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Croton Watershed Clean Water Coalition



CWCWC Calls for IMMEDIATE STUDY
of the Use of Membrane Filtration
for the Croton System...

CWCWC Position Paper on the Need to Examine the Use of Membrane Technology to Treat the Waters of the Croton System

Introduction

CWCWC maintains that the New York City Department of Environmental Protection (DEP) should conduct systems evaluations to compare the performance of membrane filtration/disinfection to the Dissolved Air Flotation/filtration treatment process (DAF) that DEP has chosen to filter and disinfect the waters of the Croton system.

The protocol for the comparative systems evaluations should be developed by experts in the field of membrane technology and DAF, and, preferably, the testing should be supervised by the Watershed Inspector General from the Environmental Protection Bureau of the New York State Attorney General's Office.

The results of the comparative systems evaluations should be reviewed by an independent panel of experts in the water treatment field, including experts in both DAF and membrane technology. If the independent panel recommends that membrane technology would be a preferable means to ensure the provision of safe drinking water to the people of New York, while minimizing or avoiding adverse environmental impacts, then DEP should immediately commence the design of a membrane facility and simultaneously contact the other parties to the Consent Decree to agree to revised interim milestones that would ensure that a facility is in operation by May 1, 2011, as required by the Consent Decree.

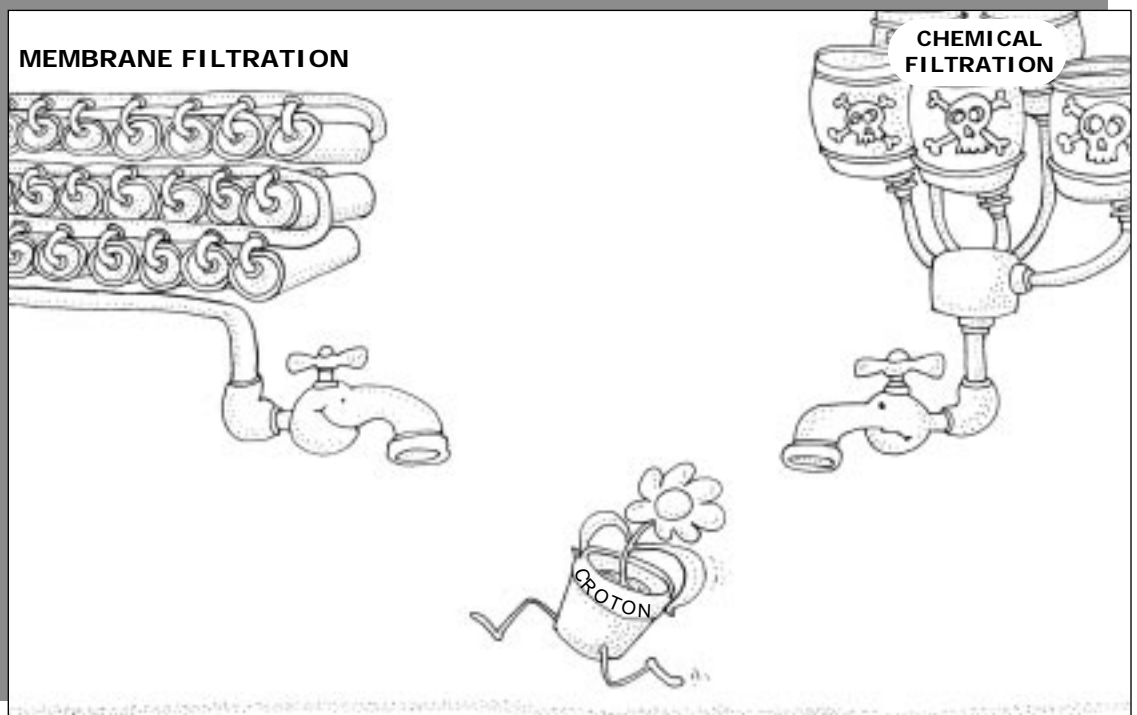


Illustration by Enrique Dura

Despite reports to the contrary, CWCWC is not urging the adoption of membrane technology without further study. As explained in greater detail below, CWCWC maintains that available information in the public domain demonstrates that there is a reasonable likelihood that a membrane filtration plant would be more effective in

pathogen removal, would have a substantially smaller footprint, would use far less power on a daily basis, would use and store fewer chemicals, and might cost as much as \$1 billion less. CWCWC believes comparative systems evaluations should be conducted to determine if such is the case.

The Proposed DEP Water Treatment Plant

DEP proposes to filter the Croton waters with a combination of anthracite and sand. The pretreatment will consist of coagulation, flocculation, and dissolved air flotation. The pretreatment process, using at least 5 chemicals, is an important step, since the filter is too porous to block the transmission of pathogens such as Cryptosporidium. The pretreatment is needed to bind the Cryptosporidium oocysts into larger aggregates, so that they will be blocked by the filter. DEP is using ultraviolet light (UV) as a disinfectant. Such a powerful disinfectant is needed in the event that something goes wrong with the pretreatment step and pathogens pass through the filter.

The proposed facility will occupy approximately eleven acres of former parkland. The footprint of the main treatment building is 8.7 acres (555 feet by 685 feet), or 380,175 square feet. It will utilize at least five chemicals in the pre-treatment process, and

DEP will store between 163,840 and 171,135.5 gallons of chemicals on site on a continuous basis. The higher volume would result from the use of potassium permanganate in pretreatment. DEP has stated that the plant will use 21.6 megawatts of power on a regular basis, with a peak usage of 32.3 megawatts.

In order to limit post-construction impacts in Van Cortlandt Park, DEP is planning to put most of the water treatment plant (WTP) underground. Doing so will necessitate the excavation and removal by truck of approximately 1,250,000 cubic yards of dirt and rock.

The present estimate for the cost of the DAF facility is at least \$1.4 billion. DEP has not indicated what portion of

the cost is attributable to site preparation, construction of the main treatment building or the installation of the UV lamps.



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Consideration of Alternatives to DAF

DAF was selected in 1997, based on the recommendation of two consulting engineering firms. Those firms conducted pilot testing of four forms of filtration, including membrane filtration. The DAF process tested was the process that DEP now proposes to use, except that the DAF units will now be stacked to save space, different pretreatment chemicals will be used, and UV will be substituted for the ozone disinfection step used in the pilot test. The membrane technology was pilot tested without any pretreatment of the water, as described below, and with the use of only chlorine as a disinfectant.

Membrane technology was passed over in 1997 because the consulting engineers concluded on the basis of the pilot testing that membrane filtration was too costly, had never been scaled up to the capacity needed to treat the Croton, was too risky, and might not be sufficient to treat dissolved organic carbon in the future if chlorine was used as the sole disinfectant. The last two reasons are hard to document, even based on 1997 information, but the first two reasons could be supported in 1997. Consequently, CWCWC does not take issue with the decision reached at that time.

CWCWC maintains that the performance of membrane technology in the pilot testing was sufficient to put DEP on notice that it should monitor the development of membrane filtration in the years before it had to submit a final design for the Croton WTP. In the pilot testing, membrane filtration produced water that met all the stated water quality goals, many of which exceeded any required standard. Membrane filtration removed comparable numbers of pathogens, and was rated first in operation and function, and first in environmental concerns. The consultants had expressed concern about the ability of membrane filtration to remove dissolved organic carbon (DOC). If DOC was not removed in sufficient amount, and if chlorine was used as the disinfectant, the interaction



Finals day of the Fall at Cross River Reservoir

between the DOC and the chlorine could cause the formation of disinfectant by-products (DBP) at levels exceeding federal standards. The consultants' fears were not realized. The membranes did remove sufficient DOC, and the levels of DBPs were within the water quality goals set by DEP.

In addition to the promising test results, DEP knew or should have known that the period after 1997 was a period of very rapid growth and commercial acceptance of the technology. Whereas DAF technology did not progress significantly, membrane technology did. The arguments made for rejecting membrane filtration in 1997 no longer applied after 2000. The technology was found to be preferable for meeting stricter standards for pathogen removal that EPA intended to propose. More suppliers entered the field, the technology improved, and the costs rapidly declined. Membrane technology became the choice for the design and construction of WTPs with greater capacity. A comparison of the number of DAF plants is instructive. There are approximately 20 DAF plants in operation today, compared to 161 membrane plants on line or scheduled to begin operation before the end of the year. Many more membrane plants are being proposed, and most research today is being conducted into further refinements of membrane technology, not DAF.

DEP never considered membrane technology after the 1997 recommendation to adopt DAF.

LANDMARK VIDEO DOCUMENT CHRONICLING "THE FIGHT FOR THE CROTON" AVAILABLE SOON!

CWCWC Board Member David Ferguson announces the imminent release of the broadcast-quality video, **Unfiltered Facts**, which chronicles the many facets of the fight surrounding the DEP's potential chemical treatment/filtration of Croton water.

The running time for **Unfiltered Facts** will not be certain until final edit, sometime before the end of the year. It may come in two sections, each under 40 minutes. There will also be available a 10-minute

version to introduce the video to as many potential media outlets as possible.

We are in the process of getting the word about this landmark video document to the major media. *If you might assist us in this regard, please contact the CWCWC office! We would be most appreciative!*

**Contact the CWCWC office at: (914)234-6470
or via email at: crotonwshed@aol.com.**

A Membrane Treatment Facility

If DEP had monitored the developments with membrane filtration, it could have developed a membrane filtration WTP with the following characteristics.

The membrane filtration plant could be expected to be 1000 times more effective in removing such pathogens as *Cryptosporidium*. (6-7 log reduction compared to 3-4 log reduction with DAF). This result is confirmed by EPA. Pathogen removal is the single most important objective of a water system operator.

The membrane filtration plant would have a dramatically smaller footprint than the DAF plant, permitting greater flexibility in siting. Based on the footprint for a 250 mgd plant proposed for Portland, Oregon, it is estimated that the 290 mgd Croton membrane filtration plant would occupy slightly less than one-half acre of land, or 20,750 square feet. That is 5.5 % the size of just the main DAF treatment building. Depending on the method of disinfection chosen, the membrane plant footprint might increase, but it will never approach the size of the DAF facility. DEP acknowledged in 1997 that the membrane facility would be smaller.

The construction of a membrane facility would obviate the need to excavate the 1,250,000 cubic yards of dirt and rock proposed for the DAF plant. The membrane facility could be built above ground, sparing local residents the serious hazards of massive construction.

Professional engineers at the most experienced manufacturer of membrane filters estimate that a DAF plant would use 3 times more power than would a membrane facility for average daily water production.

As DEP acknowledged in 1997, a membrane plant would use few chemicals. Indeed, the initial phase of the pilot testing done used a coagulant with the microfiltration, but the coagulant was dropped in the final pilot test because the consulting firms said it was not needed to meet treatment goals. This result is in sharp contrast to the extensive use of chemicals for coagulation in the DAF process. Aside from the necessary use of a disinfectant, that is common to both processes, the only chemicals that would

likely be used in the membrane filtration treatment process would be a small amount used for cleaning and maintenance. Those chemicals would be piped out as wastewater, without entering the treatment stream.

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The cost of a membrane facility can only be estimated until further plans are made. A leading membrane filter manufacturer has confirmed that a large membrane filtration facility was recently built for a total capital cost of approximately \$1.00 a gallon. Other published reports indicate that one plant was recently built for \$0.57 per gallon, while another cost \$0.86 per gallon. Using the \$1.00 per gallon figure, since it is the highest, would suggest the possibility that the membrane plant could be constructed for

something less than \$300 million, or more than \$1 billion less than the proposed DAF plant. This information, by itself, would warrant the comparative testing of membranes and DAF.

DEP's Recent Comments Regarding Membrane Technology

CWCWC urged consideration of membrane technology earlier this year, in comments made as a part of the environmental review process for the DAF facility. DEP rejected the suggestion, saying that while membrane technology had advanced a great deal in the last few years, and did remove pathogens, no membrane filtration plant had been scaled up to the capacity needed to treat the Croton water. That statement is true, but it is also true of DAF. The largest DAF plant is presently treating 75 mgd. There are membrane plants treating comparable volumes of water now, and membrane plants are scheduled to start operation this year that will treat even larger volumes of water. Membrane filtration plants are now being designed to treat 400 mgd, or more than 100 mgd more than is needed for the Croton. DEP's argument relating to scale up is without merit.

DEP also stated that an expensive form of membrane filtration, reverse osmosis (RO), would be needed to deal with dissolved organic carbon (DOC). DEP said that using

RO would increase cost and add complexity to the water treatment. Reverse osmosis could be used to treat DOC, but no expert CWCWC consulted could understand the need for such a step. The membrane filters themselves may trap the DOC. If not, it could be trapped on an as needed basis after the filtration step, perhaps by the periodic use of nanofiltration. If not, other materials, such as biologically active carbon (BAC), could be used. CWCWC believes the RO argument was raised only to try to offset the apparent cost differences between DAF and membrane technology. If that is the case, the effort was not successful.

A related objection to the above is that membrane filtration means putting "all your eggs in one basket" and is too risky compared to the considerable redundancy built into the DAF process. The argument is disingenuous. DEP knows that enhanced disinfection would have to be used in conjunction with membrane filtration, since the use of a disinfectant is required by law. CWCWC has never advocated the use of membrane filters alone. Instead, they will be used as a part of a treatment process appropriate to the condition of the Croton water. The redundancy DEP lists as an advantage is actually an effort to offset the limitations of the dual filter media by the use of strenuous pre-treatment and post-treatment disinfection.

An engineer for one of the consulting firms

that designed the DAF plant has indicated that there are a number of factors that could increase the size and footprint of a membrane filtration plant to the point where it would not have an advantage over the DAF plant. The engineer offered no substantiation for his opinions, and his assertions are at odds with the published literature. The only way to resolve such disagreements over the merits of the two systems is by a comparative systems evaluation.

A last objection raised is that it would not be possible to construct a membrane facility within the period specified in the Consent Decree. Although further study is necessary to confirm the fact, it would appear that there is sufficient time to design the plant, go through the environmental review process, and construct the plant before the present May 1, 2011 deadline. A membrane manufacturer has supplied CWCWC with information on the time taken in the recent past to construct membrane filtration plants now in operation. The design period varied between 15 and 18 months. The average construction period varied from 21 to 30 months. The longest period for design and construction was four years. DEP has seven years to construct the plant. It is feasible to bring a membrane filtration plant on stream within that time period, allowing for the comparative systems evaluation, design, environmental review, construction and pilot testing. ■

Conclusion

CWCWC maintains that information in the public domain demonstrates that there is a reasonable probability that membrane filtration would be more effective because it would be an absolute barrier against pathogens. Such a plant would have less environmental impact because it would be much smaller, would use far less power, and would use and store only a fraction of the chemicals needed for DAF. The membrane facility would cost only about 25% as much as the proposed plant, affording water rate payers some relief from relentless increases in rates. CWCWC urges DEP to conduct a comparative systems evaluation of membrane technology and DAF as described above to determine if membrane filtration plus enhanced disinfection should be used for the waters of the Croton system.

Acknowledgments:

Special thanks are due to Michael Cole, Esq., who did the research for and wrote this article, with the valuable help of members of the board of CWCWC.



Kensico Dam Park on a glorious Fall day.



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Through regional action, CWCWC is dedicated to providing alternatives to chemical treatment/filtration, and to protecting and improving the naturally-filtered, high-quality waters of the Croton Watershed for today and for generations to come.

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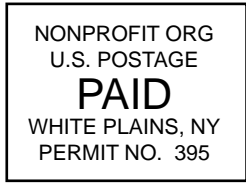
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