

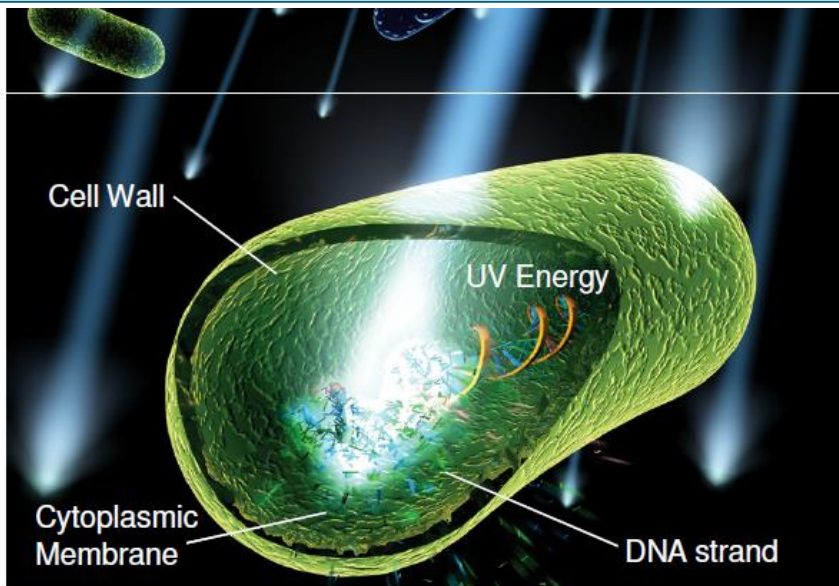
WHAT IS UV DISINFECTION

- Ultraviolet light(UV) destroys bacteria and viruses by altering DNA.
- Natural, non-chemical method of treatment



HOW DOES UV DISINFECT

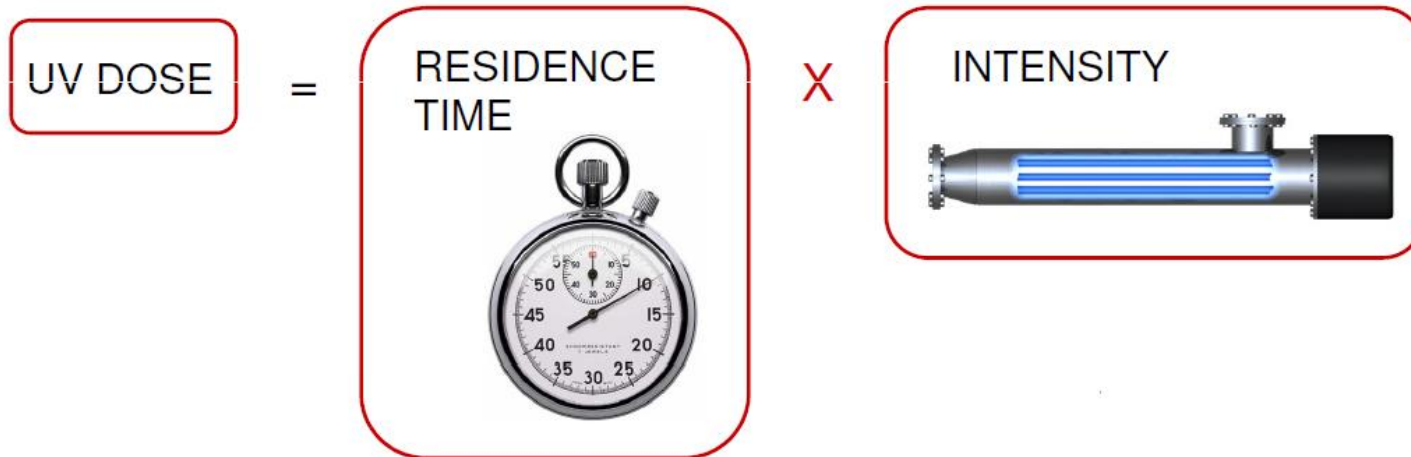
- UV light penetrates and permanently alters the DNA of the microorganisms in a process called *thymine dimerization*.
- The microorganisms are “inactivated” and rendered unable to reproduce or infects.



UV DOSE CALCULATIONS

UV Dose is a product of:

Intensity (quantity of UV light per unit area falling on a surface) and
Residence Time (contact time in the reaction chamber)



UV DOSE UNITS

UV Dose is expressed in:

- Milli-Joules/square centimeter(mJ/cm²)
- Micro-Watt seconds/square centimeter (μ Wsec/cm²)

$$40 \text{ mJ/cm}^2 = 40,000 (\mu\text{Wsec/cm}^2)$$

UV DISINFECTION DOSE REQUIREMENTS

Average UV Dose Required for Inactivation (mJ/cm²)

Pathogen	(90%) 1-Log	(99%) 2-Log	(99.9%) 3-Log	(99.99%) 4-Log
<i>Cryptosporidium parvum</i> oocysts	1.3	2.5	4.3	5.7
<i>Giardia lamblia</i> cysts	0.3	0.7	1.3	1.7
<i>Vibrio cholerae</i>	0.8	1.4	2.2	2.9
<i>Shigella dysenteriae</i>	0.5	1.2	2	3
<i>Escherichia coli</i> O 157:H7	1.5	2.8	4.1	5.6
<i>Salmonella typhi</i>	1.8 - 2.7	4.1 - 4.8	5.5 - 6.4	7.1 - 8.2
<i>Shigella sonnei</i>	3.2	4.9	6.5	8.2
<i>Salmonella enteritidis</i>	5	7	9	10
Hepatitis A virus	4.1 - 5.5	8.2 - 13.7	12.3 - 22	16.4 - 29.6
Poliovirus Type 1	4.1 - 6	8.7 - 14	14.2 - 23	21.5 - 30
Coxsackie B5 virus	6.9	13.7	20.6	30
Rotavirus SA 11	7.1 - 9.1	14.8 - 19	23 - 25	36

FACTORS EFFECTING UV DOSE

- Flow Rate
- Ultraviolet Transmittance
- Water Quality
 - Hardness
 - Iron
- Suspended Solids

UV DOSE vs FLOW RATE

Flow Rate

The flow rate affects the residence time of the water.



Fast Flow = Low Dose

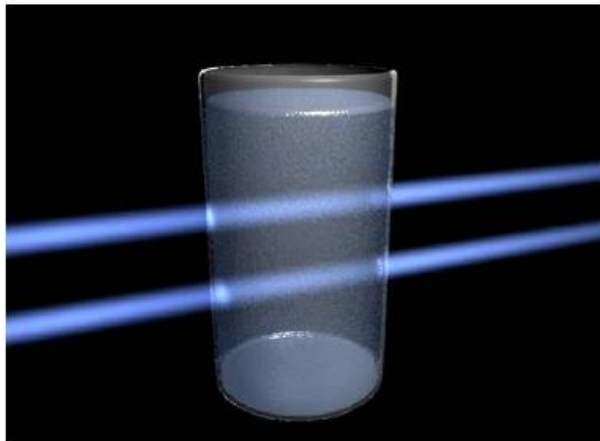


Slow Flow = High Dose

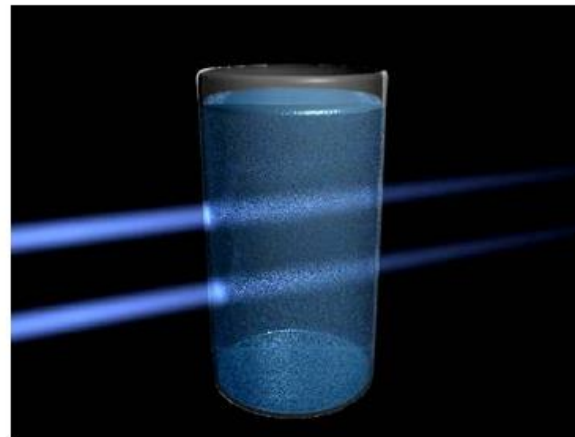
UV DOSE vs UV TRANSMITTANCE(UVT)

UV Transmittance (UVT)

UVT is a measure of how well the water is able to transmit UV light (water clarity). It affects the intensity of light reaching pathogens.



High UVT = High Dose

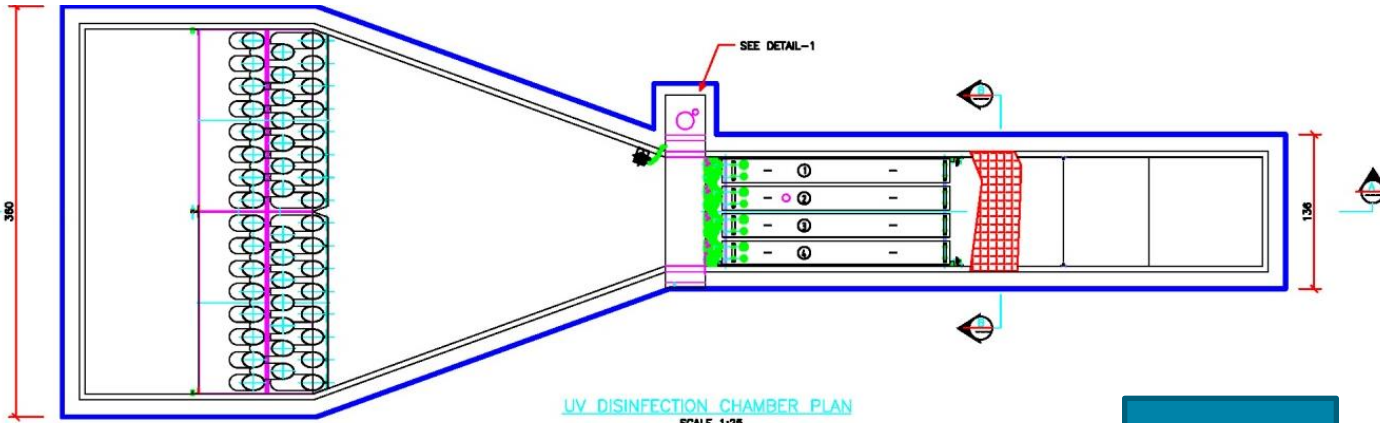
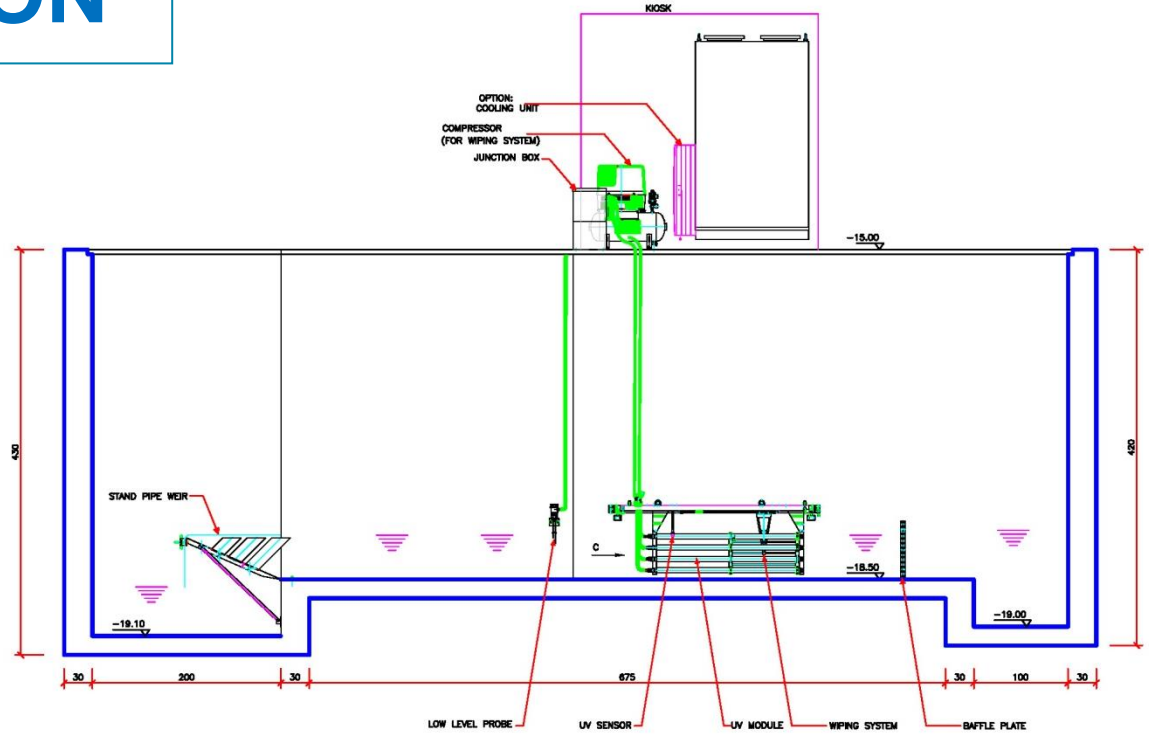


Low UVT = Low Dose

Less UV light
getting through
the water



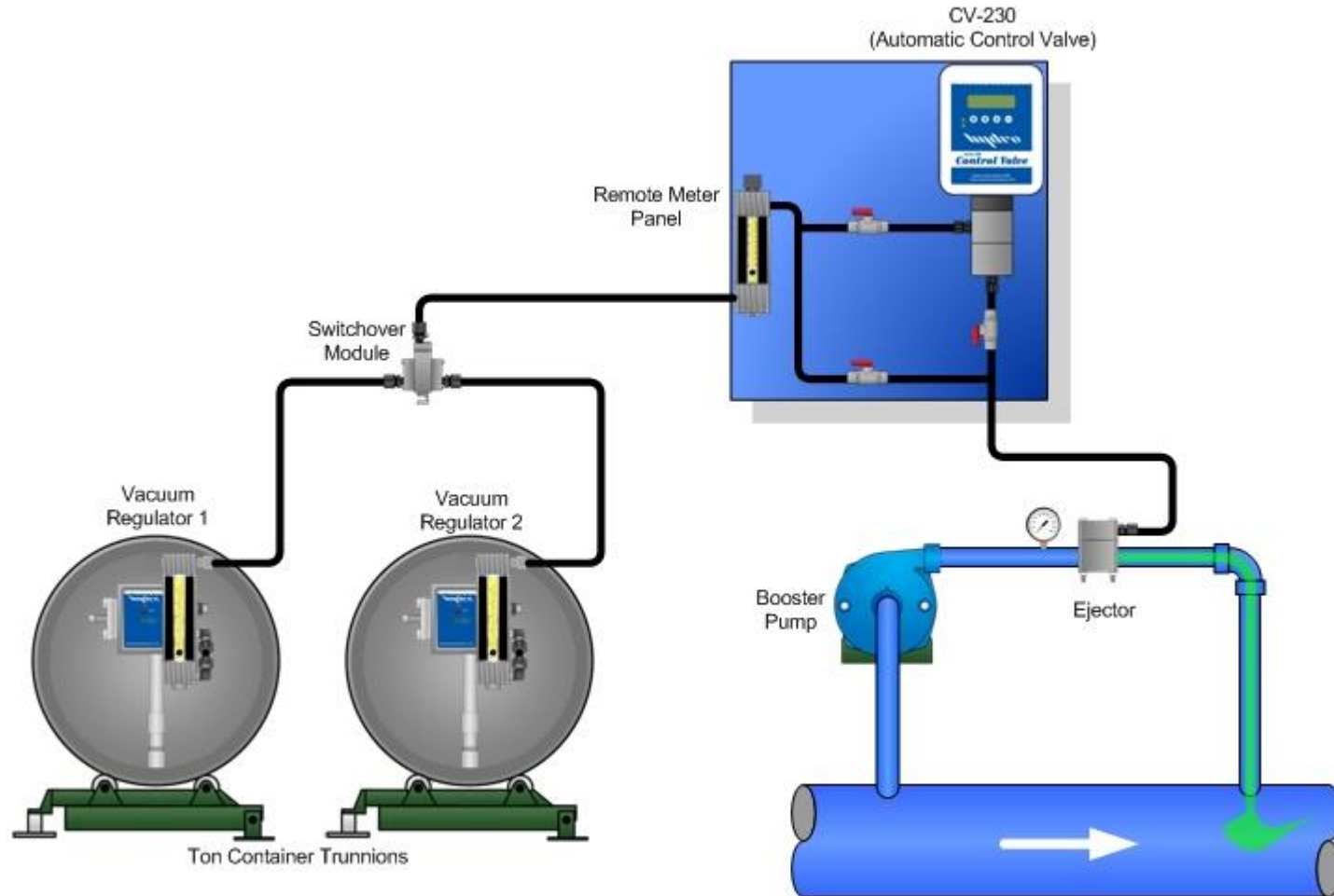
UV DISINFECTION



UV DISINFECTION CHAMBER PLAN
SCALE 1:25

UV

CHLORINATION SYSTEM SCHEMATIC



CHLORINE SYSTEM SIZING

CHLORINE DISINFECTION CALCULATOR		
Average Flow	m3/day	9,500
Peak Flow	m3/day	38,000
Retention time in contact tank @ Peak Flow	minutes	30
Total Volume of Chlorine Contact Tank	m3	792
No. of Tanks		2
Volume each Tank	m3	396
Water Depth	m	4
Area Each Tank	m2	99
Calculated Retention time @ Qav both units in operation	minutes	120
Calculated Retention time @ Qav one unit in operation	minutes	60
Assumed Chlorine Dose @Qav	mg/l	8
Chlorine Consumption @ Qav	Kg/h	3
Assumed Chlorine Dose @ Peak Flow	mg/l	8
Chlorine Consumption @ Peak Flow	Kg/h	13
Capacity of one chlorine drum	Kg	860
Required no. of drums per month @ Average Flow		2.7
No. of duty chlorinators		1
No. of standby chlorinators		1
Maximum Capacity each chlorinator	Kg Cl ₂ /h	13
Minimum Capacity each chlorinator	Kg Cl ₂ /h	0.6