Milford Power
Environmentally Effective Efficient Energy

ORIGINAL

April 6, 2010

VIA OVERNIGHT MAIL

Daniel F. Caruso, Chairman
Connecticut Siting Council
Ten Franklin Square
New Britain, CT 06051

RE: Docket No. 187 – PDC-El Paso Milford LLC (a.k.a. Milford Power, LLC) Certificate of Environmental Compatibility and Public Need: Reopening pursuant to Connecticut General Statutes (CGS) § 4-181a (b), that permits an agency to consider whether changed conditions exist, and then consider whether such changes, if any, justify reversing or modifying the Council's original decision dated January 8, 1999—Report on Alternatives to the Use of Potable Water as a Cooling Water Source

Dear Chairman Caruso:

Paragraph 4 of the Connecticut Siting Council's ("Council") Decision and Order, dated April 7, 2009, in this docket requires Milford Power, LLC ("Milford Power") to "investigate and report on alternatives to reduce use of potable water within one year of issuance of this decision." Milford Power retained Aquagenics Incorporated, in consultation with Milone and MacBroome, Inc., to investigate alternatives and to complete an alternatives report. Enclosed please find an original and ten (10) copies of the "Report on Alternatives to the Use of Potable Water as a Cooling Water Source," dated April 2010 (the "Report").

As discussed in the Report, the two alternatives that are the most effective and feasible are modification of the Air Quality Permit and the purchase of a spare intake water pump to reduce the use of potable water, in case of a failure of one of the existing pumps. Milford Power has already successfully obtained modifications to its Air Quality Permit that allow a higher total dissolved solids concentration in the cooling water. This modification has significantly decreased Milford Power's use of potable water. As indicated in the February 1, 2010 report submitted to the Council, Milford Power used 28,014,088 gallons of potable water for cooling in calendar year 2009 as compared to a total of 988,710,226 gallons of cooling water. Accordingly, 2.83% of the cooling water used in 2009 was potable water. However, it is important to recognize that use of potable water may change from year to year depending on many factors, including weather and river water turbidity conditions. Milford Power is also proceeding with the purchase of the spare intake water pump.

Please contact me with any questions at (203) 882-1010 extension 227

Sincerely,

Michael Cartney
Vice President and Plant Manager

cc: Service List *(without attachment)*
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REPORT ON ALTERNATIVES TO THE USE OF POTABLE WATER AS A COOLING WATER SOURCE AT MILFORD POWER COMPANY LLC MILFORD, CONNECTICUT

Prepared for
Milford Power Company LLC
Milford, CT

Prepared by
Aquagenics Incorporated
Woburn, MA

April 2010

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EXECUTIVE SUMMARY

Milford Power Company LLC (MPC or Milford Power) retained Aquagenics Incorporated (Aquagenics) to investigate and report on potential alternatives to the supplemental use of potable water as a cooling water source to the MPC facility. This analysis and report was completed to comply with Condition 4 of the Connecticut Siting Council Decision and Order, dated April 7, 2009. Historical water quality data for the Housatonic River shows that it can experience significant increases in total dissolved solids (TDS) concentration, resulting in the need to supplement river water with higher quality water so that the facility can meet limitations in its air, wastewater, and water diversion permits. In addition, MPC occasionally needs an alternate water source when the current Housatonic River water diversion system is inoperable either due to planned maintenance or mechanical failure.

Aquagenics assessed the feasibility of nine different cooling water alternatives. MPC has successfully implemented one of these alternatives by obtaining a modification of its Air Quality Permit for the facility's main cooling towers. Facility operation under the modified air permit since June 2009 has allowed MPC to substantially reduce its need for potable water. Assessment of the other alternatives (reduced cooling tower cycles of concentration, cooling tower makeup treatment, cooling tower side-stream treatment, groundwater development, use of reclaimed municipal wastewater, selective river water tidal cycle storage tanks, the acquisition of a spare pump, and the installation of an emergency generator) has identified considerable technical, regulatory, environmental, economic, and/ or facility operational impediments associated with each of them.

Given the air permit modification, continued use of Housatonic River water along with reduced supplemental use of potable water as makeup to the MPC facility's main cooling towers remains the most reliable, flexible option having the least operational impact. In addition, MPC will obtain a spare intake water pump to reduce the need for potable water in the event of a pump failure.

BACKGROUND

Purpose

At the request of Milford Power Company LLC (MPC), Aquagenics Incorporated ("Aquagenics") in consultation with Milone and Mac Broom, Inc.) has prepared this Report in compliance with Paragraph 4 of the Connecticut Siting Council's ("Council") Decision and Order, dated April 7, 2009, in Docket No. 187. This Report identifies and evaluates alternatives to the use of potable water supplied by the South Central Connecticut Regional Water Authority (Regional Water Authority) as a cooling water source for MPC's electric generating facility.

By way of background, Condition 1(b) of the original Decision and Order in Docket No. 187, issued by the Council on January 8, 1999, required the following:

> *"Within one year of commencement of operation, the facility shall cease use of potable water as a cooling water source, or obtain advanced approval from the Council for an extension of time if found necessary by the Council to avoid any unnecessary delay or*

curtailment of facility operations and to meet permitting requirements of other regulatory authorities."

The Council issued three extensions to MPC (on November 3, 2005; October 31, 2006; and November 29, 2007) of the deadline to cease the use of potable water. MPC completed its Housatonic River water diversion project and began using river water as its primary cooling water source on February 15, 2008.

In a letter, dated September 5, 2006, MPC requested the Council's authorization to continue to use potable water as a back-up source during certain emergency and operational conditions once the transition to river water was complete. On September 28, 2006, the Council granted this request until December 31, 2008. On December 1, 2008, MPC requested an amendment to Condition 1(b) of the Decision and Order to allow its continued use of potable during emergency and operational conditions. On April 7, 2009, the Council granted MPC's request subject to certain conditions. Specifically, Condition 4 of the Decision and Order required MPC to "investigate and report on alternatives to reduce use of potable water within one year of issuance of this decision."

Cooling Tower Water Demand

Makeup water for the main cooling towers is needed to replace water that is lost passing through the cooling towers as evaporation and drift and from the cooling tower basin as blowdown. The makeup water demand can range between 500 to 5,000 gallons per minute (gpm). The primary factors influencing the water lost through evaporation are the ambient temperature, ambient relative humidity, and the facility's power output. Drift consists of the water droplets created in the cooling tower packing or fill that exit the cooling tower with the air stream. Drift eliminators at the top of the tower minimize the amount of water lost via this pathway. The efficiency of the drift eliminators and the flow rate of water through the cooling tower determine the rate of drift. Cooling tower blowdown is the concentrated makeup water (relative to both dissolved solids and suspended solids) in the basin that is intentionally withdrawn to control the degree of concentration of the solids, which is also known as the *cycles of concentration.* The allowable cycles of concentration at which a cooling tower operates is determined primarily by the water quality characteristics of the makeup water and the materials of construction of the circulating water system, as well as permit limits relative to cooling water supply or withdrawal rates, cooling tower discharge rates and water quality, and cooling tower air outlet quality.

Water Sources and Water Qualities

The current sources of makeup water for the main cooling towers are the Housatonic River, supplemented by potable water supplied by the Regional Water Authority. During the first four years of facility operation, potable water was used exclusively for makeup to the main cooling towers. Beginning in February 2008, Housatonic River water, supplemented by potable water, was used for the cooling tower makeup.

Historical water quality data for the Housatonic River, collected primarily by the State of Connecticut Department of Environmental Protection ("DEP") in the early 1990s at locations close to the power facility's river water intake, shows that its total dissolved solids (TDS) concentration fluctuates significantly because the facility is in close proximity to Long Island Sound. The Sound is a seawater body that has a strong tidal influence on the river water quality at the intake, causing it to fluctuate from fresh water to highly brackish water. The TDS concentration is typically less than approximately 1,000 milligrams per liter (mg/L) throughout much of the year under low tide conditions and between 1,000 and 10,000 mg/L under most high tide conditions. However, during the summer months, particularly during periods of prolonged low flows in the Housatonic River, the TDS concentration can be expected to be between 1,000 and 10,000 mg/L under low tide conditions in the Sound and can reach concentrations in the mid-20,000 mg/L during high tide conditions.

Since the Milford Power facility began using Housatonic River water for cooling tower makeup, relatively wet conditions have prevailed during the two summer seasons and estimated peak TDS concentrations have been in the range of 9,600-12,800 mg/L.

The Milford Power facility uses in-line specific conductivity instrumentation to continuously monitor TDS concentrations and periodically measures TDS concentrations directly using wet chemistry methods to determine the empirical factor relating specific conductivity and TDS concentration. The use of specific conductivity for this purpose is routine throughout the power industry.

In contrast to river water, the historical water quality data collected between 2001 and 2006 for the potable water supply (Milford's exclusive cooling tower makeup water source prior to February 2008) shows that the TDS concentration in the potable water supply does not fluctuate to any great extent and is low, ranging from 40-65 mg/L.

POTABLE WATER COOLING ALTERNATIVES

In response to Condition 4 of the Council's Decision and Order, Aquagenics has evaluated the following alternatives to reduce the use of potable water as a cooling water source to the Milford Power facility:

A. Modifications to the Air Quality Permit

B. Operation of the main cooling towers at reduced cycles of concentration

C. Treatment of river water makeup to the main cooling towers

D. Main cooling tower side-stream treatment

E. Development of groundwater wells

F. Use of reclaimed municipal wastewater

G. River water tidal cycle storage tanks

H. Acquisition of a spare pump

I. Installation of an emergency generator

Aquagenics evaluated the technical feasibility, operational impacts, environmental effects, permitting issues, and financial considerations of each of these alternatives.

A. Modifications to the Air Quality Permit

In Condition 3 of its Decision and Order, the Council required MPC to "pursue the cooling tower air emission permit modification with the Department of Environmental Protection and to provide documentation of the DEP's determination." MPC has successfully obtained modifications to its Air Quality Permit pertaining to the main cooling towers that allow a higher TDS concentration to be maintained in the cooling water and, thereby, reduce MPC's use of potable water.

On the same day that the Council issued its Decision and Order (April 7, 2009), MPC met with the State of Connecticut Department of Environmental Protection (DEP) to discuss potential modifications to the air permit. In May 2009, MPC submitted proposed modifications to the DEP to increase the allowable TDS concentration in the cooling water from 20,539 mg/L to 44,000 mg/L. DEP subsequently issued draft modifications to the facility's original Air Quality Permit pertaining to the main cooling towers. The modifications included increasing the maximum averaged TDS in a 24-hour period of the cooling tower circulating water used to calculate the overall particulate emission rate from 20,539 mg/L to 44,000 mg/L and decreasing the allowable percentage of overall particulate emissions emitted as total suspended solids (TSP) (90-percent to 75-percent) and as particles with a diameter of 10 microns or less (PM-10) (60-percent to 40-percent). Based on these modifications, the maximum allowable TSP emissions limit increased from 6.11 pounds per hour (lb/hr) to 10.9 lb/hr (78.4-percent increase) and the maximum allowable PM-10 emissions limit increased from 4.08 lb/hour to 5.8 lb/hour (42.2-percent increase). The total allowable annual emissions in both the original and the modified Air Quality Permit for TSP and PM-10 did not change from 22.34 and 14.89 tons per year, respectively.

Under DEP procedure, upon application to DEP for the proposed modifications, MPC was able to operate at the new emission rates even though the final amended permit has not been issued. Consequently, MPC has been able to reduce its use of MPC potable water starting in June 2009. The public comment period on the Draft Air Quality Permit ended in early December 2009. DEP issued the final Air Quality Permit on March 18, 2010. A copy of the final Air Quality Permit is attached to this Report.

As a result of the Air Quality Permit modifications, the facility now has the flexibility to operate its cooling towers at higher cycles of concentration than under the original Air Quality Permit due to the increase in allowable TDS concentration in the cooling tower circulating water. Under this new operating mode, the cooling tower blowdown flow rate can be reduced leading to a reduction in the required cooling tower makeup water flow rate (whether the makeup source is potable water, Housatonic River water, or a blend of the two sources). Also there would be a larger cushion in meeting the cooling tower blowdown discharge average monthly and maximum daily flow rate limitations (1.52 million gallons per day (mgd) and 4.54 mgd, respectively) contained in the NPDES (National Pollutant Discharge Elimination System) Permit, especially during times when the TDS concentration of the makeup water from the Housatonic River is high.

The table below shows the significant amount of potable water saved on a daily basis and over a sustained 30-day period under various river water TDS concentrations as a result of the modifications to the original Air Quality Permit.

Housatonic River Water TDS (mg/L)	Daily Potable Water Blend Volume - Original Permit (million gals.)	Daily Potable Water Blend Volume - Modified Permit (million gals.)	30-Day Potable Water Blend Volume - Original Permit (million gals.)	30-Day Potable Water Blend Volume - Modified Permit (million gals.)	Daily / 30-Day Potable Water Blend Volume - Savings (million gals.)
7,200	0	0	0	0	0/0
8,500	0.65	0	19.5	0	0.65/19.5
10,000	1.20	0	36.0	0	1.20/36.0
15,000	2.20	0	66.0	0	2.20/66.0
17,500	2.55	0.48	76.5	14.4	2.07/62.1
20,000	2.75	1.00	82.5	30.0	1.75/52.5
25,000	3.05	1.65	91.5	49.5	1.40/42.0
30,000	3.27	2.10	98.1	63.0	1.17/35.1

The values presented above are based on the results from the circulating water optimization mass-balance model developed for this Report. This model uses Microsoft Excel software to assess the impacts of changing ambient, environmental, and plant operating conditions on the water quality characteristics within the circulating water system and the associated main cooling tower blowdown flow rate. These values are based on a plant power output of 550 megawatts (MW), an ambient temperature of 85° Fahrenheit, a relative humidity of 85-percent, and the NPDES (National Pollutant Discharge Elimination System) Permit average monthly discharge limit of 1.52 mgd for the cooling tower blowdown. They represent the rated plant power output, during summertime conditions, when the cooling tower evaporation rate is high and the TDS concentration of the river water would most likely be at its highest due to limited precipitation. A schematic of the model showing input and output values for the condition in the table above based on a river water TDS of 17,500 mg/L and the conditions of the modified Air Quality Permit is attached. The table above also shows that under the original Air Quality Permit, potable water would be needed to supplement Housatonic River water when the river water TDS concentration exceeded approximately 7,200 mg/L, while under the modified Air Quality Permit, potable water would not be needed until the river water TDS exceeds approximately 15,000 mg/L.

B. Operation of the Main Cooling Towers at Reduced Cycles of Concentration

Cooling towers typically operate so that an upper TDS concentration, measured indirectly by specific conductivity, is maintained within the tower circulating water. This upper TDS concentration is established based on the water quality characteristics of the makeup water, the construction materials of the circulating water system, the selected cooling tower chemical treatment regimen, as well as permit limitations relative to cooling water supply or withdrawal rates; cooling tower discharge rates and water quality; and cooling tower air outlet quality. Thus, should the cooling tower makeup water TDS concentration increase, the tower blowdown rate is increased accordingly to maintain the upper TDS concentration and, as a result, the cycles of concentration of the cooling tower water decreases.

This type of operation is practical for most cooling tower systems since the makeup water TDS concentration fluctuates by no more than a factor of 2 to 5. However, it would be impractical for the MPC facility since the TDS concentration of the Housatonic River makeup water fluctuates by factors of 20 or more (1,000 mg/L to greater than 20,000 mg/L) under historically observed tidal and weather conditions. Eventually, the required sustained blowdown rate would cause either the average monthly flow rate or the maximum daily flow rate to exceed the discharge limits (1.52 mgd average monthly or 4.54 mgd maximum daily, respectively) contained in the NPDES Permit. To avoid exceeding these discharge flow rate limits, the facility's power output would have to be decreased if the makeup water TDS concentration continues to increase. This decrease would reduce cooling tower evaporation, allowing the blowdown flow rate to remain the same while decreasing the cycles of concentration. Reducing the facility's power output would be highly undesirable, since the most likely ambient conditions under which this scenario would occur would be during a hot summer dry spell when the demand for power is typically at its peak.

The circulating water optimization mass-balance model produced the values shown in the following table, without use of supplemental potable water.

Housatonic River Water TDS (mg/L)	Housatonic River Intake Flow Rate (mgd)	Cooling Tower Blowdown Flow Rate (mgd)	Cooling Tower Cycles of Concentration	Cooling Tower Water TDS (mg/L)	Power Output Level (MW)
15,000	4.51	1.52*	2.93	44,000	550
20,000	5.45	2.45	2.20	44,000	550
25,000	6.86	3.85	1.76	44,000	550
26,750	7.56	4.54**	1.65	44,000	550
30,000	9.25	6.00	1.46	44,000	550

* NPDES average monthly discharge limit ** NPDES daily maximum limit

The table shows that at a power output level of 550 MW and at the maximum cooling tower water TDS concentration of 44,000 mg/L contained in the modified Air Quality Permit, a river water TDS concentration of 15,000 mg/L is the maximum concentration that can be continuously sustained based on meeting the NPDES average monthly discharge limit of 1.52 mgd. As the river water TDS concentration increases above 15,000 mg/L, the blowdown flow rate would have to increase above 1.52 mgd (reduced cycles of concentration) to meet the maximum allowed cooling tower water TDS concentration of 44,000 mg/L. However, the length of time that these higher blowdown rates could be sustained would have to be limited to comply with the 1.52 mgd average monthly NPDES flow rate limit. The above table also shows that a river water TDS concentration of 26,750 mg/L is the maximum that can meet the NPDES daily maximum blowdown flow rate limit of 4.54 mgd. However, to produce intake flow rates above approximately 6.5 mgd (4,500 gpm), additional pumping capacity would be required to supplement the two existing river intake pumps. The requirement of additional pumping capacity requires land acquisition, new construction permits and significant construction costs, revised operational permits, and, operational impacts.

The existing easement for the intake pump structure was made on the smallest footprint possible at the landowner's request. The additional pumping capacity would have to incorporate a new structure as there is no room for another pump in the existing building. This would require the acquisition of additional property from the landowner and the corresponding easement cost.

The construction of the new intake building would need permits from the DEP's Office of the Long Island Sound Programs and the Army Corps of Engineers, including permits for a cofferdam. There would also need to be a revision to the Diversion Permit to allow for the additional water to be withdrawn from the river. The construction cost would be significant, estimated at $3.4 million dollars. The ability of the existing piping to carry the additional water would need to be verified. If the existing piping could not carry the additional water, the cost estimate for a new pipeline would be $1.8 million dollars.

In order to operate in excess of 15,000 mg/l TDS over a sustained 30-day period, a significant revision to the existing NPDES permit would be required, increasing average monthly discharge from 1.52 mgd to 6.0 mgd and increasing maximum daily discharge from 4.54 mgd to 6.0 mgd if operation at river water TDS concentrations up to 30,000 mg/L were to occur. The cooling tower blowdown discharge utilizes a shared pipe with the City of Milford Housatonic Wastewater Treatment Plant (Housatonic WWTP). Hydraulic capacity and potential impacts with the Housatonic WWTP discharge could be an issue. This mode of operation may also increase the river water treatment system filter backwash discharge that is routed to the Housatonic WWTP headworks, thus impacting MPC's pre-treatment permit limits as well. Finally, Milford's existing average daily diversion (river withdrawal) permit limit of 8.01 mgd would need to be increased to 9.25 mgd and the maximum instantaneous withdrawal would need to increase from 12.39 cubic feet per second (ft^3/sec) to 14.31ft^3/sec .

The current Milford water treatment facility is designed to accommodate a flow rate of 5,000 gallons/minute (7.2 mgd). Although designed for capacity greater than proposed, operating at the increased flow rate could reduce the reliability of the system.

The following table shows approximately how the power output level would have to be reduced for various river water TDS concentrations to operate for extended periods of time and meet the current 1.52 mgd average monthly limit.

Housatonic River Water TDS (mg/L)	Housatonic River Intake Flow Rate (mgd)	Cooling Tower Blowdown Flow Rate (mgd)	Cooling Tower Cycles of Concentration	Cooling Tower Water TDS (mg/L)	Power Output Level (MW)
15,000	4.51	1.52	2.93	44,000	550
20,000	3.41	1.52	2.20	44,000	300
25,000	2.70	1.52	1.76	44,000	140
26,750	2.53	1.52	1.65	44,000	100

In conclusion, the permitting, capacity, water quality issues, and power output restrictions associated with this alternative are prohibitive.

C. Treatment of Makeup Water to the Main Cooling Towers

Currently, the Housatonic River water used as makeup to the main cooling towers is treated through pressure filtration. This treatment removes suspended solids from the water but does not remove dissolved solids. Treatment of a portion of the river water for the removal of total dissolved solids (TDS) would allow limitations in both the modified Air Quality Permit and the NPDES Permit to be met during times when the makeup water quality becomes highly brackish, approaching that of seawater. This type of treatment, known as desalination, would employ reverse osmosis (RO).

The RO treatment system would be designed so that approximately 50 percent of the feed water entering the RO system becomes product water when treating highly brackish water or seawater. The other 50 percent of the feed water would have to be disposed of as RO reject.

Using the circulating water optimization mass-balance model, the makeup treatment flow rates that would be required to maintain the maximum TDS concentration of the cooling tower water at 44,000 mg/L allowed by the Air Quality Permit and the average monthly cooling tower blowdown flow rate of 1.52 mgd allowed by the NPDES Permit (excluding the RO reject flow rate) are shown in the table below for TDS concentrations in the Housatonic River ranging from 17,500 to 30,000 mg/L.

Housatonic River Water TDS (mg/L)	Housatonic River Intake Flow Rate (mgd)	Untreated Makeup Flow Rate (mgd)	Makeup Treatment Flow Rate (mgd)	Makeup Treatment Reject Flow Rate (mgd)	Makeup Treatment Reject TDS (mg/L)
17,500	4.84	3.84	1.00	0.50	34,825
20,000	5.34	3.34	2.00	1.00	39,800
25,000	5.98	2.68	3.30	1.65	49,750
30,000	6.43	2.23	4.20	2.10	59,700

As shown above, the makeup treatment flow rates would range from 1.0 to 4.2 mgd based on a plant output power level of 550 MW, an ambient temperature of 85° Fahrenheit, and a relative humidity of

85-percent. The corresponding total Housatonic River intake flow rate would range from 4.84 to 6.43 mgd. This is within the current permitted withdrawal rates.

The makeup treatment RO reject flow rate would range from 0.50 to 2.10 mgd with corresponding TDS concentrations of 34,825 to 59,700 mg/L. The RO reject could not be discharged along with the cooling tower blowdown back into the Housatonic River without the NPDES Permit average monthly flow rate limit of 1.52 mgd being exceeded. While modification of the flow rate may be allowed, it is unclear if the quality of the discharge would be acceptable for direct discharge into the Housatonic River due to potential adverse impacts to the receiving water body. The RO reject would also cause MPC's Pretreatment Permit flow rate limitations to be exceeded by six times the current average monthly limit and by more than three times the current maximum daily limit if it were discharged to the sewer and would likely overwhelm the capacity of the Housatonic WWTP. In addition, the increase in total dissolved solids (TDS) concentrations entering the Housatonic WWTP would likely adversely affect settling processes and inhibit biological treatment. Thus, without modifications to the water discharge permits or a new permit specifically regulating the discharge of the RO reject, the RO reject stream would have to be treated to dryness using costly evaporation and crystallization processes.

The makeup treatment RO system would not have to be used for most of the year when the river water TDS concentration averages less than 17,500 mg/L. Maintaining the system in a wet chemical layup condition when it is not in use will require rigorous maintenance procedures to be followed to prevent the RO membranes from biofouling.

The estimated total capital cost for a makeup treatment system using reverse osmosis desalination having the capacity to treat up to 4.5 mgd of Housatonic River water with a TDS up to 30,000 mg/L is approximately $21.5 million dollars. The associated monthly operation and maintenance (O&M) cost would be approximately $393,000. An evaporation and crystallization system sized to treat 2.1 mgd of RO reject would have an estimated total capital cost of approximately $46 million dollars and an approximate monthly O&M cost of $583,000. This would make the overall total capital cost for this alternative a cost- prohibitive $67.5 million dollars.

Since the RO reject produced by the above desalination alternative would need to be treated by costly means, desalination using evaporation and crystallization directly on river water could be used. The following table shows the capacities of the combination evaporation and crystallization treatment systems that would be needed for various river water TDS concentrations.

Housatonic River Water TDS (mg/L)	**Housatonic River Intake Flow Rate (mgd)**	**Untreated Makeup Flow Rate (mgd)**	**Makeup Treatment Flow Rate (mgd)**
17,500	4.56	4.01	0.55
20,000	4.59	3.49	1.10
25,000	4.63	2.83	1.80
30,000	4.65	2.35	2.30

The estimated total capital cost for a makeup treatment system using evaporation and crystallization having the capacity to treat 2.3 mgd of river water would be approximately $48 million dollars with an associated monthly O&M cost of $585,000. Although the total capital cost of this desalination alternative is less than that of the RO desalination alternative, it is still cost-prohibitive.

D. Main Cooling Tower Side-Stream Treatment

An alternative approach to directly treating Housatonic River makeup water to the cooling towers is to treat a side-stream of circulating water in the cooling tower basin. One of the typical side-stream treatments uses reverse osmosis (RO) to reduce the circulating water TDS concentration and returns the treated demineralizer water (RO product) to the cooling tower basin. Using this treatment approach, water to be treated has a higher TDS concentration than the Housatonic River makeup water due to its concentrating within the cooling tower basin. In addition, the circulating water is at a higher temperature than the makeup water taken from the river.

Using the circulating water optimization mass-balance model, the side-stream treatment flow rates required to maintain the average monthly cooling tower blowdown flow rate of 1.52 mgd allowed by the NPDES Permit, exclusive of any RO reject flows, are shown in the table below for TDS concentrations in the Housatonic River ranging from 17,500 to 30,000 mg/L. Side-stream treatment using RO limits the TDS concentration in the cooling tower circulating water feed to the RO system to a maximum of approximately 30,000 mg/L to prevent fouling of the reverse osmosis membranes.

Housatonic River Water TDS (mg/L)	Housatonic River Intake Flow Rate (mgd)	Side-Stream Treatment Flow Rate (mgd)	Side-Stream Treatment Reject Flow Rate (mgd)	Side-Stream Treatment Reject TDS (mg/L)	Cooling Tower Cycles of Concentration
17,500	5.06	1.40	0.70	60,000	1.95
20,000	5.34	2.00	1.00	60,000	1.79
25,000	6.12	3.50	1.75	60,000	1.55
30,000	7.18	5.60	2.80	60,000	1.39

The required side-stream treatment flow rates range from 1.4 to 5.6 mgd and are based on a plant output power level of 550 MW, an ambient temperature of 85° Fahrenheit, and a relative humidity of 85-percent. The corresponding Housatonic River intake flow rate would range from 5.06 to 7.18 mgd, which is within the existing permitted withdrawal limits, however this would require additional construction and associated permitting for the additional pumping capacity.

As shown above, side-stream treatment RO reject flow rates would range from 0.70 to 2.80 mgd with a corresponding TDS concentration of 60,000 mg/L. As with river water makeup treatment using RO, the RO reject could not be discharged along with the cooling tower blowdown back into the Housatonic River without the NPDES Permit average monthly flow rate limit of 1.52 mgd being exceeded. The magnitude of this exceedence would be greater for the side-stream treatment alternative, with similar water quality issues. While modification of the flow rate may be allowed, it is unclear if the quality of the discharge would be acceptable for direct discharge into the Housatonic River due to potential adverse impacts to the receiving water body. The RO reject would also cause MPC's Pretreatment Permit flow rate limitations to be exceeded by eight times the current average monthly limit and by more than four times the current maximum daily limit if it were discharged to the sewer, a condition that would likely overwhelm the capacity of the Housatonic WWTP. In addition, the increase in total dissolved solids (TDS) concentrations entering the Housatonic WWTP would likely adversely affect settling processes and inhibit biological treatment. Thus, without modifications to the water discharge permits or a new permit specifically regulating the discharge of the RO reject, the RO reject stream would have to be treated to dryness using the costly evaporation and crystallization processes described above.

The estimated total capital cost for a side-stream treatment system using reverse osmosis desalination with the capacity to treat 5.6 mgd of cooling tower circulating water with a TDS of 30,000 mg/L is approximately $26.4 million dollars, with an associated O&M cost of $473,200 per month. An evaporation and crystallization system sized to treatment 2.8 mgd of RO reject would have a total capital cost of approximately $55.5 million dollars and an approximate monthly O&M cost of $670,000. The overall total capital cost of $81.9 million dollars for this alternative is cost-prohibitive.

E. Development of Groundwater Wells

Groundwater in the vicinity of the Milford Power facility would be expected to have a relatively low TDS concentration that is typical of most southern Connecticut groundwater supplies ranging from approximately 140 to 280 mg/L.

The following table, based on results from the circulating water optimization mass-balance model, shows the river water and groundwater flow rates that would be required if groundwater were to supplement river water as makeup to the main cooling towers based on a plant output power level of 550 MW, an ambient temperature of 85° Fahrenheit, and a relative humidity of 85-percent.

Housatonic River Water TDS (mg/L)	Housatonic River Intake Flow Rate (mgd)	Cooling Tower Blowdown Flow Rate (mgd)	Cooling Tower Cycles of Concentration	Cooling Tower Water TDS (mg/L)	Groundwater Flow Rate (mgd)
17,500	4.00	1.52	2.83	44,000	0.5
20,000	3.48	1.52	2.83	44,000	1.0
25,000	2.80	1.52	2.83	44,000	1.65
30,000	2.32	1.52	2.83	44,000	2.10

This table shows that approximately 0.5 to 2.1 mgd (350 to 1,440 gpm) of groundwater would be needed.

The site has been extensively investigated by Tighe & Bond as part of an environmental investigation. More than two dozen groundwater sampling wells are on the Milford Power site as part of that active investigation. The overburden has very limited saturated thickness ranging in thickness from approximately 2 to 16 feet. The bedrock is comprised of schist which has limited fracturing and low potential for water production. Additionally, the bedrock wells are sampled quarterly which involves pumping and purging of groundwater from the wells. Based on this sampling, the wells have very low yield and will not produce the quantity of water needed for the cooling water needs either individually or in a network of pumping wells. Thus, it is clear that the hydrogeological characteristics of the Milford Power site and surrounding area are not favorable for water supply development. It is estimated that a single on-site well would typically only produce 3-5 gpm, with a possible maximum of 10 gpm, and that the entire MPC site would only expect to produce a maximum of approximately 100 gpm, while 350 to 1,440 gpm of groundwater is needed. Thus, the quantities of groundwater required for the supplemental source cooling water are not sustainable for the aquifer.

Regarding off-site locations for water supply, there may be sufficient thickness of sand and gravel adjacent to the Housatonic River; however, there are a number of issues with this area. First, the wells may draw in brackish water, causing problems with solids similar to those experienced with the river water intake. Second, there is an area wide contamination problem and pumping of water may cause contaminated groundwater to migrate to the wells and into properties not previously impacted by the contamination.

Consequently, the use of groundwater as an alternative to potable water is not technically feasible.

F. Use of Reclaimed Municipal Wastewater

Reclaimed secondary treated municipal wastewater from the City of Milford Housatonic Wastewater Treatment Plant (Housatonic WWTP) located within 0.5 miles of the Milford Power Facility is a potential source of makeup water to the main cooling towers. Reclaimed wastewater has been used at electric generating plants in the United States for over 30 years. Some states require additional treatment including filtration of secondary treated effluent prior to its use with treatment equipment being located either at the municipal wastewater treatment plant or at the power facility. There have also been issues related to potential odor from the use of reclaimed municipal wastewater. The State of Connecticut does not currently have a final policy regarding this issue and has only authorized the use of reclaimed municipal wastewater in one instance, for golf course irrigation at the Mashantucket golf course. The State is currently reviewing an application for supplying reclaimed municipal wastewater to the central utility plant and irrigation system at the University of Connecticut.

Typical secondary treated municipal wastewater in New England would be expected to have a TDS concentration of 1,000 to 2,000 mg/L along with organic constituents. The following table, based on the circulating water optimization mass-balance model, shows the river water and reclaimed wastewater flow rates that would be required as makeup to the main cooling towers based on a plant output power level of 550 MW, an ambient temperature of 85° Fahrenheit, and a relative humidity of 85-percent to meet the limitations in the facility's NPDES and Air Quality Permits for a reclaimed wastewater TDS level of 1,500 mg/L and treated using filtration to meet typical reuse water turbidity limitations. Seasonal water quality testing of the secondary treated wastewater would need to be conducted to determine if additional treatment processes were necessary to remove unwanted constituents that could possibly cause scaling or fouling on the circulating water wetted surfaces.

Housatonic River Water TDS (mg/L)	Housatonic River Intake Flow Rate (mgd)	Cooling Tower Blowdown Flow Rate (mgd)	Cooling Tower Cycles of Concentration	Cooling Tower Water TDS (mg/L)	Reclaimed Wastewater Flow Rate (mgd)
17,500	4.00	1.52	2.83	44,000	0.5
20,000	3.37	1.52	2.83	44,000	1.1
25,000	2.69	1.52	2.83	44,000	1.75
30,000	2.22	1.52	2.83	44,000	2.20

The use of reclaimed wastewater would impact the quality of the cooling tower blowdown discharge and the river water treatment system backwash water discharge. The concentrations of various constituents in the secondary treated wastewater from the Housatonic WWTP could prevent these discharges from meeting associated water quality limits. Thus, the change in source water would necessitate modification of both the NPDES permit as well as the pretreatment permit. The approximate 0.5 to 2.2 mgd (350 to 1,530 gpm) flow of reclaimed wastewater needed for cooling tower makeup would likely be available from the 8.0-mgd Housatonic WWTP, but would need to be confirmed. If filtration of the secondary treated wastewater from the POTW prior to its reuse were required by the State, it would also be likely that the existing pressure filters within the river water treatment system at the Milford Power Facility could adequately treat the combined river water and secondary treated wastewater makeup water for turbidity reduction. Should new media filters located at the Housatonic WWTP site be required to provide tertiary treatment, their estimated cost would be approximately $2.8 million dollars to treat 2.2 mgd. In addition, the cost of approximately 3,830 feet of 10-inch pipe and pumps to convey the reclaimed wastewater to the power facility would be approximately $1.8 million dollars. The annual O&M costs are estimated to be $34,300 per year, exclusive of the additional cost of the reclaimed wastewater supply. In addition to the significant $3.8 million dollar capital cost for this option, as described above, substantial uncertainties exist regarding the ability to negotiate a commercially reasonable arrangement with the Housatonic WWTP (for the purchase of the reclaimed water and other matters), as well as the ability to obtain changes to both the MPC NPDES and Pre-Treatment permits.

G. River Water Tidal Cycle Storage Tanks

As previously discussed, historical water quality data for the Housatonic River, at locations close to the power facility's river water intake, shows that its total dissolved solids (TDS) concentration can fluctuate significantly due to the facility's close proximity to Long Island Sound. The Sound with its seawater salinity has a strong tidal influence on the river water quality causing it to fluctuate from fresh water to highly brackish water. The TDS typically can be less than approximately 1,000 mg/L throughout much of the year under low tide conditions and between 1,000 and 10,000 mg/L under most high tide conditions. However, during the summer months, particularly during periods of prolonged low flows in the Housatonic River, the TDS can be expected to be between 1,000 and 10,000 mg/L under low tide conditions in the Sound and can reach concentrations in the mid 20,000's during high tide conditions.

The concept of tidal cycle storage involves pumping water from the Housatonic River during low or near low tide conditions in the Sound when the river's TDS concentrations are close to their lowest values and storing this higher quality water in tanks to be used as cooling tower makeup. This approach avoids using river water having elevated TDS levels that would make meeting the facility's Air Quality Permit limitation on maximum cooling tower circulating water TDS concentration and/or NPDES Permit limitations on average monthly and maximum daily flow rates difficult.

A potential scenario for conditions whereby the low tide TDS is 10,000 mg/L and the high tide TDS is 30,000 mg/L would be to pump for the first three hours on the rising tide and for the last three hours on the outgoing tide. Since there are approximately two tidal cycles per day, the total river water pumping time would be 12 hours. This operation would store river water having an average TDS of approximately 15,000 mg/L. Thus to satisfy the daily makeup demand of approximately 4.5 mgd during full power output and summer conditions, approximately 1.2 million gallons of river water would have to be stored so that it could be used when river water is not being pumped.

This scenario would also require that the river intake pumping capacity be approximately 9.0 mgd (6,250 gpm) to both fill the storage tanks and meet the cooling tower makeup water demands. Since the two existing river intake pumps can only pump approximately 4,500 gpm when both are running concurrently, additional intake pumping capacity would be needed as previously discussed in this Report. Since installation of the additional pumping capacity would require in-water construction, a Structures, Dredging, and Fill Permit would be required from DEP's Office of Long Island Sound Programs. In addition, it will be necessary to modify MPC's Water Diversion Permit and to obtain a Section 404 Permit from the Army Corps of Engineers for dredging activities.

The higher intake flow rate would also impact the carrying capacity of the existing 12-inch pipe line from the intake structure to the river water pressure filters and the filtering capability of the existing river water system pressure filters, designed for a maximum flow rate of 5,600 gpm. The facility's current diversion permit that limits maximum water withdrawal to 12.38 ft^3/second (8.0 mgd) would also be impacted by the higher intermittent pumping rate.

Since the existing river intake does not withdraw directly from the Housatonic River but rather from the Quarry Pond, river water blending conditions in the pond may render this alternative difficult to properly control without modifying pond flow patterns or relocating the intake directly to the River. The feasibility of this alternative would also require the analysis of long term river water quality data trends that are currently lacking.

It is estimated that the cost for a 1.5 million gallon above-ground storage tank would be approximately $2.5 million dollars. In addition, the construction cost for modifications to the intake structure would be significant as previously presented, with an estimated cost $3.4 million dollars. If the existing piping is not sufficient to carry the additional water, the estimated cost for a new pipeline would be $1.8 million dollars. This significant cost along with the uncertainty of intake water quality, permitting issues, and the limited space available at the Milford Power site for installation of the new storage tank make this alternative impractical.

H. Acquisition of a Spare Pump

Provisions for spare pump capacity at the river water intake structure would enhance the reliability of river water as the primary cooling tower makeup source. Currently there are two river water supply pumps each rated at approximately 2,500 gallons per minute (gpm). Installation of additional pumping capacity within the existing river water intake structure would require a significant construction effort due to its current equipment layout and lack of available space. As mentioned previously in this Report, since this installation would require in-water construction, a Structures, Dredging, and Fill Permit would be required from DEP's Office of Long Island Sound Programs. In addition, it will be necessary to modify MPC's Water Diversion Permit and to obtain a Section 404 permit from the Army Corps of Engineers for dredging activities.

Consequently, purchase of an on-site spare pump would be a better option. The estimated equipment cost for a third spare pump rated at 2,500 gpm to be held on site in case it is needed to quickly replace one of the currently installed pumps is $125,000. MPC has informed Aquagenics that it intends to procure the spare pump in 2011.

I. Installation of an Emergency Generator

The installation of an emergency generator at the river water intake structure was also investigated as a means of enhancing the reliability of river water supply. Permanently installing 350 kilowatts (KW) of emergency power at the intake location is expected to cost $250,000 and would involve new air permitting and third party real estate easements or leases which cannot be assured at this time. In addition, installation of this emergency generation at the existing intake structure would be difficult due to the limited available space close to the structure. Since outages relating to the unavailability of power supplied by the local utility are uncommon, the cost and complexity of this option seems excessive.

CONCLUSIONS AND RECOMMENDATIONS

As required by Condition 4 of the Council's April 7, 2009 Decision and Order, Aquagenics has investigated a number of alternatives to the current use of potable water to supplement Housatonic River water as makeup to its main cooling towers. The findings supported by the circulating water optimization mass-balance model developed for this Report indicate that river water alone can now be used up to a point where the TDS concentration approaches approximately 15,000 mg/L as a result of modifications pursued by MPC to its Air Quality Permit. Above this TDS concentration, flow rate limits in the facility's NPDES Permit and/or the maximum cooling tower circulating TDS concentration limits in the Air Quality Permit cannot be met unless potable water is used as a portion of the cooling tower makeup supply or the facility's power output is reduced. The variability in year to year seasonal weather conditions that result in significant fluctuations in the river water quality make it difficult to predict just how often the TDS level of 15,000 mg/L would be approached in any given year.

The modifications contained in the Air Quality Permit have been extremely beneficial in allowing river water with higher TDS concentrations to be used as makeup to the main cooling towers and in requiring less potable water than under the original Air Quality Permit as shown in this Report.

Operation of the main cooling towers by lowering cycles of concentration to offset increases in river water TDS levels would significantly limit the capability of the facility to meet NPDES Permit discharge limits without restricting its power output levels. This alternative would allow sustained full plant power output for river water TDS concentrations up to approximately 15,000 mg/L under the modified Air Quality Permit. However, above this TDS concentration, the facility would be limited in the duration that it could operate at the TDS level and still meet NPDES Permit discharge flow rate limitations. Sustained operation at these higher TDS levels could be achieved if the facility were to operate at reduced power output levels, but this approach would not be a preferred option for either MPC or the electric power grid.

Desalination of a portion of the Housatonic River water used as cooling tower makeup water using reverse osmosis (RO) would be extremely expensive and require significant operator attention. This is especially so if the RO reject stream cannot be discharged without volume reduction under the current or modified NPDES or Pretreatment Permits. These same economic and regulatory issues would apply to the main cooling tower side-stream treatment alternative.

The use of groundwater to supplement river water for cooling tower makeup is not feasible due to the hydrogeological characteristics of the Milford Power site that would not support the groundwater flow rate requirements.

Approximately 0.5 to 2.2 mgd of reclaimed municipal wastewater would be required as a supplement to river water to satisfy the facility's main cooling tower needs. The cost of filtering secondary treated wastewater from the City of Milford Housatonic Wastewater Treatment Plant for reuse and conveying it to the Milford Power site are significant. In addition, the reliable availability of high quality reclaimed wastewater, the cost of this supply from the Wastewater Treatment Plant, and the time period and conditions that may be imposed in the permitting process are all unknown at this time making this option not feasible.

Approximately 1.5 million gallons of low TDS river water would have to be stored if the Milford Power facility were to use river water as cooling tower makeup only during low or near low tide conditions when the river water's TDS concentration is at its lowest levels. Installation of storage for this volume of water is not practical due to the limited area available at the Milford Power site, the cost involved and the significant technical uncertainties.

MPC has substantially reduced the use of potable water by obtaining modifications to its Air Quality Permit. Additionally, MPC has committed to purchasing a spare intake water pump that should also reduce its use of potable water.

Assessment of the other alternatives (reduced cooling tower cycles of concentration, cooling tower makeup treatment, cooling tower side-stream treatment, groundwater development, reclaimed wastewater reuse, selective river water tidal cycle storage tanks, spare pump and emergency generator) identifies considerable technical, regulatory, environmental, economic, and/ or facility operational impediments associated with each of them. Given the Air Quality Permit changes MPC obtained, the reduced use of potable water is the most reliable, flexible alternative having the least operational impact.

ATTACHMENT A

Air Quality Permit

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

March 10, 2010

RECEIVED
MAR 1 6 2010
BY: ____

Michael Cartney
Vice President and Plant Manager
Milford Power Company LLC
55 Shelland Street
Milford, CT 06460

Dear Mr. Cartney:

Enclosed is a certified copy of your modified original permit to construct and operate a Marley cooling tower at the above location.

This letter does not relieve you of the responsibility to comply with the requirements of other appropriate Federal, State, and municipal agencies. The permit is not transferable from one permittee to another (without prior written notification), from one location to another (unless the subject equipment is a portable rock crusher or stripping facility), or from one piece of equipment to another. The permit must be posted for easy access at the site of operation.

Permit renewal applications must be filed at least one hundred twenty (120) days prior to the permit expiration date, if applicable. Pursuant to Section 22a-174-3a of the Regulations of Connecticut State Agencies (RCSA), Milford Power Company LLC must apply for a permit modification/revision in writing if it plans any physical change, change in method of operation, or addition to this source which constitutes a modification or revision pursuant to RCSA Section 22a-174-1 and 22a-174-2a, respectively. Any such changes should first be discussed with Mr. David LaRiviere of the Bureau of Air Management, by calling (860) 424-4152. Such changes shall not commence prior to the issuance of a permit modification.

Sincerely,

Gary S. Rose

Gary S. Rose
Director
Engineering and Enforcement Division
Bureau of Air Management

GSR:DPL:srj
Enclosure

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

NEW SOURCE REVIEW PERMIT TO CONSTRUCT AND OPERATE A STATIONARY SOURCE

Issued pursuant to Title 22a of the Connecticut General Statutes (CGS) and Section 22a-174-3a of the Regulations of Connecticut State Agencies (RCSA).

Owner/Operator:	Milford Power Company LLC
Address:	55 Shelland Street, Milford, CT 06460
Equipment Location:	55 Shelland Street, Milford, CT 06460
Equipment Description:	Marley Cooling Tower

Town-Permit Numbers:	105-0087
Premises Numbers:	0251
Original Permit Issue Date:	July 1, 2004
Modification Issue Date:	March 10, 2010
Expiration Date:	None

RECEIVED MAR 1 6 2010 BY:

for Amey Marrella
Commissioner

March 10, 2010
Date

I CERTIFY THAT THIS IS A TRUE COPY OF THE ORIGINAL

ORIGINAL

PERMIT FOR PROCESS EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION BUREAU OF AIR MANAGEMENT

This permit specifies necessary terms and conditions for the operation of this equipment to comply with state and federal air quality standards. The Permittee shall at all times comply with the terms and conditions stated herein.

PART I. DESIGN SPECIFICATIONS

A. General Description

Marley cooling tower used to reduce the temperature of Milford Power Project cooling water by intimate air-water contact. The cooling tower is made up of ten (10) cells. Mist eliminators are used to prevent drift.

B. Equipment Design Specifications

Maximum Averaged TDS in a 24-hour period: 44,000 ppmw
Water Circulating Flow Rates:

# Pumps Operating	Flow rate (gpm)
1	32,500
2	90,000
3	115,000
4	132,200

C. Control Equipment Design Specifications

Type:	Mist Eliminator
Pollutant Controlled:	PM
% Drift:	0.0005 vol %
Collection Efficiency:	100%

D. Stack Parameters

Maximum Gas Flow Rate:	$1x10^7$ acfm
Minimum Distance to Property Line:	78 ft
Minimum Stack Height:	50

PART II. OPERATING REQUIREMENTS

A. Operating Parameter Limitations

Type of Water Used:	Housatonic River
Typical Total Dissolved Solids (TDS) range:	18,760 - 44,000 ppmw
Maximum Circulating Flow Rate:	132,200 gpm

ORIGINAL

PERMIT FOR PROCESS EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

PART II. OPERATING REQUIREMENTS, continued

B. O & M Requirements

1. The Permittee shall inspect the suction screen, distribution system and nozzles weekly for clogging.

2. The Permittee shall inspect the drift eliminators and the fill monthly for clogging.

3. The Permittee shall clean the drift eliminators, fill, suction screen, distribution system and nozzles as required by the manufacturer.

4. The Permittee shall operate and maintain the cooling tower and all associated equipment as recommended by the manufacturer and in accordance with the facility's Operations and Maintenance plan.

PART III. MONITORING, RECORD KEEPING AND REPORTING REQUIREMENTS

A. Monitoring

1. The Permittee shall monitor the TDS concentration continuously using a conductivity meter that converts conductivity to TDS concentration in parts per million (ppm).

2. The conductivity meter shall be calibrated once annually or as recommended by the manufacturer.

B. Record Keeping

1. The Permittee shall keep daily records of the number of pumps in use. From the number of pumps in use the flow rate will be determined.

2. For the purposes of calculating emissions, TDS shall be calculated using the daily average TDS concentration. The Permittee shall keep this record of daily average TDS concentration.

3. The Permittee shall keep daily, monthly, and annual records of PM and PM-10 emissions. Annual emissions for each pollutant shall be determined by adding the current month's emissions to that of the previous eleven months. These calculations shall be made on a monthly basis.

4. The Permittee shall keep maintenance records as detailed in the facility's Operations and Maintenance Plan.

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STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

PART III. MONITORING, RECORD KEEPING AND REPORTING REQUIREMENTS, cont.

5. The Permittee shall keep records on premises indicating continual compliance with all above conditions at all times and shall make them available upon request by the Commissioner for the duration of this permit, or for the previous five (5) years, whichever is less.

PART IV. OPERATION AND MAINTENANCE REQUIREMENTS

A. The Permittee shall operate and maintain this equipment in accordance with the manufacturer's specifications and written recommendations.

B. The Permittee shall properly operate the control equipment at all times that this equipment is in operation and emitting air pollutants.

PART V. ALLOWABLE EMISSION LIMITS

The Permittee shall not cause or allow this equipment to exceed the emission limits stated herein at any time.

A. Criteria Pollutants

Pollutant	lb/hr	tpy
PM	10.9	22.34
PM_{10}	5.8	14.89

Demonstration of compliance with the above emission limits shall be met with the following

The overall particulate emission rate ($E_{particulate}$) shall be calculated using the following generalized AP-42 equation.

$$E_{particulate}(lb/hr) = \text{Water Circulation Flow Rate(gpm)} \times 0.0005(\%Drift)/100 \times TDS(ppmw)/1{,}000{,}000 \times 8.34(lb/gal, \text{ water density}) \times 60(min/hr) \quad [1]$$

The pollutant specific emission rate shall be calculated by multiplying the overall particulate rate by 75% for TSP and 40% for PM10. These percentages were calculated from *Calculating Realistic PM_{10} Emissions from Cooling Towers*, Reisman and Frisbie, 2001, and are the percentage of emissions emitted as TSP and PM_{10} based on a drift rate of 0.0005% and Marley drift eliminator the droplet size distribution data.

FIRM NAME: Milford Power Company LLC
EQUIPMENT LOCATION: 55 Shelland Street, Milford, CT
EQUIPMENT DESCRIPTION: Marley Cooling Tower

Town No: 105 Premises No:0251 Permit No: 0087 Stack No: 02

ORIGINAL

PERMIT FOR PROCESS EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION BUREAU OF AIR MANAGEMENT

PART V. ALLOWABLE EMISSION LIMITS, continued

$PM = E_{particulate} \times 75\%$ [2]

$PM_{10} = E_{particulate} \times 40\%$ [3]

The commissioner may require other means (e.g. stack testing) to demonstrate compliance with the above emission limits, as allowed by state or federal statute, law or regulation.

B. Hazardous Air Pollutants (HAPs) - (State Only Requirement)

The Permittee shall not exceed the emission limits stated herein at any time.

Pollutant	MASC ($\mu g/m^3$)
Chlorine	64.6

PART VI. STACK EMISSION TEST REQUIREMENTS (Applicable if -X- Checked)

Stack emissions testing shall not be required at this time.

PART VII. SPECIAL REQUIREMENTS

A. STATE ONLY REQUIREMENT: The Permittee shall not cause or permit the emission of any substance or combination of substances which creates or contributes to an odor beyond the property boundary of the premises that constitutes a nuisance as set forth in RCSA Section 22a-174-23.

B. STATE ONLY REQUIREMENT: The Permittee shall operate this source and all accompanying equipment at all times in a manner so as not to violate or significantly contribute to the violation of any applicable state noise control regulations, as set forth in RCSA Sections 22a-69-1 through 22a-69-7.4.

PART VIII. ADDITIONAL TERMS AND CONDITIONS

A. This permit does not relieve the Permittee of the responsibility to conduct, maintain and operate the regulated activity in compliance with all applicable requirements of any federal, municipal or other state agency. Nothing in this permit shall relieve the Permittee of other obligations under applicable federal, state and local law.

ORIGINAL

PERMIT FOR PROCESS EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

PART VIII. ADDITIONAL TERMS AND CONDITIONS, continued

B. Any representative of the DEP may enter the Permittee's site in accordance with constitutional limitations at all reasonable times without prior notice, for the purposes of inspecting, monitoring and enforcing the terms and conditions of this permit and applicable state law.

C. This permit may be revoked, suspended, modified or transferred in accordance with applicable law.

D. This permit is subject to and in no way derogates from any present or future property rights or other rights or powers of the State of Connecticut and conveys no property rights in real estate or material, nor any exclusive privileges, and is further subject to any and all public and private rights and to any federal, state or local laws or regulations pertinent to the facility or regulated activity affected thereby. This permit shall neither create nor affect any rights of persons of municipalities who are not parties to this permit.

E. Any document, including any notice, which is required to be submitted to the commissioner under this permit shall be signed by a duly authorized representative of the Permittee and by the person who is responsible for actually preparing such document, each of whom shall certify in writing as follows: "I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that any false statement made in the submitted information may be punishable as a criminal offense under Section 22a-175 of the Connecticut General Statutes, under Section 53a-157b of the Connecticut General Statutes, and in accordance with any applicable statute."

F. Nothing in this permit shall affect the commissioner's authority to institute any proceeding or take any other action to prevent or abate violations of law, prevent or abate pollution, recover costs and natural resource damages, and to impose penalties for violations of law, including but not limited to violations of this or any other permit issued to the Permittee by the commissioner.

ORIGINAL

PERMIT FOR PROCESS EQUIPMENT

STATE OF CONNECTICUT, DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR MANAGEMENT

PART VIII. ADDITIONAL TERMS AND CONDITIONS, continued

G. Within 15 days of the date the Permittee becomes aware of a change in any information submitted to the commissioner under this permit, or that any such information was inaccurate or misleading or that any relevant information was omitted, the Permittee shall submit the correct or omitted information to the commissioner.

H. The date of submission to the commissioner of any document required by this permit shall be the date such document is received by the commissioner. The date of any notice by the commissioner under this permit, including but not limited to notice of approval or disapproval of any document or other action, shall be the date such notice is personally delivered or the date three days after it is mailed by the commissioner, whichever is earlier. Except as otherwise specified in this permit, the word "day" means calendar day. Any document or action which is required by this permit to be submitted or performed by a date which falls on a Saturday, Sunday or legal holiday shall be submitted or performed by the next business day thereafter.

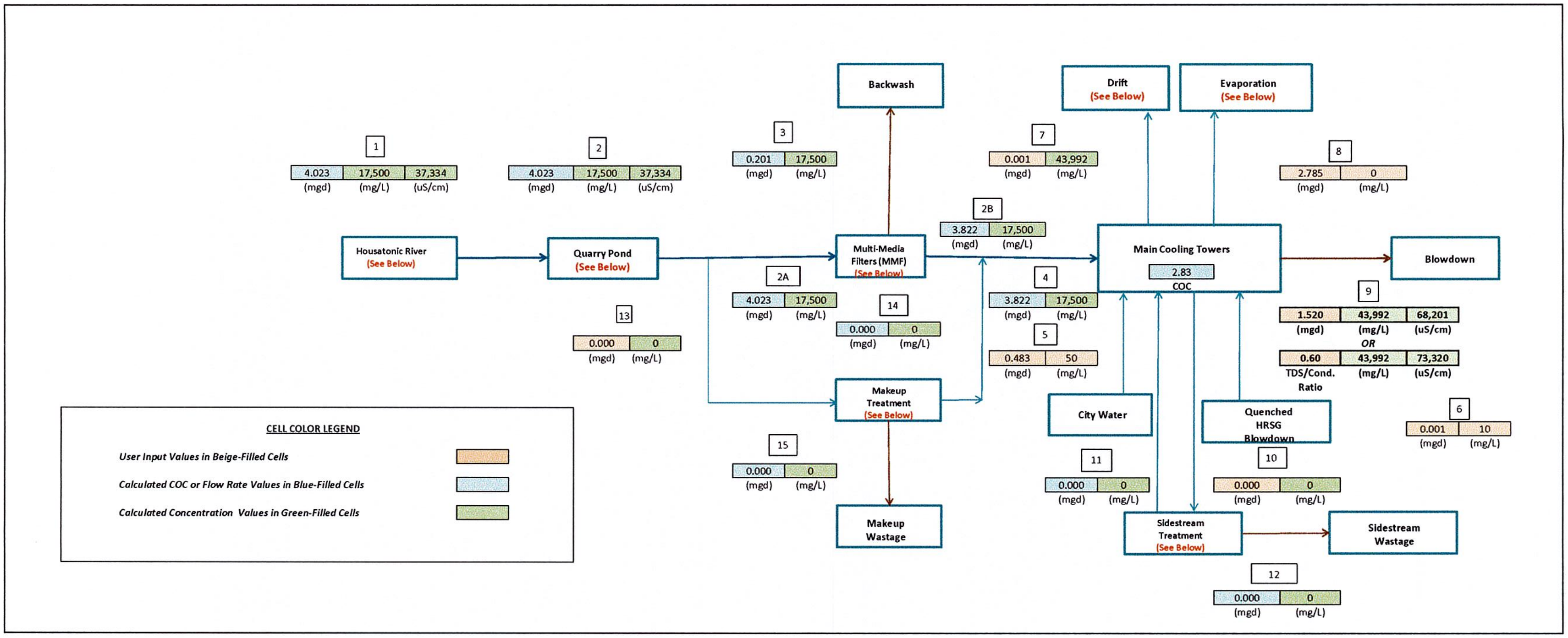
I. Any document required to be submitted to the commissioner under this permit shall, unless otherwise specified in writing by the commissioner, be directed to: Office of Director; Engineering & Enforcement Division; Bureau of Air Management; Department of Environmental Protection; 79 Elm Street, 5th Floor; Hartford, Connecticut 06106-5127.

ATTACHMENT B

Schematic-Circulating Water Optimization Mass-Balance Model

MASS-BALANCE MODEL
CIRCULATING WATER OPTIMIZATION
MILFORD POWER COMPANY LLC

Prepared by Aquagenics Incorporated
Version 2.0 Sept. 2009



River Water Quality Input

User input River Water TDS (Indicate either Yes or No) — Yes — 17,500 (mg/L)

OR — *OR*

User Input River Water Conductivity and TDS to Conductivity Ratio — 0.75 TDS/Cond. Ratio — 9,999 (uS/cm) — 7,499 (mg/L)

Quarry Pond Outlet Water Quality

Quarry Pond Outlet Water Quality Same as River Water (Indicate either Yes or No) — Yes

OR — *OR*

Quarry Pond Outlet Water Quality Different From River Water (User Input Water Quality) — 16,000 (mg/L) — 20,000 (uS/cm)

Multi-Media Filter (MMF) Treatment Parameters

MMF Recovery (%/100) — 0.95

MMF Contaminant Removal (%/100) — 0.00

Makeup Treatment Parameters

Makeup Treatment Water Recovery (%/100) — 0.50

Makeup Treatment Contaminant Removal (%/100) — 0.99

Stream Number and Identification

1. Housatonic River Water
2. Quarry Pond Effluent

2A. MMF Influent

2B. MMF Effluent

3. MMF BackWash
4. River Water Makeup to Cooling Tower
5. City Water Makeup to Cooling Tower
6. Quenched HRSG Blowdown to Cooling Tower
7. Cooling Tower Drift
8. Cooling Tower Evaporation
9. Cooling Tower Blowdown
10. Sidestream Treatment Influent
11. Sidestream Treatment Effluent
12. Sidestream Treatment Wastage
13. Makeup Treatment Influent
14. Makeup Treatment Effluent
15. Makeup Treatment Wastage

Cycles of Concentration (COC)

Cooling Tower Evaporation Rate

Input Temp (F)	*Input RH (%)*	*Input Load (MW)*	*Evap Calc (gpm)*	*Evap Calc (mgd)*
85.00	85.00	550.00	1,933.13	2.785

Cooling Tower Drift Values

No. of Circ Wtr Pumps On	*Circ Wtr Flow Rate (gpm)*	*Cooling Tower Drift (gpm)*	*Cooling Tower Drift (mgd)*
2	90000	0.45	0.00064841
3	115000	0.575	0.00082853
4	132200	0.661	0.00095245

Side-Stream Treatment Parameters

Sidestream Treatment Water Recovery (%/100) — 0.50

Sidestream Treatment Contaminant Removal (%/100) — 0.99

MASS-BALANCE MODEL
CIRCULATING WATER OPTIMIZATION
MILFORD POWER COMPANY LLC

Prepared by Aquagenics Incorporated
Version 2.0 Sept. 2009

CELL COLOR LEGEND

User Input Values from Graphic Display Sheet in Purple-Filled Cells	
Calculated COC or Flow Rate Values in Blue-Filled Cells	
Calculated Concentration Values in Green-Filled Cells	

Input Parameter	Input Value
Cooling Tower Blowdown (mgd)	1.520
Cooling Tower Evaporation Rate (mgd)	2.785
Cooling Tower Drift (mgd)	0.001
Quenched HRSG Blowdown (mgd)	0.001
City Water Makeup Flow Rate (mgd)	0.483
MMF Recovery (%/100)	0.95
River Water Concentration (mg/L)	17,500
Quarry Pond Effluent Concentration (mg/L)	17,500
Quenched HRSG Concentration (mg/L)	10
MMF Contaminant Removal (%/100)	0.00
City Water Makeup Concentration (mg/L)	50
Cooling Tower Evaporation Concentration (mg/L)	0.00
Sidestream Treatment Influent Flow Rate (mgd)	0.000
Sidestream Treatment Water Recovery (%/100)	0.50
Sidestream Treatment Contaminant Removal (%/100)	0.99
Makeup Treatment Influent Flow Rate (mgd)	0.000
Makeup Treatment Water Recovery (%/100)	0.50
Makeup Treatment Contaminant Removal (%/100)	0.99
Cooling Tower Blowdown TDS to Conductivity Ratio (If Selected)	0.60

Stream Number and Identification		Flow Rate (mgd)	Conc. (mg/L)
1. Housatonic River Water		4.023	17,500
2. Quarry Pond Effluent		4.023	17,500
2A. MMF Influent		4.023	17,500
2B. MMF Effluent		3.822	17,500
3. MMF BackWash		0.201	17,500
4. River Water Makeup to Cooling Tower		3.822	17,500
5. City Water Makeup to Cooling Tower		0.483	50
6. Quenched HRSG Blowdown to Cooling Tower		0.001	10
7. Cooling Tower Drift		0.001	43,992
8. Cooling Tower Evaporation		2.785	0
9. Cooling Tower Blowdown		1.520	43,992
10. Sidestream Treatment Influent		0.000	0
11. Sidestream Treatment Effluent		0.000	0
12. Sidestream Treatment Wastage		0.000	0
13. Makeup Treatment Influent		0.000	0
14. Makeup Treatment Effluent		0.000	0
15. Makeup Treatment Wastage		0.000	0
Cycles of Concentration (COC)	2.83		