

UV Dosage Requirements

The list below details the UV dosage required for deactivation of specific microbiological contaminants to achieve a four log reduction. (This is based upon the UV emitting a 254 nanometer wave length at a UV dose stated in mJ/cm² and rounded to the next highest decimal.)

Pathogen	UV Dose (mJ/cm ²)
BACTERIA	
Aeromonas hydrophilia ATCC 7966	5
Aeromonas salmonicida	5.9
Agrobacterium lumefaciens 5	9
Bacillus anthracis 1,4,5,7,9 - Anthrax veg	9
Bacillus anthracis spores - Anthrax spores	46
Bacillus megatherium sp (veg.)	2.8
Bacillus megatherium sp (spores)	5.6
Bacillus paratyphosus	6.3
Bacillus subtilis	12
Bacillus subtilis Spores	23
Campylobacter jejuni ATCC 43429	5
Citrobacter diversus	12
Citrobacter freundii	13
Clostridium tetani	23
Clostridium botulinum	11
Corynebacterium diphtheriae 1,4,5,7,8,9	7
Dysentary bacilli	4
Eberthella typhosa	4
Escherichia coli ATCC 11229	5
Escherichia coli ATCC 11303	10
Escherichia coli ATCC 25922	8
Escherichia coli O157:H7	6
Halobacterium elongata ATCC 33173	1
Halobacterium salinarum ATCC 43214	20
Klebsiella pneumonia	20
Klebsiella terrigena ATCC 33257	11
Legionella bozemanii 5	4
Legionella dumoffii 5	6
Legionella gormanii 5	5
Legionella micdadei 5	4
Legionella longbeache 5	3
Legionella pneumophila ATCC 43660 - Legionnaires Disease	9
Leptospira canicola - infectious Jaundice	6
Leptospira interrogans 1,5,9	6
Micrococcus candidus	13
Micrococcus sphaeroides	16
Mycobacterium tuberculosis 1,3,4,5,7,8,9	11
Neisseria catarrhalis 1,4,5,9	9
Phytomonas tumefaciens 1,4,9	9
Proteus vulgaris 1,4,5,9	7

Pathogen	UV Dose (mJ/cm ²)
BACTERIA (continued)	
Pseudomonas aeruginosa - Environmental Strain 1,2,3,4,5,9	11
Pseudomonas aeruginosa - Laboratory Strain 5,7	4
Pseudomonas fluorescens 4,9	7
Rhodospirillum rubrum 5	7
Samonella	11
Salmonella spp.	7
Salmonella enteritidis 3,4,5,9	10
Salmonella infantis	6
Salmonella paratyphi - Enteric fever 5,7	7
Salmonella species 4,7,9	16
Salmonella typhi ATCC 19430	8
Salmonella typhimurium 4,5,9	16
Salmonella typhosa - Typhoid fever 7	7
Sarcina lutea 1,4,5,6,9	27
Serratia marcescens 1,4,6,9	7
Shigella dysenteriae ATCC 29027 - Dysentery	4
Shigella flexneri - Dysentery 5,7	4
Shigella paradysenteriae 4,9	35
Shigella sonnei 5 - ATCC 9290 5	8
Spirillum rubrum 1,4,6,9	7
Staphylococcus albus 1,6,9	7
Staphylococcus aureus 3,4,6,9 - ATCC 25923	10
Staphloccus epidermidis 5,7	6
Streptococcus faecalis 5,7,8 - ATCC 29212	11
Streptococcus hemolyticus 1,3,4,5,6,9	6
Stephtococcus lactis 1,3,4,5,6	10
Streptococcus pyrogenes	5
Streptococcus salivarius	5
Streptococcus viridians 3,4,5,9	5
Vibrio anguillarum	2
Vibrio cholerae 1,5,8,9 - ATCC 25872	7
Vibrio comma (cholera) 3,7	7
Yersinia enetrocolitica ATCC 27729	5
Yersinia ruckeri	5
VIRUS	
PRD-1 (Phage)	30
B40-8 (Phage)	28
MS2 (Phage)	83
Adenovirus type III 3	5
Adenovirus type 2	100
Adenovirus type 3	
Adenovirus type 15	165
Adenovirus type 40	155
Adenovirus type 41	112

Pathogen	UV Dose (mJ/cm ²)
VIRUS (continued)	
Bacteriophage (E. coli) 1,3,4,5,6,9	7
Calicivirus canine	30
Calicivirus feline	25
Coxsackie AZ	6.3
Coxsackievirus B3	33
Coxsackievirus B5	36
Echovirus I	33
Echovirus II	28
Hepatitis A HM175	16
Infectious hepatitis 1,5,7,9	8
Influenza 1,2,3,4,5,7,9	7
Poliovirus 1	7
Reovirus-3	23
Rotavirus 5	24
Rotavirus SA-11	36
Tobocca mosaic	469
PROTOZOA	
Blue -Green algae	420
Chlorella vulgaris (Algae) 1,2,3,4,5,9	24
Cryptosporidium parvum	4
E. hystolytica	84
Encephalitozoon cuniculi, microsporidia	13
Encephalitozoon intestinalis, microsporidia	6
Giardia lamblia (cysts) 3	< 1
Giardia muris	3
Nematode eggs	98
Nematode eggs 6	40
Paramecium 1,2,3,4,5,6,9	21
SPORES	
Bacillus subtilis ATCC 6633	81
MOLD	
Aspergillus amstelodami	77
Aspergillus flavus 1,4,5,6,9	105
Aspergillus glaucus 4,5,6,9	91
Aspergillus niger (Bread mold) 2,3,4,5,6,9	350
Mucor mucedo	77
Mucor racemosus (A & B) 1,3,4,6,9	38
Oospora lactis 1,3,4,6,9	11
Penicillium chrysogenum	56
Penicillium digitatum 4,5,6,9	91
Penicillium expansum 1,4,5,6,9	23
Penicillium roqueforti 1,2,3,4,5,6	28
Rhisopus nigricans (Cheese mold) 3,4,5,6,9	350

Pathogen	UV Dose (mJ/cm ²)
YEAST	
Bakers yeast 1,3,4,5,6,7,9	9.1
Brewers yeast 1,2,3,4,5,6,9	7
Common yeast cake 1,4,5,6,9	14
Saccharomyces cereisiae 4,6,9	14
Saccharomyces ellipsoideus 4,5,6,9	14
Saccharomyces spores 2,3,4,5,6,9	24

References

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- (2) C.B. Huff, H.F Smith , W.O. Boring, N.A. Clark "Study Ultraviolet Disinfection of Water and Factors in Treatment Efficiency" Public Health Reports 1965
- (3) R.W. Yip , D.E. Konasewich "Ultraviolet Sterilization of Water It's Potential and Limitations" 06/1972
- (4) "The Use of Ultraviolet Light for Microbial Control" Ultrapure Water 04/1989
- (5) W.V. Collentro, Treatment of Water with Ultraviolet Light" Part 1 Ultra pure Water 07/08/86
- (6) J.E. Cruver, PHD "Spotlight on Ultraviolet Disinfection" Water Technology 06/1984
- (7) Dr. R.W. Legan "Alternative Disinfection Methods-A Comparison of UV and Ozone" Industrial Water Engineering 03/04/1982
- (8) R. Nagy, Research Report BL-R-6-1059-3023-1, Westinghouse Electric Cooperation
- (9) M. Lupal, UV Offers Reliable Disinfection" WCP Magazine 1993
- (10) J. Treij, "Ultraviolet Technology" WCP Magazine 12/1995 / B. Srikanth, "The Basic Benefits of Ultraviolet Technology" WCP Magazine 12/1995
- (11) In addition to the list of references stated, numerous individual research studies were used. For a specific reference not listed please contact Outback Water.

Please Note: Various sources may report different dosages required to inactivate a microorganism.