<u>Charbert Project Follow-up Report #2</u>

Eugene Park (2/1/07)

I have previously written 2 reports, *Preliminary Evaluation of Pollution Prevention Opportunities at Charbert* (submitted on May 4, 2006) and *Charbert Follow-up Report* (submitted on June 2, 2006), providing my assessments of minimal pollution prevention and environmental technologies that should be employed by Charbert relevant to management and disposal of its process waste water. I based my findings in those reports on public documents. Since writing those reports, I visited the site on October 19, 2006. Based upon my assessment at that time, I am providing additional opinions as to how Charbert should proceed with the handling and treatment of its process wastewater.

Charbert has apparently recognized the need to change the present method of treating process wastewater. I believe that there are additional approaches that can be employed that will substantially reduce pollution, as well as lead to lower costs to Charbert over the long term.

In my site visit, Charbert represented that it achieved a 20% reduction in its wastewater. This reduction, combined with waste treatment and water recycling methodologies, should allow Charbert to eliminate the use of outdoor lagoons, a wastewater disposal technology that is grossly inappropriate.

The following are the steps that must be taken by Charbert:

1. <u>Daily Water Use and Wastewater Production Figures</u> – Charbert has represented that its average daily wastewater volumes have been reduced from 250,000 gallons per day to 200,000 gallons per day and that the calculated water used per pound of product is now at approximately 10 gallons per pound. Based upon EPA data, this is approximately the minimum that Charbert should be achieving. Under no circumstances should Charbert deviate away from the 10 gal/lb. water consumption rate that has provided the 20% reduction in its generation of process wastewater. In fact, water conservation measures should be studied further to reduce overall wastewater output even more.

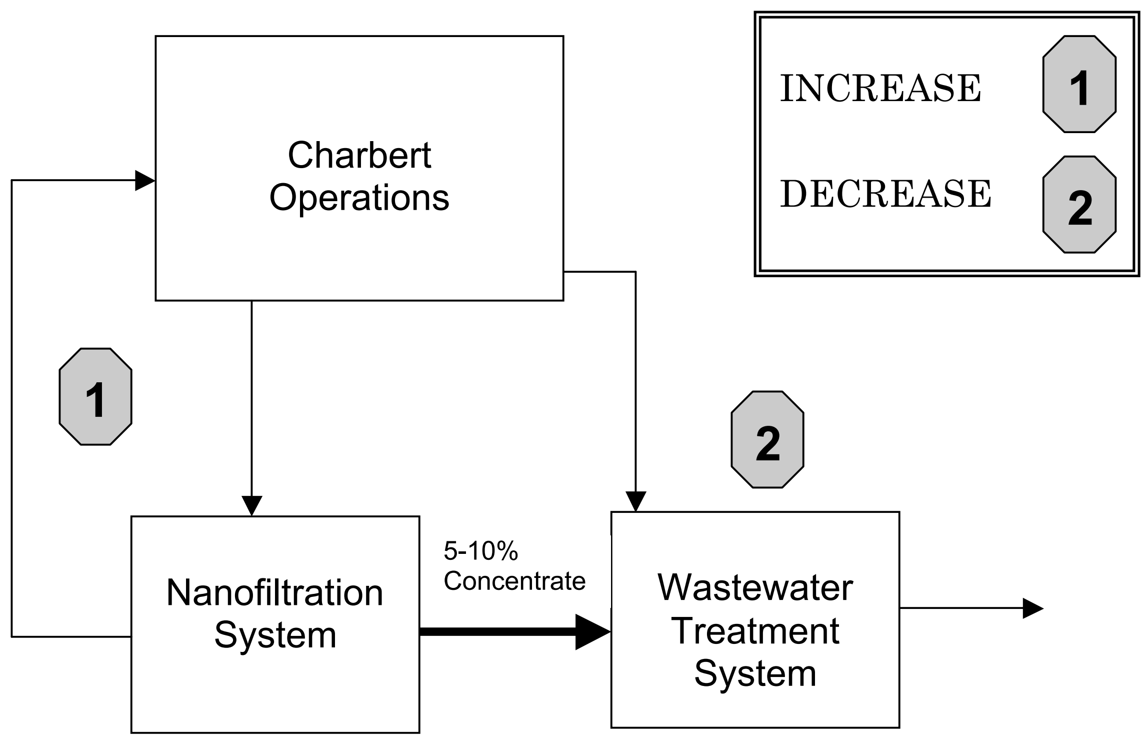
2. <u>Environmental Management System (EMS)</u> – Despite the progress achieved thus far, Charbert should implement a well-organized EMS to evaluate the best options and efficiently monitor all environmental impacts (see original main report).

3. Lagoon Closure – In light of the significant history of anoxic conditions in the lagoons, Charbert's long-term plan must require the elimination of the lagoons. In addition to the problems from odor, the lagoons represent an unacceptable risk for ground contamination.

4. Process Modification and Pollution Prevention – As demonstrated by the 20% reduction in water use, Charbert has already implemented various source reduction measures to reduce water consumption and subsequent wastewater volumes. Lowering the levels of dye baths and reusing rinses have contributed to the overall reductions. Other methods to lower water use include the filtering and reuse of certain process wastewater streams. Charbert has already investigated the possibility of using reverse osmosis (RO) to reuse some of the wastewater in their operations. Water from Lagoon 3 was chemically pre-treated with coagulants and flocculants prior to filtration with RO. While the quality of the filtered water was deemed acceptable, the anticipated costs associated with this type of arrangement are too high for large-scale implementation. Charbert was originally advised by the vendor/consultant to chemically pre-treat the solution to minimize fouling of the RO membranes; from a true pollution prevention perspective, chemical use is not recommended and is most likely not required in Charbert's application since the level of contaminants is relatively low for membrane applications.

   Charbert should commence a different membrane feasibility study that does not require the use of chemicals and incorporates a comparison of RO with another, more cost-effective membrane process called nanofiltration (NF). NF can be considered a "loose" RO membrane that achieves excellent separation but at lower pressures than needed for RO. The end result is that the capital equipment costs are lower since less expensive materials of construction (lower pressure pumps, piping, fittings) are used; energy costs associated with NF are also lower. Wastewater directly from the pump house (where all wastewater is commingled from the facility) rather than Lagoon 3 should be the test solution since it is to be assumed that the lagoons will not be used in the near future. Any water that can be successfully filtered and reused will reduce the size and cost of the wastewater treatment system that is ultimately installed. The process flow diagram is shown below. Increasing the volume of the recycle stream will decrease the volume of wastewater and help to reduce potential liabilities.

The resultant concentrate from the membrane process can be added to the biological treatment system. It can be expected that 5 to 10% of the total volume processed through the membrane system will end up as concentrate.

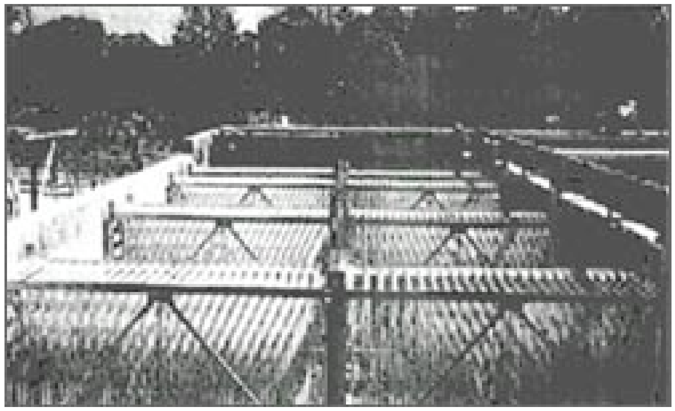


5. Wastewater Treatment – At the same time that all pollution prevention methodologies (source reduction and recycling) are being implemented, the most effective treatment system needs to be evaluated and installed. Charbert is currently evaluating an activated sludge biological system.

The small scale system shown above has demonstrated some reductions in BOD and COD, but the results have been inconsistent. The set up at Charbert would allow for easy retrofit to test other designs. *Biofilm* systems provide a large surface area for entrapment and fixing (holding) of wastewater digesting microbes. Fixed microbes replace or supplement wastewater treatment processes. Once attached, this biofilm works continuously rather than randomly and does not exit the system. The result is a high-performing "integrated fixed activated sludge" technology mirroring the natural, biological metabolism that occurs when bacteria attached to root filaments in lagoons, swamps and wetlands remove pollutants from the surrounding water.

Looped cord media (LCM) consisting of specially treated, chemically resistant filaments. Unlike other media (such as sand filters, plastic matrices and sponge material), LCM ensures maximum exposure of activated sludge to the waste stream by providing a vast and stable, 360º surface on which activated sludge adheres. Fixed bacteria create a stable biomass that provides enhanced BOD/COD removal and an established source or nitrifiers for ammonia reduction. The media is arranged in a tightly-packed cartridge that can be used in different configurations to save on space. Other system design features optimize exposure of wastewater to oxygen and to the biofilm, allowing wastewater to be purified without chemicals and additional aeration basins or clarifiers; little energy is used in the process, and required maintenance is minimal.

Small LCM frames (*immersion platforms*) could be inserted into the aeration tank at Charbert. After several weeks, data can be compared with the existing data that has already been compiled for the traditional activated sludge process.



Conclusion

Charbert should commence two simultaneous feasibility studies to 1) test recycling using nanofiltration membrane technology and 2) optimize the biological treatment with the LCM process. Nanofiltration membranes offer a lower cost option than reverse osmosis (which Charbert has already evaluated) to reuse a significant portion of the water, and LCM fixed-film technologies should improve the effectiveness of the biological process that Charbert is presently evaluating. Both studies would take several months to complete. The combined effect of reducing wastewater flows and implementing the proposed technologies would eliminate the need for the existing lagoons.