Maine Center for Disease Control and Prevention
An Office of the Department of Health and Human Services

Department of Health and Human Services
Maine Center for Disease Control and Prevention
286 Water Street
11 State House Station
Augusta, Maine 04333-0011
Tel.: (207) 287-8016; Fax: (207) 287-9058
TTY Users: Dial 711 (Maine Relay)

Tel. (207) 287-2070 Drinking Water Program Fax (207) 287-4172

DRINKING WATER TREATMENT

REVIEW AND APPROVAL

POLICY & PROCEDURE

TABLE OF CONTENTS

PURPOSE: To provide a step by step process for treatment review and approval for DWP staff which will promote consistency in DWP's delivery of treatment review and approval, to provide basic related information and references where more detailed information can be obtained, to provide specifics (case studies) for "special" contaminants not documented elsewhere, to define roles & responsibilities, and to provide guidance for training DWP staff.

SCOPE: The Maine Rules Relating to Drinking Water, Section 3: Facilities Approval, Plan Submission states: No new construction, addition, or alteration involving the source, treatment, or storage of water in any system shall be commenced until the plans and specification have been submitted to and approved in writing by the Department. This document covers the DWP review and approval of treatment chemical and process changes and additions. This document only applies to Public Water Systems.

BACKGROUND: Drinking water treatment is used to reduce levels of contaminants in drinking water to make water safe for human consumption and/or improve the aesthetic qualities of the water. Depending on the water chemistry and the contaminants present, treatment processes can be basic or very complex. Treatment technology also varies depending on the size of the water system. These variations can make the review and approval of treatment technology complicated. The Maine Drinking Water Program staff is tasked with the review of treatment proposals to ensure that safe water is provided to consumers. This document is created to provide policy, procedure, and guidance for the review of water treatment chemical and process changes and additions. Use of this document will promote a thorough and consistent review and approval of drinking water treatment proposals. Also included in this document are fundamentals of water contaminants and treatment processes to help new staff rapidly become familiar with drinking water treatment and to refer staff to more detailed information.

ORIGINATOR: DWP Treatment Document Team

OWNER: Engineering Supervisor

DEFINITIONS:

CA: Drinking Water System Change Application (DWP0227) and supporting documentation

Contaminant: Anything found in water (including microorganisms, minerals, chemicals,) which may be harmful to human health.

DM: Data Management Team

DWP: Maine Drinking Water Program

DWSRF: Drinking Water State Revolving Fund, often termed as "SRF"

ENG: DWP Engineering

EPA: Environmental Protection Agency

MCL: Maximum Contaminant Level: The maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

MEG: Maximum Exposure Guideline: Maximum exposure guidelines are set by the Maine Center for Disease Control, Environmental and Occupational Health Program. MEGs may be enforceable with input from that program, depending on the specifics of the exposure scenario, including, for example, the method of exposure and the population exposed.

Pathogenic: disease causing; causing an illness

PI: DWP Public Water System Inspector

Primary Contaminant: Contaminants in drinking water as identified by the EPA in the "National Primary Drinking Water Regulations" All primary contaminants have MCLs, treatment techniques, or action levels that are enforceable by the Maine Drinking Water Program.

PO: Primary Operator

PWS: Public Water System

RS: Rule Specialists, are part of the Data Management Team.

SDWIS: Safe Drinking Water Information System… the database used by the DWP for all PWS specific information and data.

Secondary Contaminant: Contaminants in drinking water as identified by the EPA in the "National Secondary Drinking Water Regulations" that primarily affect the aesthetic qualities relating to the public acceptance of drinking water. At considerably higher concentrations of these contaminants, health implications may also exist as well as aesthetic degradation. The regulations are not Federally enforceable but are intended as guidelines for the States.

Standard: the same as NSF/ANSI Standard

RESPONSIBILITIES:

Public Water System Inspector (PI): The PI, as the DWP contact for all PWSs, is responsible for coordinating chemical and process treatment changes with the PWS and DWP staff involved with reviewing and approving treatment changes. The PI uses the Treatment Installation/ Modification/ Removal Project Checklist (Appendix K) to help ensure that all treatment project steps are completed. The PI provides input to the Engineer and Rule Specialist for the treatment review and approval process and completes final inspection of installed equipment. All treatment related letters from the DWP to a PWS are identified as coming from the PWS Inspector.

Engineer: The Engineer is responsible for reviewing and approving all treatment chemical and treatment process related changes to ensure the design and installation does not adversely affect the safety of the drinking water and to ensure that the change is an acceptable chemical or technology applied toward resolving water quality deficiencies, resulting in water quality that is safe for human consumption. To complete this review process, the engineer obtains input from the PWS Inspector and Rule Specialists for:

1. reviewing the physical aspects of the treatment and/or process change (including but not limited to cross connection review, location of the treatment in the water system), and;
2. reviewing the water quality aspects of treatment chemical and/or process changes.

Rule Specialist: provides input to the Engineer and PWS Inspector for the treatment review and approval process.

Data Management: Updates PWS information (specifically treatment information) in SDWIS.

PWS Owner: The PWS Owner must ensure that water treatment equipment and design meet the rules and policies of the Maine Drinking Water Program and that all water after the treatment process meets drinking water standards.

Treatment Designer/Engineer: The Treatment Designer/Engineer is responsible for providing all necessary documentation and information, as specified in this document, for DWP review of the proposed treatment chemical or process change.

Treatment Installer: The Treatment Installer is responsible for installing treatment equipment in accordance with the specifications of the treatment design approved by the DWP.

Designated Operator: The Designated Operator is responsible for properly operating and maintaining the treatment process so that all water quality and quantity parameters are acceptable.

Department of Environmental Protection (DEP): For drinking water treatment processes that involve the disposal of backwash or other residual waste into a location or structure other than a sanitary leach field, the DEP is responsible for reviewing and approving, or disapproving, the method of waste disposal for the backwash or other waste. For radionuclide removal treatment, the DEP works with the DWP and the DEH Radiation Control Program to determine how backwash and media waste needs to be disposed. For greater detail, refer to the "Treatment Residuals (backwash) and Media Disposal" section of this document.

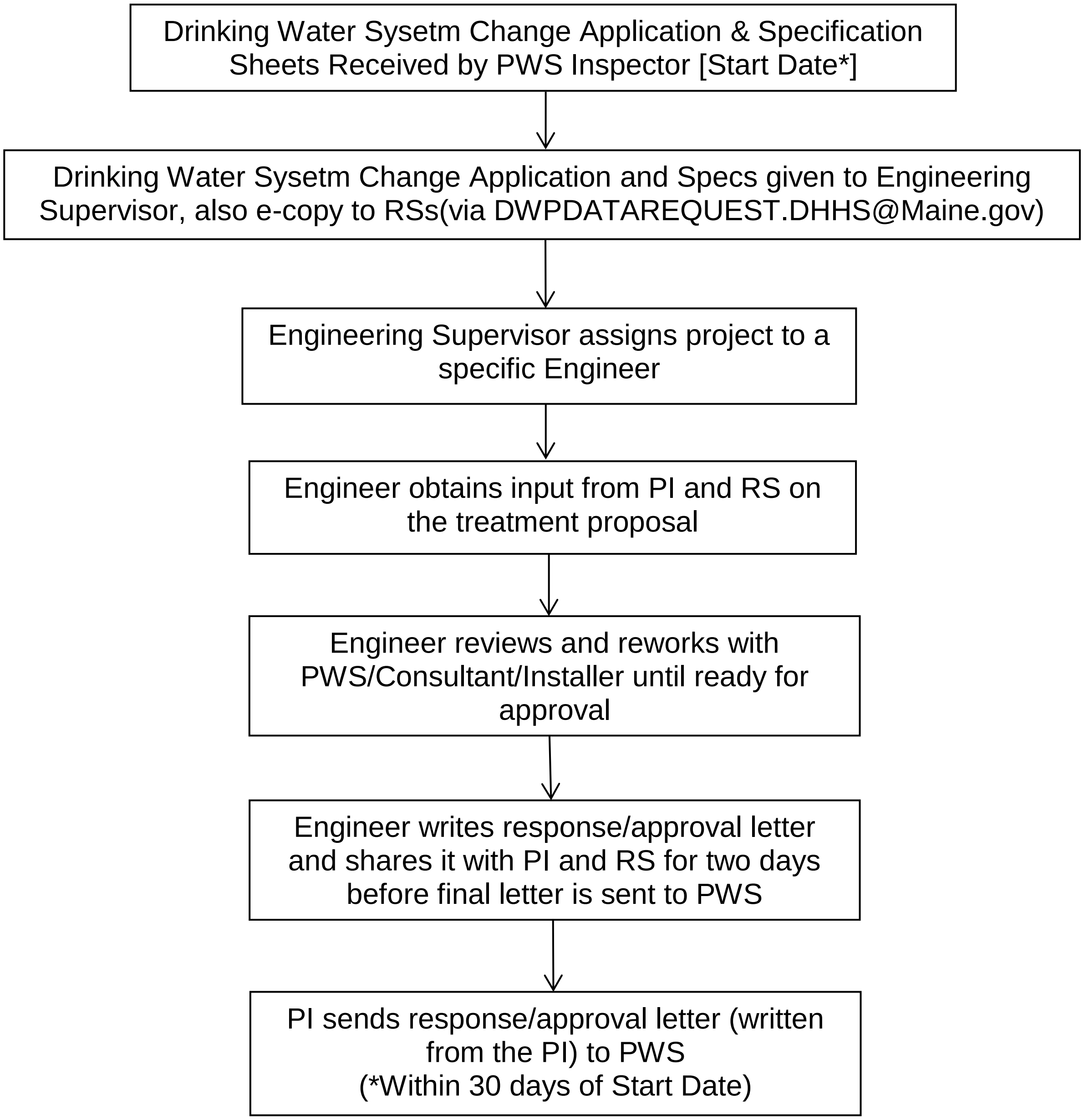
Division of Environmental and Community Health Radiation Control Program (RCP): For the design and evaluation of treatment used for radionuclide removal, with information provided by the DWP, the RCP is responsible for determining specific technical data (e.g., levels of radioactivity, amounts of radioactive material) necessary for the DEP and the RCP to determine the proper method of disposal for the proposed waste. For greater detail, refer to the "Treatment Residuals (backwash) and Media Disposal" section of this document.

I. DRINKING WATER TREATMENT REVIEW AND APPROVAL

A. General Procedure for Treatment Review and Approval

The general, overall flow of DWP Treatment Review and Approval is shown in the flow chart below. For a treatment chemical change, the Engineer uses checklists #1 and #3 in Appendix A, C of this document. For a treatment process change, the Engineer uses the checklists #2 and #3 in Appendix B, and C of this document. For more specific details on individual topics within the checklists, refer to applicable individual topics covered in this document (See Index). See also Appendix K: Treatment Installation/Modification/Removal Project Checklist, and Appendix M: Steps for Treatment Review and Approval.

Flow and Timing of Treatment Review and Approval



B. Description of Required Water Treatment

‘Required’ treatment must meet certain requirements for design, specifications, operation, maintenance, sampling, and reporting.

Water treatment is considered to be ‘required’ if:

1. It was installed to meet the requirements in a DWP order to resolve a compliance issue*,
2. It is water treatment that provides support to the operation of ‘required’ treatment, or
3. It is treatment that was required under the SWTR for a PWS that has a surface water source or a groundwater source under the influence of surface water.

*Any facility classified as a PWS must meet the requirements in the Safe Drinking Water Act (SDWA). These include the requirement that the PWS must provide water for its consumers that meets the drinking water standards for regulated contaminants. There are other applicable water quality requirements not included in SDWA that are listed in the State of Maine Rule Relating to Drinking Water under Chapter 231 Section 3 G and Section 7 G 5. and also in the Unregulated Contaminants in Public Water Systems Policy (DWP0187). When a PWS does not meet the water quality requirements in any of the aforementioned, the DWP issues a notice of noncompliance for the specific contaminant(s) that includes an order to have the contamination problem resolved by a certain date. One option that a PWS usually has for reducing the contaminant level in their water is to install a water treatment system. If a water treatment system is installed under such circumstances it is considered 'required' treatment.

Note: When treatment is required at a PWS, all connections served by the PWS source must be treated. See Case Study on "All Connections Served Must be Treated" in Appendix J of this document. This applies to potable use water lines only; we do not require drinking water treatment on water lines for non-potable uses such as irrigation or process water.

C. Water Treatment Not Required

PWS are allowed to have water treatment systems in operation for their own purposes. Such treatment systems are often used to reduce aesthetic contaminants such as iron. Public water systems are required under the Maine Drinking Water Rules Section 3 to receive approval before making any modifications to their water systems 'which may affect the quality of water produced'. This applies not only to mandatory/required treatment systems but also to PWS installing, removing, or discontinuing use of optional water treatment (including water softeners), because all water treatment affects water quality. Many small PWS, however, are not aware of the requirement and often make changes to their water system without notifying our office.

The review of optional water treatment has fewer requirements than for required treatment because safeguards are not needed to ensure proper removal of the target contaminant. However, there can still be many things to consider when doing an approval review of optional treatment, due to the different treatment types, uses, and the variety of settings in which it can be. The following are examples of some optional treatment scenarios that illustrate some different review considerations:

- If a PWS installs a chlorinator due to bacteria contamination ahead of the DWP requiring it (and therefore considered optional treatment), the system would still have to meet all of our chlorination requirements regarding specifications, design, operation, and reporting. However, if a PWS installs a chlorinator to remove iron, we would still require the use of ANSI/NSF Standard 60 certified chemical, ANSI/NSF Standard 61 certification for equipment, and regular chlorine residual testing and reporting. (See Section I.D. below for complete description of Standard 60 and 61.) We would have no requirements in regards to contact time or for a minimum entry point chlorine residual.
- If a PWS installs GAC to improve taste and odor, we might have no requirements beyond the system meeting Standard 60 and 61. However, if GAC was being installed to improve taste by removing chlorine, a Point of Use (POU) GAC system

might be approved, whereas entry point GAC treatment may not be, depending on the reasons for the chlorination and other factors.

- If a PWS were to install a water softener to remove an aesthetic contaminant we may not have any requirements beyond Standard 60 and 61. However, if a PWS had a high arsenic level that was being reduced with the removal of iron, discontinuation of the treatment or inconsistent treatment operation might result in high arsenic going to consumers. Requirements for resolution of that problem might be necessary.

Other review concerns include the effect that adding, removing, or improperly maintaining optional treatment may have on other water treatment that is present. Example: If a system had high iron and manganese that were being removed by a water softener ahead of a chlorinator, failure to properly maintain the water softener could result in problems with the chlorinator due to clogging or a drop in the chlorine residual level due to the increased chlorine demand. DWP staff should inform the PWS of the importance of keeping the water chemistry constant in order to avoid problems such as noted above, along with other problems that can develop. To ensure constant water chemistry, all water treatment ‘required’ or ‘optional’ must be operated consistently and properly.

In summary, DWP review of optional water treatment should include most of the same considerations as the review for required treatment. It should be an assessment of the properties of the treatment design and process in regards to potential health risks to consumers. We would not make requirements for operation and maintenance of the system as we would for required treatment. However, approval letters for optional water treatment should include our strong recommendation that the treatment always be operated properly and consistently to avoid possible problems that could develop in the plumbing and with water quality.

D. NSF/ANSI Standards 60 and 61

NSF/ANSI Standards 60 and 61 are certification requirements that set standards for chemicals added to drinking water and materials in contact with drinking water respectively. For ANSI/NSF Standard 60 and 61 requirements, see the Maine Rules Relating to Drinking Water, Section 3: Facilities Approval, F.7 and F.8. For additional information and guidance see Appendix L.

There are three organizations that certify chemicals and equipment to NSF/ANSI standards: NSF International, UL (United Laboratories), and the WQA (Water Quality Association). Information on chemicals and equipment that is certified by these organizations is usually recorded on the organization’s website.

It is the responsibility of the public water system, their designer, contractor, or supplier to provide evidence of certification to NSF/ANSI Standard 60 and/or 61; it is not the responsibility of DWP staff to research whether or not certain chemicals or components are properly certified.

Exemptions that are not already provided in rule may be approved by the Drinking Water Program on a case by case basis. Exemption requests are considered if no equipment of a certain type is available that has certification and/or when equivalent certification is present such as “FDA approved for use with food”. Exemption requests need to be made in writing to the DWP, accompanied by appropriate justification.

E. Regulated vs. Non-Regulated Treatment (Where only a portion of the water served by a PWS is treated)

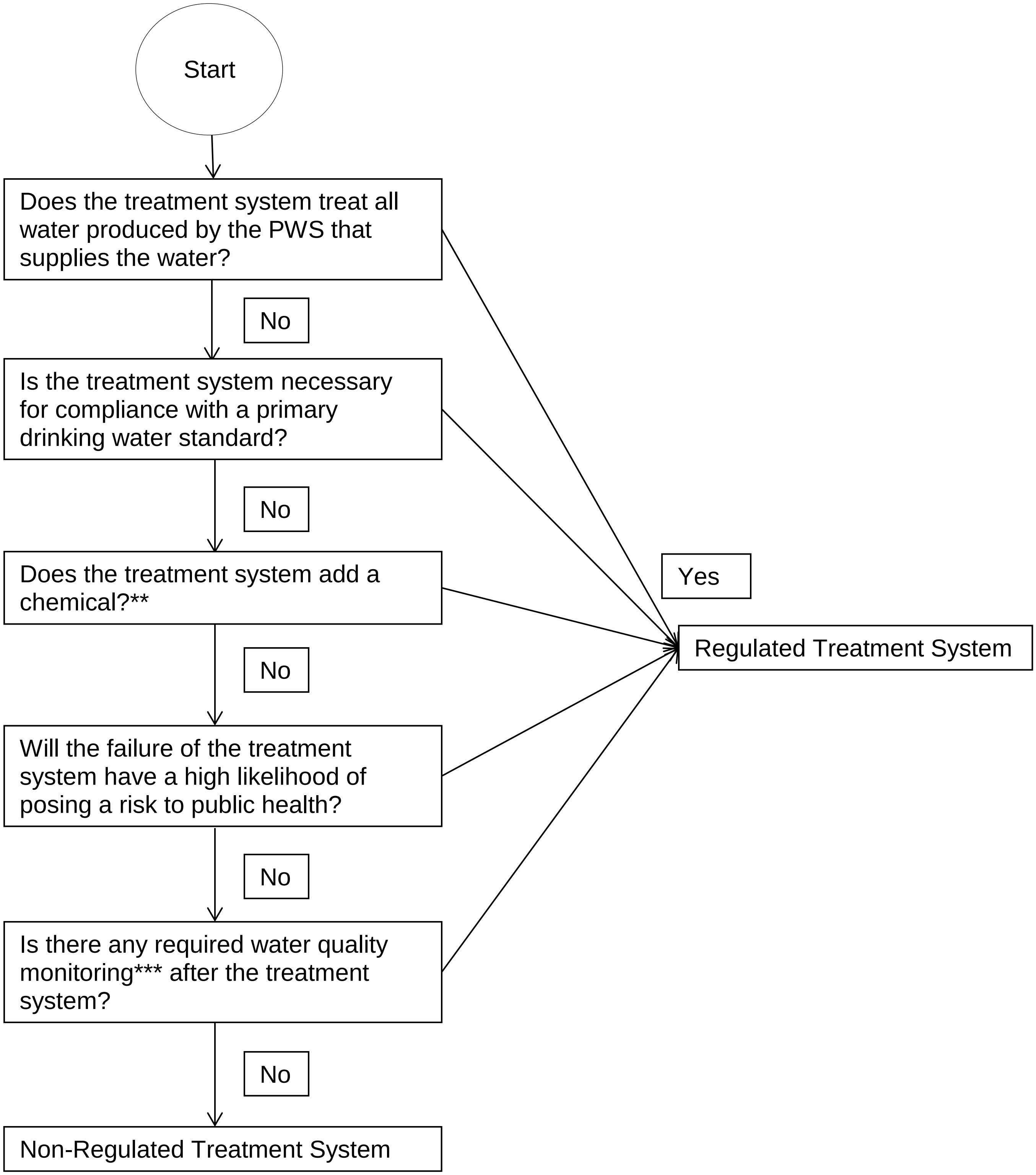
Numerous facilities provide “polishing” treatment to the drinking water served by a public water system to improve taste, to ensure a consistent product quality or to provide an additional protection barrier to a sensitive population. This policy provides direction for Drinking Water Program staff to determine if the treatment system must meet the DWP regulatory requirements and if the treatment system and subsequent distribution systems meet the criteria of a “consecutive” public water system.

When a PWS serves water to another establishment that treats the water again, this policy is used to determine whether the other establishment will be regulated as a “Consecutive PWS” and to determine what steps are necessary by DWP staff for review, approval, and data management for the consecutive treatment.

Determining if a treatment system will be regulated by the DWP

Use the following flow chart to determine if treatment is regulated or non-regulated treatment:

Regulated vs. Non-Regulated Treatment



** excluding salt

*** monitoring that is related to this treatment or other treatment, including bacteria. For example, if Bacteria testing is required after POU use treatment (e.g. at a child care facility), then that POU treatment becomes “regulated” treatment.

Regulated Treatment Systems – Regulated treatment systems must meet all DWP rules and standards. Regulated treatment must be recorded in SDWIS and have appropriate water quality monitoring schedules.

Non-Regulated Treatment Systems – Plans and specifications for non-regulated treatment systems do not require DWP approval, similar to all non-regulated treatment installed on services from municipal supplies. No water quality monitoring is required to evaluate non-regulated treatment. During a sanitary survey, questions about non-regulated treatment may be asked, such as questions about maintenance. Non-regulated treatment is inspected by the DWP during the normal sanitary survey process and is recorded on the sanitary survey report as "non-regulated treatment". Non-regulated treatment is not entered into SDWIS.

Consecutive Public Water System – A consecutive public water system is created when a regulated treatment system is installed downstream of the entry point to distribution of a public water system.

<u>Example 1</u>: The only treatment a water system has is a softener which treats all of the water supplied by the PWS. Is the water softener regulated or non-regulated treatment? Looking at the flow chart above,

- the water softener treats all of the water produced by the PWS.

Therefore, the water softener is regulated treatment.

<u>Example 2</u>: A water system supplies water to several businesses is a strip-mall, one of which is a franchise coffee shop with water polishing treatment (Reverse Osmosis and filters). Is the polishing treatment regulated or non-regulated treatment? Looking at the flowchart,

- the treatment does not treat the whole flow of the water system,
- the polishing treatment is not necessary for compliance with a primary drinking water standard,
- No chemical is added,
- Failure of the treatment is not likely to have a high likelihood of posing a risk to public health
- No water quality monitoring is required after the treatment.

Therefore, the polishing treatment at the franchise coffee shop is non-regulated treatment.

F. Exceptions to Treatment Requirements

Federal regulations provide for some circumstances where public water systems are not required to treat their water.

Avoidance to Filtration: The Surface Water Treatment Rule (40 CFR 141, Subpart H), allows qualifying surface water public water systems to avoid filtration (treatment to remove certain microbes), if certain conditions are met. The criteria for avoiding filtration are listed at 40 CFR §141.71, which requires specific source water quality conditions (relating to coliform and turbidity levels), as well as adhering to a number of site-specific conditions, which include, but are not limited to, monitoring activities related to source water quality, maintaining a watershed control program, be subject to an annual inspection, reporting coliform levels below the MCL 11 out of 12 months, not being identified as a source of a waterborne disease outbreak, and reporting disinfection byproducts below the MCL.

Variances: 40 CFR 142, Subpart K, allows variances from the requirement to comply with a maximum contaminant level or treatment technique for public water systems with populations fewer than 10,000. A variance is an allowance for a delay in meeting requirements. The Maine DWP grants such variances by extending deadlines for compliance with treatment techniques and MCL's through its administrative enforcement process. Examples include changing requirement deadlines within compliance schedules of administrative orders.

G. Requirements for Removing Treatment

This section applies to the elimination of treatment for specific compliance issues; it does not apply to the removal of treatment that will be replacement with different treatment.

From the Maine Rules Relating to Drinking Water, Sec. 3: Facilities Approval, C.1.a, C.1.b:

C.1.a. – No new construction, addition, or alteration involving the source, treatment, or storage of water in any system shall be commenced until the plans and specification have been submitted to and approved in writing by the Department (DHHS)…..

C.1.b. – Changes in treatment processes which involve the addition or deletion of any chemicals require prior approval by the department.

Based on these rules, the removal of regulated drinking water treatment (see section I.E., this document), whether required or not required by the DWP, must be approved by the DWP. This applies to "active" treatment only, not treatment that is out of service, unless the treatment was required and the PWS turned it off. Before a PI can grant a PWS approval to remove a treatment process, the PI must receive approval from ENG and RS. The RS supervisor must sign-off on the removal of any treatment system that was installed to address a compliance issue.

<u>Discontinuing Disinfection/Chlorination Treatment</u>

Refer to two controlled DWP policies on discontinuing disinfection/chlorination:

1. DWP0030 – Approving Requests to Discontinue Disinfection at a Ground Water System
2. DWP0031 – Approving Requests to Discontinue Chlorination at a New Source

<u>Discontinuing Non-Disinfection Treatment</u>

General provisions and requirements for discontinuing treatment (other than for disinfection), including treatment for removing organic and inorganic chemicals that exceed their MCLs (VOCs, Nitrates, Fluoride, Arsenic, etc.) and treatment that adds a chemical(s) such as for corrosion control are as follows:

1. Inactive treatment equipment shall be physically disconnected from a water system, not simply isolated by a valve.

2. Requirements for discontinuation of treatment systems that remove a contaminant(s):

a. Important Notes:

    i. Treatment equipment installed to obtain a UST or leach field setback waiver due to a reduced setback cannot be removed.
    ii. Removal of pH adjustment can only be done if replaced by another pH adjustment system or a new source with a higher pH.

b. Requirements cited by the DWP for discontinuing water treatment are made to ensure that a contaminant in raw water is reliably and consistently below the MCL before the treatment is allowed to be removed.
c. Raw water monitoring will usually be required. The number (and timing, if applicable) of samples will be determined by a Rule Specialist.
d. Requirements are determined on a case by case basis depending on the situation. The removal of a contaminated water source will likely result in requirements for treatment removal that are different from when a water source has had a steadily declining contamination level. For example, for a PWS with Nitrate treatment, discontinuing a lone well that is high in nitrates, within a well field, may enable discontinuing nitrate removal equipment more readily than a PWS that has multiple wells with high nitrate levels that have been declining slowly. The latter system may require sampling over time to ensure that the nitrate levels are continuing to steadily reduce over time and will likely remain below the MCL after treatment is removed
e. The DWP may require increased monitoring after treatment is removed.

<u>Requirements for discontinuation of treatment systems that add a chemical(s)</u>

a. Special requirements regarding the discontinuation of Fluoridation equipment (for PWS that add Fluoride to the water to promote dental health) requires a vote of the consumers of the public water system. Refer to the Electronic Compliance Manual, Fluoride folder, for more information on that process. The DWP must receive a copy of the “Certification of Election Results” from the town and a letter from the water district indicating the date they will discontinue fluoridation before we can approve discontinuation of fluoridation.

b. Water treatment for corrosion control cannot be discontinued unless the water source has been replaced by one that shows consistent acceptable water quality parameters. Such a situation would likely require gradual decrease in corrosion control treatment along with increased water quality parameter and distribution system lead/copper testing.

c. The addition of sequestering agents (and sometimes oxidants) is used for reduction of secondary contaminants. Discontinuation of this type of treatment should include considerations of the impacts on consumers from the probable higher levels of such contaminants. The impact on other water treatment could also be a concern.

H. Treatment Confirmation Samples

Upon installation or upgrade/repair of required treatment for removal of a contaminant (e.g., arsenic, nitrate, uranium, etc.) a minimum of one confirmation sample is to be collected after treatment but before distribution to ensure said treatment is effectively operating.

Provided the sample result is below the MCL for the particular contaminant being removed, the treatment is considered to be working properly and at this point routine monitoring can be set up per existing policy DWP0051: Required Monitoring after a PWS Installs Treatment. If the confirmation sample reveals the contaminant level is still in excess of the MCL, the treatment system will not receive final approval and the PWS must address the deficiency.

I. Required Monitoring after a PWS Installs Treatment:

Refer to existing policy DWP0051

J. Bypasses of Required Treatment

1. Hard piped bypasses are not allowed, yet an air gap with quick disconnect fittings and a temporary connection is acceptable (ion exchange media needs to be bypassed when a system is shocked with chlorine… there has to be a way to bypass the system for maintenance purposes). The only exception to this is for UV systems, where a by-pass is allowed if identified with a permanent tag stating the opening the by-pass requires a Boil Water Order and the DWP must be contacted. See UV Procedure (DWP0047).

2. The decision to disallow other bypasses (internal to an ion exchange head or within a treatment device [e.g. aeration]) will be based on an assessment of risk of exposure for consumers in the individual situation.

3. For a low risk situation (potentially identified as “chronic” vs. “acute”) no requirements will be made by the DWP regarding treatment equipment with internal bypasses.

4. For a high risk situation (potentially identified as “acute” vs. “chronic”) one, some, or all of the following system requirements may be required by the DWP to ensure that raw water is not ingested by consumers:
   a. Install a “no raw water bypass valve” which prevents raw water from bypassing treatment during a backwash/regeneration cycle
   b. Do not allow a manual bypass valve/button/switch on the treatment head
   c. Require a “No Bypass” head (no bypassing capability at all within the treatment head)
   d. Require a battery backup to ensure timer continuity through power outages.

5. Work is underway to further define what constitutes “high risk”. Initially it may include:
   a. Some threshold of contaminant concentration, e.g., arsenic at 50 ppb or greater (numbers TBD per contaminant with help from the “Environmental and Occupational Health” Program)
   b. School or similar youth population is being served
   c. Elderly or immune compromised population

Note: Special requirements that disallow bypasses, other than what is written in bullet #1 above, must be based on a “HIGH RISK OF EXPOSURE” being present in a given situation and the requirements must be approved by the PWS Inspection Team Supervisor and the Rule Specialist Supervisor.

K. Construction Standards, Codes, and State Rules Related to Drinking Water Treatment

1. Construction Standards: The Drinking Water Program strongly recommends (and may require) that treatment system designers and installers follow widely accepted construction standards such as:

    a. American Water Works Association (AWWA) Standards, which includes widely used disinfection standards and technical information from the Water System Operator's Water Treatment Manual
    b. Recommended Standards for Water Works, also referred to as the "Ten States Standards"
    c. NSF/ANSI Standards for Drinking Water Treatment Units
    d. Technical guidance from the Water Research Foundation

2. Codes and State Rules Related to Drinking Water Treatment:

    a. Maine Rules Relating To Drinking Water
    b. The Maine Internal Plumbing Code
    c. The Subsurface Waste Water Rules
    d. The Rules of the Maine Department of Environmental Protection
    e. The Maine Cross Connection Rules
    f. Maine Water Operator Rules
    g. Manufactured Housing Board Rules

L. Treatment Residuals (backwash) and Media Disposal

1. Disposal of Backwash from an Ion-Exchange Treatment System into a Leach Field Dedicated for That Disposal Only, or into a Sanitary Leach Field: The definition of Class "A" water in the State of Maine requires that any backwash disposed of in a leach field dedicated for that waste only must receive a waste discharge permit from the DEP, which generally is not easy to obtain. Waste disposed of in a sanitary leach field is not subject to the previous requirement, but instead is covered by the Subsurface Wastewater Rules. Therefore, except for the backwash from radionuclide treatment (see below), backwash from water treatment units can be disposed of in a sanitary leach field as long as the leach field design will allow the additional volume of backwash water (hydraulic loading). The DWP has historically requested acknowledgement from the treatment designer that the leach field will adequately handle the additional hydraulic loading presented by the added backwash volume.

2. Disposal of Media Used in Ion-Exchange Treatment Systems: The owner of the public water system must dispose of ion-exchange media in accordance with all State and Federal waste disposal laws and rules. The DEP makes all decisions on whether a waste disposal method meets State and Federal Rules.

    a. Iron based adsorptive media used for arsenic removal generally passes the Toxicity Characteristic Leaching Procedure (TCLP) and therefore can be disposed of in a typical landfill waste facility. Water system should discuss disposal methods with the product supplier or the DEP. Methods for the disposal of media used for removing other regulated drinking water contaminants must be approved by the DEP.

3. Disposal of Media or Backwash from an Ion-Exchange Treatment System Removing Radionuclides: Three State agencies are involved with approving disposal methods for wastes generated by treatment systems removing radionuclides from drinking water. The DEH Radiation Control Program is provided (by both the DWP and the treatment system designer) information on the:

   a. concentration of radionuclide contaminant(s) in the raw water (from CET)
   b. expected concentration of the radionuclide contaminant(s) in the backwash
   c. volume of expected backwash
   d. frequency of backwash
   e. capacity of the media
   f. volume of the media
   g. expected flows through the treatment system
   h. other information as requested by the DEH Radiation Program

   With this information, the DEH Radiation Control Program calculates:

   a. the amount of radioactive material generated as waste (media or backwash) over a given period of time
   b. the level of the waste's radioactivity and its status regarding whether or not it is a regulated nuclear material

   For backwash disposal onsite, the DEH Control Radiation program shares the result of their evaluation with the DEP for the DEP to determine what disposal method is acceptable (e.g. sanitary leach field disposal of an ion-exchange backwash), including potential disposal requirements for what may be considered regulated nuclear material (regulated by the Nuclear Regulatory Commission), either low or high level. This process of evaluation may result in the State denying the use of a particular proposed or existing treatment process.

   Note 1: For sanitary leach field disposal of a backwash from a treatment system removing radionuclides, the same amount of radionuclide material will enter the ground whether the water is left untreated or concentrated in an ion-exchange backwash water. However, when several leach fields receive water from one water system, disposing of ion exchange backwash from a point of entry treatment system into only one of several leach fields has been considered by the DEP as concentrating the contaminant discharge into one location. As a result, special backwash discharge requirements dictated by the DEP may be necessary in such situations. One past requirement was to blend treated water with the backwash stream to dilute it before it entered the leach field. In this case, the hydraulic loading of the leach field must be reviewed and approved for the additional flow.

   Note 2: The process of gathering the necessary information, providing it to DEH Radiation Control Program to evaluate, making sure that DEH Radiation Control Program determinations are communicated to DEP, then making sure that DEP provides a determination and communicates that to the PWS can require project manager type efforts to coordinate. Given this, it has been determined that the PWS Inspector, with assistance from the PWS Inspection Team Supervisor, will be the "project manager" for obtaining a DEP decision regarding the disposal of backwash from a treatment system removing radionuclides.

For backwash disposal to a Publicly Owned Treatment Works (POTW – municipal sewer): The POTW must approve of the waste discharge to their system. It is the responsibility of the PWS owner to obtain approval of their discharge to the POTW.

Note: for an un-named apartment complex in Maine, the local POTW required that any discharge to their POTW must be lower than the level permitted to be discharged from the POTW (to a river). This POTW's allowable discharge level was much lower than that expected from the ion exchange system's backwash. This required much more frequent backwash of the ion exchange system to result in lower contaminant levels in the backwash. This in turn created other water quality complications… see Case Studies, this document, on an apartment complex of approximately 25 apartments.

For Media Disposal: the disposal of media used for removing radionuclides from drinking water must meet all State and Federal regulations. The DEP determines whether or not a waste disposal process meets State and Federal Regulations.

4. Disposal of Leachate or Settled Solids from a Water Treatment Process Lagoon: The disposal of any solid or leachate from a lagoon settling process must meet all State and Federal Regulations. The DEP determines whether or not a waste disposal process meets State and Federal Regulations.

M. Treatment Equipment Labeling

All drinking water treatment equipment shall be labeled to indicate the purpose of the equipment and the contents of the vessels, e.g., arsenic removal and type of media. Chemical injection points shall be labeled if not obvious.

II. DRINKING WATER TREATMENT REVIEW AND APPROVAL ADMINISTRATION

A. What does DWP Treatment Approval Cover and Not Cover?

The DWP approval review for proposed water treatment is an assessment of the properties of the treatment design and process in regards to potential health risks to consumers. This includes verification that: the proposed treatment technology is considered by the industry to be an acceptable treatment approach for the target contaminant; the components of the treatment meet material health effects requirements (i.e. Standards 60 and 61); the design/lay-out of the water treatment (including consideration for effects on/from existing treatment) seems reasonable with limited chance for treatment failure and does not include potential hazards such as cross connections; the treatment process will not create water that is corrosive or with other unacceptable qualities; the PWS has the capability to operate and maintain the treatment properly; during installation of the equipment any necessary precautions will be taken to protect consumers from unsafe water. It should be noted that DWP approval of a proposed water treatment system is not a certification or affirmation that it will solve a contamination problem and/or resolve a PWS compliance issue. While the DWP makes every effort to assist PWS in solving their contamination problems which may include providing information about water treatment, the DWP cannot guarantee that unforeseen situations will not arise that could affect treatment performance.

B. Requirements for Submitting a Request for Treatment Review and Approval

The following information needs to be provided to the DWP for treatment review (as applicable) by the person/entity requesting the treatment review: [See DWP0227 for the **Drinking Water System Change Application**]

1. A diagram of the existing system that shows the majors pieces of equipment (e.g., source, storage, existing treatment, other major appurtenances) as well as how the proposed treatment will be integrated
2. An engineer or designer's report if available
3. A description of treatment
   a. Purpose of the treatment
   b. What is the reason for the change/addition/removal?
   c. Who is making the request for the chemical change, addition, or removal (owner, engineer, treatment installer, other?)
   d. Is it a requirement from DWP or is it voluntary … (was it based on an MCL exceedance?)
   e. Type of treatment (e.g., anion exchange, adsorptive media, etc.)
   f. Raw water quality data (e.g., pH, concentration of contaminant, concentration of competing or interfering contaminants, speciation results, etc.) – data should be recent and from an acceptable source
   g. Treatment specifications
   h. Specific type of media (e.g., Purolite A300E, ArsenXnp, etc.)
   i. Include any special concerns (e.g., range of pH values where media is effective and maximum chlorine concentration media can resist)
   j. Number of treatment vessels
   k. If greater than one unit, describe the configuration (e.g., in series, parallel, twin-alternating, etc.)
   l. Size (volume) of each vessel

m. Documentation that all chemicals and products in contact with drinking water have Standard 60 or Standard 61 certification.
n. Description of backwash/regeneration
    i. Purpose (e.g., regenerate media, remove fines, etc.)
    ii. Factor controlling backwash/regeneration (e.g., specific time, volume of water) – provide specific value (e.g., unit regenerates automatically every 3,000 gallons per flow meter attached to head unit)
    iii. Location of where spent backwash/regeneration water is being disposed (e.g., combined septic field, sanitary sewer, etc.) – note that the DEP and possibly the Radiation Control Program will be notified of all backwashing/regenerating water treatment systems with the potential that the proposed waste disposal method will be unacceptable
    iv. Description of backflow prevention measures on all drains from treatment equipment
o. For adsorptive media, what is the expected life of the media

4. Any other treatment (e.g., pre-chlorine for oxidation or post corrosion control)
5. Description of any bypasses or cross-connections
6. Provisions for additional treatment if later determined to be needed (e.g., pre-chlorine for oxidation)
7. For treatment projects costing $10,000 or more, plans stamped by a Maine Licensed Professional Engineer-See Maine P.E. Law
    a. Projects submitted without a Professional Engineer stamp must include a cost estimate for the entire project to document the exemption for the Professional Engineer stamp requirement.
8. Validation (a written statement) that all plumbing work will be completed by a Maine licensed plumber when required by the Maine Internal Plumbing Code or Maine Statutes (See II.C. Necessary Qualifications of Treatment Designers and Installers, this document)
9. A statement whether or not all plumbing components meet the Reduction of Lead in Drinking Water Act (requirements and exemptions can be found at www.epa.gov/safewater).
10. A statement from the PWS Primary Operator (signature or e-mail) acknowledging that they approve of the treatment proposal.

C. Necessary Qualifications of Treatment Designers and Installers

1. Plumbers License Requirements:

    a. Anyone who installs equipment and/or fixtures in or modifies a public drinking water system must be a licensed plumber as required by the Maine Internal Plumbing Code.

    b. Maine Statute Title 32, Chapter 49, section 3302 states that the requirement for a plumbing license does not apply to “plumbing by regular employees of public utilities”.

2. Engineering License Requirements:

    The rules of the State of Maine Board of Licensure for Professional Engineers describe when a professional engineer is required to approve water system designs. The rules are available on the State of Maine website (www.maine.gov/professionalengineers) or by contacting 207-287-3236. Questions regarding the requirement for Professional Engineer review (stamp) of a drinking water system design should be referred to the State of Maine Board of Licensure for Professional Engineers. Note that the Drinking Water Program itself does not require the oversight of a professional engineer on drinking water projects; the review and approval of a design by a professional engineer is required by laws of Maine that are overseen by the State of Maine Board of Licensure for Professional Engineers. As of 2013, we are aware of the following details from the Professional Engineering Law, General Provisions, MRS 32:

a. *Revisions or additions to plumbing systems up to $10,000, if the work has no impact on the building's compliance with the National Fire Protection Association Life Safety Code adopted by the Department of Public Safety, Office of the State Fire Marshal and does not involve roof drains (are exempt from having to have a P.E. stamp on the plans/design)*
b. *Revisions or additions to structural systems up to $10,000, if the design is in accordance with the tables provided in the International Building Code (IBC) (are exempt from having to have a P.E. stamp on the plans/design)*
c. *Revisions or additions to electrical systems up to $10,000, if the work has no impact on the building's compliance with the National Fire Protection Association Life Safety Code adopted by the Department of Public Safety, Office of the State Fire Marshal (are exempt from having to have a P.E. stamp on the plans/design)*
d. *Any department of this State or any of its political subdivisions (a water district is a political subdivision) or any county, city, town, township or plantation may engage in construction of any public work involving professional engineering without procuring the services of a licensed professional engineer, as long as the contemplated expenditure for the completed project does not exceed $100,000 and the work, both as performed and as completed, does not create an undue risk to public safety or welfare*. [Note: This may or may not be applicable for private water companies. A private water company must contact the Maine P.E. Board for a determination.]

3. <u>Engineering Studies:</u>

The DWP may require designs, studies or construction project below the $10,000 threshold to be completed by a licensed Professional Engineer if, in the opinion of the DWP, there are multiple treatment needs or there appears to be an acute risk to the public if the work is not properly done. Examples include corrosion control treatment plans/studies where the lead levels are significantly higher than the lead action level or when there are simultaneous compliance needs e.g. arsenic removal and lead action level exceedances.

D. Documenting Treatment Approval

The treatment approval letter (see Appendix D) will serve as the primary record of treatment review and approval by the DWP. The letter should include

1. A brief description of the treatment addition/change/removal
2. A reason for the treatment addition/change/removal
3. Approval or disapproval of the request to install treatment
4. Recommendations or requirements for maintenance
5. Reporting requirements, including confirmation sampling, routine sampling, and monthly operating reports

The Engineer providing treatment review shall place their completed treatment review checklists, specifications, calculations, notes, etc. to be electronically imaged by PWSID#.

E. Treatment System Inspections for Confirmation of a Treatment Installation

For treatment modifications, changes, or installations, the PI should schedule an inspection before or within one month after the treatment is on-line. The decision on when to complete an inspection is made on a case-by-case basis with input from the Rule Specialists. Situations involving the replacement of a source may require inspection before the source is allowed to go on-line. If confirmation samples are required, they should be collected before or during this inspection. Confirmation samples are collected by the DWP PWS Inspector (PI) or other designee approved by the DWP. The PI creates an inspection report and sends it to DM within three weeks of the inspection. This report should include:

1. Photographs of the new treatment
2. Date the system was put on-line
3. Illustration of process flows
4. Any special notations or requirements
5. The results of the inspection e.g., "The Drinking Water Program has completed a physical inspection of the ________ treatment equipment at the ___________ facility (public water system) and approves of its use for potable water treatment."

Along with the treatment inspection report, the PWS Inspector provides treatment system information to DM (RS) by filling out the SDWIS INFORMATION FORM – SS/Inspection and sending it to DWPDATAREQUEST.DHHS@Maine.gov and the Engineer/reviewer, upgrading the system's operating classification as appropriate. Upon reading the PI's e-mail, DM updates SDWIS as necessary for data changes or creation of appropriate monitoring schedules and sampling points. The Rule Specialist tracks water quality results to ensure that treatment is functioning adequately.

See APPENDIX M for detailed steps of the treatment review process.

Treatment related letters need to be sent (hard copy and by e-mail) from the PI to the PWS and copied (electronically) to the following:

1. Data Management (e-mail to DWPDATAREQUEST.DHHS@Maine.gov
2. Engineer/reviewer
3. DWP Imaging System
4. Water Resources Team Staff (as necessary)
5. MRWA Water Quality Specialists (as necessary)
6. Others as needed

All DWP letters are sent from the Augusta office.

F. Treatment Construction/Installation Project Bids or Quotes

Requirements related to bidding or quoting project cost only apply to projects funded with DWSRF funds, which includes projects utilizing Very Small System Compliance Loans. Projects funded only with district or private funds can use bidding or quotes at the owner's choice. See the DWSRF Project Management Procedure (DWP0157) for additional details.

G. On the Difference between Treatment Approval for Large Systems vs. Small Systems

Treatment systems for large water systems can be significantly different than those for small water systems. For both treatment chemical and process changes, municipal water systems typically employ the services of a professional engineer to oversee the change. In addition, large systems may use pilot testing to help confirm the anticipated results of a chemical or process change. On the other hand, treatment chemical or process changes at small, non-municipal, water systems are at best, overseen by a water treatment company, water professional, or plumber, and other times only by the licensed, designated operator.

When a treatment chemical or process change is proposed at a large municipal water system, seek out the technical information provided by an engineering consultant or water professional to learn the details of the proposal. For complex changes, it is reasonable to ask the consultant or designer to describe the proposed change to you in person, giving you, during that process, the opportunity to ask questions about the proposal. Make every effort to educate yourself on the technology being considered before involving others in the treatment review. If the change is complex, contact your (or a) DWP manager for assistance and also consider gathering a team of experienced DWP staff to review the proposal as a team effort. Use the treatment review checklists provided in this document as guidance for the review.

For small water systems, contact the water treatment company, water professional, plumber, or water system designated operator to discuss the treatment proposal. Work with peers and your (or a) DWP manager, as needed, to review the treatment proposal. Use the treatment review checklists provided in this document as guidance for the review.

H. DWSRF Treatment Review & Approval Procedure

1. Engineers, PWS Inspectors, and Rule Specialists are notified of SRF projects through a Priority List distributed by e-mail.
2. DWSRF Project plans & Specs are provided to the DWP Engineering group. When the engineer receives plans and specs that involve treatment additions or changes, the Engineer requests input from the PI and RS on the project following the normal process for treatment approval. See Appendix M. The DWP has 30 days to review and provide plans & specs approval.
3. The Engineer will oversee the DWSRF project from start to finish, keeping the PI and RS informed of progress along the way. The Engineers provide quarterly DWSRF project progress reports to the DWP.
4. Final Inspection of a DWSRF treatment installation should be completed by both the Engineer and the PI.
5. Confirmation sampling is accomplished per the normal process for treatment review and approval. See Appendix M.
6. The PI completes the SDWIS INFORMATION FORM – SS/Inspection, creates a treatment inspection report, and sends both to DM (using the e-mail account: DWPDATAREQUEST.DHHS@Maine.gov) and the Engineer.

ASSOCIATED DOCUMENTS:

1. Maine Rules Relating to Drinking Water
2. List of Federal MCLs (found at http://water.epa.gov/drink/contaminants/index.cfm) See tab on Basic Information about Drinking Water Contaminants
3. List of State MEGS (found at http://www.maine.gov/dhhs/mecdc/environmental-health/eohp/wells/documents/megtableoct2012.pdf)
4. Tech Briefs – Electronic Field Manual, Section 37
5. AWWA Water Quality and Treatment: A Handbook on Drinking Water, available at www.awwwa.org.
6. Making GUI Determinations for New/Proposed PWS Wells (DWP0166)
7. Point of Use Policy (DWP0175)
8. Blending Policy (DWP0174)
9. Approving Requests to Discontinue Disinfection at a Ground Water Source (DWP0030)
10. Approving Requests to Discontinue Chlorination at a New Source (DWP0031)
11. Continuous Chlorination Disinfection System Installation Guidance (DWP0120)
12. Unregulated Contaminants in Public Water Systems Policy (DWP0187)
13. UV Procedure (DWP0047)
14. Required Monitoring After a PWS Installs Treatment (DWP0051)
15. Treatment Plant Plan Review Checklist (to be developed)
16. Procedures for SDWIS Record of Treatment – Electronic Field Manual (For Data Management only)
17. One page Fact Sheet on Treatment Review and Approval
18. Use of Sea Water and Reverse Osmosis to Produce Drinking Water (DWP0176)
19. Sanitary Survey – Small System Procedure (DWP0114)
20. Sanitary Survey – Large System Procedure (DWP0115)
21. FIT – Electronic Field Manual (G:\DWP\Field Inspection\Field Manual – Electronic)
22. CET – Electronic Compliance Manual (G:\DWP\CET TEAM\Electronic Compliance Manual)
23. See EPA Fact Sheet EPA/600/F13/153c "How to identify Lead-Free Certification Marks for Drinking Water System & Plumbing Materials.
24. Approval of Non-Treatment Related Water System Modifications (DWP0012)
25. EPA Drinking Water Rule Quick Reference Guides: https://www.epa.gov/dwreginfo/drinking-water-rule-quick-reference-guides

SUPERCEDED DOCUMENTS:

1. Treatment Design Approval (DWP0015-OBS)
2. SRF Treatment Approval Procedure (DWP0054-OBS)

RETENTION:

This document is retained per the DWP Record Retention Schedules.

REVISION LOG

Section	Page	Rev.	Date	Description Of Change	Approved by:
		Original	3-27-2014		**Roger Crouse**
several	several	A	10-7-2014	Added Appendix K. Added to Required Treatment – all services must be treated and added a related case study in Appdx J Added to flowchart on Regulated vs. non-regulated treatment re. monitoring. Added to non-regulated treatment description. Added to G – applies to active treatment only. Added name line on FIT and CET checklists. Added UV exception for bypasses. Added yes/no checkboxes to meeting lead-free requirements on Treatment Approval Application. Added the term "Greensand" to oxidation treatment description.	**Roger Crouse**
Index, I, Apndx B	2, 16, 26	B	11-19-2014	Added section I. M. Treatment Equipment Labeling. Added reference to this new section in the FIT treatment process review checklist (Appendix B) on the question which asks about treatment labeling.	Minor change impacting Field Inspector treatment review only. Nathan Saunders
Section 1.B,D Appndx L	6,7,61	C		Added note that a requirement for DW treatment applies only to potable use water lines, not non-potable water uses such as irrigation and process water. (Section 1.B). Changed reference to NSF 61 Guidance from the Electronic Field Manual to Appendix L, this document (Section 1.D). Added Appendix L (moved NSF 61 Guidance from the Electronic Field Manual into this document)	Nathan Saunders
Multiple	Multiple	D	6-30-16	Changed document to reflect reorganized structure of the DWP including responsibilities for the PWS Inspector, the Rule Specialists, the Engineering Supervisor, Engineers, and Data Management. Modified Appendix L. Added Appendix M	Nathan Saunders
1A Apndx M	6 67,68	E	7-18-16	Changed who sends the treatment approval letter, from the Engineer to the PI.	Nathan Saunders
Appdx D Appdx E	34,35	F	4/12/17	The Sample Treatment Approval Letter was updated. The Treatment Review & Approval Applpication was enhanced to cover both treatment and non-treatment related proposed PWS changes and was removed as a stand-alone document (DWP0227)	Nathan Saunders

Appendix A
Checklist #1 for Review and Approval of a Treatment Chemical Change

Engineer Reviewer:_______________________________________

Information and Documentation Required for Evaluation (*have PWS or treatment designer/installer fill out the Drinking Water System Change Application DWP0227*)

___What is the reason for the chemical change/addition/removal?
___Who made the request for the chemical change, addition, or removal (owner, engineer, treatment installer, other)?
___Is the treatment chemical change required by the DWP or was it voluntary? (was it based on an MCL exceedance?)
If yes, which regulation?_________________________________
___No, then refer to Section I.C. of this policy
___For chemical changes or additions, obtain specification sheets on the chemical (will be provided as part of the Drinking Water System Change Application – DWP0227).
___Ask for a diagram of the treatment equipment configuration (will be provided as part of the Drinking Water System Change Application – DWP0227).
___Review the engineer or designer's report
Note: Obtain input from Rule Specialists for the review the raw water parameters and how the chemical will affect the rest of the treatment train regarding water quality.
Note: The Engineer documents a treatment review for chemical changes, additions, or removals with this completed checklist and notes, sent to Imaging by PWSID#.

Checklist Steps:

Note: The DWP approval review for proposed water treatment is an assessment of the properties of the treatment design and process in regards to potential health risks to consumers. This includes verification that: the proposed treatment technology is considered by the industry to be an acceptable treatment approach for the target contaminant; the components of the treatment meet material health effects requirements (i.e. Standard 60 and 61); the design/lay-out of the water treatment (including consideration for effects on/from existing treatment) seems reasonable with limited chance for treatment failure and does not include potential hazards such as cross connections; the treatment process will not create water that is corrosive or with other unacceptable qualities; the PWS has the capability to operate and maintain the treatment properly; during installation of the equipment any necessary precautions will be taken to protect consumers from unsafe water. It should be noted that DWP approval of a proposed water treatment system is not a certification or affirmation that it will solve a contamination problem and/or resolve a PWS compliance issue. While the DWP makes every effort to assist PWS in solving their contamination problems which may include providing information about water treatment, we cannot guarantee that unforeseen situations will not arise that could affect treatment performance.

___Was a pilot test done?
___For a chemical change or addition, is the new chemical Standard 60 certified and will it be dosed within the range of the Standard 60 certification?
___Review where the chemical is going to be injected
___Are there backwash disposal issues?
___How will the PWS routinely test/monitor for the chemical (manual/batch, automated/continuous)?
___How will the chemical be stored? Will there be secondary containment?
___Will the chemical be labeled properly (OSHA required Hazardous Material Information System - HMIS, or Globally Harmonized System - GHS). Have the system contact Maine Safety Works for more information (623-7900)
___Will MSDS sheets be available where the chemical is used?
___Will there be written procedures covering the chemical's use?
___Has the chemical change proposed been shared with the PWS's Primary Operator? (Drinking Water System Change Application [DWP0227] requires signoff or written approval of the Designated Operator)
Note: For complex chemical changes, obtain input from peers and/or management when the complexity of the review requested is beyond your capability.

____

____

Appendix B
Checklist #2 for Review and Approval of a Treatment Process Change

Engineer Reviewer:______________________________________

Information and Documentation Required for Evaluation (*have PWS or treatment designer/installer fill out the Drinking Water Sysetm Change Application, DWP0227*)

___Obtain a drawing of the existing system that shows the majors pieces of equipment (e.g., source, storage, existing treatment, and other major appurtenances) as well as how the proposed treatment will be integrated.
___Review the engineer or designer's report
___The following bullets are requested in the Drinking Water System Change Application – DWP0227

- Purpose of the treatment
  - What is the reason for the change/add/removal?
  - Who made the request for the chemical change, addition, or removal (owner, engineer, treatment installer, other)?
  - Was it a requirement from DWP/CET or was it voluntary … (was it based on an MCL exceedance?)
- Type of treatment (e.g., anion exchange, adsorptive media, etc.)
- Obtain input from Rule Specialists for the review the raw water parameters and how the chemical will affect the rest of the treatment train regarding water quality. (e.g., pH, concentration of contaminant, concentration of competing or interfering contaminants, speciation results, etc.) – data should be recent and from an acceptable source
- Treatment specifications
  - Specific type of media (e.g., Purolite A300E, ArsenXnp, etc.):
    - Include any special concerns (e.g., range of pH values where media is effective and maximum chlorine concentration media can resist)
  - Number of treatment vessels:
    - If greater than one unit, describe the configuration (e.g., in series, parallel, twin-alternating, etc.)
  - Size (volume) of each vessel
- Documentation that media and vessels have necessary NSF certification (Standard 60 for chemicals and Standard 61 for equipment [and media] coming in contact with water)
- Discussion on backwash/regeneration:
  - Purpose (e.g., regenerate media, remove fines, etc.)
  - Factor controlling backwash/regeneration (e.g., specific time, volume of water) – provide specific value (e.g., unit regenerates automatically every 3,000 gallons per flow meter attached to head unit)
  - Location of where spent backwash/regeneration water is being disposed (e.g., combined septic field, sanitary sewer, etc.) – note that the DEP and possibly the Radiation Control Program will be notified of all backwashing/regenerating water treatment systems with the potential that the proposed waste disposal method will be unacceptable
  - Description of backflow prevention measures on all drains from treatment equipment
- For adsorptive media, what is the expected life of the media?
- Any other treatment (e.g., pre-chlorine for oxidation or post corrosion control)
- Description of any bypasses or cross-connections
- Provisions for additional treatment if later determined to be needed (e.g., pre-chlorine for oxidation)

Note: Obtain input from Rule Specialists for the review the raw water parameters and how the chemical will affect the rest of the treatment train regarding water quality.
Note: The Engineer documents a treatment review for chemical changes, additions, or removals with this completed checklist and notes, sent to Imaging by PWSID#.

Checklist Steps:

Note: The DWP approval review for proposed water treatment is an assessment of the properties of the treatment design and process in regards to potential health risks to consumers. This includes verification that: the proposed treatment technology is considered by the industry to be an acceptable treatment approach for the target contaminant; the components of the treatment meet material health effects requirements (i.e. NSF/ANSI Standards 60 and 61); the design/lay-out of the water treatment (including consideration for effects on/from existing treatment) seems reasonable with limited chance for treatment failure and does not include potential hazards such as cross connections; the treatment process will not create water that is corrosive or with other unacceptable qualities; the PWS has the capability to operate and maintain the treatment properly; during installation of the equipment any necessary precautions will be taken to protect consumers from unsafe water. It should be noted that DWP approval of a proposed water treatment system is not a certification or affirmation that it will solve a contamination problem and/or resolve a PWS compliance issue. While the DWP makes every effort to assist PWS in solving their contamination problems which may include providing information about water treatment, the DWP cannot guarantee that unforeseen situations will not arise that could affect treatment performance.

___Backwash disposal review. See Section I.J. this document. (Check with Compliance Officer… this is a joint review)
___Check for bypasses (see policy on bypasses)
___For chemical injection, review where the chemical will be injected. A length of ten pipe diameters is recommended after the injection point to ensure proper mixing before residual measurement.
___Check for cross connections (air gaps/backflow prevention valves/improper valves). Go by the treatment diagram first, then verify in the field
___Look for adequate raw water tap(s)
___No hard piped bypasses (Refer to Section I.J. of this policy)
___Does an internal bypass exist (e.g., ion-exchange heads)? (Refer to Section I.J. of this policy)
If Yes: Assess the risk of the contaminant and provide any recommendations or requirements.
___Is the treatment equipment going to be labeled? (Refer to Section I M. of this policy)
___Will the chemical(s) be labeled properly (OSHA required Hazardous Material Information System - HMIS, or Globally Harmonized System - GHS)
___Will secondary containment be provided for chemicals?
___Are there serial or parallel treatments/vessels? Is this configuration correct for the type of treatment?
___All establishments served by a PWS must be treated (e.g. #ME0005015, #ME0008202)
___Is the chemical used Standard 60 certified?
___Is the equipment [and media] used Standard 61certified?
___Evaluate the system classification points added due to the new treatment. Verify that the PWS's Primary Operator has the necessary license to cover the PWS after the treatment is added.
___For treatment projects costing $10,000 or more, are the plans stamped by a Maine Licensed Professional Engineer? See Section II.C. Necessary Qualifications of Treatment Designers and Installers.
___Validation (a written statement) that all plumbing work will be completed by a Maine licensed plumber when required by the Maine Internal Plumbing Code or Maine Statutes. (See Necessary Qualifications of Treatment Designers and Installers, Section II.C. this document)
___Has a statement been provided that all plumbing components will meet the Reduction of Lead in Drinking Water Act? (Requirements and exemptions can be found at www.epa.gov/safewater)
___Has the Treatment Process Change Proposal been shared with the PWS's Primary Operator? (Drinking Water System Change Application [DWP0227] requires signoff or written approval of the Designated Operator)
___ Look for sample taps pre and post treatment. Discuss sample tap plan with the Rule Specialist to determine what will be required for adequate sampling
___ Obtain input from Rule Specialists on obtaining water quality test results as needed for the evaluation of how the treatment will affect water quality.

Notes: For complex treatment process changes, obtain input from peers and/or management when the complexity of the review requested is beyond your capability.

Details on Review of Specific Types of Treatment
[See also: -Sanitary Survey - Small System Procedure (DWP0114) and Sanitary Survey - Large System Procedure (DWP0115)]

1. Chlorination for Disinfection

___See the Continuous Chlorination Installation Guidance Document (DWP0120)
___Use the Log Reduction Calculator (Electronic Field Manual, Section 16) to ensure design will meet 4-log removal of viruses
___See Approving Requests to Discontinue Disinfection at Groundwater Systems (DWP0030 and DWP0031)
___See also (next): "chlorination by chemical feed pumps" for chemical feed pump specifics.

2. **Chlorination for oxidation; chlorination by chemical feed pump [these tasks are common for other chemical feed applications]**

___Will the chemical (chlorine) feed pump be paced to flow? If a flow meter is used whose signal output varies with the water system demand, then a variable speed chemical feed pump is required.
___Will the chemical (chlorine) feed pump be turned on/off by a flow switch, detecting flow or no flow? A non-variable speed chemical (chlorine) feed pump can be used with a flow switch.
___Will the chemical feed pump be electrically tied directly to the pressure switch that turns on the well pump? A non-variable speed chemical (chlorine) feed pump can be used for this application.
___Where is the chemical (chlorine) solution being injected? Is the location acceptable?
___Where is the chemical (chlorine) residual measured?
___As needed, see Approving Requests to Discontinue Disinfection/Chlorination (DWP0030/DWP0031)

3. **Other Oxidants**

___Is this air injection (by venturi)?
___For Ozone, review the engineer's report and see Sanitary Survey – Large System Procedure (DWP00115)
___Is this accomplished with Potassium Permanganate for Greensand Filtration (Manganese Removal)?

4. **Anion Exchange (for removal of arsenic, uranium, nitrates, tannins, fluoride, antimony)**

___Is the media used Standard 61 certified? Note that certified media that is regenerated does not retain its Standard 61 certification, unless the regeneration process is certified to Standard 61.
___What is the frequency of backwash?
___What is the expected volume of each backwash?
___Review backwash disposal plan
___Look for backwash air gaps / cross connections
___For rad removal, approval of backwash disposal plans requires review by the Radiation Program and the DEP. See Section I.L. this document.
___Does it backwash?... Some anion media (e.g. for uranium) is not backwashed. In this case, the anion resin is working as an adsorptive media.
___Evaluate specifications of the media
___Ensure Standard 60 certification on the salt used
___Review salt/brine tanks and make sure they are adequate…no Rubbermaid trash cans

5. **Cation Exchange (for water softening, radium, or gross alpha removal)**

___Is the media used Standard 61 certified? Note that certified media that is regenerated does not retain its Standard 61 certification, unless the regeneration process is certified to Standard 61.
___What is the frequency of backwash?
___What is the expected volume of each backwash?
___Review backwash disposal plan
___Look for backwash air gaps / cross connections
___For rad removal, approval of backwash disposal plans requires review by the Radiation Program and the DEP. See Section I.L. this document.
___Ensure Standard 60 certification on the salt used
___Review salt/brine tanks and make sure they are adequate…no Rubbermaid trash cans

6. **Adsorptive Media**

___Is the media used Standard 61 certified? Note that certified media that is regenerated does not retain its Standard 61 certification, unless the regeneration process is certified to Standard 61.
___Will there be a media backwash (Fluffing of the media to avoid channeling)?
___Will potable water be used for the backwash?
___What is the volume of the backwash
___For rad removal, approval of backwash and media disposal plans requires review by the Radiation Program and the DEP. See Section I.L. this document.
___Review backwash/fluffing disposal plan
___Evaluate specifications of the media

___Review sampling tap location to enable the identification of spent media (prior to, between, after)
___Review Expected lifecycle of the treatment with vendor

7. Point of Use

___See Point of Use Policy (DWP0175)

8. Blending

___See Blending Policy (DWP0174)

9. Corrosion Control (by aeration, chemical feed, calcite contactor)

___See similar… e.g., chlorination for oxidation [chemical feed]).

Note: Obtain input from Rule Specialist on water quality parameters and the effect on water quality.

10. Granular Activated Carbon (GAC) (for VOC, chlorine removal)

___Cannot be installed after required Cl2 (Point of Use GAC has been an exception: e.g., at a restaurant)
___Pre and post treatment sample taps are required for VOC removal
___For Underground Storage Tanks, see UST Policy (DWP0057)

11. Powdered Activated Carbon (typically for a large municipal surface water filter bed or it may be applied to the raw water in a surface water plant directly).

___ The use of Powdered Activated Carbon is treated as a "Treatment Chemical Change". See FIT Checklist for Review and Approval of a Treatment Chemical Change.

12. Cartridge Filters

___Why is the filter needed?
___What size particle will be removed (micron designation of the filter: micron to submicron)
___Has the pressure drop been estimated? Can the system still work with the expected pressure drop?
___We recommend a change-out SOP (usually recommended at a sanitary survey)
___Are there pressure gauges before and after the filter housing(s)?
___When should filter cartridge(s) be changed? At what pressure-drop across the filter?

13. Sequestration (keeping something in solution)

___Accomplished by chemical addition (see similar… e.g., chlorination for oxidation [chemical feed]).

14. Aeration (for Radon, VOC, and CO2 Removal)

___Bubbler using blowers
    ___HEPA filters on blower intakes recommended if bacteria problems occur
___Splash type without a blower
___Cascade type (like a small waterfall) (S. Berwick)
___Chlorination is only required if bacteria problems occur
___See draft policy on aeration vent design (Field Inspection Team Manual)

15. Reverse Osmosis (for seawater or other contaminant removal)

___NSF/ANSI Standard 58 is acceptable
___What is the expected discharge flow (gal/min)… for RO it is usually 60-80% of water used
___Does the well have the capacity to provide enough water for RO to provide needed quantity of potable water?
___Point of Use vs. Point of Entry… using RO treated water for toilets is costly and not necessary
___Review water storage plans
___Obtain specs on the membranes used

___Membranes need to be cleaned (backwashed) using potable water, from potable water storage
___Is a DEP discharge permit needed? A permit will be required for anything not disposed of in a sanitary leach field. Will it be an overboard discharge?
___Review the ocean intake specifics… intake should not sit on the bottom and should be screened
___See "Use of Seawater and Reverse Osmosis to Produce Drinking Water" (DWP0176)

16. Ultraviolet Disinfection

___For small Groundwater systems, see the DWP UV Policy (DWP0047). Take note of the concerns expressed in the introduction to DWP0047 regarding the use of UV with the Ground Water Rule in place.
___A small system bypass is acceptable with the required Boil Water Order tag attached securely to the bypass valve (see DWP0047)
___For large systems, both Groundwater and Surface water, see the EPA UV Guidance Manual and the DWP Document: Sanitary Survey – Large System Procedure (DWP0115)

17. Surface Water Treatment

___For a large PWS, see the engineering report
___For a small PWS, review the treatment proposal against the Approved Alternative Filtration Technologies available on the DWP website (www.medwp.com, under Rules, Surface Water Treatment Rule). Also available there is the Alternative Filtration Technologies Guidebook.
___Surface water treatment requires both filtration and disinfection that meets the requirements of the Surface Water Treatment Rule. The Compliance Officer plays the major role in evaluating and approving surface water treatment
___ Is there a "baffling factor" for the clear-well? Baffling factors in a clear-well (structural considerations) are used in CT calculations

Note: Obtain input from Rule Specialists on the expected log removal of viruses (4-log required) and CT values

Appendix C
Checklist #3 for Review and Approval of a Treatment Chemical and/or Process Change

Engineer Reviewer:______________________________________

Information and Documentation Required for Evaluation (*have PWS or treatment designer/installer fill out the Drinking Water System Change Application, DWP0227*)

All of the following shall be evaluated for a treatment chemical or process change (as applicable):

___Is the treatment a reasonable/accepted BAT? (Refer to Appendices G & H of this policy for more detail)
  ___No, then discuss with PWS and have PWS resubmit proposal
___Confirmation sample after treatment (Contact Rule Specialists for input)
___Review of raw water data and effects of any chemical on existing water quality (refer to Appendix G: Common Treatment Technologies) (Contact Rule Specialists for input)
___Evaluate CT (concentration*time) if applicable. (Contact Rule Specialists for input)

Note: For complex chemical or treatment process changes, obtain input from peers and/or management when the complexity of the review requested is beyond your capability.

Note: the Rule Specialists will determine the PWS monitoring plan upon making the treatment changes in SDWIS after receiving the SDWIS INFORMATION FORM – SS/Inspection from the PWS Inspector, after the treatment inspection site visit.

Additionally, the following shall be evaluated for a treatment process change (as applicable):

___Equipment specs and design-acceptable
___Do the plans and specs received from the PWS/treatment company appear to be complete?
  If No: Notify the responsible party for the information needed.
___Do the plans and specs include water quality test results or mention that such tests were conducted to consider interfering ions? (Contact Rule Specialists for input)
  If No: Consider whether such tests are necessary for the type of treatment and if so, notify the responsible party for the needed information.
___Is the location of the new treatment with respect to existing treatment or other proposed treatment acceptable? (See effect on other treatment below).
___Does the proposal include information about any adverse effects created by the treatment? (i.e. corrosive water) (Contact Rule Specialists for input)
  If No: Consider the treatment type, proposed backwash cycles, raw water quality, etc. and whether a potential for problems exists. If so, notify the responsible party about installing corrosion control treatment, additional testing, or whatever action is appropriate.
___Is the tank configuration lead/lag (in-series) for adsorptive media?
  If No: Discuss with the responsible party, the financial advantages and added safeguards such configuration provides.
___Does the treatment meet applicable regulatory requirements listed in the CFR? (i.e. UV validation), DWP policies, State Rules? (Contact Rule Specialists for input)
  If No: Notify responsible parties as treatment is not acceptable.
___Does the proposed treatment seem reasonable for the target contaminant? (Contact Rule Specialists for input)
  If No: Notify responsible party about the problem area.
___Will there be an effect on other treatment? (Contact Rule Specialists for input)
___Will oxidation treatment likely cause clogging downstream due to precipitated metals (i.e. from high levels of Fe or Mn in the water) (Contact Rule Specialists for input)
  If Yes: Consider installing cation exchange (or other treatment to remove the problem metal) before oxidation treatment.
___Is anion removal treatment upstream of all treatment that adds treatment anions? (Contact Rule Specialists for input)
  If No: Anion removal treatment must be located upstream of all other treatment that is adding treatment anions.
___Is cation exchange upstream of oxidation treatment?
  If No: It is better that cation exchange be upstream of oxidation treatment unless adverse consequences have been ruled out. (Contact Rule Specialists for input)
___Is charcoal treatment upstream of chlorination?
  If No: Charcoal must be upstream of chlorination. (Sometimes POU charcoal units are

permitted for the purpose of removing chlorine when it is not required for disinfection)

___Is reverse osmosis upstream of chlorination?
If No: RO must be located upstream of chlorination.

___Is reverse osmosis upstream of other treatment that is adding treatment chemicals?
If No: Since RO removes everything, it must be located upstream of any treatment that is adding a chemical.

___Is aeration and other treatment that raises pH located downstream of adsorptive media that is sensitive to high pH? (Contact Rule Specialists for input)
If No: Relocate treatment that raises pH so it is downstream of adsorptive media.

___Are there adequate safeguards to protect consumers from media dumping due to failure of treatment that lowers pH that is upstream of adsorptive media that is pH sensitive? (Contact Rule Specialists for input)
If No: Adequate safeguards must be in place.

___Is UV upstream from chlorination?
If No: UV should be located before chlorination since it destroys chlorine compounds.

___For bypasses of required treatment, refer to Section I.J. of this policy

___Does an internal bypass exist (e.g., ion-exchange heads)? (Refer to Section I.J. of this policy)
If Yes: Assess the risk of the contaminant and provide any recommendations or requirements.

___Is the backwash protocol satisfactory? See Section I.L. this document.
___If No, recommendations:___________________________________

___Reasonable maintenance plan (plan or SOP developed)
___If No, recommendations:___________________________________

___Longevity of adsorptive media
___Did the treatment company provide the expected time in which exhaustion of the adsorptive media would occur?
If No: Get the information from the treatment company.

___ Considering the time to media exhaustion, has the required compliance testing for the target contaminant been determined and the PWS been informed of the testing?
If No: Contact the Rules Specialists to determine testing requirements and have the PWS Inspector inform the PWS/operator.

Upon conclusion of the treatment review, the Engineer will write a draft of the treatment approval letter. See template letter, Appendix D, this document.

Note: The DWP approval review for proposed water treatment is an assessment of the properties of the treatment design and process in regards to potential health risks to consumers. This includes verification that: the proposed treatment technology is considered by the industry to be an acceptable treatment approach for the target contaminant; the components of the treatment meet material health effects requirements (i.e. NSF/ANSI Standards 60 and 61); the design/lay-out of the water treatment (including consideration for effects on/from existing treatment) seems reasonable with limited chance for treatment failure and does not include potential hazards such as cross connections; the treatment process will not create water that is corrosive or with other unacceptable qualities; the PWS has the capability to operate and maintain the treatment properly; during installation of the equipment any necessary precautions will be taken to protect consumers from unsafe water. It should be noted that DWP approval of a proposed water treatment system is not a certification or affirmation that it will solve a contamination problem and/or resolve a PWS compliance issue. While the DWP makes every effort to assist PWS in solving their contamination problems which may include providing information about water treatment, we cannot guarantee that unforeseen situations will not arise that could affect treatment performance.

APPENDIX D:
Sample Treatment Approval Letter (with conditions)

Maine Center for Disease Control and Prevention
An Office of the Department of Health and Human Services
Paul R. LePage, Governor Mary C. Mayhew, Commissioner

Department of Health and Human Services
Maine Center for Disease Control and Prevention
286 Water Street
11 State House Station
Augusta, Maine 04333-0011
Tel.: (207) 287-8016; Fax: (207) 287-9058
TTY Users: Dial 711 (Maine Relay)

Tel. (207) 287-2070 Drinking Water Program Fax (207) 287-4172

March 22, 2017

Name of the person who completed the Drinking Water System Change Application (on the application – DWP0227)
Address
Town, ME 04400

Re: Water System Design PWS Name PWSID# 99999

Dear Contact Person Name:

As required by 22 M.R.S.A., Section 2612, the Drinking Water Program (DWP) has reviewed the design plans and specifications submitted by _________________ for describe engineering-project or "treatment of Well HD 1" at PWS Name. Specifically, the project includes the installation of … describe engineering project or treatment components individually at PWS Name. We have found the proposed design to be in compliance with applicable standards and policies and grant approval with the following condition(s):

► *For an engineering-project review – include any requirements related to the engineering project.*
► *If applicable -* All new components of the treatment system that will come in contact with the water must be certified to meet NSF/ANSI Standard 61.
► *If applicable -* All new chemicals added to drinking water must be certified to meet NSF/ANSI Standard 60.
► *If applicable -* All plumbing components must meet the Reduction of Lead in Drinking Water Act (requirements and exemptions can be found at www.epa.gov/safewater)
► *If applicable -* All drinking water treatment equipment shall be labeled to indicate the purpose of the equipment and the contents of the vessels, e.g., arsenic removal and type of media. *If applicable, include the following:* Chemical injection points shall be labeled if not obvious.
► *If applicable -* A check valve is required after the raw water tap and before the pressure tank. Please install one if there is not one presently.
► *If applicable –* All plumbing components must meet the Reduction of Lead in Drinking Water Act.
► We have received information that indicates that the engineering project or treatment system will be installed the week of February school vacation. If this is not the case, please notify us as soon as possible.

Immediately upon installation, contact me at TEL-NMBR, so that I can conduct an inspection and review the operation of the engineering project or treatment system with the water operator.

Please do not hesitate to contact me if you have any questions.

Sincerely,

PWS Inspector Signature

Name
PWS Inspector
Drinking Water Program
TEL-NMBR name.name@maine.gov

CC or Ec: PWS Administrative Contact, PWS Primary Operator, DWP- RS, DWP-ENG

APPENDIX E:
~~Treatment Review & Approval Application~~

Note: the Treatment Review & Approval Application (TA) was replaced with the “Drinking Water System Change Application” (CA) in order to accommodate both treatment and non-treatment related proposed changes. The application has been made into a stand alone document (DWP0227) in SharePoint.

APPENDIX F
<u>Common Contaminants</u>

For more detail, see “Drinking Water Contaminants” at the EPA website: http://water.epa.gov/drink/contaminants/index.cfm See tab on Basic Information about Drinking Water Contaminants

Also See Links to “Tech Brief - Fact Sheets” published by the National Drinking Water Clearing House, available from a file with links found in the Electronic Field Manual:

G:\DWP\Field Inspection\Field Manual - Electronic\37- Tech Briefs\Tech Brief Fact Sheets - Drinking Water.mht

1. Microbial Pathogens (Bacteria, Cysts, etc.)

    a. Coliform bacteria – since it is expensive and impractical to test for the many different biological pathogens, coliform bacteria (total coliform bacteria) testing is required and acts as a surrogate for all the others. Total coliform bacteria are fairly ubiquitous but their presence is an indication that harmful bacteria may also be present. When no total coliform is present, it is assumed that there are no harmful bacteria. Total coliform bacteria itself is not considered harmful. Testing is based on system type and size; it can be as infrequent as one sample per quarter to as many as 480 per month.

    b. *E. coli* – whenever total coliform is detected the sample must be analyzed for *E. coli* as well. *E. coli* is found in the intestines of warm blooded organisms, is considered harmful, and its detection in finished water is almost always followed by a boil water order. The *E. coli* strain O157:H7 is deadly and was responsible for several deaths in 2003 during an outbreak in Walkerton, Ontario.

    c. *Giardia lamblia* – a cyst that can be found in surface waters. It is the pathogen associated with “beaver fever” or gastrointestinal disorder. It is handled by robust source protection (unfiltered surface systems) followed by disinfection or via filtration (filtered surface systems) followed by disinfection. Not normally tested for (addressed using surrogate methods – see Turbidity below).

    d. *Cryptosporidium parvum* – an oocsyt that can be found in surface waters though never detected in any sampling in drinking water sources in Maine. Effects are similar to Giardia. Crypto was responsible for an outbreak in Milwaukee in 1993 that resulted in several hundred deaths. Not normally tested for (addressed using surrogate methods– see Turbidity below), but is part of the Long Term 2 Enhanced Surface Water Treatment Rule (LT2) testing requirements on a semi-regular basis.

    e. Sulfur Producing Bacteria: are not pathogenic. These bacteria can be found in wells or in distribution system piping. They give off sulfur which is a secondary contaminant.

2. Volatile Organic Compounds (VOCs): otherwise known as VOCs and are refined from petroleum products. Toluene, Xylene, and Trichloroethylene (TCE) are examples. These are usually present when there has been a leak (such as from a leaking underground storage tank at a gas station or an outside home heating oil tank) or via leaching (from a

landfill or a dumping site). A special subset of these compounds are called disinfection byproducts:

   a. Disinfection byproducts (DBPs): comprised of two groups of compounds, trihalomethanes (THMs) and haloacetic acids (HAAs). These are formed when chemical disinfectants react with naturally occurring organic matter in the source water (decomposing plant matter). Typically this is an issue only experienced by surface water systems though there are a couple of groundwater systems that also have to deal with DBPs. Generally, the longer the chlorine is in contact with the organic matter the greater the potential for formation of DBPs.

3. Synthetic Organic Compounds (SOCs): these are manmade compounds that include herbicides, pesticides, and dielectric fluids. They are only present when there has been an application (such as spraying a corn field) or a leak (such as illegal dumping or leaching from a landfill). Compared with the number of compounds there are only a few of these that are regulated. Systems may apply for a 3-year testing waiver for these compounds.

4. Inorganic Compounds: some are beneficial (to a point) like alkalinity. Others have negative aesthetic effects associated with them such as iron and manganese (red/orange/brown and black staining respectively). Yet others are harmful such as:

   a. Arsenic: Naturally occurring element that has negative health effects that include skin damage, circulatory problems, and may be carcinogenic.

   b. Antimony: Antimony is a metal found in natural deposits such as ores containing other elements. Some people who drink water containing antimony in excess of the maximum contaminant level (MCL) for many years could experience increases in blood cholesterol and decreases in blood sugar.

   c. Nitrate: Nitrates and Nitrites are nitrogen-oxygen chemical units which combine with various organic and inorganic compounds. Unborn babies and those newly born (up to about 6 months) that ingest high levels of nitrate are subject to a condition called methemoglobinemia or blue baby syndrome. The nitrate attaches to the hemoglobin, instead of oxygen attaching to the hemoglobin, causing the child to suffocate (due to oxygen starvation). Its presence is usually associated with agriculture fertilizing or nearby leaking septic systems.

   d. Nitrite: Nitrites and Nitrates are nitrogen-oxygen chemical units which combine with various organic and inorganic compounds. Infants below six months who drink water containing nitrite in excess of the maximum contaminant level (MCL) could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue baby syndrome.

5. Turbidity: a measure of a water’s cloudiness in nephelometric turbidity units (NTU). Adhering to turbidity limits is the surrogate that surface water systems use to ensure most pathogens (Crypto and Giardia) are removed from the water. Testing turbidity against limits (such as 0.3 NTU 95% of the time and 1.0 NTU 100% of the time) is called a Treatment Technique.

6. Total Organic Carbon (TOC): is the amount of carbon bound in an organic compound and is often used as a non-specific indicator of water quality. TOC is a sum measure of the concentration of all organic carbon atoms covalently bonded in the organic molecules of a given sample of water. TOC is typically measured in Parts Per Million (ppm or mg/L). A typical analysis for TOC measures both the Total Carbon (TC) as well as Inorganic Carbon (IC, or carbonate). Subtracting the Inorganic Carbon from the Total Carbon yields TOC. (TC-IC=TOC). TOC monitoring is required for conventional filtration systems and also systems wishing to maintain reduced DBP monitoring.

7. Natural Organic Matter (NOM): is matter composed of organic compounds that has come from the remains of once-living organisms such as plants and animals and their waste products in the environment. Basic structures are created from cellulose, tannin, cutin, and lignin, along with other various proteins, lipids, and sugars.

8. Lead: Lead is a toxic metal that was used for many years in products found in and around homes. Even at low levels, lead may cause a range of health effects including behavioral problems and learning disabilities. Children six years old and under are most at risk because this is when the brain is developing. The primary source of lead exposure for most children is lead-based paint in older homes. Lead in drinking water can add to that exposure. Infants and children who drink water containing lead in excess of the action level could experience delays in their physical or mental development. Children could show slight deficits in attention span and learning abilities. Adults who drink this water over many years could develop kidney problems or high blood pressure.

9. Copper: is a metal found in natural deposits such as ores containing other elements. Copper is widely used in household plumbing materials. Some people who drink water containing copper in excess of the action level may, with short term exposure, experience gastrointestinal distress, and with long-term exposure may experience liver or kidney damage.

10. Radionuclides: includes compounds that emit alpha, beta, and/or gamma particles. Gross alpha radiation testing is used as a surrogate to catch several alpha emitters in ongoing sampling. Three most common radionuclides found in Maine waters are radium, uranium, and radon. Typically only a concern with groundwater.

11. Radon: Radon is a gas that has no color, odor, or taste and comes from the natural radioactive breakdown of uranium in the ground. One can be exposed to radon by two main sources:
    a. radon in the air in your home (frequently called "radon in indoor air") and
    b. radon in drinking water.

    Radon can get into the air you breathe and into the water you drink. Radon is also found in small amounts in outdoor air. Most of the radon in indoor air comes from soil underneath the home. As uranium breaks down, radon gas forms and seeps into the house. Radon from soil can get into any type of building - homes, offices, and schools - and build up to high levels in the air inside the building. Radon gas can also dissolve and accumulate in water from underground sources (called ground water), such as wells. When water that contains radon is used in the home for showering, washing dishes, and cooking, radon gas escapes from the water and goes into the air. It is similar to carbonated soda drinks where carbon dioxide is dissolved in the soda and is released when you open the bottle. Some radon also stays in the water. Breathing radon in indoor air can cause lung cancer. Radon gas decays into radioactive particles that can get trapped in your lungs when you breathe it. As they break down further, these particles release small bursts of energy. This can damage lung tissue and increase your chances of developing lung cancer over the course of one's lifetime. People who smoke have an even greater risk. Not everyone exposed to high levels of radon will develop lung cancer. However, radon in indoor air is the second leading cause of lung cancer. About 20,000 deaths a year in the U.S. are caused by breathing radon in indoor air. Only about 1-2 percent of radon in the air comes from drinking water. However breathing radon increases the risk of lung cancer over the course of your lifetime. Some radon stays in the water; drinking water containing radon also presents a risk of developing internal organ cancers, primarily stomach cancer. However this risk is smaller than the risk of developing lung cancer from radon released to air from tap water. Based on a National Academy of Science report, EPA estimates that radon in drinking water causes about 168 cancer deaths per year: 89% from lung cancer caused by breathing radon released to the indoor air from water and 11% from stomach cancer caused by consuming water containing radon. Not all drinking water contains radon. If your drinking water comes from a surface water source, such as a river, lake, or reservoir, most radon that might be in the water will be released into the air before reaching your water supplier or home. Radon is only a concern if your drinking water comes from underground, such as a well that pumps water from an aquifer, though not all water from underground sources contains radon.

12. Fluoride: Fluoride compounds are salts that form when the element, fluorine, combines with minerals in soil or rocks. Many communities add fluoride to their drinking water to promote dental health. Exposure to excessive consumption of fluoride over a lifetime may lead to increased likelihood of bone fractures in adults, and may result in effects on bone leading to pain and tenderness. Children aged 8 years and younger exposed to excessive amounts of fluoride have an increased chance of developing pits in the tooth enamel, along with a range of cosmetic effects to teeth.

13. Iron: a secondary contaminant commonly found in groundwater. Iron in well water usually does not present a health problem. In fact, iron is needed to transport oxygen in the blood. The amount of iron in water is usually low, and the chemical form of the iron found in water is not readily absorbed by the body. Iron bacteria, that may be associated with iron in water, are not a health problem. Iron in water can cause yellow, red, or brown stains on laundry, dishes, and plumbing fixtures such as sinks. Iron can clog wells, pumps, sprinklers, and other devices such as dishwashers, which can lead to costly repairs. Iron gives a metallic taste to water, and can affect foods and beverages -turning tea, coffee, and potatoes black. Addition information can be found at: http://www.health.state.mn.us/divs/eh/wells/waterquality/iron.html#ironinwater

14. Manganese: a secondary contaminant also commonly found in groundwater. Manganese is a mineral that naturally occurs in rocks and soil and is a normal constituent of the human diet. It exists in well water in Maine as a naturally occurring groundwater mineral. Manganese may become noticeable in tap water at concentrations greater than 0.05 milligrams per liter of water (mg/l) by imparting a color, or taste to the water. Manganese levels above 0.05mg/l are most noticeable in graying of whites in the laundry and nuisance staining in bathroom fixtures. However, health effects from manganese are not a concern until concentrations are approximately 10 times higher.

15. Chloride: a secondary contaminant usually associated with sodium chloride (common table salt). There is no federally enforceable standard (i.e., Maximum Contaminant Level) for chloride in drinking water. However, EPA did set a recommended standard for chloride levels in drinking water at 250 mg/L. Drinking water with chloride levels above 250mg/L may exhibit a salty taste.

16. Elemental Sulfur: dissolved sulfur, Sulfur is a secondary contaminant.

APPENDIX G
Common Treatment Technologies

1. Disinfection – General: used to inactivate pathogens in the water. Typically the chlorine concentration (dose) and amount of time in contact with water affect the inactivation that is achieved. A higher disinfectant dose and longer contact time increases inactivation and broadens the range of pathogens that are inactivated. Note that disinfection is not sterilization (sterilization is complete destruction of all living organisms in the water).

2. Disinfection - Chlorination (gas, sodium hypochlorite, Chlorine Dioxide, Calcium hypochlorite): most common disinfectant used by water systems.

    a. Sodium Hypochlorite – The most commonly used disinfectant for both large and small systems. Small systems use "Clorox bleach" (5%-8%) while the large systems will use the full strength (12%). Sodium hypochlorite is a liquid. Chlorine provides a residual that can be maintained throughout the distribution system. Effective against most pathogens but not Cryptosporidium. Can react with natural organic matter to form DBPs.
    b. Gas – years ago chlorine gas was used by many large public water supplies but over the years this has drastically changed likely due to the hazardous risk management of this chemical. Currently very few systems in Maine use chlorine gas.
    c. Chlorine Dioxide – another form of disinfection in a gaseous form. Used by very few PWS in Maine.
    d. Calcium Hypochlorite - is in the form of a white powder, granular or pellet. A few systems in Maine still use this chemical.
    e. See the Continuous Chlorination Disinfection System Installation Guidance (DWP0120)

3. Disinfection - Ammonia (Chloramines): when ammonia is added to chlorinated water it creates chloramines. Though not as effective as chlorine as a disinfectant, chloramines are better than chlorine at keeping the residual in the distribution system. It is also less likely than chlorine to form DBPs which is why many larger systems now utilize chloramines as a way to help control DBP's. There are two types of Ammonia that are used:

    a. Ammonia Gas – very few systems use this as it is a very hazardous material. Typically used with compressed cylinders and a weight scale to determine how much chemical is being used.
    b. Liquid Ammonia – is the more common type of ammonia used in a liquid form with a day tank and a chemical feed pump.

4. Disinfection – Ozonation: primary disinfectant at some of the unfiltered surface water systems. Very effective against many pathogens. Very reactive. Ozone residuals are short lived and not maintained in treated water like chlorine residuals. Ozone can convert bromide (which may be present in the raw water) to bromate (a DBP) which has negative health effects and is regulated in drinking water.

5. Disinfection – Iodine: No longer in use at Maine PWSs.

6. Ultraviolet Light – General: energy targeted at specific wavelengths that disrupt pathogen DNA. Monochromatic UV systems operate at 254 nm while polychromatic UV systems utilize germicidal wavelengths over a broad spectrum. A few small water systems as well as the unfiltered surface water systems are using or will be using UV. Does not provide a residual. Not very effective against specific viruses but effective against Crypto and Giardia. No known DBPs formed by UV.

7. Ultraviolet Light (UV) – large systems: refer to the CFR for mandatory UV requirements under the SWTR. The EPA UV Guidance Manual provides information on meeting those requirements.

8. Ultraviolet Light (UV) – small systems: refer to DWP UV Policy for Small systems (DWP0047)

9. Oxidation ("greensand" filtration, potassium permanganate, sodium permanganate, chlorine, etc.): is defined as the loss of at least one electron when two or more substances interact. Those substances may or may not include oxygen. In the water treatment industry, oxidation of an element is achieved using air, chlorine, potassium permanganate or sodium permanganate. In certain situations, oxidizing a contaminant, like arsenic, iron, manganese, and sulfur, will make that contaminant more filterable. Sometimes oxidation is used to complete two processes at once, thereby eliminating the need for other pieces of equipment. Sometimes oxidation is necessary as a pre-treatment for other treatment processes. Equipment used in the oxidation process usually includes a chemical feeder or an air venturi, although air venturis are generally not allowed for public water systems because of the injection of surrounding air into the water supply. The classic result of excess potassium permanganate is pink water; reduce the chemical feed rate to eliminate the pink color in the water. Note: Greensand filtration is a media that is commonly regenerated with potassium permanganate for the purposes of oxidizing and removing iron and manganese.

10. Ion Exchange (Anion, Cation): utilizes a chemical exchange process by which innocuous ions (such as sodium or chloride) are exchanged for unwanted constituents (such as a water softener removing calcium and magnesium to reduce hardness) or harmful contaminants (such as arsenic or radium). An ion exchange system is a vessel packed with the resin material that attracts either anions or cations depending on the type of resin. As water flows through the resin, the sites on the resin gradually become occupied by the ions of the target contaminant. Just before all the sites on the resin become filled (this point in time can be determined by calculation), the system needs to be regenerated. A concentrated brine solution is pumped through the resin and this drives the ions off the resin sites and to waste. The more weakly charged sodium or chloride ions from the brine (depending on the type of resin) take up the resin sites. After rinsing with fresh water, the treatment system goes back into normal operation. A brine tank is always part of an ion exchange treatment system.

    a. Anion exchange systems remove negative ions (like arsenic, uranium, nitrates, tannins, fluoride, antimony, and also alkalinity which sometimes can create corrosive water and result in lead/copper problems.)

    b. Cation exchange systems remove positive ions (like calcium, magnesium, manganese, ferrous iron, radium, and gross alpha)

11. Adsorptive Media: Adsorptive media is granular material through which water passes. Depending on the nature of the media, certain substances present in the water will “stick” to the surface of the media by adsorption. There are many types of adsorptive media available that can remove a variety of substances from water. For arsenic removal, two common types of adsorptive media are activated alumina and iron based sorbents (IBS). Exhaustion of the adsorptive media is dependent on other chemicals present in the water such as interfering ions, the arsenic concentration, and the valence number of the arsenic. that is present. Specific water parameters as well as empty bed contact time (EBCT) must be met in order for adsorptive media to work well, or work at all. Most systems are installed in a lead/lag position (vessels in series) with a sample port in between to determine when the lead tank is spent.

12. Corrosion Control (poly-phosphates, pH adjustment): used to reduce the internal corroding of piping and plumbing materials. Corrosive water can cause metals such as lead and copper to leach from solder, fittings, pipes, and fixtures. Corrosion in a system can be reduced by adjusting pH and alkalinity; softening the water with lime; reducing the level of dissolved oxygen, (adding chemicals so that protective films and layers form on the plumbing, etc.

    a. pH and/or alkalinity addition – Operators can promote the formation of a protective calcium carbonate coating (scale) on the metal surface of plumbing by adjusting pH, alkalinity, and calcium levels. Calcium carbonate scaling occurs when water is oversaturated with calcium carbonate Chemicals can be added using a chemical feed pump and day tank to increase either the pH, alkalinity, or both. Generally this will help stabilize the water and reduce the amount of corrosion. Chemicals used for this purpose include:

        i. Sodium Carbonate (soda ash) – is a powdery/dry substance usually stored in 50 pound bags. It is typically dissolved in water and injected using a chemical feed pump and day tank. For larger systems a “hopper” is used to store the chemical.
        ii. Potassium Carbonate (potash) – a powdery/dry substance that is similar to soda ash but doesn’t add the high sodium (salt) content. It is safe to handle as opposed to caustic and will not cause skin irritation. It dissolves more easily than lime. Potash is more expensive then soda ash but is more soluble and easier to handle
        iii. Sodium or Potassium Hydroxide (Caustic Soda) (NaOH) – a liquid chemical that is very hazardous if not handled carefully. It can cause severe burns to the skin and damage to the eyes. It is only used to adjust pH and is injected with a chemical feed pump and a day tank. It is often stored in large storage tanks. Typically it is only used by municipalities due to its hazardous nature.
        iv. Lime Softening - Hard water can cause scaling problems in water heaters and soap does not lather well in hard water. Therefore, some water utilities soften water to improve its quality for domestic use. Lime softening is best suited to groundwater sources, which have relatively stable water quality. In the lime-softening process, the pH of the water being treated is raised sufficiently to precipitate calcium carbonate and, if necessary, magnesium hydroxide. The normal pH of water is between 6.5–8.5. In small systems, lime softening is typically practiced by adding hydrated lime to raw water to raise the pH to approximately 10. This removes calcium carbonate, essentially limestone.

b. Corrosion inhibitor – a chemical used to coat the inside walls of piping, creating a barrier between water and exposed metal. Examples include zinc orthophosphate, phosphate blend, and sodium silicate.
   i. Inorganic phosphates: Inorganic phosphate corrosion inhibitors include polyphosphates, orthophosphates, and Zinc orthophosphates which are designed to help inhibit corrosion in some cases.
   ii. Silicates: The effectiveness of sodium silicates depends on both pH and carbonate concentrations. Sodium silicates are particularly effective for systems with high water velocities, low hardness, low alkalinity, and pH of less than 8.4. They offer advantages in hot-water systems because of their chemical stability, unlike many phosphates.

c. Air stripping – some natural waters contain high levels of dissolved carbon dioxide. The CO2 can form carbonic acid and reduce both pH and alkalinity. Air stripping (vernacular is aeration) the raw water involves passing bubbles of air through the water to remove much of the CO2, which results in more stable water. This is a good "no chemical addition" alternative.

13. Fluoride removal: See Anion Exchange

14. Fluoride addition (Fluorosilicic Acid, Sodium Fluoride saturator) In Maine, adding fluoride to drinking water for the purpose of promoting dental health must be approved by citizens of the community by vote. In Maine fluoride is added using a sodium fluoride saturator or by adding hydrofluorosilicic acid (aka silli acid) utilizing direct feed. Day tanks and chemical feed pumps are used. The fluoride target level in water reaching consumers is 0.7 mg/L. There are about 66 communities in Maine that add fluoride to the water.

15. pH adjustment (Caustic, soda ash, calcite contactor): See Corrosion Control

16. Granular Activated Carbon (GAC): granular activated carbon is pure carbon heated to promote "active" sites which can adsorb pollutants. GAC is used in some water treatment systems to remove certain organic chemicals (VOCs) and radon. GAC can be used to remove chlorine in some cases but not for public water systems that are required to chlorinate.

17. Mechanical Filtration (cartridge, membrane, reverse osmosis, microfiltration, nanofiltration, ultrafiltration, rapid mix, coagulation, flocculation, sedimentation, clarification, conventional, direct, slow sand, schmutzdecke, Diatomaceous Earth, alternative-clarifier/filter, alternative-other): there are several types of filters used for different applications. From cartridge filters to remove sediment, membrane filters such as reverse osmosis to remove just about everything, and conventional type rapid sand filters to treat surface water.

    a. Alternative Filtration: Membrane Filtration - A membrane or, more properly, a semipermeable membrane, is a thin layer of material capable of separating substances when a driving force is applied across the membrane. These filters are typically used for the removal of bacteria and other microorganisms, particulate material, and natural organic material often found in surface water supplies. Below is a list of specific types of membrane filters. What the filter can remove is dependent on its pore size

i. Cartridge Filtration: usually made of string-wound fibers and used to remove dirt, sediment, rust, and other small particles. Most are not rated for more than removing these aesthetic contaminants (special cartridge filters are available for surface water treatment). Sometimes used as pretreatment in front of other treatment that would get clogged or damaged by particulate matter. Once a filter element is spent it is removed, discarded, and replaced with a new filter element. This is usually determined either by visually noting the build-up of material/discoloring or excessive head-loss across the filter (a pressure drop of 10 psi may trigger the need to change the filter). Often the pore sizes for these filters can range from a 1 micron all the way up to a 50 micron.

ii. Bag Filters: (Strain-Rite is a popular brand of bag filter used in Maine) this type of filter consists of a membrane housed in a small vessel often used for very small surface water systems (campgrounds, summer camps, etc.). These filters are designed to remove *Crypto* and *Giardia* as required by the Surface Water Treatment Rule.

iii. “Bob Campbell Filters”: a specific design using both bag and cartridge filters to comply with the SWTR and used by several very small surface water systems here in Maine. This design often consists of PVC pipe enclosed cartridge filters, followed by a bag filter.

iv. Reverse Osmosis (RO): is a water purification technology that uses a semipermeable membrane. RO can remove many types of molecules and ions from solutions to produce potable water. The process of reverse osmosis forces water with a greater concentration of contaminants (the source water) into a tank containing water with an extremely low concentration of contaminants (the processed water). High water pressure on the source side is used to "reverse" the natural osmotic process, with the semi-permeable membrane still permitting the passage of water while rejecting most of the other contaminants. The specific process through which this occurs is called ion exclusion, in which a concentration of ions at the membrane surface form a barrier that allows other water molecules to pass through while excluding other substances. Reverse Osmosis is most commonly seen as a point of use method of treatment for transient and NTNC supplies for singular contaminants like uranium, fluoride, arsenic and gross alpha. Large Reverse Osmosis units are generally used for desalination purposes. The reverse osmosis process removes all chemicals from the water and consequently creates very low alkalinity (i.e., corrosive water). RO systems installed at the entry point, must be followed by corrosion control treatment such as a calcite contactor.

v. Microfiltration: is a filtration process where contaminated water (usually surface water) is passed through a special pore-sized membrane to separate microorganisms and suspended particles from the water. The typical particle size used for this filtration ranges from a 0.1 to 10 micrometer. Microfiltration will remove sediment/particles, algae, *Crypto* and *Giardia* from water. Currently one surface water system in Maine uses this filtration technology.

vi. Ultrafiltration (UF): Essentially the same process as reverse osmosis except the membrane excludes molecules rather than ions. In other states, ultrafiltration has been used to either replace existing secondary (coagulation, flocculation, sedimentation) and tertiary filtration (sand filtration and chlorination) in water treatment plants or as standalone systems in isolated regions with growing populations. When treating water with high suspended solids, UF is often integrated into the process, utilizing primary (screening, flotation, and filtration) and some secondary treatments as pre-treatment stages. UF processes are currently preferred over traditional treatment methods because no chemicals are required (aside from cleaning), it is a compact form of treatment, and it is capable of exceeding regulatory standards of water quality, achieving 90-100% pathogen removal.

vii. Nanofiltration: is a membrane filtration based method that uses nanometer sized cylindrical through-pores that pass through the membrane at a 90°. Nanofiltration membranes have pore sizes from 1-10 Angstrom, smaller than that used in Microfiltration and Ultrafiltration, but just larger than that in reverse osmosis. It also is used for the removal of *Giardia* and *Crypto* along with organics (DBP precursors). At this time no systems in Maine are using this filtration method.

b. Slow Sand Filtration: is a filtration process typically used for surface water supplies. Slow sand filters differ from all other filters used to treat drinking water in that they work by using a complex biological film (schmutzdecke) that grows naturally on the surface of the sand. The sand itself does not perform any filtration function but simply acts as a substrate. The schmutzdecke consists of bacteria, fungi, protozoa, rotifera and a range of aquatic insect larvae. The schmutzdecke is the layer that provides the effective purification in potable water treatment. The water produced from a well-managed slow sand filter can be of exceptionally good quality with 90-99% bacterial reduction.

c. Conventional surface water filtration: many surface water systems add either a coagulant or polymer to the raw water. These help eliminate the natural charge of the particles in the water, which assists in forming larger particles. The step in which these particles form is called flocculation. These larger particles, called floc, are easier to remove. Following flocculation is usually a step called either clarification or sedimentation, depending on the specific technology used to remove the particles. After this clarification or sedimentation process is filtration. Turbidity is used to monitor surface water filtration performance. When the filters get too dirty (usually indicated with higher turbidity readings or head loss) they are cleaned using a process called backwashing. Backwashing flows (usually) treated water up through the filter in a reverse flow. The backwash water is usually sent to waste (lagoon or wastewater system). Some systems decant the backwash and recycle the supernatant.

d. Backwashing filters: these filters can be configured with an inert media (called Aggregate or Filter Ag) for heavy particulate removal, or for high flow situations. The filter can also be configured with calcite to perform filtration as well as mild pH correction. In this instance, the level of media must be monitored since calcite is sacrificial and will dissolve into the water over time.

18. Sequestration: Sequestration is a chemical combination of a chelating agent and metal ions in which soluble complexes are formed. Hardness ions are metal ions commonly found in water and include calcium and magnesium. Groundwater supplies use polyphosphate to sequester iron, manganese, calcium, and magnesium, while surface water plants use orthophosphates. Sequestration is dependent upon pH; a given sequestrant works best in a particular pH range. Polyphosphates, a common drinking water treatment chemical used for corrosion control, works best under alkaline conditions.

19. Air Stripping / Aeration (bubble, cascade) – Mainly used for waterborne radon, See also Corrosion Control. Aeration, also known as air stripping, mixes air with water to volatilize contaminants (turn them to vapor). The volatilized contaminants are typically released directly to the atmosphere. Aeration is used to remove volatile organic chemicals (VOC’s) and radon. This is a very simple process that involves no chemicals, is low maintenance, and has low operational costs.

APPENDIX H
Treatment Technology Tables

TABLE 3.1 General Effectiveness of Water Treatment Processes for Contaminant Removal[1–45]

				Ion exchange		Membrane processes				Adsorption		
Contaminant categories	Aeration and stripping (Chap. 5)	Coagulation processes, sedimentation, filtration (Chaps. 6,7,8)	Lime softening (Chap. 10)	Anion (Chap. 9)	Cation (Chap. 9)	Reverse osmosis (Chap. 11)	Ultra filtration (Chap. 11)	Electrodialysis (Chap. 11)	Chemical oxidation, disinfection (Chaps. 12,14)	GAC (Chap. 13)	PAC (Chap. 13)	Activated alumina (Chap. 9)
A. Primary contaminants												
1. Microbial and turbidity												
Total coliforms	P	G–E	G–E	P	P	E	E	—	E	F	P	P–F
Giardia lamblia	P	G–E	G–E	P	P	E	E	—	E	F	P	P–F
Viruses	P	G–E	G–E	P	P	E	E	—	E	F	P	P–F
Legionella	P	G–E	G–E	P	P	E	E	—	E	P	P	P–F
Turbidity	P	E	G	F	F	E	E	—	P	F	P	P–F
2. Inorganics												
Arsenic (+ 3)	P	F–G	F–G	G–E	P	F–G	—	F–G	P	F–G	P–F	G–E
Arsenic (+ 5)	P	G–E	G–E	G–E	P	G–E	—	G–E	P	F–G	P–F	E
Asbestos	P	G–E	—	—	—	—	—	—	P	—	—	—
Barium	P	P–F	G–E	P	E	E	—	G–E	P	P	P	P
Cadmium	P	G–E	E	P	E	E	—	E	P	P–F	P	P
Chromium (+ 3)	P	G–E	G–E	P	E	E	—	E	F	F–G	F	P
Chromium (+ 6)	P	P	P	E	P	G–E	—	G–E	P	F–G	F	P
Cyanide	P	—	—	—	—	G	—	G	E	—	—	—
Fluoride	P	F–G	P–F	P–F	P	E	—	E	P	G–E	P	E
Lead	P	E	E	P	F–G	E	—	E	P	F–G	P–F	P
Mercury (inorganic)	P	F–G	F–G	P	F–G	F–G	—	F–G	P	F–G	F	P
Nickel	P	F–G	E	P	E	E	—	E	P	F–G	P–F	P
Nitrate	P	P	P	G–E	P	G	—	G	P	P	P	P
Nitrite	F	P	P	G–E	P	G	—	G	G–E	P	P	P
Radium (226 and 228)	P	P–F	G–E	P	E	E	—	G–E	P	P–F	P	P–F
Selenium (+ 6)	P	P	P	G–E	P	E	—	E	P	P	P	G–E
Selenium (+ 4)	P	F–G	F	G–E	P	E	—	E	P	P	P	G–E
3. Organics												
VOCs	G–E	P	P–F	P	P	F–E	F–E	F–E	P–G	F–E	P–G	P
SOCs	P–F	P–G	P–F	P	P	F–E	F–E	F–E	P–G	F–E	P–E	P–G
Pesticides	P–F	P–G	P–F	P	P	F–E	F–E	F–E	P–G	G–E	G–E	P–G
THMs	G–E	P	P	P	P	F–G	F–G	F–G	P–G	F–E	P–F	P
THM precursors	P	F–G	P–F	F–G	—	G–E	F–E	G–E	F–G	F–E	P–F	P–F
B. Secondary contaminants												
Hardness	P	P	E	P	E	E	G–E	E	P	P	P	P
Iron	F–G	F–E	E	P	G–E	G–E	G	G–E	G–E	P	P	P
Manganese	P–F	F–E	E	P	G–E	G–E	G	G–E	F–E	P	P	P
Color	P	F–G	F–G	P–G	—	—	—	—	F–E	E	G–E	G
Taste and odor	F–E	P–F	P–F	P–G	—	—	—	—	F–E	G–E	G–E	P–F
Total dissolved solids	P	P	P–F	P	P	G–E	P–F	G–E	P	P	P	P
Chloride	P	P	P	F–G	P	G–E	P	G–E	P	P	P	—
Copper	P	G	G–E	P	F–G	E	—	E	P–F	F–G	P	—
Sulfate	P	P	P	G–E	P	E	P	E	P	P	P	G–E
Zinc	P	F–G	G–E	P	G–E	E	—	E	P	—	—	—
TOC	F	P–F	G	—	G–E	G	G–E	P–G	G–E	F	F–G	—
Carbon dioxide	G–E	P–F	E	P	P	P	P	P	P	P	P	P
Hydrogen sulfide	F–E	P	F–G	P	P	P	P	P	F–E	F–G	P	P
Methane	G–E	P–E	P	P	P	P	P	P	P	P	P	P
C. Proposed contaminants												
VOCs	G–E	P	P–F	P	P	F–E	F–E	F–E	P–G	F–E	P–G	P
SOCs	P–F	P–G	P–F	P	P	F–E	F–E	F–E	P–G	F–E	P–E	P–G
Disinfection by-products	—	P–E	P–F	P–F	—	P	F–G	F–G	F–G	F–E	P–G	—
Radon	G–E	P	P	P	P	P	P	P	P	E	P–F	P
Uranium	P	G–E	G–E	E	G–E	E	—	E	P	F	P–F	G–E
Aluminum	P	F	F–G	P	G–E	E	—	E	P	—	—	—
Silver	F–G	G–E	P	G	—	—	—	P	F–G	P–F	—	—

P—poor (0 to 20 percent removal); F—fair (20 to 60 percent removal); G—good (60 to 90 percent removal); E—excellent (90 to 100 percent removal); "—"—not applicable/insufficient data
Note: Costs and local conditions may alter a processes applicability.

American Water Works Association, Water Quality and Treatment, A Handbook of Community Water Supplies, Fourth Edition, McGraw-Hill, Inc. 1990 p. 184-185

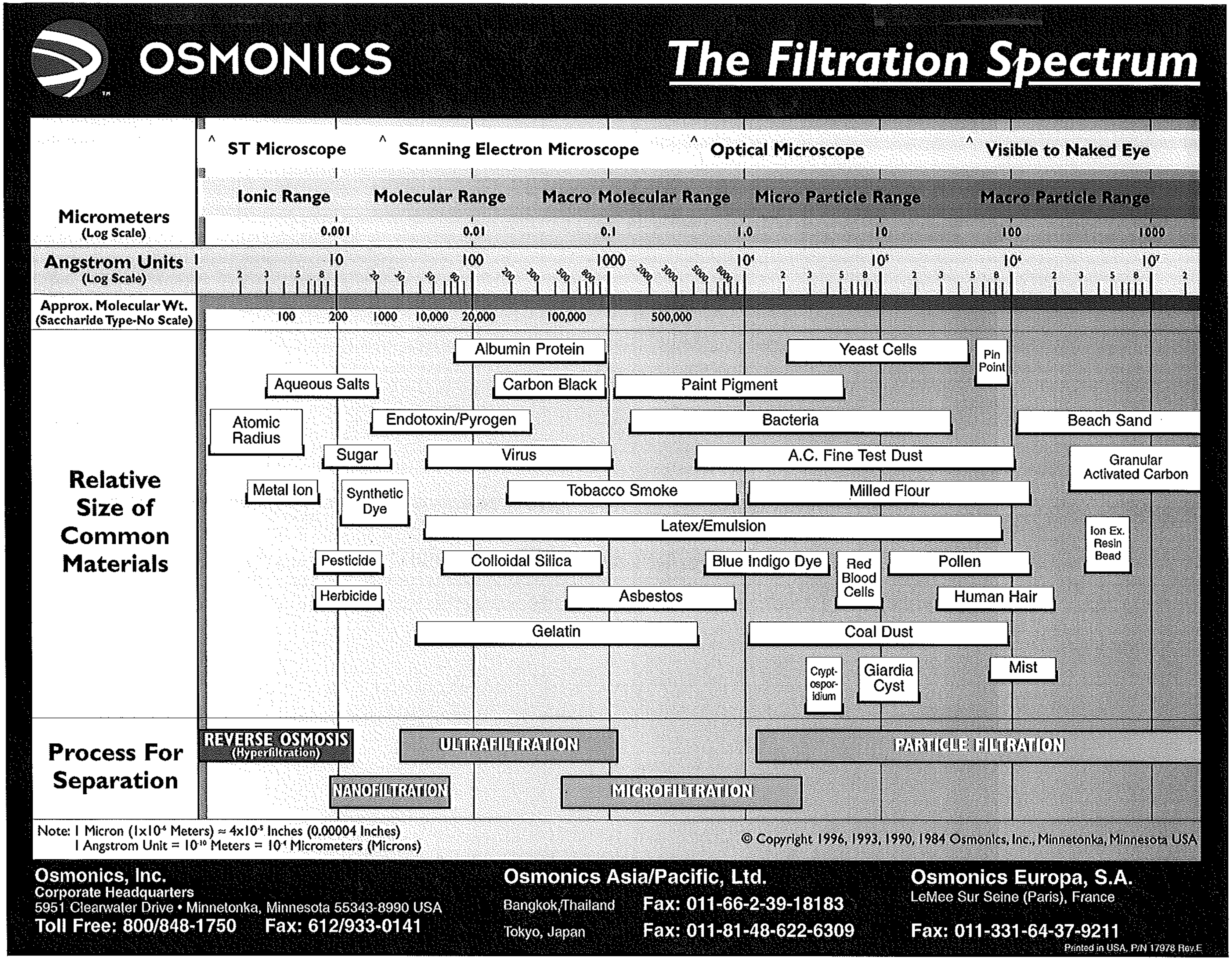
TABLE 3.1 General Effectiveness of Water Treatment Processes for Removal of Soluble Contaminants

						Membrane processes			Ion exchange		Adsorption		
Contaminant categories	Aeration and stripping	Coagulation, sedimentation or DAF,* filtration	Precoat filtration	Lime softening	Chemical oxidation and disinfection	Nanofiltration	Reverse osmosis	Electrodialysis/ ED reversal	Anion	Cation	Granular activated carbon	Powdered activated carbon	Activated alumina
Primary contaminants													
Inorganics													
Antimony							X†	X					
Arsenic (+3)		XO‡		XO			X	X	X				X
Arsenic (+5)		X		X			X	X	X				X
Barium				X			X	X		X			
Beryllium		X		X			X	X					
Cadmium		X		X			X	X		X			
Chromium (+3)		X		X			X	X		X			
Chromium (+6)							X	X	X				
Cyanide					X								
Fluoride				X			X	X					X
Lead§													
Mercury (inorganic)				X			X	X					
Nickel				X			X	X		X			
Nitrate							X	X	X				
Nitrite							X	X	X				
Selenium (+4)		X					X	X	X				X
Selenium (+6)							X	X	X				X
Thallium							X	X					X

TABLE 3.1 General Effectiveness of Water Treatment Processes for Removal of Soluble Contaminants *(Continued)*

						Membrane processes			Ion exchange		Adsorption		
Contaminant categories	Aeration and stripping	Coagulation, sedimentation or DAF,* filtration	Precoat filtration	Lime softening	Chemical oxidation and disinfection	Nanofiltration	Reverse osmosis	Electrodialysis/ ED reversal	Anion	Cation	Granular activated carbon	Powdered activated carbon	Activated alumina
Primary contaminants													
Organic Contaminants													
Volatile organics	X										X		
Synthetic organics							X				X	X	
Pesticides/Herbicides						X	X				X	X	
Dissolved organic carbon		X				X	X				X	X	
Radionuclides													
Radium (226 + 228)				X			X	X		X			
Uranium							X	X	X				
Secondary contaminants and constituents causing aesthetic problems													
Hardness				X		X	X	X		X			
Iron		XO	XO	X						X			
Manganese		XO	XO	X						X			
Total dissolved solids							X	X					
Chloride							X	X					
Sulfate						X	X	X					
Zinc				X			X	X		X			
Color		X			X	X	X				X	X	
Taste and odor	X				X						X	X	

* DAF, dissolved air flotation.
† X, appropriate process for this contaminant.
‡ XO, appropriate when oxidation used in conjunction with this process.
§ Lead is generally a product of corrosion and is controlled by corrosion control treatment rather than removed by water treatment processes.


OSMONICS
The Filtration Spectrum
ST Microscope
Scanning Electron Microscope
Optical Microscope
Visible to Naked Eye
Ionic Range
Molecular Range
Macro Molecular Range
Micro Particle Range
Macro Particle Range
Micrometers (Log Scale)
0.001
0.01
0.1
1.0
10
100
1000
Angstrom Units (Log Scale)
10
100
1000
10⁴
10⁵
10⁶
10⁷
Approx. Molecular Wt. (Saccharide Type-No Scale)
100
200
1000
10,000
20,000
100,000
500,000
Relative Size of Common Materials
Albumin Protein
Yeast Cells
Pin Point
Aqueous Salts
Carbon Black
Paint Pigment
Atomic Radius
Endotoxin/Pyrogen
Bacteria
Beach Sand
Sugar
Virus
A.C. Fine Test Dust
Granular Activated Carbon
Metal Ion
Synthetic Dye
Tobacco Smoke
Milled Flour
Latex/Emulsion
Ion Ex. Resin Bead
Pesticide
Colloidal Silica
Blue Indigo Dye
Red Blood Cells
Pollen
Herbicide
Asbestos
Human Hair
Gelatin
Coal Dust
Crypt-ospor-idium
Giardia Cyst
Mist
Process For Separation
REVERSE OSMOSIS (Hyperfiltration)
ULTRAFILTRATION
PARTICLE FILTRATION
NANOFILTRATION
MICROFILTRATION
Note: 1 Micron (1x10⁻⁶ Meters) ≈ 4x10⁻⁵ Inches (0.00004 Inches)
1 Angstrom Unit = 10⁻¹⁰ Meters = 10⁻⁴ Micrometers (Microns)
© Copyright 1996, 1993, 1990, 1984 Osmonics, Inc., Minnetonka, Minnesota USA
Osmonics, Inc.
Corporate Headquarters
5951 Clearwater Drive • Minnetonka, Minnesota 55343-8990 USA
Toll Free: 800/848-1750 Fax: 612/933-0141
Osmonics Asia/Pacific, Ltd.
Bangkok, Thailand Fax: 011-66-2-39-18183
Tokyo, Japan Fax: 011-81-48-622-6309
Osmonics Europa, S.A.
LeMee Sur Seine (Paris), France
Fax: 011-331-64-37-9211
Printed in USA, P/N 17978 Rev.E

APPENDIX I
Treatment Related Rule & Policy Summaries with References

1. Revised Total Coliform Rule: defines how many bacteria samples need to be collected and how often. Samples are taken in the distribution system to help ensure that not only the treatment but the pipes and storage vessels are also maintained properly. Whenever a positive sample is reported, follow-up or recheck samples need to be collected from the distribution system and the source, if a ground water system (see GWR below). Confirmed total coliform triggers follow-up items, and currently, 3 non-acute MCL (total coliform only) violations within 12 months leads to a disinfection order. Refer to CET Procedure on how the DWP responds to MCLs… currently in TCR SOP, CET to develop 3 MCL Policy. (*40 CFR 141.21*)

2. Surface Water Treatment Rule (SWTR): includes regulations for all systems using surface water and all systems with GUI sources, requiring filtration and disinfection (*40 CFR 141.70-76*). The rules also include special requirements for unfiltered surface water systems (*40 CFR 141.71, 40 CFR 141.520*). Several updates to this rule have occurred including the Interim Enhanced Surface Water Treatment Rule (IESWTR; *40 CFR 141.170-175*), the Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR or LT1; *40 CFR 141 Subpart T*), and the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR or LT2; *40 CFR 141 Subpart W*).

3. Groundwater Rule – related to the TCR (requirements for 4-log inactivation of viruses): Whenever a positive TCR sample is reported at a groundwater system that does not have 4-log virus inactivation, raw water samples are collected at each of the wells to determine whether source contamination is the cause for the distribution system bacteria. If E. coli is confirmed in the well, that well must either meet 4-log inactivation of viruses, be repaired to eliminate the potential for bacterial contamination, or a new source must be found. (*40 CFR 141.400-405 Subpart S*)

4. Stage 1 and Stage 2 Disinfectants and Disinfection Byproducts Rules (D/DBP Rule): Community and NTNC systems using a chemical disinfectant are required to monitor for disinfection byproducts and disinfectants in the distribution system on a regular basis. DBPs include total trihalomethanes, haloacetic acids, bromate and chlorite, and all are suspected or known carcinogens. While disinfectants are often necessary to inactivate harmful pathogens in drinking water, using too much disinfectant can create excess DBPs. DBP formation is affected by disinfectant concentration, water age, temperature, pH, as well as natural organic matter and TOC in the source water. The balancing act between using disinfection to comply with rules such as TCR and SWTR and formation of DBPs is referred to as "simultaneous compliance". (*40 CFR 141 Subparts L & V*)

5. Radionuclides Rule: includes testing for alpha particles (also known as gross alpha), radium, and uranium. While there is no current federal standard for radon, there is a Maine MEG (maximum enforceable goal) of 4,000 pCi/L and we typically advocate for treatment when the levels are above this standard. There are some waters in the state with radon concentrations ten times that high. (*40 CFR 141.26*)

6. Lead and Copper Rule: different from the other rules in that the internal plumbing of the customers for that water system affect the results. Samples are taken directly from kitchen

or bathroom sink faucets of the customers. Compliance is based on the 90th%, and high levels do not result in violations; rather Action Level Exceedances. ALEX's do require the system to conduct additional activities including public notification, water quality parameter testing and a corrosion control treatment plan or study in order to reduce the levels of lead and/or copper in the water. (*40 CFR 141.42-43 and Subpart I*)

7. Inorganics and Organics (Phase II/V) Rule (arsenic, antimony, nitrate, VOCs, etc.): requires regular monitoring of inorganic, volatile organic (VOCs) and synthetic organic compounds (SOCs). SOC Waivers are available for eligible systems and waive sampling for a 3-year period. (*40 CFR 141.23-24*)

    a. Arsenic Rule – previously a subset of the Phase II/V Rule. Back in the mid-2000s the standard was reduced from 0.050 mg/L (or 50 µg/L or 50 parts per billion) to 0.010 mg/L (or 10 ppb). Arsenic is prevalent in several areas of the state where bedrock wells are common.

8. Fluoride Rule: Some municipal systems add fluoride to their drinking water to reduce tooth decay. These systems must monitor daily the fluoride concentration in the finished water as well as collect a monthly compliance sample to ensure proper dosage is being maintained. The addition or removal of fluoride requires a town/city referendum vote. Additionally, natural fluoride can be found in many water systems across the state and some may have levels above 4 mg/L requiring removal of fluoride. (*40 CFR 141.162 and 10-144 Chapter 231 Section 4. J.*)

9. Policy – Making GUI Determinations for New/Proposed PWS wells: See DWP Policy DWP0166

10. Policy – Point of Use Policy: See DWP Policy DWP0175

11. Policy – Blending Policy: See DWP Policy DWP0174

12. Policy – Approving Requests to Discontinue Chlorination at a New Source: See DWP Policy DWP0031

13. Policy – Approving Requests to Discontinue Disinfection at a Groundwater System: See DWP Policy DWP0030.

14. Policy – Use of Seawater and Reverse Osmosis for Drinking Water: See DWP0176.

15. Policy – Unregulated Contaminants in Public Water Systems: See DWP0187

See also: [EPA Drinking Water Rule Quick Reference Guides](https://www.epa.gov/dwreginfo/drinking-water-rule-quick-reference-guides)
https://www.epa.gov/dwreginfo/drinking-water-rule-quick-reference-guides

APPENDIX J
Case Studies

1. **An Apartment Complex of Approximately 25 Apartments:** In 2005, arsenic and uranium treatment were required by the DWP due to exceedance of the MCL. An ion exchange system was installed in May 2006 to remove both uranium and arsenic. This system was also connected to public sewer; therefore the backwash for arsenic was carefully considered so not to exceed the arsenic wastewater limits required by the municipal sewer department (MSD). To meet those requirements the ion exchange system had to backwash every 2000 gallons (once a day). With the system backwashing so frequently it continually stripped the alkalinity and reduced the pH which consequently created very corrosive water. Within a few months high lead levels occurred in the distribution system with some levels at 3200 ppb. The apartment complex was placed on a Do Not Drink Order. In January 2007, after several months of treatment adjustments failed to reduce the lead levels, the uranium and arsenic treatment system was discontinued. The apartment complex continued to have sporadic high lead readings and it was not until August 2008 that the Do Not Drink Order could be removed. With assistance from water experts from EPA, new treatment was installed and lead levels gradually came back into compliance. The treatment consisted of Ion Exchange for the Uranium removal that backwashed only once a year, Adsorptive media for arsenic removal, an aeration system for radon removal and removal of carbon dioxide for pH control, and chemical injection of Potassium Carbonate for corrosion control. **FINDINGS:** The events that occurred at this apartment complex provided an important learning experience not only for the DWP but also for EPA, and other science experts that assisted in finding solutions for the arsenic, uranium and lead problems. In this instance, efforts to meet the requirement from the MSD resulted in the creation of very corrosive water and subsequent high distribution lead levels. Since then, the DWP has put policies in place to help prevent such situations from occurring again when ion exchange and other certain water treatment systems are installed.

2. **Antimony in Maine Public Water Systems**

   Antimony (Sb) is a naturally occurring metal commonly found in Maine in ores of copper, silver, and lead. In the central-eastern part of the state, Sb is abundant enough so that it has been mined in the past. Sb mining locations included Gouldsboro, Hampden, Linneus, Carmel, and Levant. Sb has been detected in drinking water at levels that exceed the MCL (6 ppb) at several public water systems (PWS) in Maine.

   Effective treatment for removing Sb from drinking water is very limited. EPA's 'Best Available Technology" (BAT) lists only reverse osmosis for Sb treatment for small water systems. {A community public water system in Utah has had a long standing Sb contamination problem. They piloted 17 antimony treatment types to find few worked successfully and those that did were cost prohibitive. Their investigation cost them over $100,000. In 2010, (after a piloted study indicated good results) they installed an adsorptive media treatment system using Adsorpsia media. To date, this treatment has been reliably removing the Sb. (For their story, see "Antimony a Continuing Saga. Our Effort to Comply with the EPA" in our reference library.)}

   The following discusses some of the cases of PWS in Maine that have had high Sb levels.

Case #1 Mobile Home Park in Corinth (Population 100)

This facility had a 250 foot well in use for several years with chlorination for treatment. The Sb levels in samples ranged from 37 ppb to 62 ppb. In 2002, a 600 foot deep well was drilled with the hope that the Sb level in that well would be acceptable and could be used to replace the other well which had unreliable yield and secondary contaminant problems. While the yield of the new well was good, the Sb was 110 ppb in the initial sample. After several options were considered, a Jaswell Seal was installed in the well. The Sb in the water coming out of the well dropped to an acceptable level within a few days. After intensified sampling over a period of several weeks confirmed that the Sb level in the water from that well was staying consistently below the limit, the well was allowed to be put on line and replace the original well. The PWS was required to conduct monthly Sb testing so the constancy of the level could be closely monitored. Several years of monthly testing showed the Sb level always below the limit. In 2005, another well was drilled some distance away which showed low Sb and provided sufficient yield to meet the needs of the park. With that, the high Sb well was abandoned. Of note, the PWS was always in compliance with the Sb standard after 2002.

Case #2 School in Carmel (Population 200)

This school has two wells and uses blended water coming from both wells. The Sb level reaching consumers was typically in the mid-teens. One well has Sb at 25 ppb with the other well less. Arsenic (As) was around 20 ppb but at that time the standard was 50 ppb so they were not out of compliance for As.

In 2002, the school was issued an MCL violation for the Sb and with that they voluntarily decided to provide bottled water for drinking and for food preparation in the kitchen. The school remained on the Do Not Drink Order for the next 2 years while various approaches to solving the Sb problem were explored. We had received information from some manufacturers of iron based sorbents (developed mainly for As removal) that it would also successfully treat Sb. Initially, the school considered POU treatment with RO but then decided on a system wide Adedge 33 adsorptive media treatment system, which our office approved. The Adedge 33 would also remove As, an added benefit in light of the upcoming change in the federal As drinking water standard and rule. The adsorptive media was to be installed after the present chlorinator which would continue to provide disinfection and now also would convert any As III to As V. However, by this point in time, the school had paid out over $4000 for bottled water and was having difficulty securing money to pay for the treatment system.

Considering the school's financial situation and the problems with other PWS out of compliance for Sb at the time, the DWP approached EPA about the Sb cases in Maine being considered for EPA pilot studies. As it turned out, EPA eventually conducted pilot studies at the school. First they installed a mini RO system treating a split stream. After that showed success at removing the Sb, they installed a system wide treatment system that included RO along with a calcite contactor (corrosion control). EPA ran the study and collected data for a year which showed the RO as being a reliable treatment for Sb. At the conclusion of the study, the treatment system was turned over to the school. To date, that treatment system is still in place and operating and the school has remained in compliance for As and Sb.

Case #3 A Town Water Supply in Down East Maine (Population 50)

The PWS was created due to many private wells in the town being contaminated with gasoline. In response, the Department of Environmental Protection installed a 620' well that would serve as the central water supply for the town providing water to those houses along with others that were on surface water. Initially, the As level in the well was 30 ppb and the Sb level was below the MCL of 6 ppb. Our office required that the As contamination problem be resolved. While solutions to that problem were being considered, additional water tests showed that the Sb level had risen to 8.6 ppb. With that, the contamination problems became much more complicated.

The town requested bids on a treatment system to remove the As and Sb. They ended up choosing the bidder that assured them that their proposed granular ferric hydroxide adsorptive media treatment would remove both the Sb and the As and promised a longer media life than other media on the market. The treatment consisted of two tanks installed in series (after we indicated to the engineers that for several reasons, tank arrangement in series was preferable over the parallel configuration that they proposed). The vendor for the treatment indicated that the media would last 14 months before the lead tank would need to be changed out. Considering that claim and our experience with Sb treatment, we urged the town to get a guarantee in writing from the vendor, that if the media exhausted sooner than they predicted, the vendor would cover the cost for the replacement of the media. After many months, the vendor finally agreed to pay for one change out of the media if there was early exhaustion. The treatment went on-line in September 2011. The Sb was bleeding through at ½ the MCL by January and was over the MCL by May. (As was still being removed effectively). The vendor changed out the media and in the process discovered that one tank had a crack and was leaking. They replaced the tank. As of this date, a little over a year later, the media has been effectively keeping the As reduced to about 3 ppb from a raw water level of around 35 ppb. The treated water Sb level has been consistently just below the 6 ppb MCL since shortly after the media was changed out. A raw water Sb test in November 2013 was 6.4 ppb which showed that the treatment has been reducing the Sb level by about 1 ppb.

3. **<u>A Mobile Home Park of Approximately 40 Mobile Homes</u>**
In 2007, a new well was drilled to obtain more supply. The arsenic in the new well turned out to be 800 ppb, one of the highest readings at a PWS that we have recorded in Maine. An ion exchange arsenic removal system was installed followed by adsorptive media as a precaution due to the extremely high arsenic level. The treatment worked acceptably to begin with, but within months began to have difficulty with routine samples exceeding 10 ppb arsenic. Much adjustment was done to this system by the operator (who was also the treatment designer and installer) with mixed results. In the end, this arsenic treatment system was not meeting the needs of the system; it could not consistently bring the arsenic levels below the MCL of 10 ppb. The solution was to pursue the use of an older well on the property that had a much lower arsenic content in its water. Routing this older well into the existing treatment plant enabled the system to consistently keep the arsenic levels below 10 ppb. **FINDINGS:** In this instance, the high level of arsenic in the well was not reasonably treatable with the ion exchange technology provided. This has made us aware that when a well comes up with high levels of contamination, the viability of the treatment technology needs to be critically scrutinized to its ability to work with the contamination levels present.

4. **<u>All Connections Served Must Be Treated</u>**

In 2005 a campground had a confirmed e-coli routine water sample and was put on a Boil Water Order. The PWS was given the option of installing continuous disinfection or drill a new well. During an inspection, it was determined that the well was shallow, near a pond, and in addition to the well serving the campground, the well also supplied drinking water to the residence of the campground owner and two other residences along the shore of the pond. These different water services were accomplished using three separate water systems that all used the same well as a source, the well (the regulated drinking water source) that was now under a BWO due to e-coli. After a review of the Maine Rules Relating to Drinking Water, the Drinking Water Program required that all services provided by the PWS source must be treated. A lawyer for the two residences on the pond challenged the requirement to treat all water services from the well because of local landowner agreements that were in place. Upon legal investigation, the DWP overruled the challenge by the fact that Maine's Safe Drinking Water Act superseded the local landowner agreements. The records surrounding this situation contain the background of the DWP's requirement that that when treatment is required at a PWS, all water services provided by the PWS source must be treated. Specific details of this case study can be located within an e-mail dated 8-5-14 which is retained in the Electronic Field Manual, Section 27 – Treatment.

APPENDIX K

PWS Inspector Treatment Installation/Modification/Removal Project Checklist
(next page)

Name system
PWSID
Date

PWS Inspector Treatment Installation/Modification/Removal Project Checklist

Name of PWS Inspector: ________________________________

____ Date of letter (from PI) ordering treatment (if applicable). _______________

____ Date when treatment is required to be installed (if applicable). _______________

____ Drinking Water System Change Application received**. Date __________

____ Name of DWP Engineer assigned for treatment review: __________________________________

____ Treatment Review checklists complete (#1 and #3 or #2 and #3) and on file. Date __________ (Engineer to complete)

____ Treatment Approval letter from PI (written by ENG, with or w/o conditions), sent to PWS

____ Treatment confirmation sample requirements identified and communicated to PWS. Date ________

____ Treatment Installation complete. Date ________

____ Treatment inspection complete and results are satisfactory (PI). Date ________

____ Treatment inspection report and SDWIS INFORMATION FORM – SS/Inspection completed, and both are e-mailed to DWPDATAREQUEST.DHHS@Maine.gov . Date: ________

____ Treatment confirmation samples taken and results are satisfactory. Date: ______

____ Lift DWO if applicable. Date __________

____ Data Management resolves any related violations if possible.

____ Treatment project documentation imaged (Engineer). Date: ________

APPENDIX L

NSF/ANSI Standard 61 Guidance

This document was created to help DWP staff determine if products are in compliance with State Regulations regarding NSF/ANSI Standard 61.

The State of Maine Rules Relating to Drinking Water requires the following:

8. *NSF/ANSI Standard 61:*

   All materials, products and coatings that contact drinking water installed or applied after July 1, 2008 shall be certified to meet NSF/ANSI Standard 61-2007: Drinking Water System Components – Health Effects. Certification shall be by an ANSI-Accredited, third-party testing and certification organization.

   a. *Exemption may include the following:*
      - i. *Miscellaneous valves and fittings, three inch diameter and smaller, may be exempt from this requirement if NSF/ANSI 61 Certified products are not readily available;*
      - ii. *Steel well casing;*
      - iii. *Existing stocks of materials. When stocks need to be reordered the new materials must comply with this section;*
      - iv. *A concrete structure, tank, or treatment tank basin constructed onsite that is not normally coated or sealed. If a coating or sealant is specified by the design engineer, the coating or sealant shall be certified to comply with ANSI/NSF Standard 61;*
      - v. *An earthen reservoir or canal located upstream of water treatment;*
      - vi. *A synthetic tank constructed of material that meets Food and Drug Administration standards for a material that comes into contact with drinking water or aqueous food, or a galvanized steel tank, either of which is:*
        1. *Less than 15,000 gallons in capacity, and*
        2. *Used in a public water system with 500 or fewer service connections; or*
      - vii. *A pipe, treatment plant component, or water distribution system component made of lead-free stainless steel.*

NSF/ANSI Standard 61

NSF/ANSI Standard 61, adopted on October 7, 1988, covers indirect additives products and materials, including process media, protective materials, joining and sealing materials, pipes and related products, mechanical devices, and mechanical plumbing devices (including faucets). In essence, every material from the well or water intakes through to the faucet are covered.

NSF/ANSI Standard 61 addresses crucial aspects of drinking water system components: whether contaminants that leach or migrate from the product/material into the drinking water are above acceptable levels in finished waters.

The standard also covers products, components and materials. When a material is certified under Standard 61, its certification indicates use restrictions on parameters such as maximum use temperature or surface area to volume ratio when the material is used in a finished product. This option allows manufacturers using certified materials to bypass some or all chemical testing when seeking certification, and assures that finished products meet all requirements.

NSF/ANSI Standard 61 (NSF 61) covers many items, including, but are not limited to:

a. Pipes, fittings and related products
b. Protective barrier materials (coatings, linings, liners, cement, cement ad-mixtures, etc.)
c. Joining and sealing materials (adhesives, lubricants, elastomers, etc.)
d. Process media (activated carbon, sand, ion exchange resin, regenerated media etc.)
e. Mechanical devices used in treatment and distribution (valves, pumps, filters, chlorinators, etc.)

f. End-point devices dispensing drinking water (faucets, end-point control valves, riser tubes, supply stops, etc.)

NSF/ANSI Standard 61 does not address all aspects of product use. The standard is focused and limited to addressing potential health effects except where specific application and performance standards are referenced. Some items not addressed by this standard are performance (such as burst pressure), taste and odor, microbiological growth support, and electrical safety. Other standards address these aspects of products, and NSF can provide testing and certification to these as well.

NSF/ANSI Standards Comparison to Standard 61		
NSF/ANSI Standard	**Description**	**Equivalent to, or Includes Standard 61**
42	Drinking Water Treatment Units - Aesthetic Effects Overview: This standard covers point-of-use (POU) and point-of-entry (POE) systems designed to reduce specific aesthetic or non-health-related contaminants (chlorine, taste and odor, and particulates) that may be present in public or private drinking water.	Point of entry devices -Yes Point of Use devices - No
44	Cation Exchange Water Softeners Overview: This standard covers residential cation exchange water softeners designed to reduce hardness from public or private water supplies. Additionally, this standard can verify the system's ability to reduce radium and barium.	Point of entry devices – Yes
53	Drinking Water Treatment Units - Health Effects Overview: Standard 53 addresses point-of-use (POU) and point-of-entry (POE) systems designed to reduce specific health-related contaminants, such as *Cryptosporidium*, *Giardia*, lead, volatile organic chemicals (VOCs), MTBE (methyl tertiary-butyl ether), that may be present in public or private drinking water.	Point of entry devices – Yes Point of Use devices - No
55	Ultraviolet Microbiological Water Treatment Systems Overview: This standard establishes requirements for point-of-use (POU) and point-of-entry (POE) non-public water supply (non-PWS) ultraviolet systems and includes two optional classifications. Class A systems (40,000 uw-sec/cm2) are designed to disinfect and/or remove microorganisms from contaminated water, including bacteria and viruses, to a safe level. Class B systems (16,000 uw-sec/cm2) are designed for supplemental bactericidal treatment of public drinking water or other drinking water, which has been deemed acceptable by a local health agency.	Point of entry devices – Yes Point of Use devices - No
58	Reverse Osmosis Drinking Water Treatment Systems Overview: This standard was developed for point-of-use (POU) reverse osmosis (RO) treatment systems. These systems typically consist of a pre-filter, RO membrane, and post-filter. Standard 58 includes contaminant	~~No~~ Yes [Roger Crouse 2013 See Addendum below]

	reduction claims commonly treated using RO, including fluoride, hexavalent and trivalent chromium, total dissolved solids, nitrates, etc. that may be present in public or private drinking water.	
62	Drinking Water Distillation Systems Overview: Standard 62 covers distillation systems designed to reduce specific contaminants, including total arsenic, chromium, mercury, nitrate/nitrite, and microorganisms from public and private water supplies.	No
177	Shower Filtration Systems - Aesthetic Effects Overview: This standard covers point-of-use (POU) shower filtration systems, designed to reduce free available chlorine that may be present in potable water (public or private).	No
NSF Protocol P231	Microbiological Water Purifiers Overview: Protocol P231 addresses systems that use chemical, mechanical, and/or physical technologies to filter and treat waters of unknown microbiological quality, but that are presumed to be potable.	Point of Entry Devices covered by Standards 53 and 55 – Yes All Others - No
CSA B483.1	Drinking Water Treatment Systems Overview: Canadian Standards Association (CSA) developed additional requirements, outside the existing NSF/ANSI standards, to meet plumbing, mechanical, and electrical requirements for drinking water treatment components and complete systems. Products under this scope include POU and POE plumbed systems and POU non-plumbed systems. The regulation will go into Canadian National Plumbing Code in 2010 but provinces can adopt the standard at any time.	No

NSF-ANSI Standard 61 Guidance Document Addendum

Update: 1/9/2015

- Based on an ASDWA query of practices in other states, the Maine Drinking Water Program determined that further clarification is needed regarding materials, products, and coatings that contact chemicals added to drinking water. The Drinking Water Program will consider the certification or adherence to other food grade standards, such as ANSI/NSF 2-8, 12, 18, 25, 51, 59, or compliance to FDA standards, or similar food grade compatibility, when approving materials, products, and coatings that contact chemicals added to drinking water. No change is made regarding the Maine rules requirement that "All materials, products, and coatings that contact drinking water installed or applied after July 1, 2008 shall be certified to meet NSF/ANSI Standard 61-2007; Drinking Water System Components – Health Effects".

  One immediate result of this change is that the DWP approves the use of the Pulsafeeder Pulsatron diaphragm chemical feed pump, used for pumping chlorine, which is not certified to ANSI/NSF Std 61 but is certified to several other food grade related ANSI/NSF standards.

Update: 7/26/2013

- A review of NSF-ANSI Standard 58 with Tara Sniezek of NSF (734-913-5726, ext 5727) identified that the committees that developed Std 58 and Std 61 are completely independent. In practice, a reverse osmosis device certified to Std 58 will not be certified to Std 61, even though much of the requirements of these two standards are the same. Given this, Reverse Osmosis drinking water treatment systems will not be tested to NSF-ANSI Std 61. As a result, it has been decided that the Maine Drinking Water Program will accept NSF ANSI Std 58 certification as an acceptable equivalent to Std 61 for Reverse Osmosis units. This acceptance has been approved by the DWP Director.

- For your awareness, when an NSF Standard approves a device for Point of Entry (POE) applications and not for Point of Use (POU), it is commonly due to the fact that the device has met the standard at the higher flow rate associated with POE application, but either has not been tested at the lower flow rate associated with POU, or has not met the standard at the lower POU flow rates. Given this information, the Drinking Water Program will continue to adhere to the different decisions on Std 61 equivalence as stated related to POE or POU.

Update 10/11/16

- Certification to the lead free NSF/ANSI STD 372 does not indicate NSF/ANSI STD 61 Certification. There are point of use water filters that are 372 compliant that did not pass STD 61 testing. However, certification to ANSI/NSF STD 61 after January 4, 2014 does indicate compliance with the lead free NSF/ANSI STD 372. This information came from Tara Sniezek of NSF (734-913-5726, ext 5727)

Appendix M

Steps for Treatment Review and Approval
(for both process and treatment chemical changes)

Responsibilities are included for:

Rule Specialist (RS)
PWS Inspector (PI)
Engineering Supervisor (Eng-Sup)
Engineer (Eng)

Written Procedure – Sequential Process Checklist:

1. ___ RS identifies a treatment requirement due to an exceedance, writes the NON letter with treatment requirement and sends it to the PI for review.

2. ___ PI reviews letter and provides input back to the RS within 3 days.

3. ___ RS finalizes the NON/treatment-requirement letter and PI sends it to the PWS, with requirement to send the Drinking Water System Change Application (**CA**) to the PI.

4. ___ RS requests a compliance schedule to be created for treatment installation, based on the timeframe specified in the letter requiring treatment installation.

5. ___ PWS or treatment company provides CA to the PI. Note: we will also receive CAs from a PWS that is voluntarily making a treatment change, not the result of a rule exceedance.

6. ___ PI (or whoever gets the CA) sends the CA to ENG-SUP and copies RS(via DWPDATAREQUEST.DHHS@Maine.gov]. When a CA is received, both the PI and RS need to have a copy sent to them.

7. ___ After receiving CA, ENG-SUP determines which ENG will be reviewing the CA, includes this decision on the CA Tracking Sheet (visible to all), and sends the CA to this ENG, copying the PI and RS on the assignment of the project to a specific ENG. The ENG-SUP makes or prints a copy of the CA to put in the basket for imaging, or sends an electronic copy of the CA to DWPDATAREQUEST.DHHS@Maine.gov to be imaged]

8. ___ At this point, all DWP parties (PI, RS, ENG) have the TA. PI and RS provide any other pertinent info regarding the treatment proposal to ENG at this time.

9. ___ ENG begins review, using treatment review checklists Appendix A, B, and C of DWP0161, working directly with the PWS or treatment installer and Primary Operator (if there is an operator) to gather additional information and to discuss project details. Engineering will evaluate the completeness of the application and send back incomplete applications to the PWS and treatment installer. *If the ENG has not received any input from the PI or RS, this is the time for the ENG to contact the PI and RS to be sure they have no input on the design.*

10. ___ As needed, the ENG gathers a meeting of knowledge experts to best address complex treatment issues that involve simultaneous compliance and other challenging issues. RS will be a primary contributor in this type of meeting and others who could provide valuable input will be gathered. [It is important, especially for large projects, for the ENG to be communicating with all parties involved (all stakeholders): owner, owner's engineer, primary operator, and internal peers: RS and PI]

11. ___ ENG obtains confirmation sampling requirements (if needed) from RS, to include the requirements in the treatment approval letter.

12. ___ ENG writes treatment approval letter and sends it to RS and PI for input within 2 days. (This should not be the first correspondence between the ENG, PI, and RS on the project. Hopefully any input from the PI or RS on the design would have been sent to the ENG earlier, or the ENG would have followed up with the RS and PI to get input before the point of writing the treatment approval letter.)

13. ___ When PI, RS, and ENG agree with the contents of the letter, the PI adds their signature and sends the treatment approval (written from the PI) to the PWS via DWPDATAREQUEST.DHHS@maine.gov, and e-copies the Primary Operator, RS, treatment installer, ENG, and ENG-SUP.

14. ___ ENG keeps TA tracking spreadsheet up to date.

15. ___ PWS Installs treatment

16. ___ PWS informs PI that the treatment is installed

17. ___ If confirmation samples have been required PI orders confirmation sample kit for PWS or PI to take the required sample(s)

18. ___ PI inspects the treatment and if a confirmation sample is required, either takes the confirmation sample or determines that the installer took a confirmation sample and then obtains the results. Results must come from a Maine certified lab. If the installer provides confirmation sample results, the PI provides the sample results to the RS and ENG.

19. ___ RS reviews sample results. If results are unacceptable, RS communicates with PI and ENG and the work of reworking the treatment installation occurs until the confirmation sampling is successful.

20. ___ PI completes treatment inspection report and provides SDWIS INFORMATION FORMs on the treatment change and site visit <u>within one week</u> of the inspection so that sampling schedules can be setup, etc.

21. ___ If treatment has not been installed in the required timeframe, PI writes a violation or writes a referral to pre-enforcement as needed.

22. ___ Requests for time extensions on treatment installation are provided in writing to PI. PI discusses the request with the RS for approval or denial and keeps ENG informed.

Responsibility Based Checklist of the Written Procedure (See written procedure for more detail)

___ RS writes the NON letter with treatment requirement and sends it to the PI for review.
___ RS finalizes NON/treatment-requirement letter and sends it to PWS.
___ RS requests a compliance schedule for treatment installation.
___ If the RS receives the CA from the PWS, the RS sends the CA to ENG-SUP and copies the PI.
___ RS and PI provide input on treatment proposal to ENG
___ RS reviews sample results. If unacceptable, RS tells PI and ENG, and reworking treatment installation occurs until the confirmation sampling is successful.
___ RS and PI provide input to ENG on the Draft Treatment Approval letter within 2 days of receipt from ENG.

___ PI reviews treatment requirement letter and provides input back to the RS within 3 days.
___ If the PI receives the CA from the PWS, the PI sends the CA to ENG-SUP and copies the RS (via DWPDATAREQUEST.DHHS@Maine.gov).
___ PI and RS provide input on treatment proposal to ENG
___ PI and RS provide input to ENG on Draft Treatment Approval letter within 2 days of receipt from ENG.
___ When PI, RS, and ENG agree on the treatment approval letter written by the ENG, the PI adds their electronic signature and sends the letter to the PWS (via DWPDATAREQUEST.DHHS@maine.gov) and sends an e-copy of the letter to the EC contacts (PO, RS, treatment installer, ENG, ENG-SUP) on the bottom of the letter.
___ If confirmation samples required (PI asks RS), PI orders kit for PWS or PI to take.
___ PI inspects treatment. If confirmation sample required, PI takes the sample or if installer took sample, PI obtains sample results and provides to RS.
___ PI completes treatment inspection report and provides SDWIS INFORMATION FORMs on the treatment change and site visit within one week of the inspection.
___ If treatment has not been installed as required, PI writes a NON or refers PWS to pre-enforcement.
___ PI discusses a request for time extension with RS and keeps ENG informed.

___ PWS or treatment company provides CA to the PI.
___ PWS Installs treatment
___ PWS informs PI that the treatment is installed

___ ENG-SUP, after receiving CA, chooses ENG to review CA, updates CA tracking sheet, sends CA to ENG (copying PI and RS), and has CA imaged.

___ ENG begins treatment review, using Appendix A, B, and C of DWP0161, working with PWS or treatment installer and PO. *If no input from PI or RS yet, ENG contacts PI & RS for input.*
___ ENG gathers knowledge experts if needed, communicates with all stakeholders.
___ ENG obtains confirmation sampling requirements (if needed) from RS and includes requirements in the treatment approval letter.
___ ENG writes treatment approval letter and sends it to RS and PI for input within 2 days.
___ ENG keeps CA tracking spreadsheet up to date.