



# WEDECO's iDuron

Intelligent solution for wastewater disinfection needs

First, let's have a closer Look:

**WEDECO**

a xylem brand

# Wedeco Production and Services in Herford

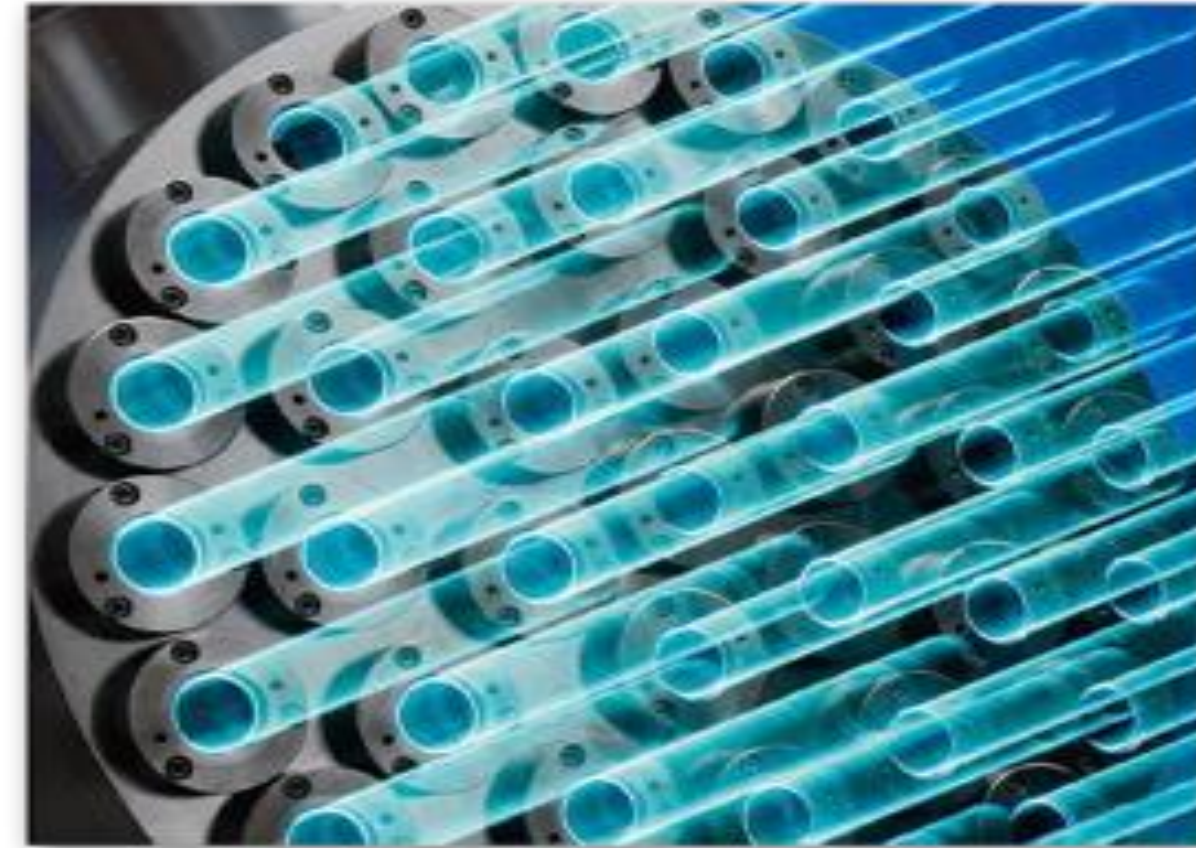


Revenues 2017: 127 Mio.\$

Employees: 250

*Leading global Player for UV Disinfection & Ozone Oxidation Systems and Services*

# The Wedeco Portfolio



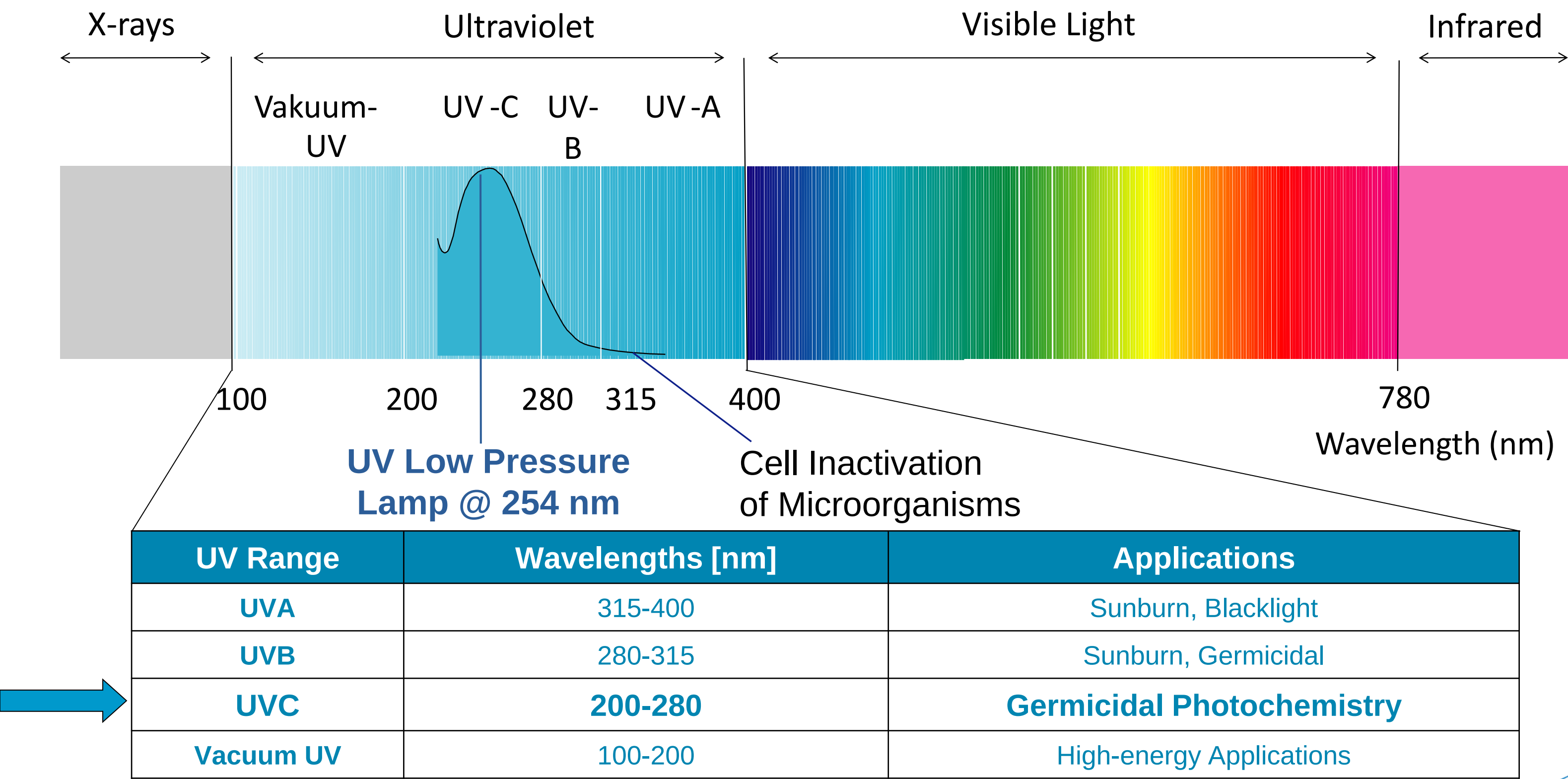
- Wedeco's UV and Ozone product portfolio covers municipal drinking & wastewater, industrial air, process water, & wastewater, and residential/commercial water
- > 200,000 Ozone & UV installations worldwide
- ranging from ~ 0.5 to > 90,000 m<sup>3</sup>/hr (~ 0.01 - > 2,000 MLD)
- Focus on Reliability and Efficiency

# Outline

1. How does UV work?
2. Why UV Disinfection for Wastewater?
3. How to design UV Systems for Wastewater Disinfection?
4. The iDuron Design
  - ❑ Overview with Concept Configuration
  - ❑ Details about Lamps & Ballasts
  - ❑ Control Philosophy for permanent Performance
  - ❑ Maintenance and Service Aspects
5. Selected References of Xylem's Wedeco UV Systems

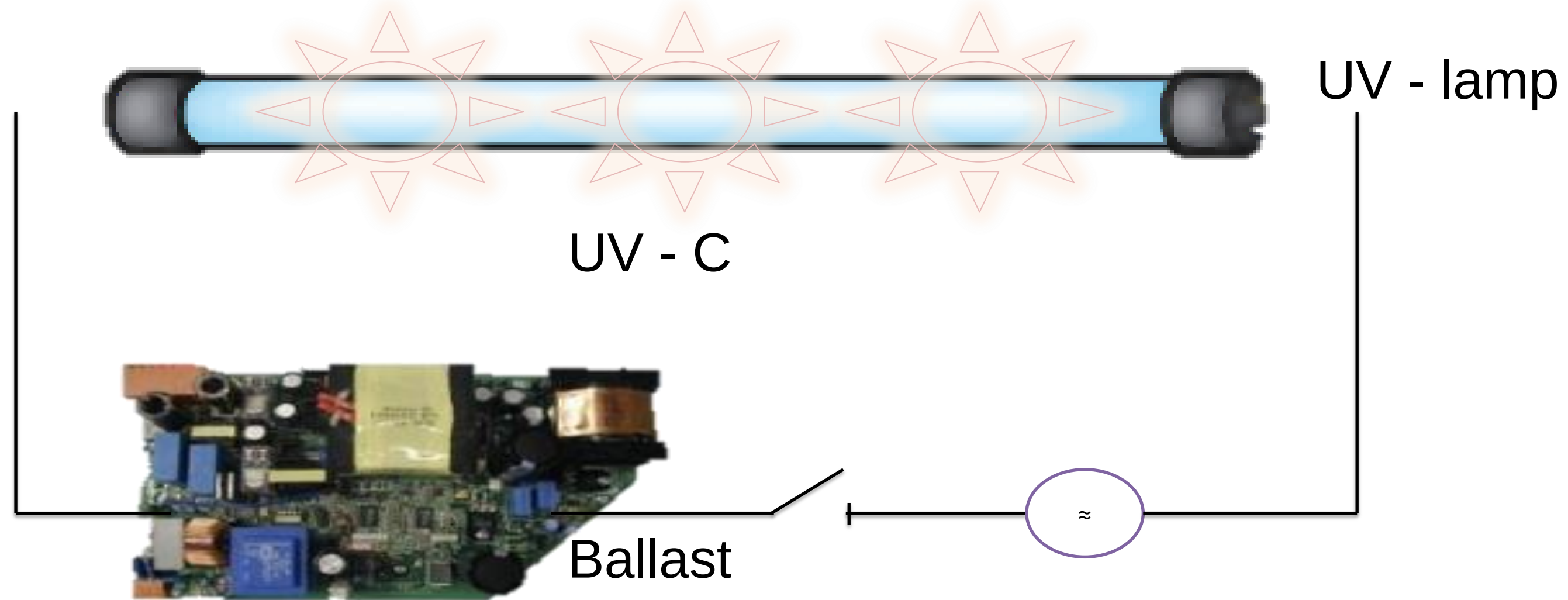
# Basics of UV Disinfection

UV stands for ultraviolet light which is a specific range of the electromagnetic spectrum



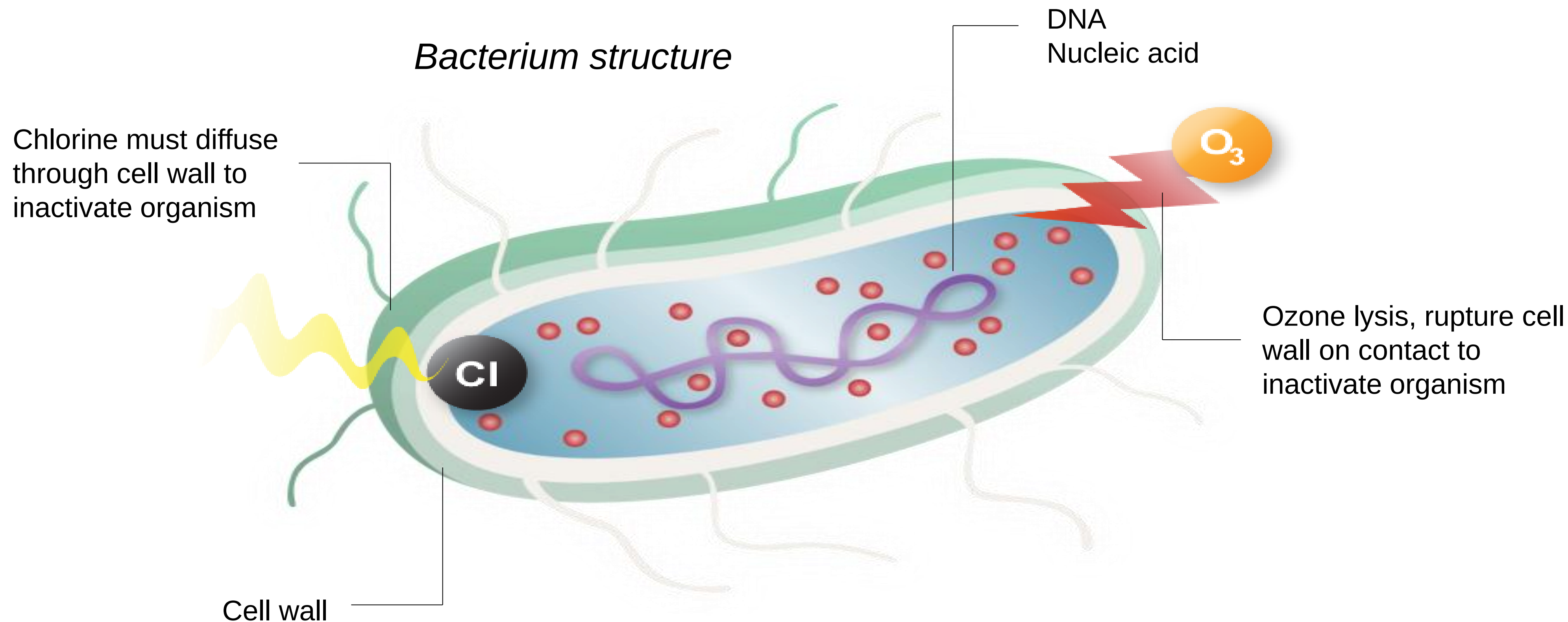
# Generation of UV Light

- Basis: Mercury atoms in gas discharge lamps (like fluorescent bulbs)
  - ✓ Electrical field brings mercury into energized but unstable state
  - ✓ Release of energy = emission of UVC light

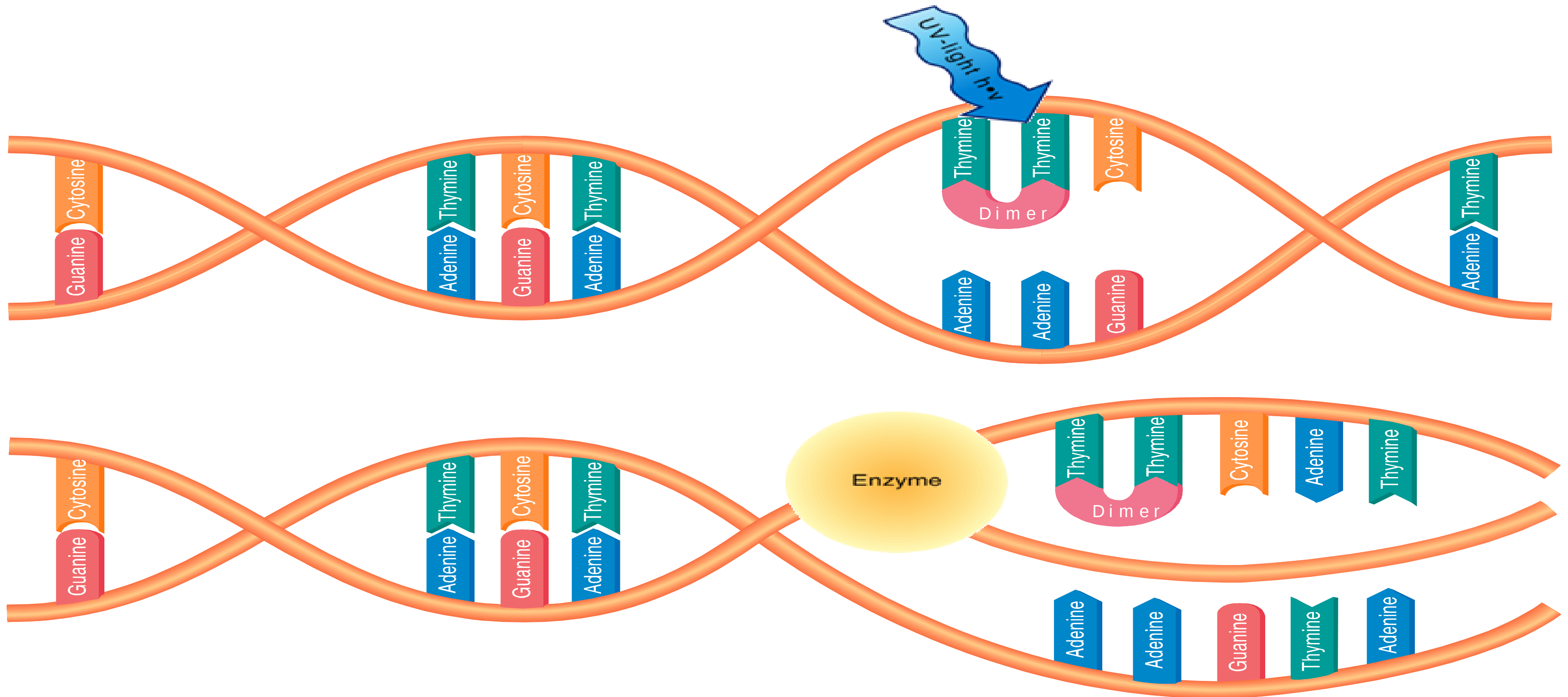


# Disinfection Mechanism

## Chlorine versus Ozone



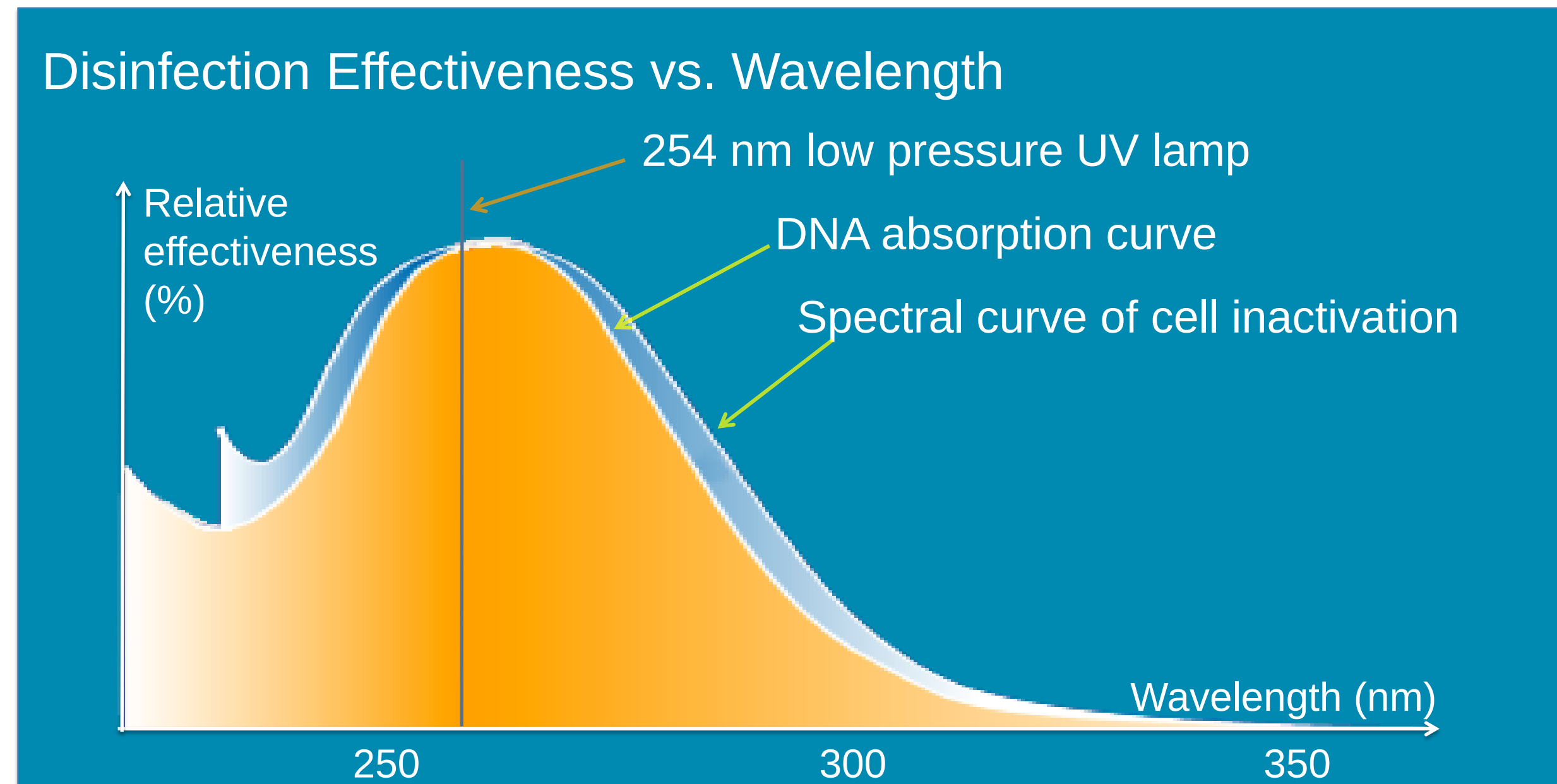
# Disinfection Mechanism UV



# How does UV work?

## Principle of UV – DNA Absorption Curve

- DNA & RNA absorb light in the UVC range emitted by UV lamps
- The microorganisms are inactivated within seconds and rendered unable to reproduce or infect



**UV irradiation @ 254 nm** is of particular relevance  
for the inactivation of pathogens

# Advantages of UV Disinfection over Chlorine

| CHLORINATION                                                             | UV                                                            |
|--------------------------------------------------------------------------|---------------------------------------------------------------|
| Affects taste & odor, change in water chemistry                          | No affect on taste & odor, no change in water chemistry       |
| Produces harmful disinfection by-products (DBPs) (carcinogenic)          | No formation of harmful DBP's                                 |
| Requires specific ESH procedures as it is a hazardous and toxic chemical | Low ESH requirements and concerns                             |
| Corrosive                                                                | Non corrosive                                                 |
| Long contact time (min. 30 min)                                          | Short contact time (< 5 sec) reduces size of civil structures |
| Large footprint, deep excavations                                        | Small footprint (~ 10% of chlorine), low excavations          |
| Low efficiency on protozoa                                               | High efficiency on protozoa                                   |
| Performance influenced by pH and temperature                             | Performance independent of pH levels and temperature          |

# Wastewater Disinfection Goal

To **always** achieve an effluent discharge with

**Fecal Coliforms < 1,000 MPN / 100ml**

This requires a reduction of **99.9%** of these bacteria after biological treatment.

Under all conditions:



# The Path to a (new) Disinfection System

## Requirements:

1. Easy to understand and operate
2. Robust in handling
3. Performing reliably under all conditions
4. Adapting to changing conditions
5. Efficient in operation
6. Low in maintenance requirements

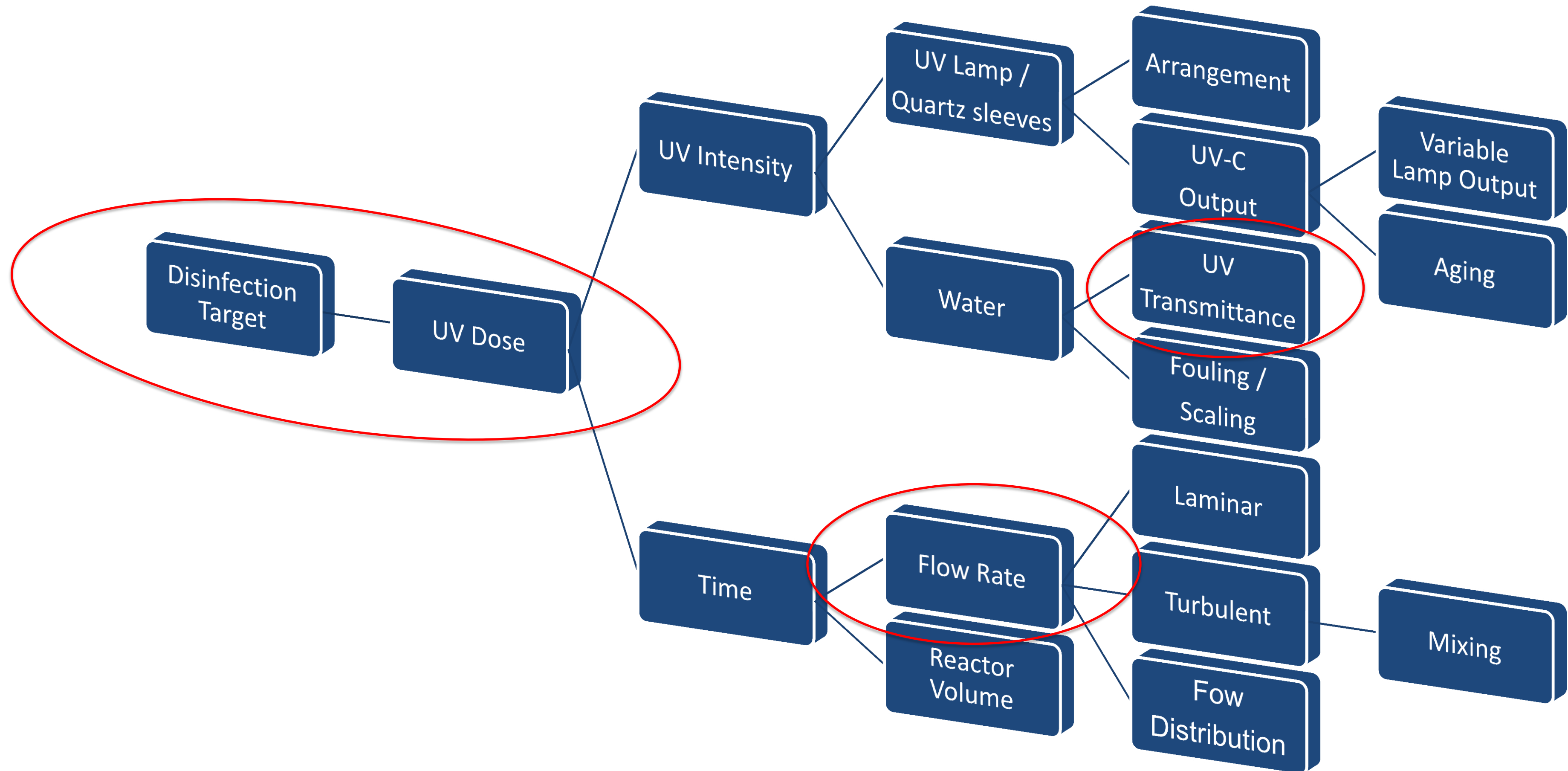


# Our Response

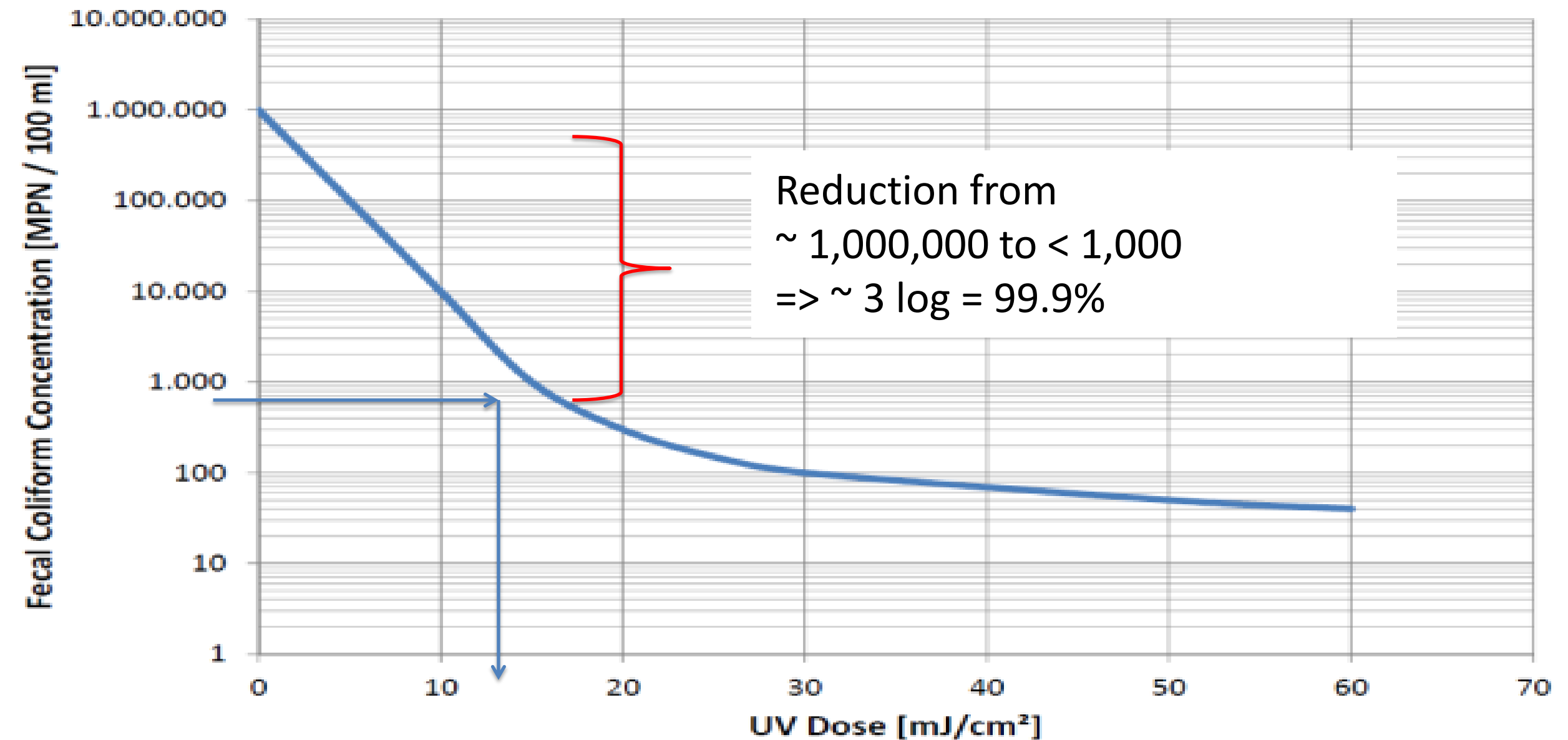
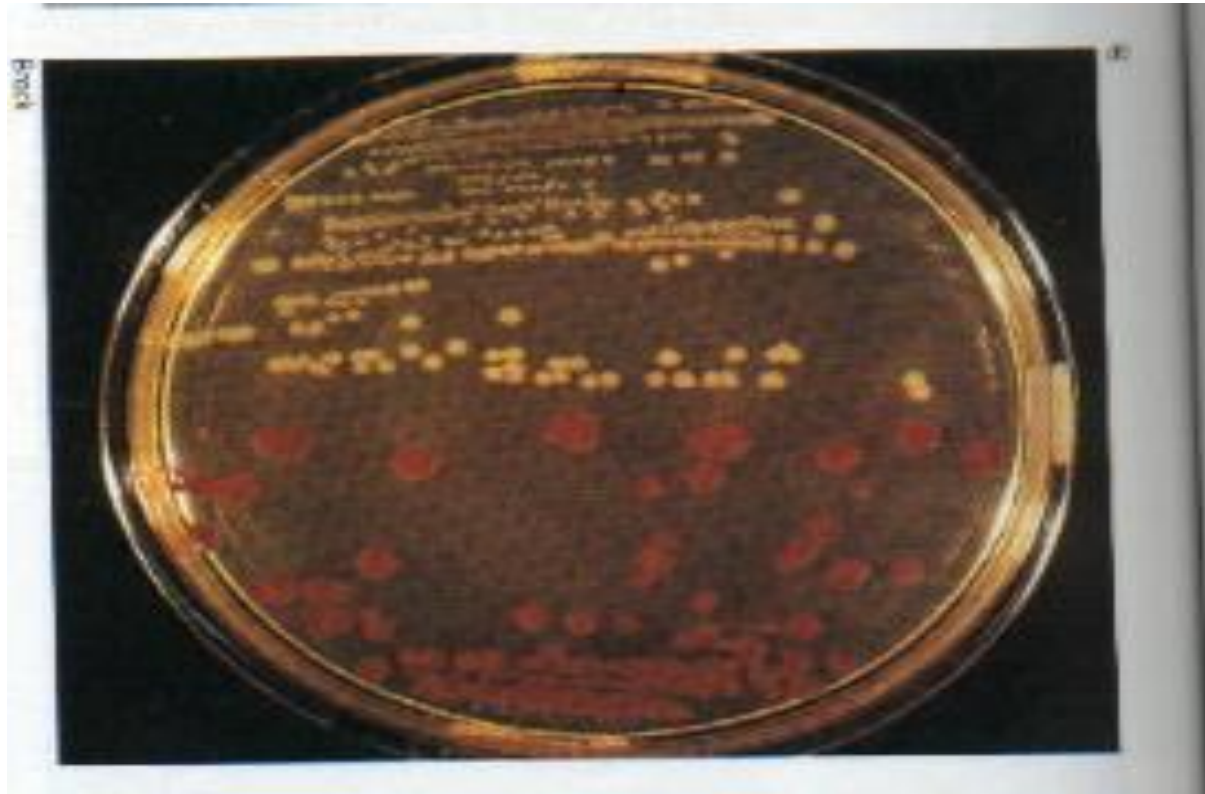
## The iDuron



# Design Aspects for UV



# Design Parameter: Disinfection Target = UV Dose



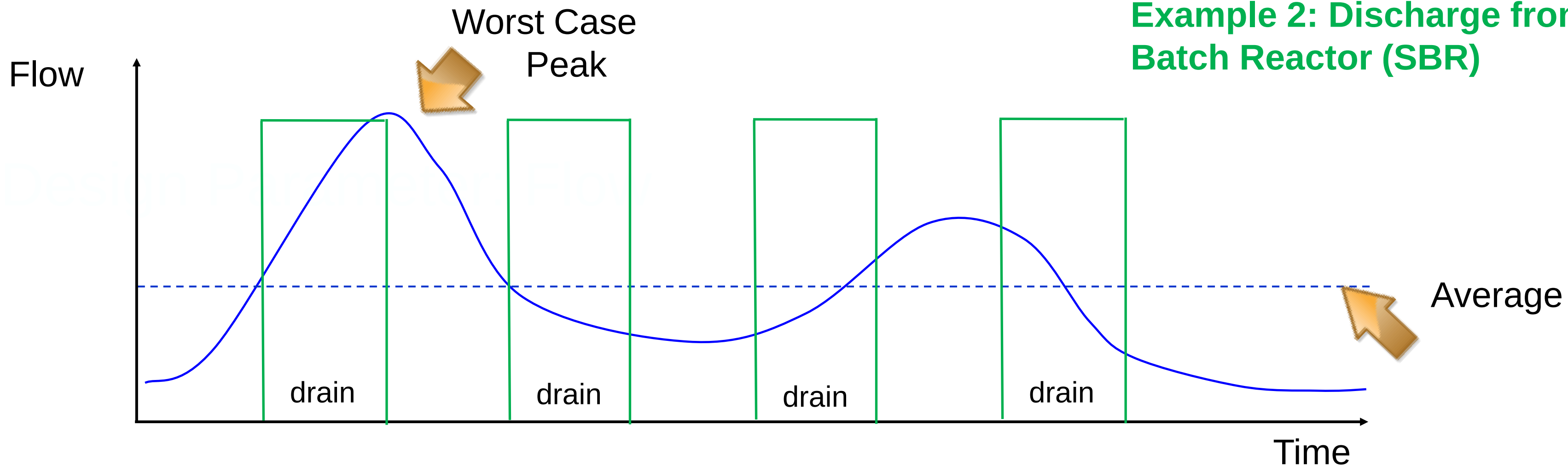
The design UV dose is determined by the log inactivation requirement and the UV sensitivity of the target pathogen(s)!

When flow  $\uparrow \rightarrow$  retention time  $\downarrow \rightarrow$  UV dose  $\downarrow$

When flow  $\downarrow \rightarrow$  retention time  $\uparrow \rightarrow$  UV dose  $\uparrow$

Example 1: Typical daily flow of an activated sludge STP

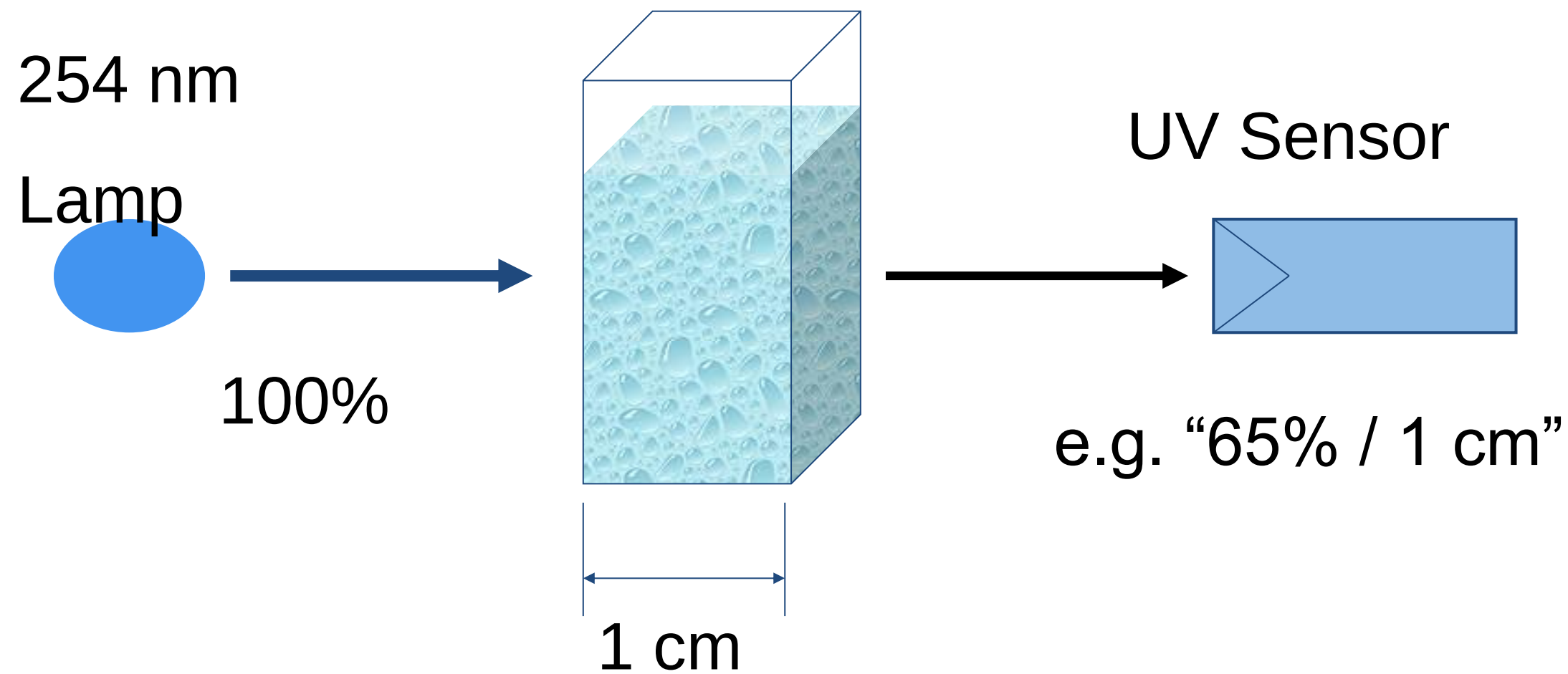
Example 2: Discharge from a Sequencing Batch Reactor (SBR)



You need to know the peak flow, average flow and minimum flow (zero?) through the UV system!

# Design Parameter: UV Transmittance

is the amount of UV light in %  
that passes through (typically) 1 cm of water



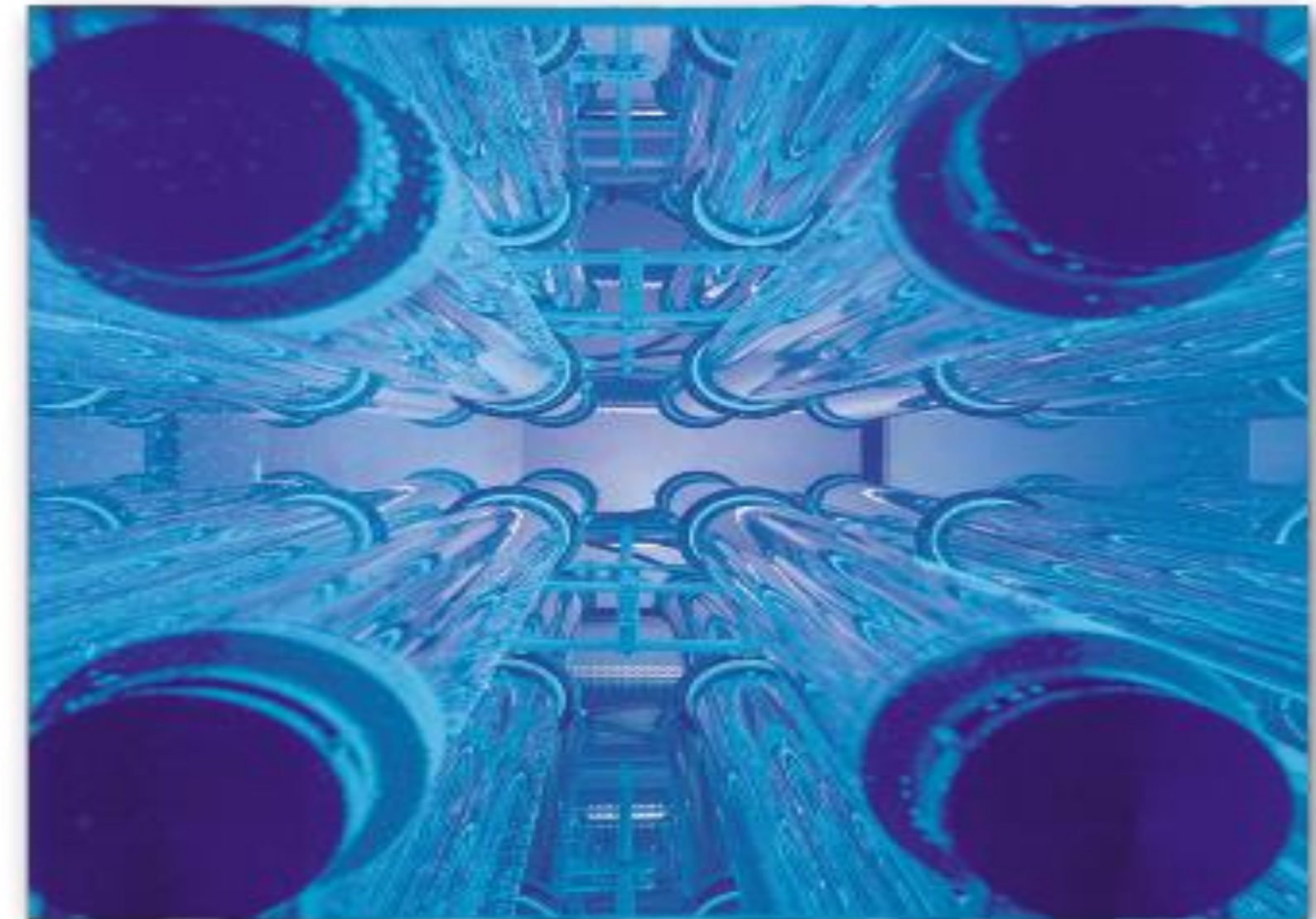
UV Transmittance (% / 1 cm):



UV transmittance needs to be measured!

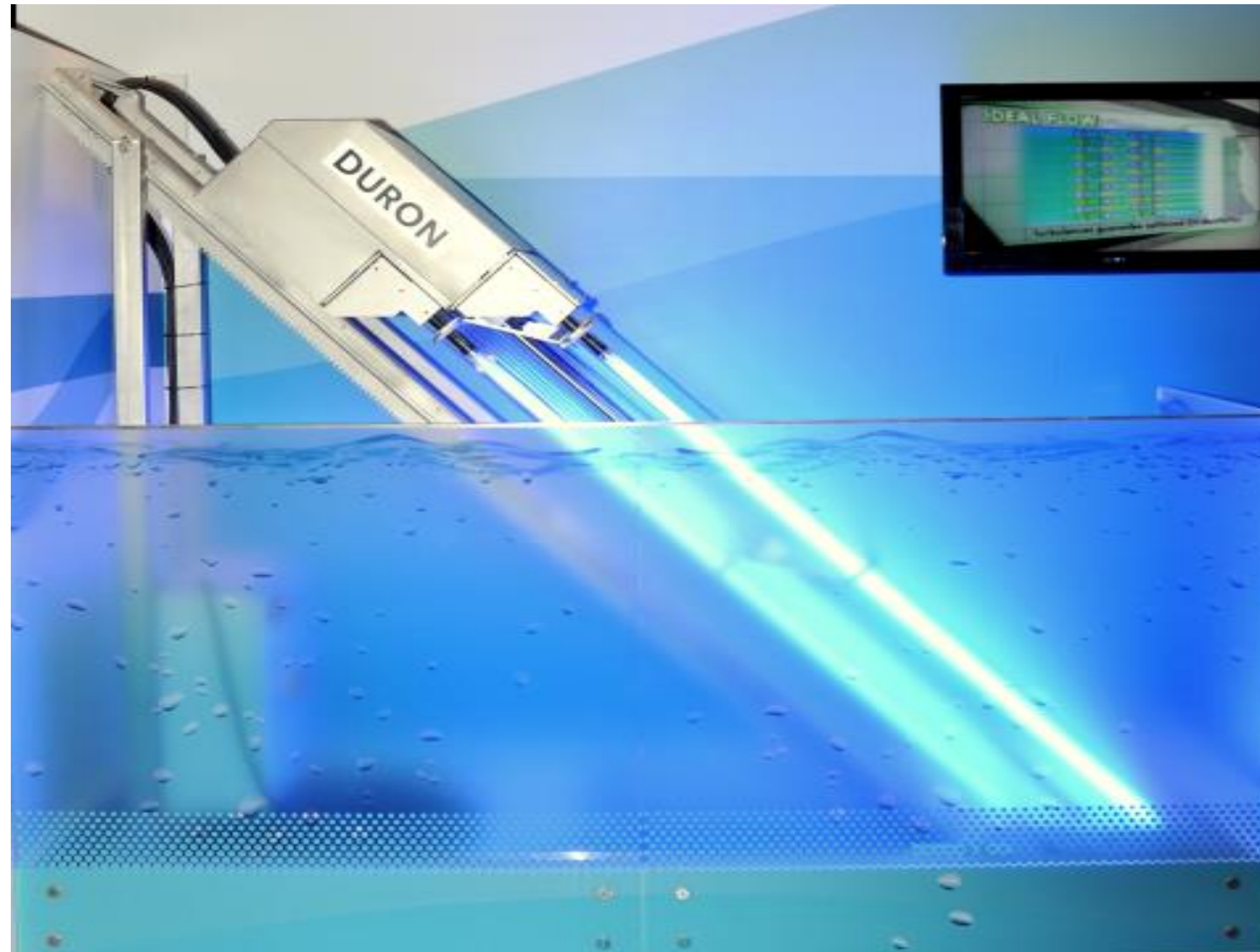
# Design Consequence for a UV System

- It should always achieve disinfection performance  
=> input of a **target UV dose**
- If water flow changes, it should react accordingly  
=> input of **flow rate** signal  
=> more/fewer lamps in operation @ higher/lower power
- If water quality changes (**UV transmittance**), it should react accordingly  
=> measurement of **UV intensity**  
=> more/fewer lamps in operation @ higher/lower power

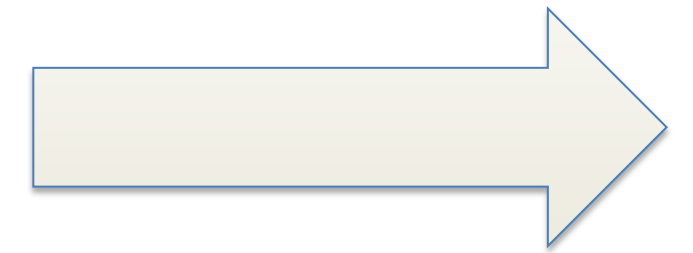


# The iDuron

- contaminated water

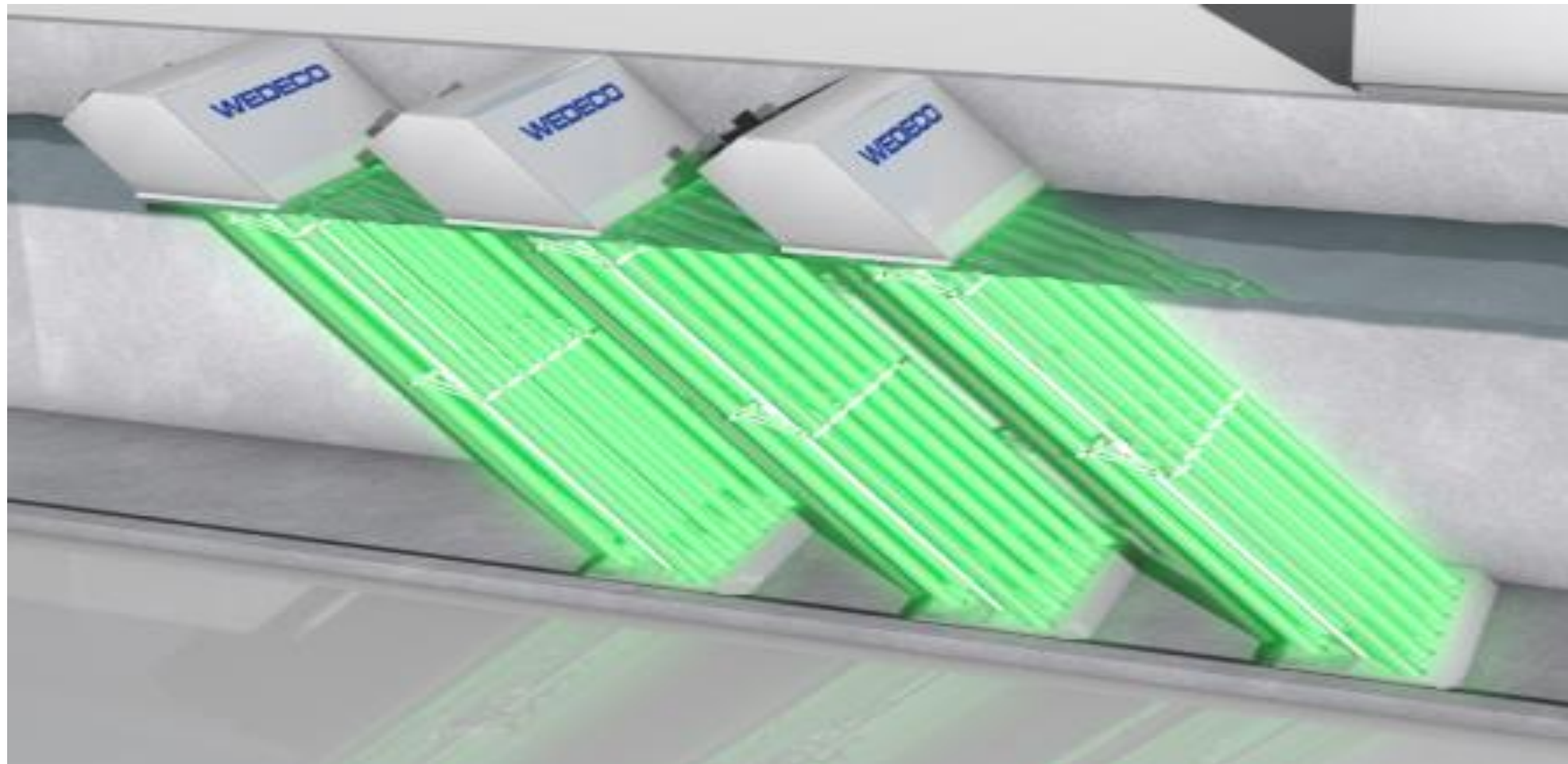


- disinfected water



# General Concept

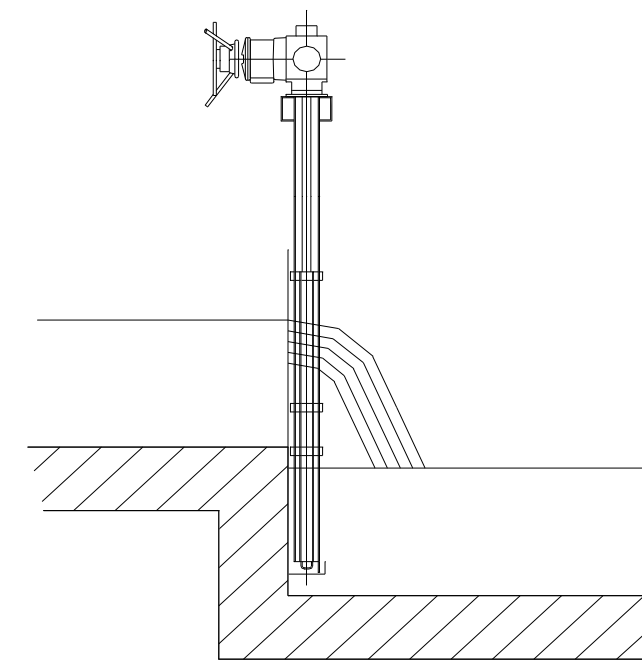
1. Modules/Banks with Lamps and automatic Wiping System



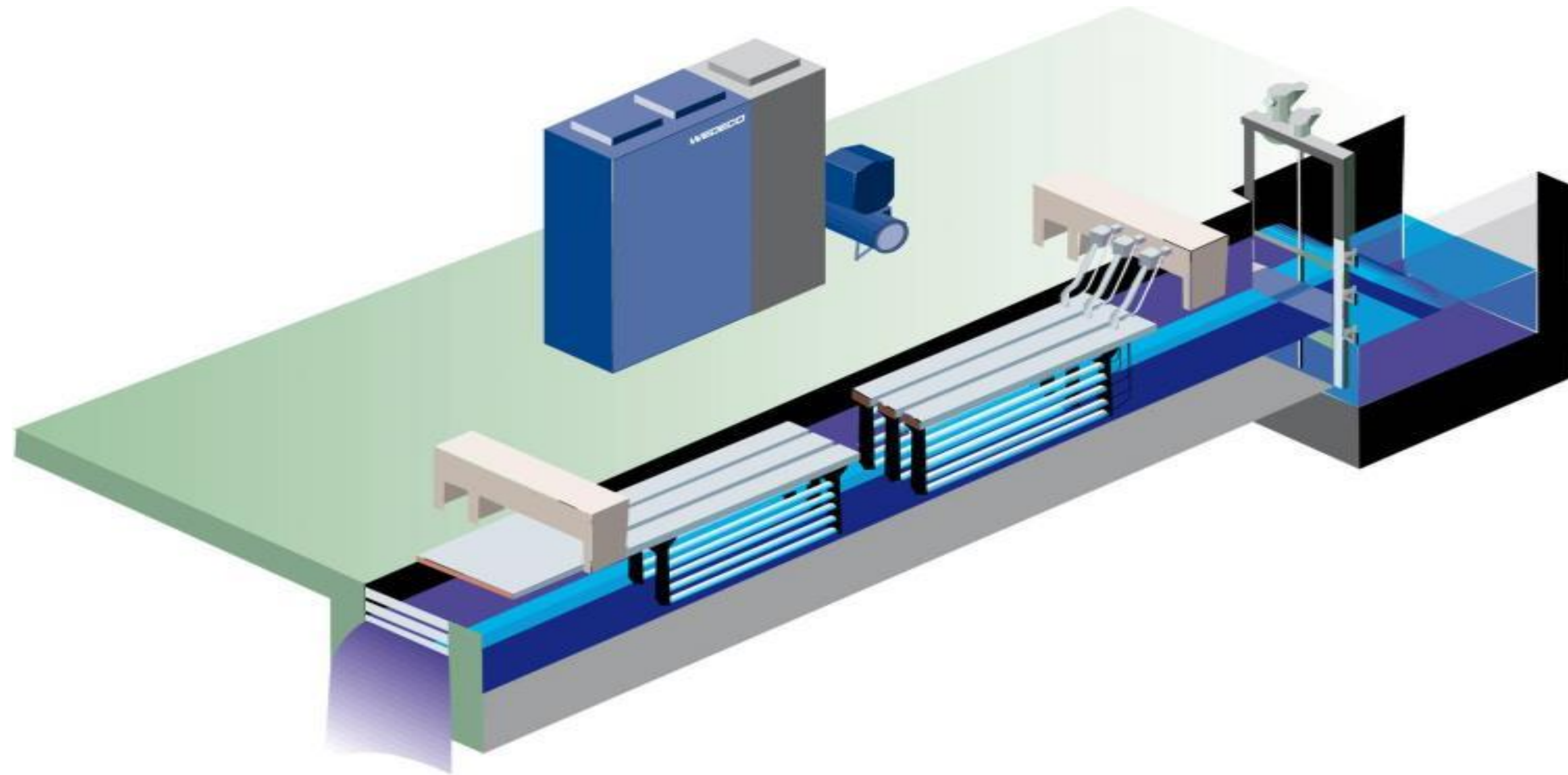
2. Cabinets for Ballasts and Controls



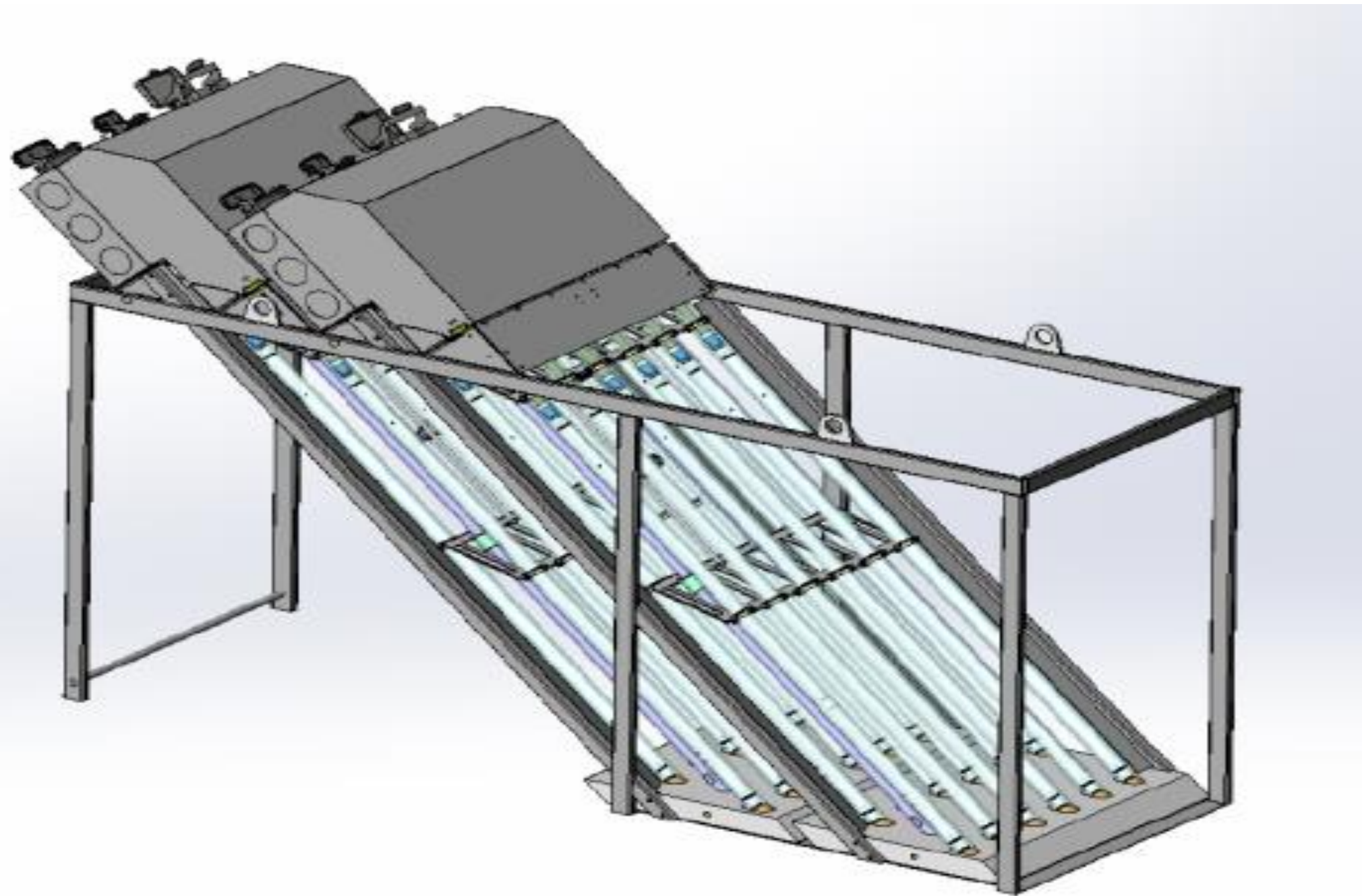
3. Level Control, e.g. Downward Opening Penstock



# Previous Generation: horizontal UV System

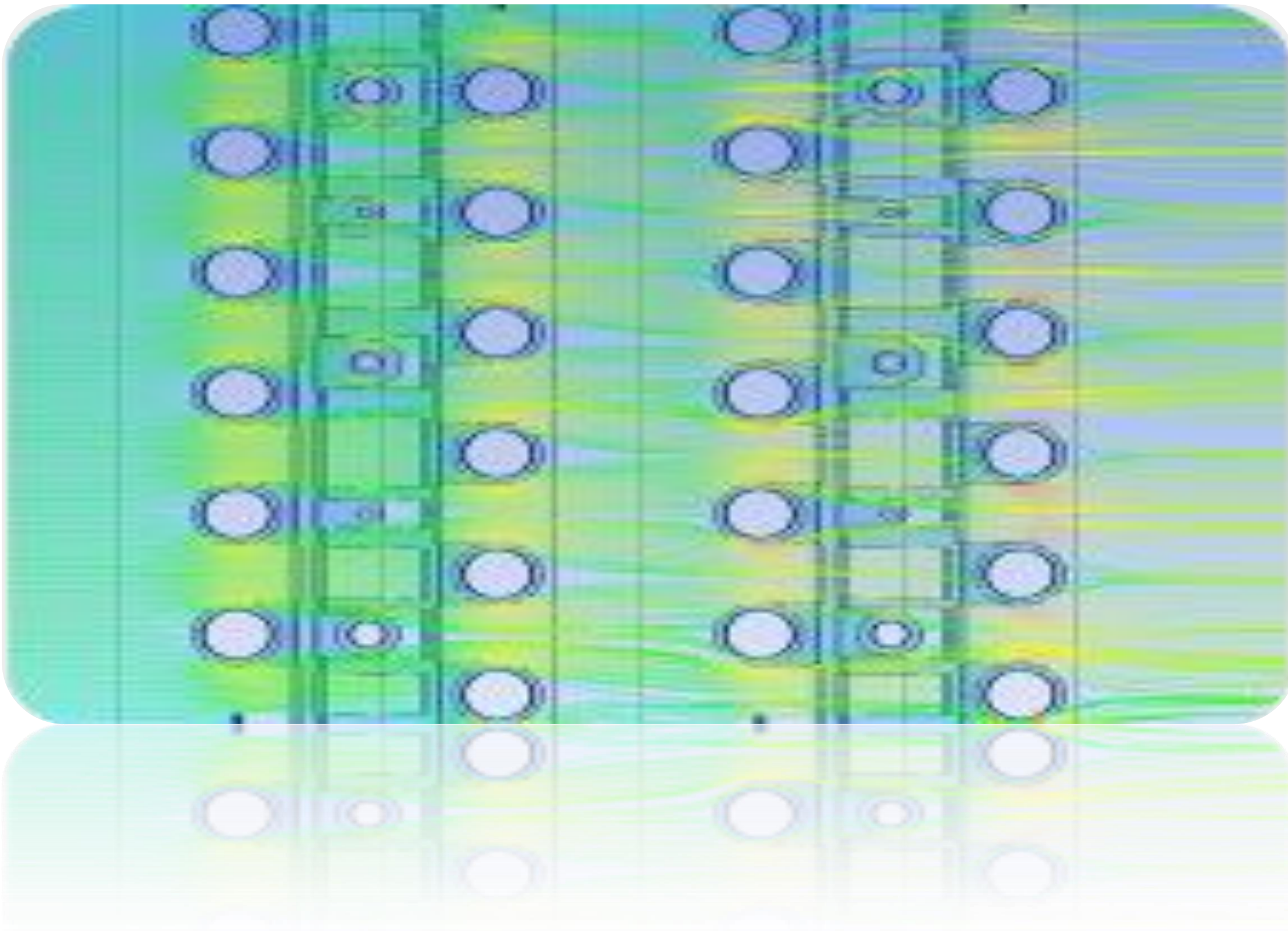


# iDuron: 45° inclined Design



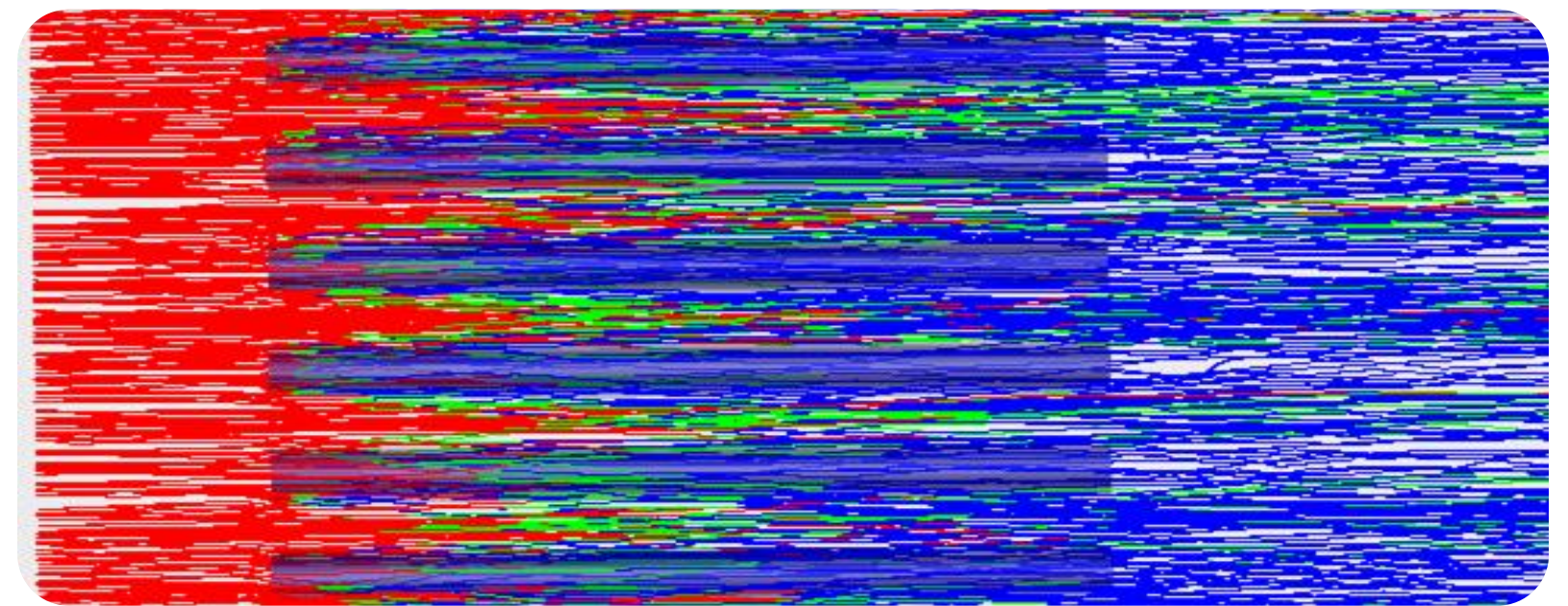
- ❑ Easy access to lamps and quartz sleeves (no module removal necessary)
- ❑ Easy adaptation to WWTP's existing space
- ❑ Low overall footprint requirements
- ❑ Reduced headloss

# iDuron: Staggered Lamp Arrangement

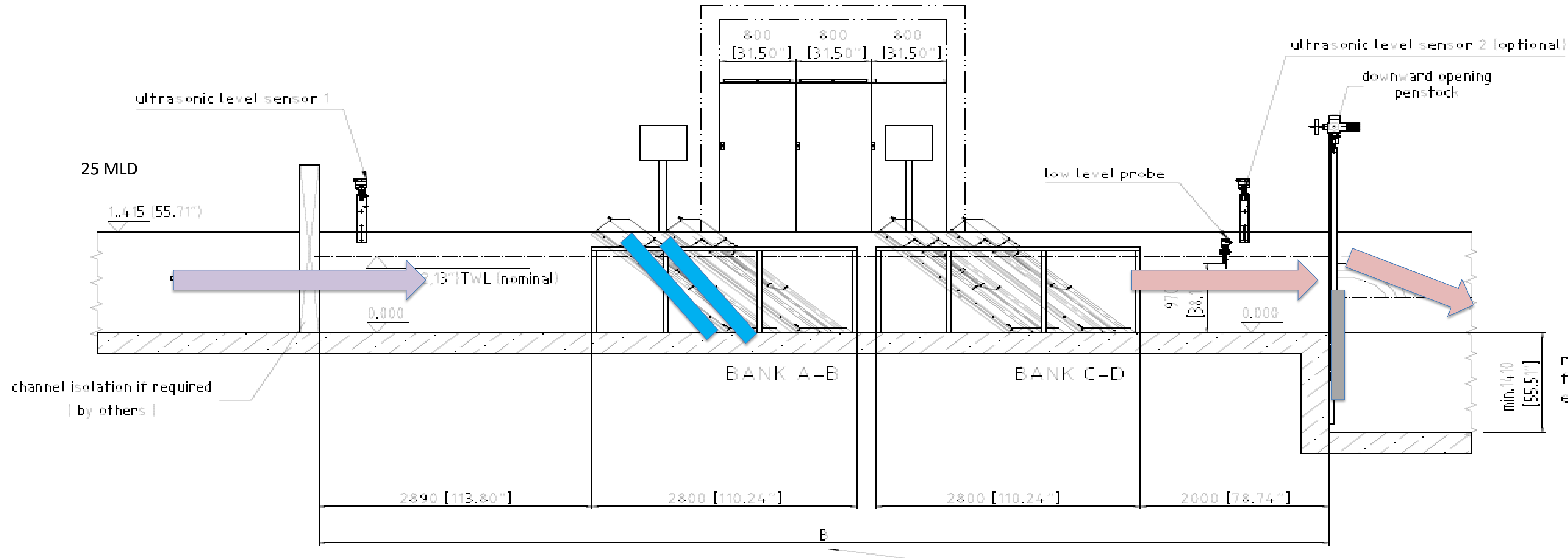


- ❑ Provide ideal mixing with uniform irradiation field and high disinfection efficiency
- ❑ Excellent UV dose distribution profile (high performance per lamp)

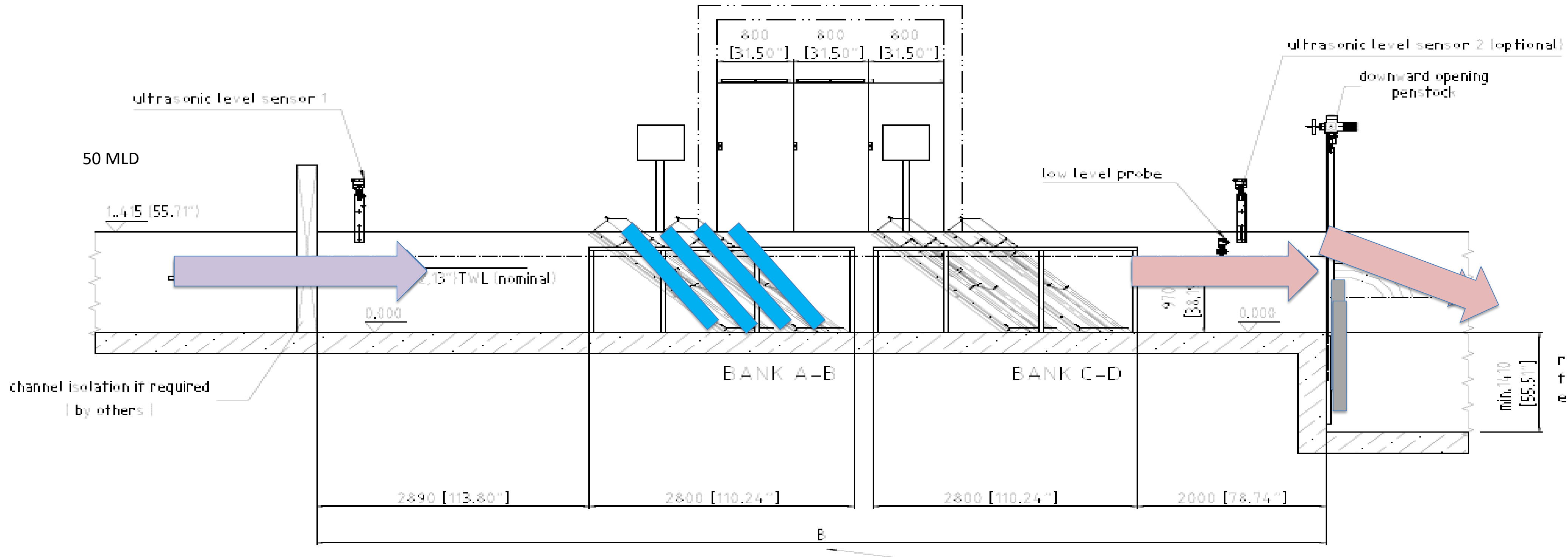
CFD on horizontal UV System:



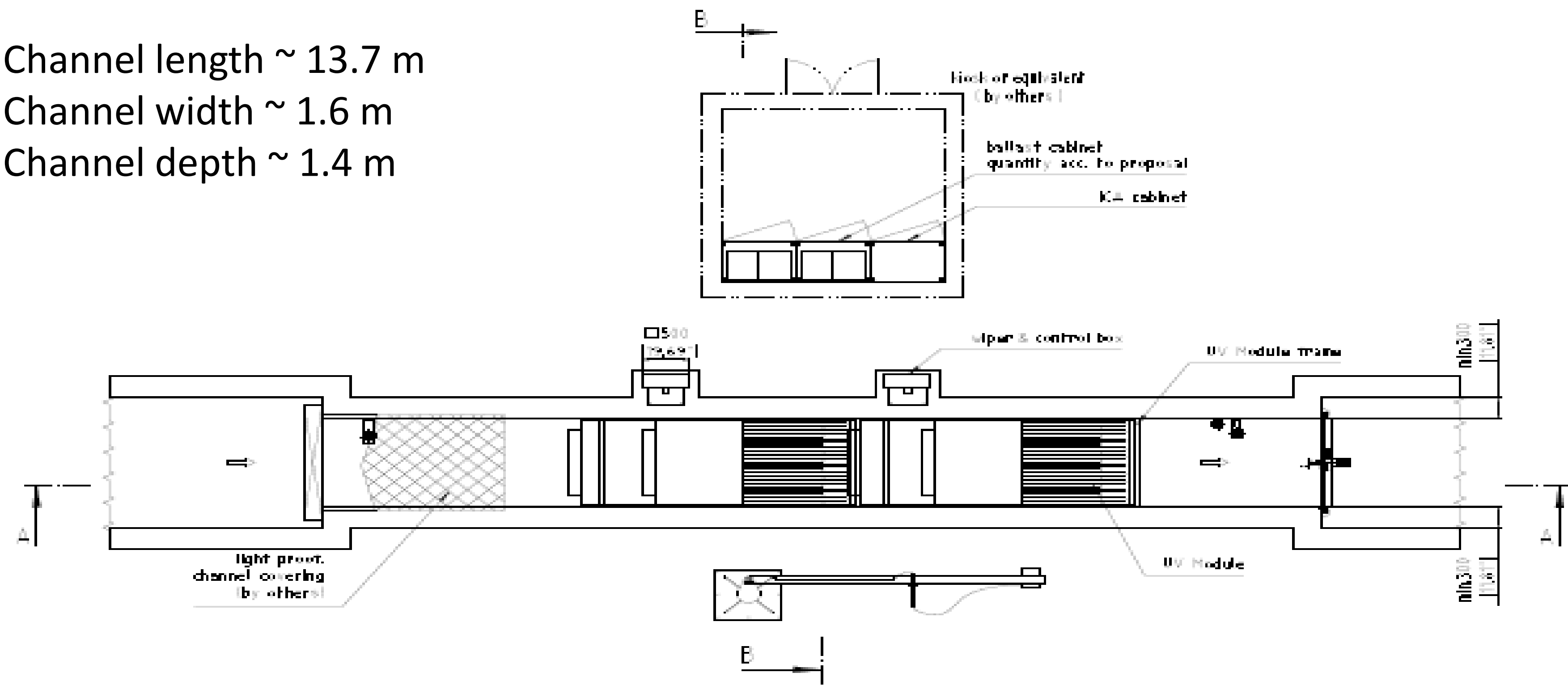
# Typical iDuron GA for 100 MLD



# Typical iDuron GA for 100 MLD



Channel length ~ 13.7 m  
Channel width ~ 1.6 m  
Channel depth ~ 1.4 m



# The UV Lamp at the Heart of iDuron

- ❑ 600 W low pressure, high intensity UV lamp
- ❑ Ecoray® model ELR60
- ❑ Combining the best of all worlds
  - ❑ High overall power
  - ❑ Short overall length of 1,430 mm
  - ❑ Excellent dimming behaviour
  - ❑ High electrical efficiency
  - ❑ Long lamp lifetime (14,000 operating hrs guaranteed)



# Lamp & Ballast: The perfect Match



- ☐ Plug-and-play state-of-the-art electronic ballast
- ☐ Powers the lamp in its most efficient manner
- ☐ Long life
- ☐ Easy replacement

# Easy Electrical Maintenance

## Easy & safe access to ballasts and controls

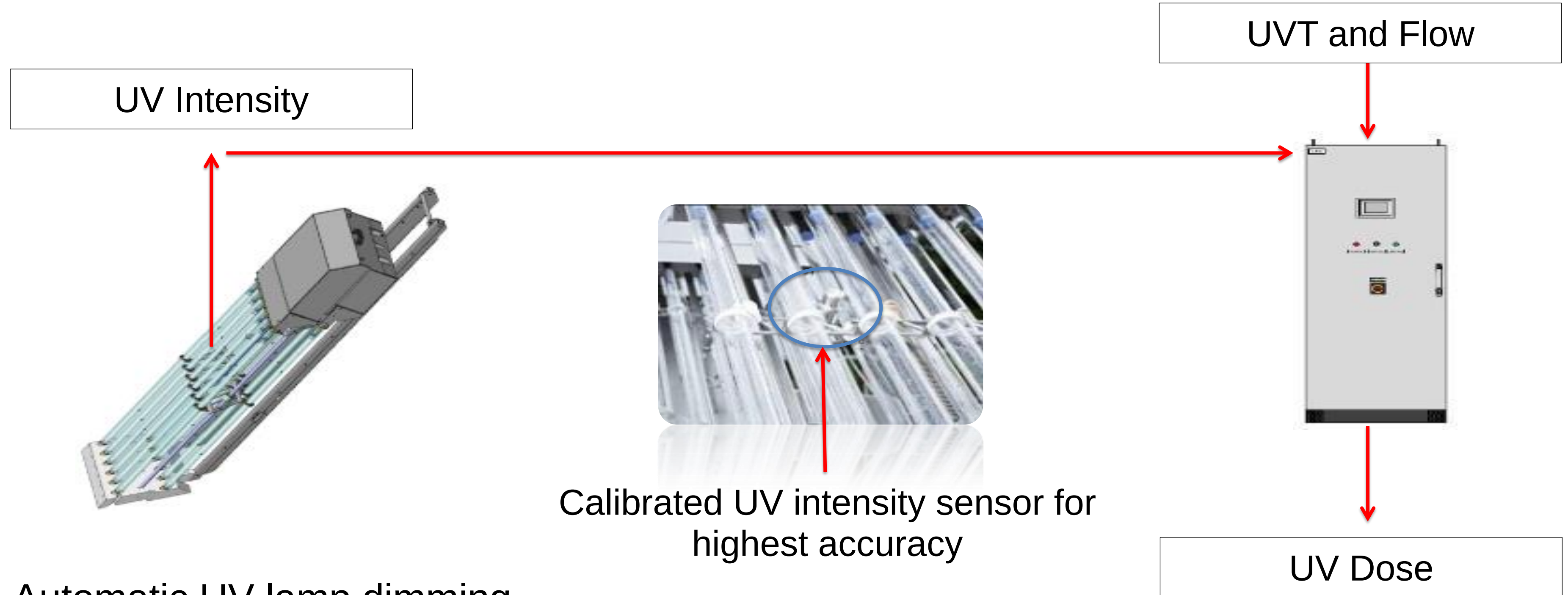


- Compact cabinet design
- Easy to access components
- Ballast card replacement in < 5 minutes
- Variable lamp power controls
- Adequate climatisation

***Wedeco's original design of separation between ballast cabinet and channel is now the industry standard: > 40 years of experience***

# OptiDose Control

Intelligent OptiDose Control for unattended automatic operation



# Automatic Cleaning Mechanism



Electric wiper drive



Proven triple blade wiper technology:  
OptiWipe

- ☐ Proven chemical-free cleaning system
- ☐ No need for chemicals and hydraulic oils!
- ☐ Minimum maintenance requirements
- ☐ Continuous cleaning also of the UV sensor



Wiper control box

# Typical Open Channel UV System Reference Site



# Replacing Chlorination with UV...



De Kalb, IL (USA) – UV System for 90 MLD

# Another Example: Berlin Ruhleben (average dry weather flow 250 MLD)



UV for partial flow of 90 MLD

# Typical Installation incl. Ballast/Control Cabinet



# iDuron Serviceability

Channel Depth  
~ 1,400 mm



- ❑ Ease of lamps and quartz sleeves replacement without lifting frame
- ❑ Wiper ring replacement will require first quartz sleeve removal and then module removal from the channel (once every 2 years)

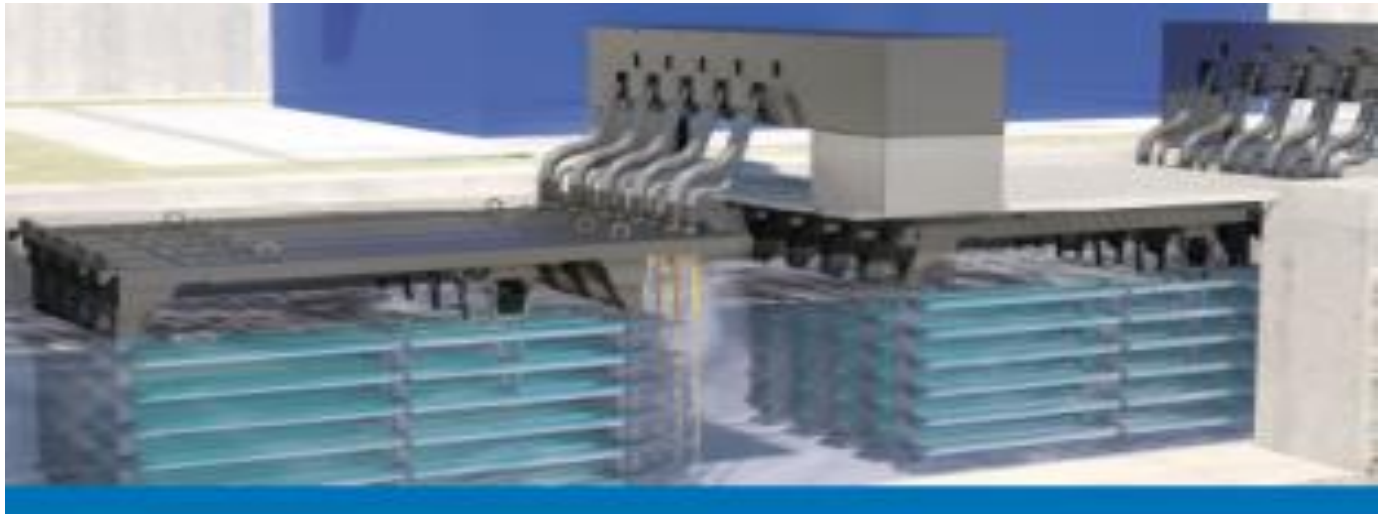
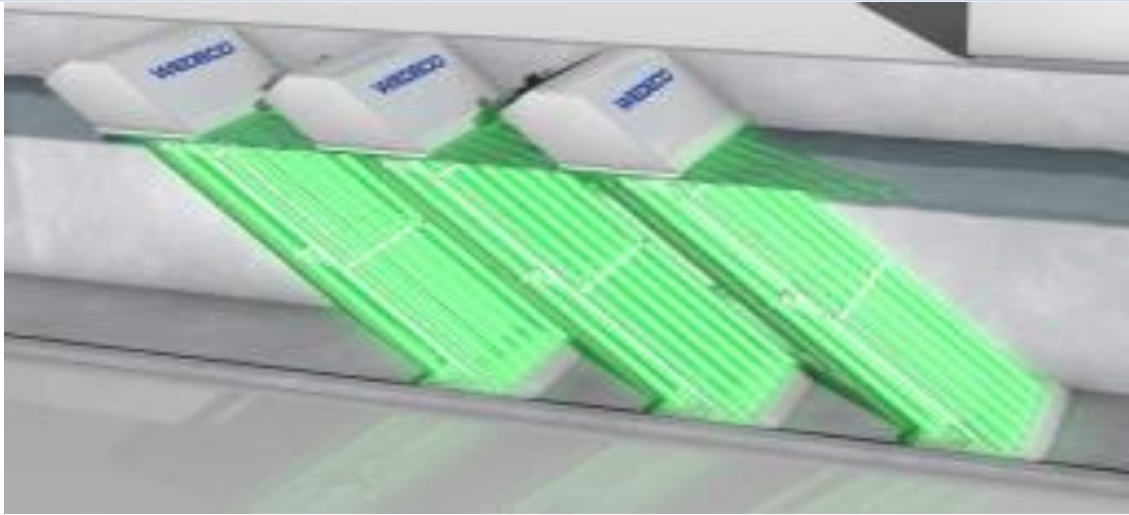
# Quick, Simple, and Safe Maintenance



1,830 mm

# Some Estimates for Design

|                           | Wedeco iDuron  | typ. horizontal<br>UV System |
|---------------------------|----------------|------------------------------|
| Power per lamp            | 600 W          | 250 – 300 W                  |
| Lamp length               | 1,430 mm       | ~ 1,400 – 1,500 mm           |
| Qty. of lamps for 100 MLD | ~ 100 lamps    | ~ 400 lamps<br>(+ 400%)      |
| Power consumption         | ~ 70 kW        | ~ 100 kW<br>(+ 40%)          |
| Banks/rows in series      | min. 2, typ. 4 | typ. 1, max. 2               |



# Selected References

## 1. Disinfection of Primary Treated Effluent : WWTP Lagares, Spain

- ❑ Flow: 7,200 m<sup>3</sup>/h = 173 MLD
- ❑ UVT: 37%
- ❑ 4 channels with 8 banks



## 2. Disinfection of Secondary Treated Effluent : WWTP Rensselaer, USA

- ❑ Flow: 10,000 m<sup>3</sup>/h = 240 MLD
- ❑ UVT: 65%
- ❑ 2 channels with 3 banks



# Selected References

## 3. Disinfection of Secondary Treated Effluent : WWTP Valparaíso, USA

- ❑ Flow: 2917 m<sup>3</sup>/h = 70 MLD
- ❑ UVT: 65%
- ❑ 2 channels with 5 banks



## 4. Disinfection of Aquaculture Effluent : Fishfarm Tjeldbergodden, Norway

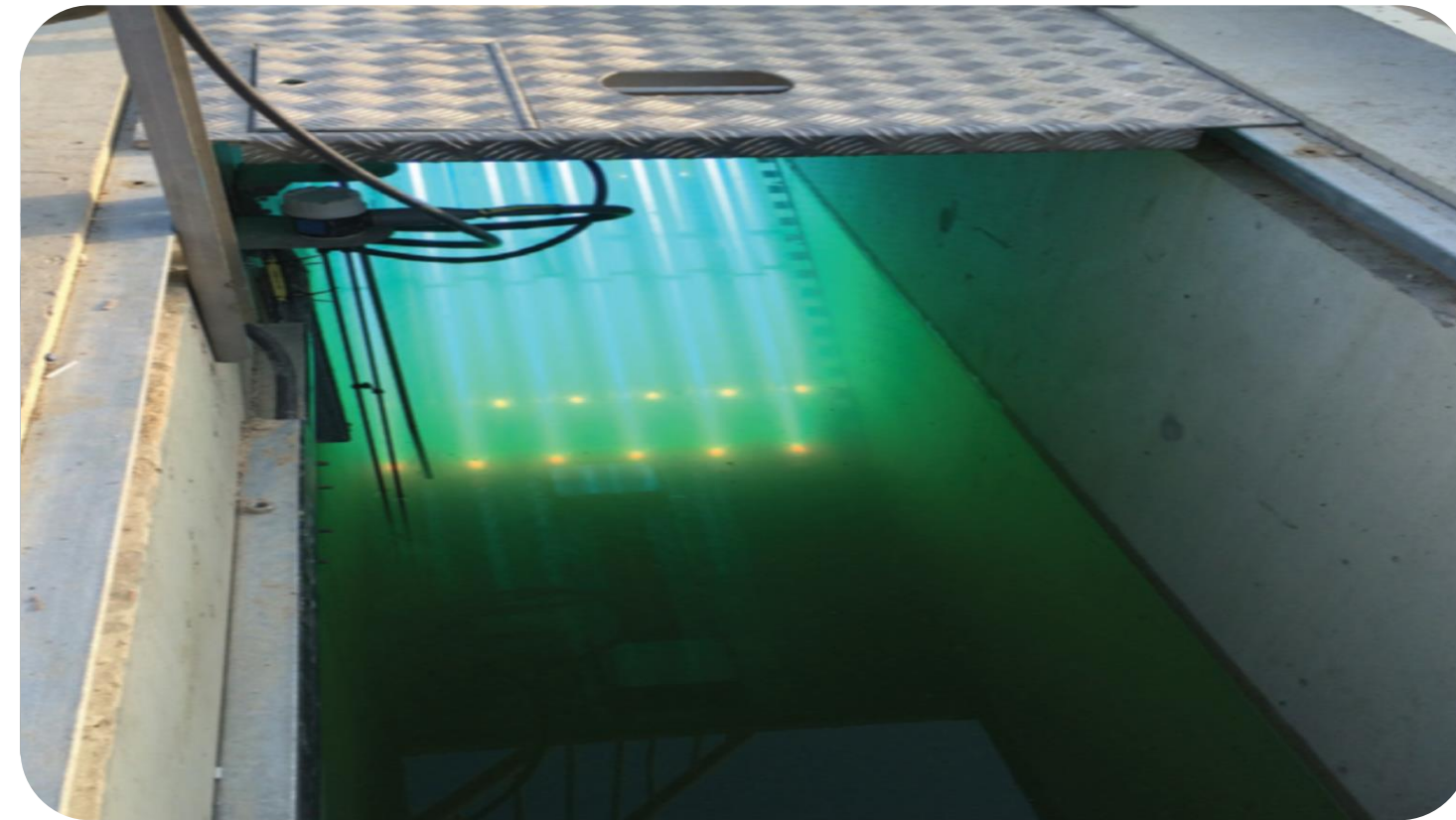
- ❑ Flow: 7,000 m<sup>3</sup>/h = 168 MLD
- ❑ UVT: 90%
- ❑ 1 channel with 3 banks



# Selected References

## 5. Disinfection of Stormwater Overflows: Chichester, United Kingdom

- ❑ Peak flow: 292 l/s = 25 MLD
- ❑ UVT: 20%
- ❑ 1 channel with 10 banks



# Wedeco's iDuron Series

## *Conclusions*

Significant capital and construction cost savings with:

- a) Compact footprint
- b) Flexible modular design
- c) Low lamp count

Significant power cost savings with:

- a) OptiDose control philosophy
- b) Ecoray lamp & ballast technology
- c) Optimized hydraulics

# Wedeco's iDuron Series

## *Conclusions*

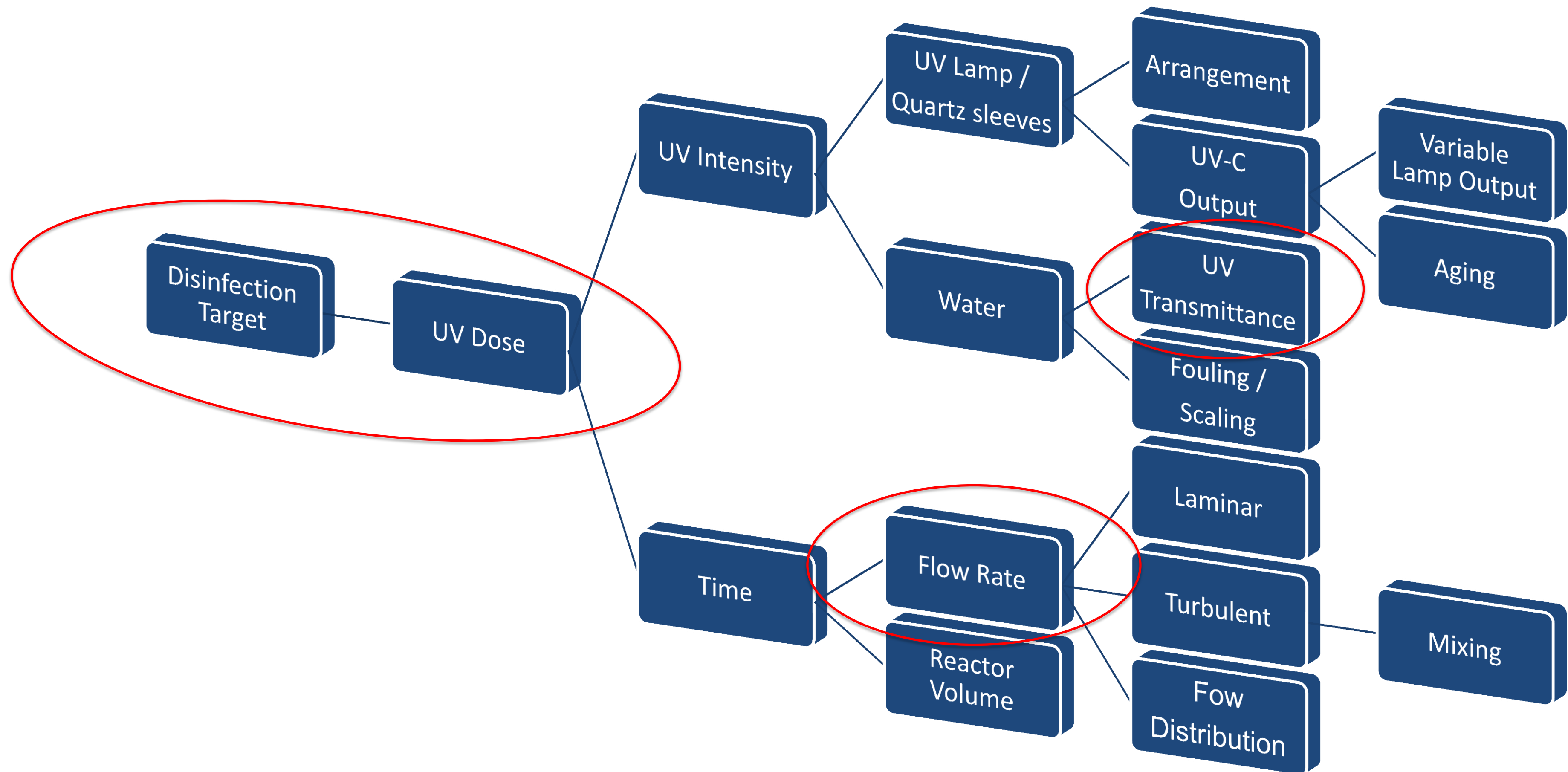
Quick, simple, and safe maintenance procedures with:

- a) Fast and easy lamp change out
- b) Automatic mechanical cleaning system; no chemicals
- c) Separation of electrical components

Reliable & accurate disinfection with:

- a) OptiDose sensor-based control philosophy
- b) Maintaining adequate UV dose for all effluent qualities

# To conclude: Information required



# Many Thanks!

## The iDuron

