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TO: Staff Engineers

THROUGH: J. Wesley Kleene, Ph.D., P.E., Director
Office of Drinking Water

FROM: Susan E. Douglas, P.E., Field Services Engineer
Division of Technical Services

SUBJECT: PERMITS AND PROJECT REVIEW - Exceptions to Surface Water Treatment
Plant Loading Rates

RELATED: WM885 (Operation Permit Procedures)

SUMMARY STATEMENT:

This memo establishes ODW's procedure on the review and approval of exceptions to treatment unit hydraulic loading rates as specified in the *Waterworks Regulations*. The following guidance is provided to ODW staff for reviewing study proposals, evaluating study results, processing, and permitting such requests.

I. INTRODUCTION

A. Maintaining Drinking Water Quality

Compliance with the Drinking Water Standards and Treatment Technique requirements (12VAC5-590 through 420), Reporting requirements (12VAC5-590-530), and Public Notification requirements (12VAC5-590-540) of the *Regulations* must be maintained at all times during the design exception evaluation process and afterward.

B. Existing Waterworks

The *Waterworks Regulations* Manual of Practice established minimum criteria for conventional surface water treatment plant design. These design criteria include maximum hydraulic loading rates for gravity filters and sedimentation basins in 12VAC5-590-890 High rate treatment processes. VDH may consider increased design hydraulic loading rates for existing waterworks that have demonstrated a high level of performance while operating at the maximum rates allowed in the *Regulations* for conventional design. The request must document successful operation at the proposed higher rate, following an approved testing protocol, during a provisional operating period. Other unit process exception requests may also be considered, when justified. If successful, the process will result in an Operating Permit with Special Conditions limiting loading rates.

C. New Waterworks

Adherence to the design criteria in the 12VAC5-590-890 High rate treatment processes¹ is expected. If the owner insists on seeking a design exception to the *Regulations*, then the special permit process for “new or nonconventional” in 12VAC5-590-290 of the *Regulations* shall be followed, as well as the evaluation procedures set forth below.

II. PROCEDURES

The steps to be followed are outlined below:

1. Preliminary Engineering Conference with waterworks
2. Preliminary Engineering Report (PER) with Study Plan (Demonstration Test protocol) is prepared and reviewed by ODW
3. Provisional Operation Permit is issued by ODW
4. Operation of waterworks during Provisional Period (Demonstration Test)
5. Final Report is submitted and reviewed by ODW
6. Standard Operation Permit is issued

The waterworks should be informed that the approval of the PER / Study Plan do not constitute nor imply approval of any exception request. The approval of the PER / Study Plan must state that the information is sufficient for ODW to make a satisfactory determination with regard to an exception request, while protecting public health.

- A. Preliminary Engineering Conference – A conference is required to discuss the proposal and procedures, including
 1. Proposed rate increase – periodic or constant, seasonal water demands, safe yield analysis, withdrawal permits required
 2. Reliability considerations
 - Flexibility / availability of alternate raw and finished water sources
 - Staffing capability
 3. Existing plant performance and operations
 - Seasonal variation of raw water quality and plant performance (temperature, pH, alkalinity and turbidity)
 - Filter ripening, rewash practices
 - Backwash capacity and flow rates
 4. Condition of existing treatment units, especially filter underdrains, piping, media
 5. Previous and proposed studies, including bench or pilot testing of chemicals and filters

¹ Specifically:

- flocculation – minimum detention time,
- sedimentation – minimum detention time, maximum surface loading rate,
- filtration – maximum surface loading rate

6. Provisional operation with full-scale demonstration testing
7. Design evaluations of treatment processes and previous study results
8. Optimization goals for settled and filtered water turbidities²

B. Evaluation Proposal - Engineer submits PER / Study Plan for ODW review.

1. Bench or pilot studies are recommended prior to full scale testing, and may include investigations of alternative coagulants, filter media, backwash requirements, addition of filter aids, and filter-to-waste practices.
2. Full scale demonstration testing is required to evaluate the plant performance during all four seasons.

The testing protocol for the demonstration period must be approved by VDH *prior* to implementing the test. The field office must obtain concurrence from the Central Office prior to approval of the study protocol. Data collection and evaluation must include: turbidity measurements of raw water, settled water and filtered water, filter headloss, filter run length, backwash frequency and volume (rate and time), chemical additives used as filtration aid (name, type and dosage), sludge production measurements and changes to sludge wasting/treatment/disposal operations. [Particle counts have not proved reliable in the past, therefore caution is advised in using this data.]

One full train of unit processes should be operated in demonstration mode, while the remainder of the plant operates in “normal” mode. A minimum period of 12 full months is recommended. The Waterworks’ representative and District Engineer must review the raw water quality data for at least the previous three years to determine the minimum duration and the raw water quality (temperature, turbidity, pH, manganese concentration, etc.) to be captured in the testing.

For sources that experience fluctuations in quality due to storm events or other incidents, the proposed study must include provisions (e.g extending demonstration testing) to capture unit performance during several events. The events must be of a magnitude and frequency consistent with that experienced during the last three or more years to demonstrate adequate performance. For example, a study may include a provision to capture three or more storms that produce raw water turbidity > 80 NTUs, if those turbidities are typical for large storms based on past data.

Additional safeguards during the full scale demonstration testing period must be addressed in the PER / Study Plan. These could include emergency shutdown and wasting procedures, increased disinfection, etc.

² VDH can and should use these Treatment Optimization Goals as a performance standard in considering Design Exceptions to the *Regulations*. These goals are achievable at an adequately designed plant, show owner responsibility/attitude, and provide a safety factor to insure public health protection.

3. If physical plant modifications are required in order to operate at the proposed rate increase, then formal plans and specifications will be needed and a Construction Permit issued prior to the demonstration testing.

C. Provisional Operation Permit

A Provisional Operation Permit with special conditions for the full scale demonstration testing period is required. The Special Conditions in the permit must describe the approved Study Plan in detail or by reference. The minimum information to be provided in the Special Conditions:

- Proposed hydraulic loading rates for each process/train,
- Duration of the testing period, including minimum periods and raw water quality,
- Proposed monitoring and reporting,
- Content of the Final Report

Refer to WM 885 for further guidance on Provisional Permits.

D. Final Report Review

A final report is required following completion of the demonstration testing approved in the Provisional Permit. The report must include a detailed technical evaluation of the plant (described subsequently) for increased loading rates, and any design exception requests. Any departures or modifications to the approved testing protocol (in the Special Conditions) must receive prior ODW approval and be clearly documented.

E. Issuance of Standard Operation Permit

ODW shall evaluate the Final Report to determine whether the request adequately protects public health. For projects involving a Construction Permit, Design Exception(s) may be granted (or denied), based on the Field Office's evaluation and concurrence from the Central Office. A Construction Permit is then issued, and the project is built.

A Standard Operation Permit is drafted by the Field Office and approved by the Central Office. If exceptions to the loading rates in the *Regulations* are granted, these shall be noted in the Capacity Evaluation in the EDS and included in the Special Conditions of the Operation Permit. Example language: "Filter loading rates shall not exceed x.y gpm/sf "

III. TECHNICAL EVALUATION

A thorough technical evaluation of the waterworks is required. The following tasks must be performed and appropriate information provided in the final report submitted for VDH review. Some of these topics may be addressed initially in the PER.

- A. Evaluate individual unit processes and overall plant hydraulics under existing and proposed hydraulic loading. Provide calculations for the following design parameters, at a minimum, and compare with *Regulations*:

1. Rapid mix velocity gradient and detention time
 2. Flocculation velocity gradient and detention time
 3. Sedimentation surface loading rate and detention time, weir loading rate
 4. Maximum velocity gradients/linear velocities in ports, pipes and conduits into and from settling basins
 5. Filter surface loading rate with all filters in operation and during filter backwash
 6. Hydraulic capacity / hydraulic profile of wash water and solids waste facilities from filters and sedimentation basins, including piping, storage, pumping, and treatment (if provided). An increase in filter backwash frequencies and resulting wash water waste production should be anticipated. The rates should be substantiated by full scale testing, described in this memo. The Filter Backwash Recycle Rule requirements should be revisited if recycling is proposed.
 7. Disinfection contact time, CT and log inactivation throughout plant (disinfection profile)
 8. Chemical feed equipment capacities and delivered dosages
- B. Ability of WTP to meet the performance standards established in the Preliminary Engineering Conference, including turbidity goals and backwash practices. Filter run times, backwash wastewater and actual finished water production must be evaluated.
- C. Address other design features that may improve plant performance or increase operational flexibility and control, including:
1. Degree of instrumentation & monitoring provided, such as on-line pH meters, turbidimeters, laser nephelometers, streaming current monitors, zeta meters, particle counters
 2. Polymer feed to aid coagulation, flocculation, settling and filtration
 3. Pre-sedimentation or other pre-treatment units
- D. Verify related plant capacity parameters, as necessary. These may include:
1. Source water withdrawal capacity for the proposed increase in flowrate
 2. High service pumping rate and WTP transmission main capacities.

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