

October 08, 2008

Mr. Bob Haynes
Manager, Water Resources
Idaho Department of Water Resources – Northern Region
7600 N. Mineral Drive; Suite 100
Coeur d'Alene, Idaho 83815

Re: License No. 95 – 8924
Rathdrum Power, LLC
Data Submittal in Support of a Modified Annual Diversion

RECEIVED
OCT 10 2008
IDWR/North

Dear Mr. Haynes:

The purpose of this letter is to provide the Idaho Department of Water Resources (IDWR) with the data and information needed to amend the annual volume limit in the subject license. The result of this analysis is that Rathdrum Power, LLC is requesting a revised annual volume limit of 1,475 acre-feet per year. Revision of this annual volume limit will not result in an increase in the rate of diversion beyond 4.49 cfs.

The annual volume limit requested in this letter was derived as follows:

1. Hourly meteorological data for the Spokane International Airport (Weather Station ID No. 40263) was purchased from the Warehouse (<http://weather-warehouse.com>). Note that this data is collected by the US Weather Weather Service. Hourly data was available for the years 1973 through 2007. The following parameters were used in the analysis:
 - Dry bulb temperature (T_{db})
 - Dew point temperature (T_{dp}); and
 - Relative humidity (RH)
2. The hourly data sets for each year were scanned for missing values. The following substitution routine was implemented to estimate values for the missing data:
 - Case 1 – when data was missing for hour “n” but present for hours “n-1” and “n+1”, the substituted value = average(n-1:n+1);
 - Case 2 – when data was missing for hours “n” and “n+1”, the substituted value = average(n-2:n+2); and
 - Case 3 – when data was missing for hours “n” through “n+2”, the substituted value = average(n-3:n+3).
 - See Table 1 for a summary of the number of data substitutions by year.
3. Wet bulb temperature (T_{wb}) and absolute humidity values for all of the hourly data sets were estimated using a psychometric Excel add-in program titled “Get Psyched!” that is commercially available from <http://www.kw-energy.com/psych.htm>.

4. The Rathdrum plant's hours of operation are limited to 8,000 hours/year (total) including 2,000 hours/year of duct firing by its air operating permit issued by IDEQ. A third operating condition, inlet fogging to reduce the temperature of the air entering the combustion turbine, is also employed at the plant and is not governed by the air operating permit. The operating hours under these conditions were assigned as follows:

- Base loaded operations (8,000 hrs/yr) – the plant is assumed to operate for all hours of each day except for approximately four weeks for assumed maintenance outages. These outages are assumed to occur during the weeks of April 12th, May 12th, September 12th, and October 12th of each year. For leap years, an additional outage day was assigned in April; and
- Base loaded operations during duct firing (2,000 hrs/yr) – the plant may supplement base load conditions with duct firing for up to 2,000 hrs each year. The actual decision to conduct supplemental duct firing is made by the plant's power off-taker and not by Rathdrum Power, LLC. Duct firing typically occurs during hours that are either warmer or cooler than average and between the hours of 6:00AM and 8:00PM. For the purposes of the model, duct firing was assumed to occur when:

$$T_{db} \leq \mu \pm C\sigma \text{ when } 6:00\text{AM} \geq \text{time} \leq 8:00\text{PM}; \text{ and}$$

$$T_{db} \geq \mu \pm C\sigma \text{ when } 6:00\text{AM} \geq \text{time} \leq 8:00\text{PM}.$$

Where:

μ = annual average T_{db} for the given year;

σ = one (1) standard deviation of the T_{db} ; and

C = a user provided correction factor to achieve the 2,000 hours in any given year. The C value is typically about 0.9.

- Inlet fogging – the plant may use “fogging” of the air entering the combustion turbine to lower the air temperature (and, increase the air's density) to achieve greater output during warm/hot operating hours. The decision to fog the inlet air is made by the plant's power off-taker and not Rathdrum Power. The fogging equipment's specification allow for its operation when $T_{db} \geq 75^\circ\text{F}$. As such, the model assumes that fogging occurs during every hour of each year that $T_{db} \geq 75^\circ\text{F}$.
 - Using the methods presented above, a summary of the estimated number of hours of operations at base loaded operations plus duct firing are shown in Table 2 and a summary of the estimated number of hours with inlet fogging are shown in Table 3.
5. Estimated plant water use from cooling tower evaporation – Cooling tower evaporation is the single largest consumptive use at the Rathdrum Power, LLC facility. The evaporation from a cooling tower at any given point in time is a function of the ambient T_{db} and T_{wb} , the plant operating condition, and the physical characteristics of the cooling tower. Derivation of the ambient temperature data and plant operating characteristics are discussed in Items 1 through 4, above. The physical characteristics of the main and

wastewater cooling towers were set during the facility's design by the equipment manufacturer. Cooling tower characteristics are provided in Table 4. Standard psychometric calculations [i.e., $\text{evaporation} = (\text{circulating water flow} / \text{L:G}) * \text{change in absolute humidity}$] can then be employed to estimate cooling tower evaporation for each hour in the data set given that hour's meteorological and operating conditions. Note that the term "L:G" is the liquid to gas ratio in the cooling tower (e.g., 1.19 lbs of air per 1.0 lbs of water is an L:G of 1.19),

6. Estimated plant water use from all other plant processes – Plant service water production (i.e., de-mineralized water for steam, wash water, etc.) comprises the remainder of the water used at Rathdrum Power. The Rathdrum plant employs a zero liquid discharge system that recycles water streams (that are discharged at a conventional plant) back into the cooling water makeup system. See Table 5 for an accounting of process water flows for the various operational scenarios.
7. Calculate annual water withdrawals – Using the data developed in Steps 1 through 6, hourly water withdrawal estimates were made for the 8,000 operational hours in each year of the data set. The hourly estimates were summed for each month and year and are presented in Table 6.
8. Long term withdrawal projections – The 35-years of hourly model runs summarized in Table 6 provide valid estimates of water use at the facility for the meteorological conditions (and, operating conditions) experienced from 1973 through 2007. These meteorological conditions are reflective of the weather the plant may experience throughout its lifetime but, they are not inclusive. A statistical model – in the form of a Monte Carlo simulation – was developed so that the spectrum of extreme withdrawal scenarios that the plant may encounter could be evaluated. This simulation was conducted as follows:
 - A 10,000 year simulation was selected as a period that was sufficiently long to encompass all reasonable variability within the data set;
 - An annual normal probability of occurrence – ranging from 0% to 100% – was assigned to each year of the 10,000 year simulation by using the RAND() function in Excel. For reference, the 50% probability equals the mean annual withdrawal presented in Table 6;
 - Values were computed on a monthly basis, and summed by year, to yield the withdrawal corresponding to the annual probability given each month's mean withdrawal and standard deviation. The individual, monthly calculations were performed in Excel as follows:

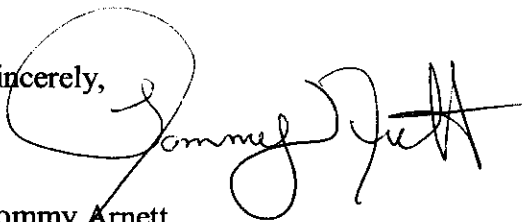
Monthly Withdrawal = NORMINV(probability, mean, stdev)
 - A maximum annual withdrawal was computer for each successive 25-year period in the 10,000-year simulation. The 25-year maximum withdrawal parameter was selected because its duration equals the currently anticipated economic life of the Rathdrum Power, LLC facility. The 25-year maxima for the simulation period are presented in Table 7.

9. Determination of the maximum annual groundwater withdrawal limit – The maximum annual groundwater withdrawal limit was computed using a log-Pearson Type III distribution on the values presented in Table 7. The log-Pearson analysis was conducted using the Excel add-in "Hydro Toolbox" that is publicly available at: <http://www.dartmouth.edu/~renshaw/hydrotoolbox/>. The results of the log-Pearson analysis are presented in Table 8. Based on this analysis, Rathdrum Power, LLC requests an annual volume limit of 1,475 acre-feet per year. With this limit, the facility's probability of compliance will be >99%.

Thank you for your attention in this matter.

As a final note, I would like to thank you and your staff for the assistance provided to Rathdrum Power, LLC in this matter. I am transitioning from my position as General Manager at Rathdrum to another Cogentrix Energy, LLC plant in Colorado. Mr. Gary Allard will be assuming the Rathdrum General Manager's position in early October. Please feel free to contact Mr. Allard or Mr. Dale Miller at the Rathdrum Plant with any questions or comments you may have regarding this matter.

Sincerely,

A handwritten signature in black ink, appearing to read "Tommy Arnett", with a large, stylized flourish extending from the end of the signature.

Tommy Arnett
General Manager

cc. Dale Miller – Rathdrum Power, LLC
C. Richard Neff, P.E. – Cogentrix Energy, LLC