WATER QUALITY ASSESSMENT for Treatment Plant Design

Applicable WQD Rules

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Laramie Peak from the Oregon Trail, 18 July 2000

Chapter 12 – Standards for Public Water Supplies Applicable Surface Treatment Rules

- Section 5 – Facilities and Systems not Specifically Covered by these Standards
- Section 6 – Engineering Design Report
- Section 8 – General Design Considerations
- Section 10 – Treatment

Section 5 –
Facilities & Systems not Specifically Covered . . .

Provided to encourage new technology & equipment.

Allows for case-by-case permitting of facilities which may be based on:

- Data obtained from a full scale, comparable installation
- Pilot plant

Section 5 – Data from comparable installation.

Little America UF Plant

General Chemical UF Modules

Section 5 – Pilot Plant

Meeteetse UF Plant

Turbimeter & Particle Counter

Section 6
Engineering Design Report

- The report shall include: "representative water quality data . . . . sufficient to determine the necessary process and the ability to meet water quality standards." [WQR&R Ch 12, Section 6(c)(v)(B)(III)]

- "Description of the watershed noting sources of potential contamination." [WQR&R Ch 12, Section 6(c)(v)(B)(IV)]

- "Description of any anticipated changes in water quality." [WQR&R Ch 12, Section 6(c)(v)(B)(V)]

Section 8
General Design Considerations

"Treatment shall be provided to produce a potable water that is

bacteriologically,
chemically,
radiologically, &
physically safe

as determined by the administrator." [WQR&R Ch 12, Section 8(c)]

Section 8 Outlines Three Surface Water Treatment Options

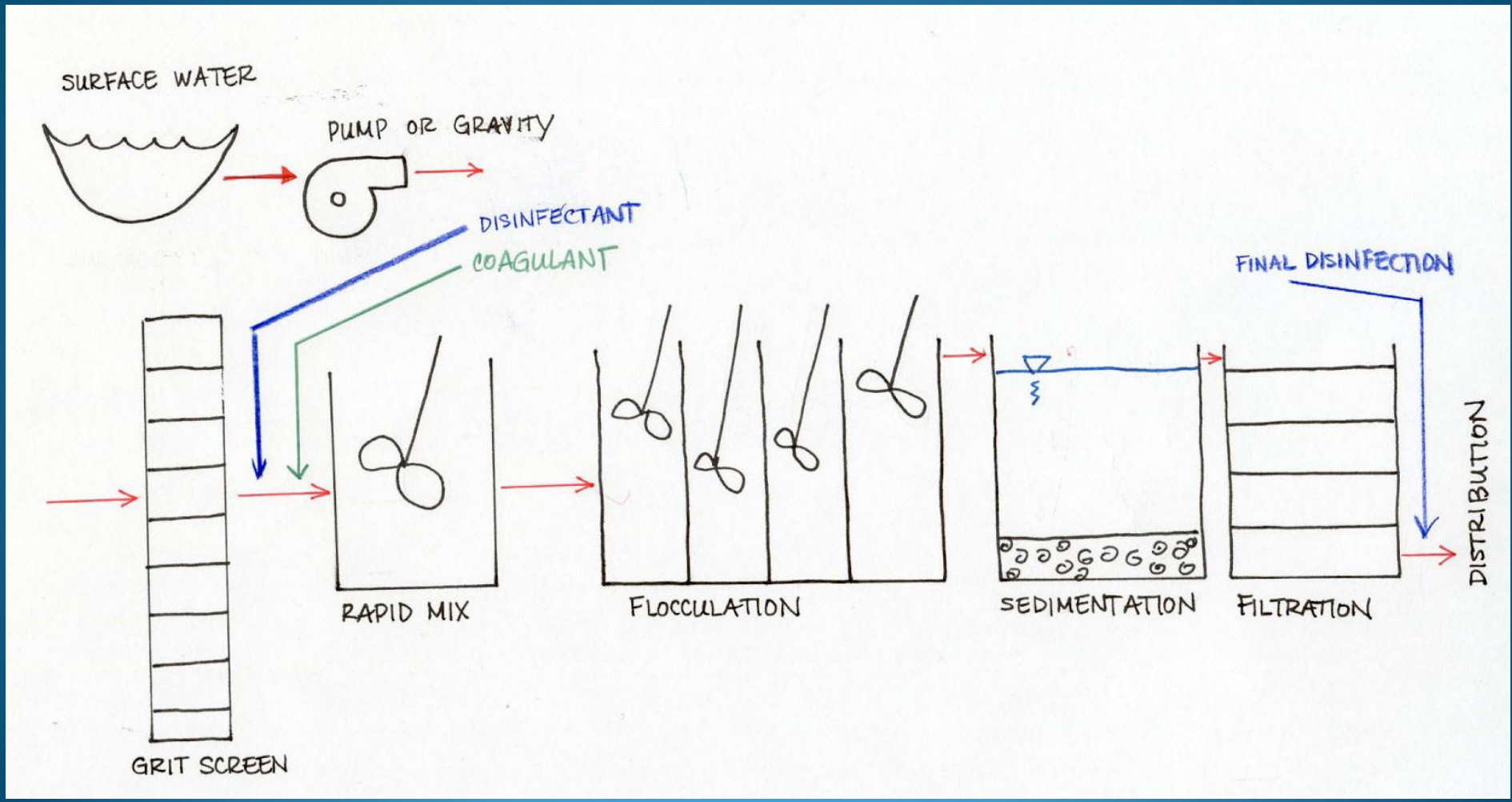
(A) Conventional; or

(i.e., Chemical addition/coagulation, flocculation, sedimentation, filtration & disinfection)

(B) Slow sand filtration & disinfection; or

(C) Diatomaceous earth filters & disinfection.

Conventional Surface Water Treatment



Surface Water Treatment Options Not Addressed in Section 8

(A) Direct Filtration (i.e., Conventional without sedimentation)

(B) Membrane Filtration (e.g., MF & UF)

(C) Bag & Cartridge Filters.

(D) Ultaviolet (UV) Disinfection

Section 10 - Treatment

If turbidity > 1000 NTUs for one week or more, then **presedimentation** is required. [WQR&R Ch 12, Section 10(b)]

Filter Limitations – Maximum Loading Rates

Rapid Rate Sand Filters

- 3 gpm/ft² for single media filters.
- 5 gpm/ft² for dual or mixed media filters
  [WQR&R Ch 12, Section 10(i)(ii)(B)]

Slow Rate Sand Filters

- 0.1 gpm/ft² (pilot test – necessary to consider higher rate)

Allowable when:

- turbidity < 50 NTUs (not attributable to colloidal clay)
- Color < 30 units
  [WQR&R Ch 12, Section 10(i)(ii)(A)]

Other Treatment Processes Limitations

Diatomaceous Earth Filtration

- 1.5 gpm/ft^2 of septum area.
- Headloss < 30 psi
  [WQR&R Ch 12, Section 10(j)]

Allowable when:

- turbidity < 25 NTUs (not attributable to colloidal clay)
- Color < 30 units

If raw water quality exceeds these limits, then flocculation and sedimentation must precede the filters.

Other Treatment Processes Limitations

Cation Exchange Process

- 7.0 gpm/ft^2 of bed area.
  [WQR&R Ch 12, Section 10(l)(ii)]

Allowable when:

- turbidity < 5 NTUs
- $[Fe^{2+}] + [Mn^{2+}] < 1.0$ mg/L

Otherwise, pretreatment is required.

Other Treatment Processes Limitations

Carbon Dioxide Addition [WQR&R Ch 12, Section 10(p)(i)]

- Recarbonation basin shall have two compartments . . . with a total detention time of 20 minutes.

Thermopolis Recarbonation Unit

Cemented Filter Media

Direct Filtration / Membrane Comparison

Applies the suspended solids load directly to the filter rather than removing the majority of the load through sedimentation.

The source water must have low average turbidity in order to provide reliable service without excessive backwash requirements (e.g., source water from large capacity reservoirs).

Direct Filtration – Utah's Design Requirements

- Must provide at least one year's record of source water turbidity, sampled at least once per week; 75% of the measurements must be below 5 NTUs.
- Pilot study or in-plant demonstration study shall be conducted.
- Required continuous turbidity monitoring and automatic shut-down when source water turbidity of 20 NTUs lasts longer than three hours.

Taste & Odor Control

for Plants with known taste & odor problems

Have at least two of the following control processes:

- Chlorination (with 2 hours contact time)
- Chlorine dioxide
- Powdered activated carbon
- Granular activated carbon adsorption units.
- Potassium permanganate.
- Ozone (with 30 minutes contact time)

[WQR&R Ch 12, Section 10(q)]

DEQ/WQD Policy 14.10.1

Expected Log Removal

Filtration Treatment Technology	Giardia	Viruses
Conventional	2.5	2.0
Direct	2.0	1.0
Slow Sand	2.0	2.0
DE	2.0	1.0

Adopted in 1991 and based upon EPA Surface Water Treatment Rule (SWTR)

DEQ/WQD Policy 14.10.1

Logs Inactivation Needed by Disinfection

Filtration Treatment Technology	Giardia	Viruses
Conventional	0.5	2.0
Direct	1.0	3.0
Slow Sand	1.0	2.0
DE	1.0	3.0

Adopted in 1991 and based upon EPA Surface Water Treatment Rule (SWTR)

EPA Region 8 Filtration Policy – Filtration Credits for Microbial Removal

FILTRATION CREDITS FOR MICROBIAL REMOVAL, TO MEET SWTR, IESWTR and LT1ESWTR**
(systems consistently meeting the CFE turbidity limits in the table below, and the operational and design requirements outlined in this policy, are granted the Logs removal credit in the table below.)

FILTRATION TREATMENT TECHNOLOGY	COMBINED FILTER EFFLUENT (CFE) TURBIDITY (95% MNTHLY/MAX) ntu	MAXIMUM LOGS OF CREDIT FOR PHYSICAL REMOVAL			MINIMUM LOGS OF INACTIVATION NEEDED BY DISINFECTION	
		Cryptosporidium	*Giardia*	Viruses	*Giardia*	Viruses
Conventional	*** 0.3/1	>2	2.5	2.0	0.5	2.0
Direct	***0.3/1	>2	2.0	1.0	1.0	3.0
Slow Sand	1/5	>2	2.0	2.0	1.0	2.0
Diatomaceous Earth	1/5	>2	2.0	1.0	1.0	3.0
Reverse Osmosis	0.3/1	>2	>3.0	3.0	0	1.0
Nanofiltration	0.3/1	>2	>3.0	3.0	0	1.0
Ultrafiltration	0.3/1	>2	>3.0	0	0	4.0
Microfiltration	0.3/1	>2	>3.0	0	0	4.0
Pretreatment plus Bag or Cartridge (B/C) *	1/5	2	2.0	0	1.0	4.0
Conventional Filtration followed by (B/C)	0.5/5	2	2.5	2.0	0.5	2.0

* See policy for description of adequate pretreatment for SW and for GWUDISW using B/C Filtration

** Additional types of alternative filtration should be evaluated on a case-specific basis. 95th percentile and maximum turbidity values will be no more than 1 NTU and 5 NTU, respectively, for all alternative filtration technologies, unless different site specific values are assigned. All NTU rounding shall be in accordance with EPA established policy. Also, these filtration credits do not apply to point-of-use devices.

*** Conventional and direct filtration also have requirements for monitoring of individual filter effluent turbidity(IFE). See IESWTR and LT1ESWTR.


Questions???