TECHNICAL MEMORANDUM			
Project:	Picnic Point Wastewater Treatment Facility Upgrade Project		
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TT/KCM Project Number:	3620124		
Subject:	Subtask 4.1.21 Summary of Evaluation of Alternative Blower for Energy Conservation at the Picnic Point WWTF	Date: Revised:	June 14th, 2007 Updated July 10th, 2007

The Alderwood Water and Wastewater District (District) is in the process of upgrading its Picnic Point Wastewater Treatment Facility (WWTF) to increase the hydraulic capacity of the plant from 3 million gallons per day (mgd) to 6 mgd (maximum monthly flow). Previously discussions have taken place between the District and the Consultant Team with regards to an alternative blower system (manufactured by Neuros Co. Ltd.). This new equipment was identified as a potential energy-saving measure. This technical memorandum summarizes and updates our evaluation of the alternative Neuros blowers compared to the positive displacement blowers for both the Aeration and the Membrane Systems.

EQUIPMENT DESCRIPTION AND OPERATING PARAMETERS

Table 1 summarizes the design criteria and the operational requirements comparing the Positive Displacement (PD) and the proposed Neuros blower.

Table 1 Design Criteria Aeration and Membrane System Blowers

	Positive Displacement Blower	Neuros Blower
Aeration System Design Criteria		
Number of Blowers[1,2]	3+(1)	4+(1)
Motor Rated Power, HP	150	75
Max Flow Rate/ blower, scfm	1600	1200

Min Flow Rate/blower, scfm	750	620
Membrane System Design Criteria		
Number of Blowers[2,3]	3+(1)	4+(1)
Motor Rater Power, HP	200	100
Max Flow Rate/ blower, scfm	3045	2333
Min Flow Rate/blower, scfm	600	1000

[1.] For the Aeration System, the 4th PD blower and the 5th Neuros Blower will be installed only in 2022 when airflow requirements increase to warrant an additional blower.
[2.] The evaluation does not consider the 4 PD blower arrangements as the larger footprint of the 4 PD blowers cannot be accommodated in the Process Mechanical layout.
[3.] For the Membrane Aeration System, the 4th PD blower and the 5th Neuros Blower will be required sooner than the Aeration System, during Phase 2 of the Project (2014) when membrane tanks 5 and 6 are also brought online.

BUSINESS CASE EVALUATION

A business case evaluation was performed to compare 20-year life cycle costs for the original positive displacement blowers and the proposed Neuros blowers. The life cycle cost took into account the following cost components;

1. Capital cost of the aeration and the membrane blowers.
2. Power costs associated with the aeration and the membrane blowers

The following assumptions were made in the analysis:

- The performance and cost data for PD blowers included the cost for the VFD.
- The performance and cost data for Neuros blowers were provided by Enviroquip.
- The capital cost for the future Phase 2 Aeration and Membrane Aeration blowers were included in terms of the cost that would need to be paid if the blowers were purchased in 2009.
- The analysis includes a 20-year time frame from 2009 to 2028 since the process modeling data with design airflow values during year 2009 and 2028 were available. The airflow values between these years are interpolated for calculation purposes.
- The power requirements for the PD blowers were provided at the design point and at turndown conditions. Performance curves were obtained for the PD blowers used in the Aeration system.
- The power requirements for the Neuros blowers were provided at the design point. The manufacturer recommended determining the BHP at turndown as proportional to flow.
- Aeration airflow requirements were based on the Aerostrip diffuser proposal to meet the standard oxygen transfer rates for the aeration system.

- The plant flow distribution from 2009 to 2028 was determined by Process modeling with start-up flow at 3.3 MGD. The flow distribution also assumed reaching the plant capacity of 6 MGD and remaining constant until 2028.
- The number of membrane tanks in operation is determined by the plant influent flow.
- The calculations do not take into account the power costs incurred by the District because of demand charges. Demand charges could be significant because of the relatively large blower motors, but are difficult to estimate since the rate schedule is not known. If demand charges could be estimated, such charges would be in favor of the Neuros blowers.
- The calculations do not account for the power fluctuations caused by diurnal flow and load fluctuations.
- Snohomish County PUD incentives are calculated assuming energy savings of Neuros Blowers compared to PD blowers for the annual first year of project savings based on the Energy Efficiency Incentives Brochure presented to the Consultant Team at the December 7th, 2006 meeting.
- Cost savings from Snohomish County PUD incentives are calculated using the proposed $0.14/Kw-hr as provided to the Consultant Team during the December 7th 2006 meeting with Snohomish county PUD.
- An average electricity rate of $0.068 per kW-hr was assumed for 2009.
- Annual Inflation rate of 4 % was assumed, which applies to blower cost, and power cost.
- Annual Discount rate of 7 % was assumed.
- Annual Interest rate of 5% was assumed.

Results of the net present worth analysis are summarized in Table 2.

Table 2. Business Case Evaluation Summary for Innovative Energy Conservation Measures Applied to the Aeration and Membrane Blowers

Alternative for Aeration and Membrane System Blowers	Capital Cost (2009 $, inclusive of Present Worth of Future Blower)[1]	2028 Energy Cost ($, non-inflated)[2,3]	20-year Net Present Worth (2009 $)[4]
PD Blower [5]	679,461	327,982	4,077,000
Neuros Blower [6]	1,168,767	263,071	3,897,000

[1] Capital costs based on budgetary quotes from Aerzen and Neuros dated June 2007.
[2] Energy consumption rates calculated assuming that design flows and loads first occur in 2022 and remain the same thereafter.
[3] Energy costs calculated assuming a unit power cost of $0.068/kW-hr.
[4] Net present worth included initial capital cost and energy cost. Net present worth is calculated assuming 4% inflation rate and 7% discount rate.

[5] 3 PD blowers required for the Aeration and Membrane System respectively, with a future 4th blower installed in 2022 and 2014 for the Aeration and Membrane System respectively.

[6] 4 Neuros blowers required for the Aeration and Membrane System respectively. A future 5th blower shall be installed in 2022 and 2014 for the Aeration and Membrane System respectively.

As shown in Table 2, installation of the alternative Neuros blowers could potentially save the District about $179,358 over a 20-year period in comparison to the PD blowers. During the design year alone, the Neuros blowers will save the District 954,573 Kw-hr. Snohomish County PUD incentive is calculated by multiplying 0.14$/kw-hr for the total Kw-hr saved during the first annual year of energy savings. This amounts to approximately $59,496. With the incentive that Snohomish County Public Utility District (PUD) might provide for installing more energy efficient equipment, the District could potentially save $235,565 over a 20-year period.

If the District decides to proceed with installing the Neuros blowers as part of the plant upgrade, the Consultant Team recommends the design layout described below for both the aeration and membrane blowers. Since better turndown conditions are achieved by designing around smaller HP Neuros blowers without impacting cost or footprint, the Consultant Team recommends installing 4 smaller HP Neuros blowers with a fifth blower installed in the future dependent on airflow requirements.

SUMMARY

A net present worth analysis was performed evaluating use of an alternative blower system as a potential energy saving measure for the upgraded Picnic Point WWTF. The evaluation demonstrated that while the initial capital cost of the Neuros Blowers is approximately $489,000 more than the PD blowers, the higher efficiency blowers result in a cost savings over a 20-year net present worth of approximately $179,000. At an incentive rate of $0.14/kWh for new construction, the Snohomish County PUD incentive would be approximately $59,496 for 8 Neuros blowers for the first year of operation. Details of the incentive would need to be addressed with Snohomish County PID once a decision has been made with regards to the alternative blower system.