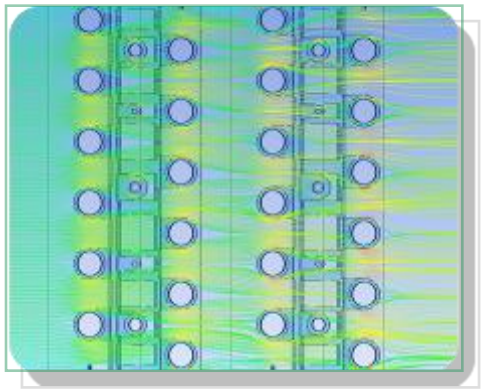
- Gives you highest disinfection efficiency
- Gives you best performance proof by outstanding validation
- Reduces the required lamp count by >50 %
  compared to conventional open channel systems
- Minimizes your time required for lamp exchange
- Generates only low headloss even at high flow rates per lamp
- Allows for excellent adaptation to whatever site specific space availabilities
- Is designed for minimal footprint requirements

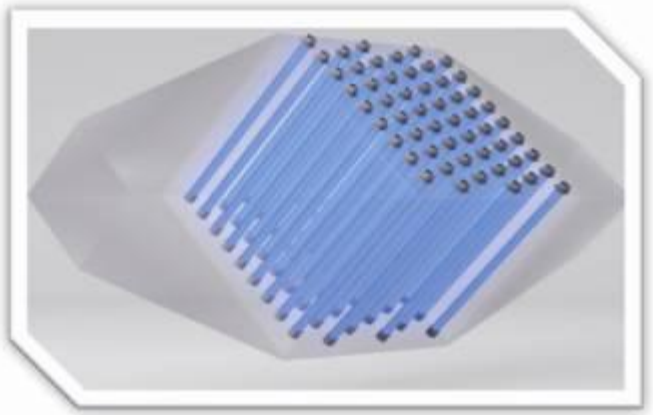
New 45° inclined vertical design

Highest disinfection efficiency

“Shining new lights on our original ideas"







- Unique 45° vertical inclined staggered lamp arrangement for ideal mixing and uniform irradiation field
- Long-term experience with vertical lamp arrangement from K-Reactor performance
- CFD modeling supported by empirical data
- “Right dose for every bug design” possible due to sophisticated validation concept

New 45° inclined vertical design

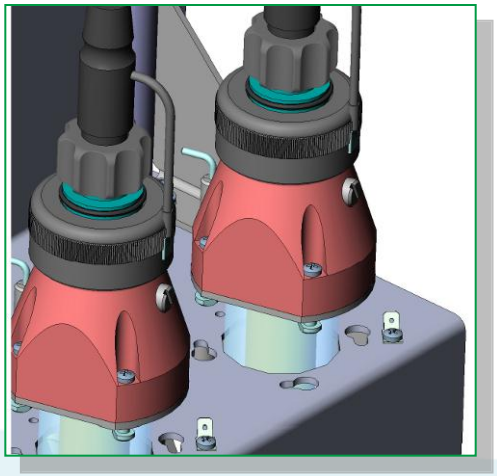
Best performance proof by outstanding validation

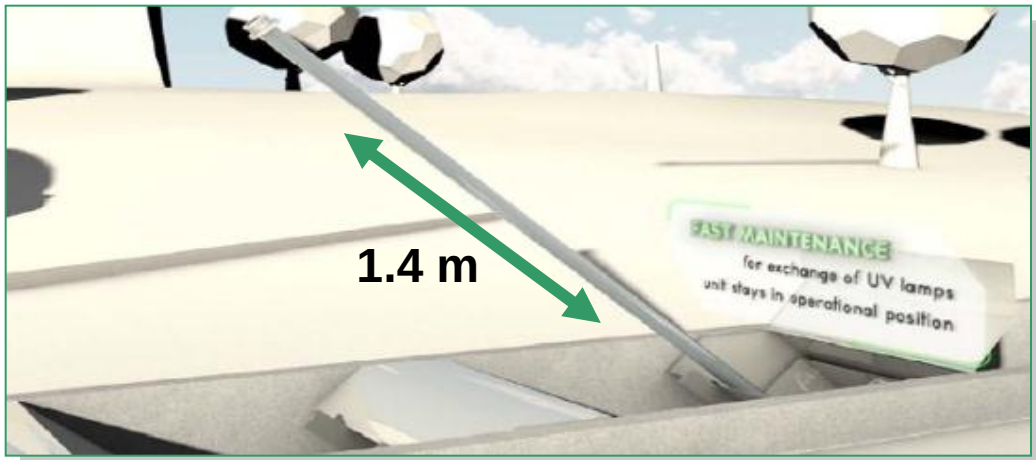
- Largest system worldwide used for validation purposes
- Average “working” flow of 700-1,400 m³/h, increase up to well above 2,000 m³/h
- Independent 3rd party validated by Carollo Engineers
- Compliant to latest NWRI 2012 standard
- Compliant to IUVA guideline and US EPA’s UV Disinfection Guidance Manual (UVDGM)
- Bug specific design possible due to the use of various surrogates
- Largest UVT range tested to allow for validated design for whatever wastewater quality

New 45° inclined vertical design

Fast and easy lamp exchange

- Easy accessible without lifting the UV module – unit stays in operational position
- Safe and reasonable handling due to lamp length of 1.4 m
- High uptime as other UV banks can remain in operation
- Safety switch automatically de-energizes entire UV module before lamp take out is possible
- No need for tools at all due to lamp quick connections





Ideal operation

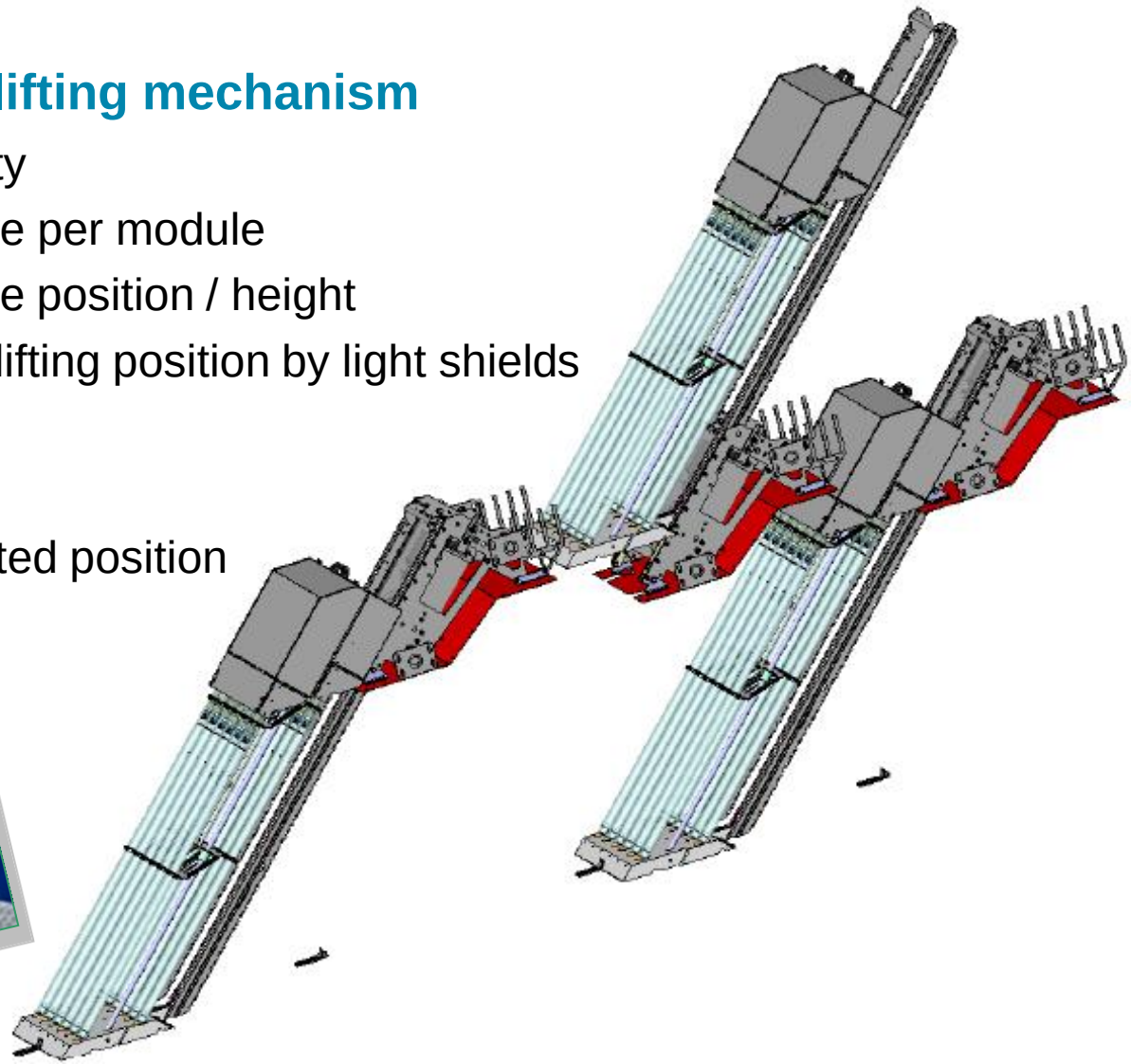
Full system automation for your convenience

- Unique compact automatic lifting mechanism makes all maintenance works easy
- Safety switches automatically de-energize UV modules prior to lifting/lamp replacement to protect operators from UV light
- Proven intelligent UV system control automatically ensures minimal energy consumption without any compromise to disinfection performance
- Safe performance due to power in the back
- Automatic wiping system keeps quartz sleeves free of deposits
- “Total care” concept completes our ‘peace of mind’ product offering

Ideal operation

Integrated compact lifting mechanism

- Easy & safe servicability
- Integrated E-motor drive per module
- Able to lift to any service position / height
- Good protection in top lifting position by light shields
- In-place lifting
- Minimal footprint
- Easy winterization in lifted position



Ideal operation

OptiDose Control

- Fully automated performance safe system operation due to continuous consideration of
  - UVT changes,
  - Lamp aging
  - Quartz sleeve fouling
- Lowest available lamp count per sensor with one sensor per module (max. 12 lamps)
- OENORM compliant UV sensor for highest accuracy

- Extensive 3rd party validation, including multiple challenge organisms

➔ **Automatic minimization of energy consumption aligned to varying operational conditions without any compromise to disinfection performance**

Ideal operation

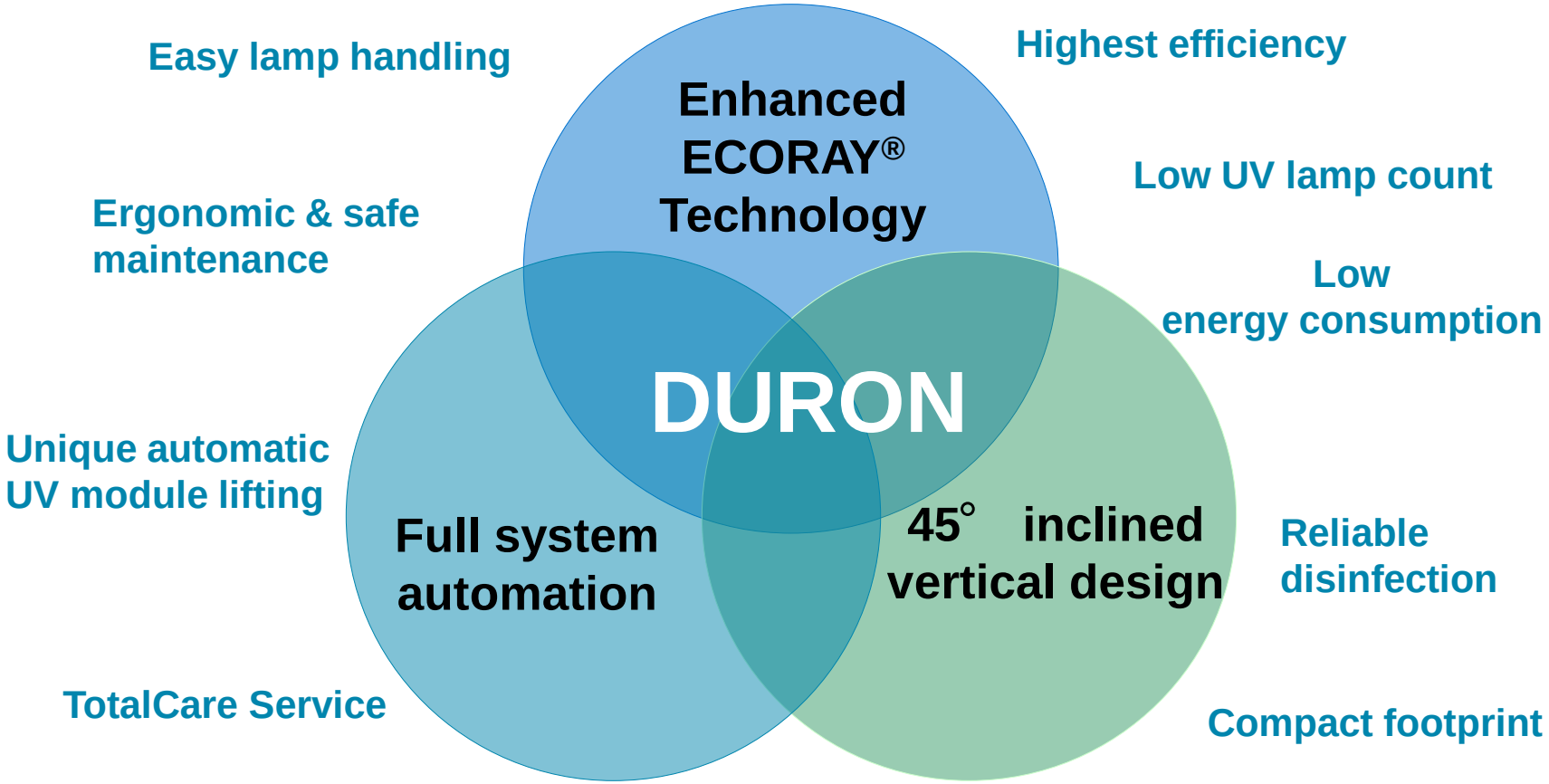
TotalCare concept

- Provides a great range of services to assure continuous availability of the customers´ systems
- Helps our customers to minimize dowmtime, save energy and optimize performance
- Outstanding own service force that directly fills in operational experience into new product development
- Unique combination of experience and technical know-how, communication philosophy and R&D
- Service concept is #1 world-wide coverage with dedicated personnel trained to highest technical and safety standards

Greener, more efficient, simply better

DURON

No need for chemicals



WEDECO
a xylem brand

WEDECO
a xylem brand

THANK YOU