

APPENDIX H

EPA GUIDELINES FOR WATER REUSE SUMMARY TABLES

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EPA Recommended Limits for Constituents in Reclaimed Water for Irrigation

TRACE HEAVY METALS			
Constituent	Long-Term Use (mg/L)	Short-Term Use (mg/L)	Remarks
Aluminum	5.0	20	Can cause non-productivity in acid soils, but soils at pH 5.5 to 8.0 will precipitate the ion and eliminate toxicity.
Arsenic	0.10	2.0	Toxicity to plants varies widely, ranging from 12 mg/L for Sudan grass to less than 0.05 mg/L for rice.
Beryllium	0.10	0.5	Toxicity to plants varies widely, ranging from 5 mg/L for kale to 0.5 mg/L for bush beans.
Boron	0.75	2.0	Essential to plant growth, with optimum yields for many obtained at a few-tenths mg/L in nutrient solutions. Toxic to many sensitive plants (e.g. citrus) at 1 mg/L. Usually sufficient quantities in reclaimed water to correct soil deficiencies. Most grasses relatively tolerant at 2.0 to 10 mg/L.
Cadmium	0.01	0.05	Toxic to beans, beets, and turnips at concentrations as low as 0.1 mg/L in nutrient solution. Conservative limits recommended.
Chromium	0.1	1.0	Not generally recognized as essential growth element. Conservative limits recommended due to lack to knowledge on toxicity to plants.
Cobalt	0.05	5.0	Toxic to tomato plants at 0.1mg/L in nutrient solution. Tends to be inactivated by neutral and alkaline soils.
Copper	0.2	5.0	Toxic to a number of plants at 0.1 to 1.0 mg/L in nutrient solution.
Fluoride	1.0	15.0	Inactivated by neutral and alkaline soils.
Iron	5.0	20.0	Not toxic to plants in aerated soils, but can contribute to soil acidification and loss of essential phosphorus and molybdenum.
Lead	5.0	10.0	Can inhibit plant cell growth at very high concentrations.
Lithium	2.5	2.5	Tolerated by most crops at up to 5 mg/L; mobile in soil. Toxic to citrus at a low doses – recommended limit is 0.075 mg/L.
Manganese	0.2	10.0	Toxic to a number of crops at a few-tenths to a few mg/L in acid soils.
Molybdenum	0.01	0.05	Nontoxic to plants at normal concentrations in soil and water. Can be toxic to livestock if forage is grown in soils with high levels of available molybdenum.
Nickel	0.2	2.0	Toxic to a number of plants at 0.5 to 1.0 mg/L; reduced toxicity at neutral or alkaline pH.
Selenium	0.02	0.02	Toxic to plants at low concentrations and to livestock if forage is grown in soils with low levels of added selenium.
Tin, Tungsten, & Titanium	-	-	Effectively excluded by plants; specific tolerance levels unknown.
Vanadium	0.1	1.0	Toxic to many plants at relatively low concentrations.
Zinc	2.0	10.0	Toxic to many plants at widely varying concentrations; reduced toxicity at increased pH (6 or above) and in fine-textured or organic cells.
Other Parameters			
Constituent	Recommended Limit	Remarks	
pH	6.0	Most effects on pH on plant growth are indirect (e.g., pH effects on heavy metals' toxicity described above).	
TDS	500-2,000 mg/L	Below 500 mg/L, no detrimental effects are usually noticed. Between 500 and 1,000 mg/L, TDS in irrigation water can affect sensitive plants. At 1,000 to 2,000 mg/L, TDS levels can affect many crops and careful management practices should be followed. Above 2,000 mg/L, water can be used regularly only for tolerant plants on permeable soils.	
Free Chlorine Residual	<1 mg/L		

Source: EPA, September 1992.

USEPA Suggested Guidelines for Water Reuse

TYPES OF REUSE	TREATMENT	RECLAIMED WATER QUALITY ¹	RECLAIMED WATER MONITORING	SETBACK DISTANCE ²	COMMENTS
<p><i>Urban Reuse</i></p> <p>All types of landscape irrigation, (e.g., golf courses, parks, cemeteries) – also vehicle washing, toilet flushing, use in fire protection systems and commercial air conditioners, and other uses with similar access or exposure to the water.</p>	<ul style="list-style-type: none"> • Secondary³ • Filtration⁴ • Disinfection⁵ 	<ul style="list-style-type: none"> • pH =6 - 9 • ≤ 10 mg/l BOD⁶ • ≤ 2 NTU⁷ • No detectable fecal coli/100 ml^{8,9} • 1 mg/l Cl₂ residual (min)¹⁰ 	<ul style="list-style-type: none"> • pH – weekly • BOD – weekly • Turbidity – continuous • Coliform – daily • Cl₂ residual – continuous 	<ul style="list-style-type: none"> • 50 ft (15 m) to potable water supply wells 	<ul style="list-style-type: none"> • See Table 19 for other recommended limits. • At controlled access irrigation sites where design and operational measures significantly reduce the potential or public contact with reclaimed water, a lower level of treatment, e.g., secondary treatment and disinfection to achieve ≤14 fecal coli/100 ml, may be appropriate. • Chemical (coagulant and/or polymer) addition prior to filtration may be necessary to meet water quality recommendations. • The reclaimed water should not contain measurable levels of pathogens.¹³ • Reclaimed water should be clear, odorless, and contain no substances that are toxic upon ingestion. • A higher chlorine residual and/or a long contact time may be necessary to assure that viruses and parasites are inactivated or destroyed. • A chlorine residual of 0.5 mg/l or greater in the distribution system is recommended to reduce odors, slime, and bacterial regrowth. • See Section 2.4.3. for recommended treatment reliability.

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<p><i>Agricultural Reuse – Food Crops</i></p> <p>Commercially Processed;¹⁴ Surface Irrigation of Orchards and Vineyards</p>	<ul style="list-style-type: none"> • Secondary³ • Disinfection⁵ 	<ul style="list-style-type: none"> • pH = 6 – 9 • ≤ 30 mg/l BOD⁶ • ≤ 30 mg/l SS • ≤ 200 fecal coli/100 ml^{8,11,12} • 1 mg/l Cl₂ residual (min.)¹⁰ 	<ul style="list-style-type: none"> • pH – weekly • BOD – weekly • SS – daily • Coliform – daily • Cl₂ residual – continuous 	<ul style="list-style-type: none"> • 300 ft (90 m) to potable water supply wells • 100 ft (30 m) to areas accessible to the public 	<ul style="list-style-type: none"> • See Table 19 for other recommended limits. • If spray irrigation, SS less than 30 mg/l may be necessary to avoid clogging of sprinkler heads. • High nutrient levels may adversely affect some crops during certain growth stages. • See Section 2.4.3 for recommended treatment reliability.
<p><i>Agricultural Reuse – Non-Food Crops</i></p> <p>Pasture for milking animals; fodder, fiber and seed crops.</p>	<ul style="list-style-type: none"> • Secondary³ • Disinfection⁵ 	<ul style="list-style-type: none"> • pH = 6 – 9 • ≤ 30 mg/l BOD⁶ • ≤ 30 mg/l SS • ≤ 200 fecal coli/100 ml^{8,11,12} • 1 mg/l Cl₂ residual (min.)¹⁰ 	<ul style="list-style-type: none"> • pH – weekly • BOD – weekly • SS – daily • Coliform – daily • Cl₂ residual – continuous 	<ul style="list-style-type: none"> • 300 ft (90 m) to potable water supply wells • 100 ft (30 m) to areas accessible to the public (if spray irrigation) 	<ul style="list-style-type: none"> • See Table 19 for other recommended limits. • If spray irrigation, SS less than 30 mg/l may be necessary to avoid clogging of sprinkler heads. • High nutrient levels may adversely affect some crops during certain growth periods. • Milking animals should be prohibited from grazing for 15 days after irrigation ceases. • A higher level of disinfection, e.g., to achieve ≤14 fecal coli/100ml, should be provided if this waiting period is not adhered to. • See Section 2.4.3 for recommended treatment reliability.
<p><i>Landscape Impoundments</i></p> <p>Aesthetic impoundments where public contact with reclaimed water is not allowed.</p>	<ul style="list-style-type: none"> • Secondary³ • Disinfection⁴ 	<ul style="list-style-type: none"> • ≤ 30 mg/l BOD⁶ • ≤ 30 mg/l SS • ≤ 200 fecal coli/100 ml^{8,11,12} • 1 mg/l Cl₂ residual (min.)¹⁰ 	<ul style="list-style-type: none"> • pH – weekly • SS – daily • Coliform – daily • Cl₂ residual – continuous 	<ul style="list-style-type: none"> • 500 ft (150 m) to potable water supply wells (minimum) if bottom not sealed. 	<ul style="list-style-type: none"> • Nutrient removal processes may be necessary to avoid algae growth in impoundments. • Dechlorination may be necessary to protect aquatic species of flora and fauna. • See Section 2.4.3 for recommended treatment reliability.

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<p><i>Environmental Reuse</i></p> <p>Wetlands, marshes, wildlife habitat, stream augmentation</p>	<ul style="list-style-type: none"> • Variable • Secondary³ and disinfection⁵ (min.) 	<p>Variable, but not to exceed:</p> <ul style="list-style-type: none"> • ≤ 30 mg/l BOD⁶ • ≤ 30 mg/l SS • ≤ 200 fecal coli/100 ml^{8,11,12} 	<ul style="list-style-type: none"> • BOD – weekly • SS – daily • Coliform – daily • Cl₂ residual – continuous 	<ul style="list-style-type: none"> • Dechlorination may be necessary to protect aquatic species of flora and fauna. • Possible effects on groundwater should be evaluated. • Receiving water quality requirements may necessitate additional treatment. • The temperature of the reclaimed water should not be adversely affect ecosystem. • See Section 2.4.3 for recommended treatment reliability.
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1. Unless otherwise noted, recommended quality limits apply to the reclaimed water at the point of discharge from the treatment facility.
2. Setback distances are recommended to protect potable water supply sources from contamination and to protect humans from unreasonable health risks due to exposure to reclaimed water.
3. Secondary treatment processes include activated sludge processes, trickling filters, rotating biological contactors, and many stabilization pond systems. Secondary treatment should produce effluent in which both the BOD and SS do not exceed 30 mg/l.
4. Filtration means the passing of wastewater through natural undisturbed soils or filter media such as sand and/or anthracite.
5. Disinfection means the destruction, inactivation, or removal of pathogenic microorganisms by chemical, physical, or biological means. Disinfection may be accomplished by chlorination, ozonation, other chemical disinfectants, UV radiation, membrane processes, or other processes.
6. As determined from the 5 day BOD test.
7. The recommended turbidity limit should be met prior to disinfection. The average turbidity should be based on a 24 hour time period. The turbidity should not exceed 5 NTU at any time. If SS is used in lieu of turbidity, the average SS should not exceed 5 mg/l.
8. Unless otherwise noted, recommended coliform limits are median values determined from the bacteriological results of the last 7 days for which analyses have been completed. Either the membrane filter or fermentation tube technique may be used.
9. The number of fecal coliform organisms should not exceed 14 100 ml in any sample.
10. Total chlorine residual after a minimum contact time for 30 minutes.
11. The number of fecal coliform organisms should not exceed 800/100 ml in any sample.
12. Some stabilization pond systems may be able to meet this coliform limit without disinfection.
13. It is advisable to fully characterize the microbiological quality of the reclaimed water prior to implementation of a reuse program.

Source: EPA, September 1992.