The renovated secondary clarifier at the Durham WWTF.

Wastewater Treatment Facility Improvements
Durham, New Hampshire

by Peter C. Atherton, P.E. / Vice President, Wright-Pierce

The town of Durham, New Hampshire owns and operates a 2.5 mgd wastewater treatment facility (WWTF) that serves the town and University of New Hampshire.

The original WWTF, constructed in the 1960s, provided primary treatment. The facility was upgraded to secondary treatment in 1977 and other targeted upgrades have occurred over the years.

In 1999 the town selected Wright-Pierce to complete wastewater facilities planning that would recommend improvements to the wastewater treatment facility as well as identify infiltration/inflow reduction measures in the sewer system. Wright-Pierce recommended a phased approach to implementing treatment facility improvements as a result of successfully negotiating revisions to proposed advanced treatment standards that were to be imposed at that time. Phase 1 dealt with “Immediate Improvements”, including the design and construction of a “selector” to improve the plant’s activated sludge system. Phase 2 of this project, termed “Baseline Improvements”, dealt with specific process system upgrades needed to continue to consistently meet present treatment requirements. At the same time, the improvements are designed to improve overall treatment efficiency and performance. Phase 3 will address the future more stringent discharge requirements that will ultimately be imposed. These future improvements will build upon the improvements implemented as part of the first two phases.

Phase 1 – Immediate Improvements

During the 1990s the Durham WWTF had routinely experienced difficulties in settling solids within
its secondary clarifiers, and odors were increasingly present in the area of the facility’s primary clarifiers and sludge storage tanks. With this in mind, Wright-Pierce reviewed opportunities for “quick-fix” improvements to address needs.

Based on a detailed review of operations data, it was determined that a combination of varying flow and loading conditions, and configuration of the facility’s infrastructure contributed to the generation of odors at various locations and the growth of large quantities of filamentous bacteria in the aeration basins, which tended to peak during the spring and fall.

Since aeration capacity within the first aeration basin had recently been increased, it was determined that the configuration of the aeration basins and certain key operating parameters were major contributors to filament growth. As a result, Wright-Pierce focused on ways of modifying aeration basins to create conditions that would encourage the rapid growth of settleable bacteria and minimize or “select out” the growth of filaments. To accomplish this, Wright-Pierce designed a cost-effective aerobic selector utilizing a timber baffle wall within the first aeration basin. The baffle wall was located between the existing aeration diffuser grids so the present level of aeration could be maintained. Chemical addition capabilities were also provided to supplement the selector zone if needed.

Constructed early in 2001, the aerobic selector has successfully minimized the growth of filamentous bacteria and markedly improved sludge settleability.

Wright-Pierce also recommended improvements for cost-effectively combining and splitting influent wastewater and filtrate recycle flows upstream of the primary clarifiers, as well as improvements in removing primary sludge from the clarifiers. These were implemented by town staff and have been successful in improving operations and in minimizing odors.

Wright-Pierce also designed improvements to sludge wasting and sludge storage, which have resulted in improved operations and the minimization of odors in the short term, while the more comprehensive improvements were being planned for the future.

Phase 2 – Baseline Improvements
The major components being upgraded under the Baseline Improvements project include:

- New fine screening and wash press facilities creatively housed within an expanded Headworks built on top of existing grit tanks;
- Upgraded aerated grit chambers featuring new aerated grit chamber blowers, grit transport screws, and grit dewatering classifier, concentrator;
- New odor control units for headworks area, septage holding tanks and sludge dewatering area;
- New septage pump and septage holding tank modifications;
- Improvements to the primary clarifiers;
- New dissolved oxygen control system for the aeration tanks;
- New flow splitting structure to improve flow distribution to secondary clarifiers;
- New secondary clarifier mechanisms and return activated sludge pumps;
- Disinfection system improvements;
- New plant water system;
- Various architectural and ventilation system modifications;
- New SCADA System; and
- New electrical power distribution facilities.

The Phase 2 Baseline Improvements contract was awarded to Charwill Construction of Meredith, New Hampshire for $2.4 million. Wright-Pierce assisted the town in project financing which included a 20 percent NHDES grant on most components. Phase 2 construction is scheduled to be completed in late 2003.
Chain of Custody Procedure
by Tim Loftus

One of your industrial users under the Industrial Pretreatment Program is disputing your sampling results. They say they have never discharged the level of PCBs that you claim they have. They may even have lawyers involved and perhaps a court date to resolve this. You know that you took the samples properly and that there is no doubt about the accuracy of the results. Unfortunately, you didn’t follow chain-of-custody procedures. Therefore, according to law, you didn’t sample their effluent. Your results are worthless for legal purposes.

The chain-of-custody procedure incorporates a number of controls to assure the integrity of a sample. These procedures, along with the required written documentation, provide you with the necessary backing to defend the integrity of the sample in any litigation — whether it is to resolve an NPDES issue or an Industrial Pretreatment Program one.

The chain-of-custody procedure starts with sample collection and follows through to the destruction of the sample. The purpose of the procedure is to ensure that the sample has been in possession of, or secured by, a responsible person at all times. It should remove any doubt about sample identification or that the sample has been tampered with. While every laboratory’s procedures may be different, there are certain aspects that should be present to assure an adequate chain-of-custody procedure. Below are the most common aspects of a chain-of-custody program developed from a survey of Standard Methods . . . , the Sacramento series, WEF’s Manual of Practice Series, and various EPA publications:

Sample Number
All samples must be assigned a sample number. This number will follow the sample through all the analyses to the final report. It should be used to identify the sample on the container, the chain-of-custody form, in all data sheets, in computer entry, and reports. In our lab for example, if we were to sample an industrial user named Bay Coast Services, on February 28, 2003, we would assign the composite sample an identification number of BCCO22803. The first two letters, BC, are an abbreviation of the company’s name. The fourth letter will either be a C (for composite) or a G (for grab). The numbers represent the date the sample was collected. For grab samples we add the time to the end of the sample number. This is how we identify samples. Whatever way you choose to develop samples, it must be consistent.

Sample Tag or Label
Attach to every sample container a tag or label with the following information written in waterproof ink: sample number, location where sample was taken, date and time of collection, what preservation is used, and you initials. Sample containers are often sealed with a tamperproof seal at this point.

Field Notebook
Record in your field notebook all the basic information such as sample number, location, times and dates of sampling, addresses, types of samples taken, volume of composite sample collected, and composite sample temperature. Also record anything about the sample and sampling event that you may need for future reference. These can include calculations, who you spoke to at the company you sampled, what processes they were running at the time of sampling, and anything else that relates to the sampling event. A recent example of where I needed to record information in my notebook happened while I was trying to sample for VOCs at a local industrial user. This company neutralizes their waste stream with carbon dioxide. So trying to take a VOC sample without gas bubbles in the vial was like trying to sample a can of ginger ale. Recording this information like this is not only important to help explain potential erroneous lab results, but to warn future samplers of what to expect at that sample location.

Chain-of-Custody
(or Chain-of-Possession as some other sources suggest). This form is filled out at sample collection and follows the sample through every person involved in the chain of possession until it reaches the laboratory. It includes information such as sample number, location where sample was taken, preservative used in each container, type and size of container for each sample (1 L glass, 500 mL amber glass, 250 mL plastic, 40 mL VOC vials, etc.), dates and times of collection, type of sample (water, soil, wastewater, etc.) and the name of person collecting the sample. Every time the sample changes possession, the person relinquishing the sample and the person receiving it must sign and date/time

Chain of Custody — Continued on Page 7
Standard Operating Procedure for Chlorine Analysis Prior to Dechlor

Many WWTF’s rely on other town staff to perform the routine chlorine residual test when the regular operator is off or on leave. As a stranger to lab work and wastewater, the fill-in staff require clear, simple, precise written instructions with pictures to help them properly perform this analysis. Following is an article written by the operators at the Star Island Company WWTF. It is clearly written with pictures on chlorine analysis with the Hab 850 Colorimeter. Sumar Maji, Star Island Company WWTF Supervisor, did an excellent job writing this article and Joe Watts, Star Island Company WWTF Chief Operator, edited this article.

Safety:
Gloves must be worn prior to the start of the test and worn until the completion of the test. The primary concern is not contamination, but the potentially high level of bleach in the chlorination tank and in the sample. Avoid contact with clothes or skin with the gloved hands and do not bring the non-dechlored effluent in contact with your eyes or in the area of your eyes. Doing so could result in permanent damage to your eyesight.

Equipment Needed for
Chlorine Analysis Prior to Dechlor:

- Colorimeter (preferably the Hab 850 colorimeter – figure 3)
- 1 (one) sample jar
- 2 (two) colorimeter sample cells and caps
- At least 1 (one) pipet, preferably the 2ml sized pipet
- Blue pipet pump
- 1 (one) Total Chlorine Reagent DPD packet
- Wash bottle containing DI water

Standard Operating Procedure for
Chlorine Analysis Prior to Dechlor:

1) The first step is to prepare for the test. Rinse two pre-washed sampling cells thrice with De-ionized, or “DI” water. Place them on the lab counter along with the Hab Colorimeter. Rinse a sampling jar with drinking water (see figure 1). The person taking the sample must put on a pair of gloves, the nitrile gloves are recommended (see figure 3).

2) With the free hand place the sampling jar into the incoming flow from the contact tank. Dump the contents and repeat, saving the contents after the second grab. This rinses the sampling jar and the sample is now ready to be tested.

3) Once the sample is in the lab, place it on the counter next to the sample cells. Place the sample cells in a row so that there is a forward-facing cell and a cell behind it, this will be the “blank”. Analysis must take place in the next fifteen minutes to yield valid test results.

4) Record the sample time on the “Chlorine Analysis Prior to Dechlor” benchsheet.

5) Take one 2 (two) ml pipet out of its sterile package and place it in a pipet pump, the blue pipet pump is recommended.

6) Extract 1 (one) ml of the sample and place it into one of the sample cells.

7) Repeat step 7 so that both sample cells contain 1 (one) ml of sample.

8) Using the wash bottle of DI water, add 9 (nine) ml of DI water to each sample cell. Be sure that the bottom of the meniscus just touches the 10 (ten) ml line at eye level for each sample cell.

9) Add 1 (one) Total Chlorine Reagent DPD packet (see figure 2) to the forward-facing colorimeter cell and cap both cells.

10) Turn on the colorimeter. The program number indicated in the lower left corner of the colorimeter display should be nine. If the colorimeter is not on program nine, press the “program”, the “nine” and the “enter” key (see figure 3).

11) Press the “timer” button (see figure 3) on the colorimeter. Press the “enter” button (see figure 3) and allow the reagent to react for the full three minutes.

12) Gently shake the forward facing cell and clean the outside of both bottles with a Kim wipe.

13) Once the colorimeter’s alarm sounds, place the furthest colorimeter cell into the colorimeter and cover.

14) Press the “zero” button (see figure 3). The display will eventually read “zero”.

15) Replace the blank cell with the forward-facing colorimeter cell.

16) Press the “read” button (see figure 3). Multiply the reading by 10 (ten) and record the analysis time and result on the benchsheet in the appropriate spaces. If the result is equal to or less than desired, then:

   a) if a WTF operator – take action to raise the chlorine percentage in the chlorine tanks

   b) if a member of night crew – notify a WTF operator at the end of the test.
17) Place the Colorimeter back on the shelf. Rinse out the sampling jar with drinking water. Rinse the sample cells with drinking water and finish the rinse with DI water. Place all rinsed glassware and plastic ware on drying rack.

18) Clean counter and discard all trash. Lab should be ready for the next testing.

Figure 1

Figure 2

Town of Jaffrey, NH –
Chief Wastewater Treatment Plant Operator

The Town of Jaffrey, NH is accepting applications for the position of Chief Operator (Wastewater Operator 2) / Foreman. This position performs supervisory, technical and manual work related to the operations and maintenance of the Town’s secondary wastewater treatment plant and collection system. The applicant must possess a NH Grade II Wastewater Treatment Plant Operator’s license and a valid driver’s license with CDL preferred. Overtime and weekend rotation is required. Please forward resume and salary requirements to Jaffrey DPW, 23 Knight Street, Jaffrey, NH 03452. You may also call, e-mail or fax to:

Telephone: (603) 532-6521
Fax: (603) 532-4290
E-mail: curriera@town.jaffrey.nh.us

PUZZLE

The local chemical salesman from Huckster International had a great deal on a dissolved metal salt for phosphorus removal. It’s a chance for the chief operator of the North Dump & Klump Wastewater Treatment Facility to save a tremendous amount of money on 2500 gallons, or a season’s supply, of this chemical.

However, problems started when the metal salt was shipped to the facility. Apparently the salesman, who since skipped town, never mentioned that the chemical comes only in 20-gallon totes. Also, the only pump they have for such small totes gets air-bound after pumping only 16-gallons. But this is okay since that is exactly the amount needed each day to treat phosphorous in the waste stream. At least the tote can be changed at the same time every day. Then after every five days, the remaining solution (4-gallons) in the used totes can be combined to fill one tote giving a day’s worth of treatment. It wasn’t an ideal situation, but it was a workable one.

How many times during the season did the workers at the North Dump & Klump Wastewater Treatment Facility make up 20-gallon totes from the daily remainder of metal salt solution?

Answer: 31 times.

The North Dump & Klump Wastewater Treatment Facility received 125 totes of metal salt. Since an extra tote of chemical can be made at the end of every five days, this gives twenty-five more full totes that can be made for daily use (total make-up batches so far = 25). Then, once the 16-gallons from each of these twenty-five totes are used, five more make-up batches with the remaining 4-gallons left in each tote can be made (total now = 25 + 5 = 30). Once these five totes are used, one additional tote can be made from the unused portions, giving a grand total of 31 (25 + 5 + 1) times the workers had to make up totes. There will be 4-gallons left over that cannot be pumped on the final day.
# COURSE ENROLLMENT FORM

Fall 2003 NHDES Wastewater Operator Training

<table>
<thead>
<tr>
<th>Date</th>
<th>Course Name</th>
<th>Registrant Name(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCTOBER 1</td>
<td>Current Issues Roundtable</td>
<td></td>
</tr>
<tr>
<td>OCTOBER 3</td>
<td>NHWPCA Fall Meeting</td>
<td>Register with NHWPCA</td>
</tr>
<tr>
<td>OCTOBER 8</td>
<td>Laboratory Review (a.m.)</td>
<td></td>
</tr>
<tr>
<td>OCTOBER 8</td>
<td>Voluntary Lab Analyst Exam (p.m.)</td>
<td>Register with NEWEA</td>
</tr>
<tr>
<td>OCTOBER 15</td>
<td>Chlorination/ Dechlorination</td>
<td></td>
</tr>
<tr>
<td>OCTOBER 22</td>
<td>Instrumentation, Controls and SCADA Basics</td>
<td></td>
</tr>
<tr>
<td>OCTOBER 28 – 31</td>
<td>NEIWPC Basic Wastewater Treatment</td>
<td>Register with NEIWPC</td>
</tr>
<tr>
<td>NOVEMBER 5</td>
<td>Clarifier Performance and Flow Measurement</td>
<td>Register with NHWPCA</td>
</tr>
<tr>
<td>NOVEMBER 12</td>
<td>Sludge Dewatering</td>
<td></td>
</tr>
<tr>
<td>NOVEMBER 18</td>
<td>Wastewater Lagoon Operations</td>
<td></td>
</tr>
<tr>
<td>NOVEMBER 20</td>
<td>Basics of Nutrient Removal</td>
<td></td>
</tr>
<tr>
<td>DECEMBER 2</td>
<td>Applied Wastewater Math Review</td>
<td>Register with NHWPCA</td>
</tr>
<tr>
<td>DECEMBER 4</td>
<td>NHWPCA Winter Meeting</td>
<td></td>
</tr>
<tr>
<td>DECEMBER 10</td>
<td>CERTIFICATION EXAMS—ALL GRADES</td>
<td>Separate Registration Required</td>
</tr>
</tbody>
</table>

**NOTE:** See course description sheet for cost of each class. NO CASH ACCEPTED!

**Make checks payable to:** TREASURER-STATE OF NEW HAMPSHIRE

Send enrollment form w/payment to: State of New Hampshire DES – Water Division
ATTN: Wastewater Operations Section
PO Box 95
29 Hazen Drive, Concord, NH 03301

Facility Name: __________________________ Facility Supt: __________________________
Facility Phone: __________________________ Date: __________________________
Facility Fax: __________________________ Type of Payment: __________________________
the Chain of Custody form. For example, the sampler may relinquish the sample to a courier. At the transfer, both parties sign and date/time the form. Then the courier delivers the sample to the laboratory where now the courier and lab representative sign and date/time the form.

Log-in at Laboratory

All samples should be logged in at the laboratory where the integrity of the samples are checked (correct preservation was used, tamperproof seals are intact, the proper signatures are present, the holding times fall within the requirements, and so on). If you deliver to a contract lab, they may assign their own ID number at this point.

Chain-of-custody procedures seem like a lot of work. But considering the amount of time spent calibrating and cleaning equipment, the labor of placing samplers in manholes or at industrial users, and the time spent doing lab work or the cost of sending it out to a contract lab, then the little bit of extra paperwork to make this a "legal" sample is well worth the time.

The information in this article is very general. As usual, check your federal, state, and local regulations. You may have additional regulations or requirements that you must meet.

If you have any questions, suggestions, or comments, please contact NEWEA Lab Practices Committee Chair Phyllis Arnold Rand at (207) 782-0917 (prand@lawpca.org) or Tim Loftus at (508) 949-3865 (timloftus@msn.com).
Look at This – Sludge Dewatering Bags
Newport, NH WWTF

The bags used here by Arnold Greenleaf at Newport happened to be a standard size, 12' in diameter and 100' long. Newport also was fortunate in having 2 unused concrete tanks that are just the right size, so by removing one end, doing a little grading and installing a liner they were able to use the tanks as containments. The existing pump and piping system connected to these tanks enabled the return of the filtrate back to headworks. The bags pictured are approximately ½ full.

A 4" perforated PVC pipe was laid the full length of the bag to help in dewatering. (Pictures taken by Larry Anderson, Milford WWTF)