

**CWMN**  
***The Citizen Water Monitoring Network***  
***Restoring a Swimmable Neponset River***

***Optical Brightener Sampling Manual***  
***1<sup>st</sup> Edition, January 2007***

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## Introduction

Optical Brighteners are fluorescent white dyes that are added to almost all laundry soaps and detergents because clothing made from cotton fabrics naturally looks yellowish and drab. This occurs because cotton absorbs blue rays that are present in sunlight. When Optical Brightener is applied to cotton fabrics, they will absorb ultraviolet rays in sunlight and release them as blue rays. These blue rays will then interact with the yellowish color and give the garment the appearance of being "whiter than white". Because the main commercial use of these dyes is in laundry detergents and textile finishing, Optical Brightener dyes are generally found in domestic waste waters that have a component of laundry effluent (Sargent and Castonguay 1998). Optical Brighteners can therefore enter the subsurface environment or rivers and streams as a result of ineffective sewage conveyance or treatment (Fay, Spong, and Alexander, 1995).

Optical Brighteners are removed from underground waters by adsorption onto soil and organic materials, they are removed from surface waters by adsorption and by photo decay. Since adsorption is a critically important process in the performance of septic field systems, the recovery of Optical Brighteners in nearby waters (either surface or ground water) indicates ineffective natural cleansing of waste waters (Aley, 1991).

Fluorescent dyes (such as Optical Brightener) have been used extensively for tracing surface water and groundwater because of their low detection limits, ease and economy of detection, availability and safety. Fluorescent dyes have successfully been used for delineating otherwise unpredictable groundwater movement (Quinlan, 1981). Fluorescent dyes have also been used as adsorbing tracers in order to predict the possible breakthrough of pesticides in agricultural settings (Everts and Kanwar, 1994).

Because Optical Brighteners are fluorescent white dyes that absorb ultraviolet "U.V." light and fluoresce in the blue region of the visible spectrum, they can therefore be detected by use of a long wave fluorescent "U. V." or a "black" light.

Two Massachusetts groups, the Ipswich Coastal Pollution Control Committee and the Gloucester Shellfish Department / Shellfish Advisory Commission, have found that Optical Brightener testing when

done in combination with a larger sampling program is a reliable indicator in helping to identify: faulty septic systems, sewage exfiltration, storm drain cross-connections, and human/animal waste differentiation.

\*This section has been taken from Sargent and Castonguay 1998

## **Optical Brightener Equipment**

The following is a list of equipment necessary for Optical Brightener sampling:

- Untreated cotton pads
- Vinyl coated 0.5 in. wire cages
- Black plastic netting
- Fishing line (20lb. test)
- Aluminum spikes
- Elastic bands
- Staples
- Labels
- Plastic bags
- Disposable latex gloves
- Long wave UV lamp and viewing box
- Data sheet
- Sharpie marker
- Clipboard
- Procedure checklist

Equipment specific to certain sampling conditions will be determined on a per event basis by NepRWA staff. Sampling equipment to be used by volunteers will be picked up at the NepRWA office prior to sampling events, and returned upon retrieval from sampling locations.

## **SAFETY PROCEDURES**

NepRWA volunteer and staff safety is the CWMN program's top priority. The following safety procedures have been developed to ensure the safety of everyone who participates in the CWMN program. However, common sense is the most important safety tool: under no circumstances should anyone put themselves in harm's way, to complete the sampling.

Reporting an Emergency

In case of an emergency while monitoring, volunteers should call 911 from any location. All towns in the watershed have “enhanced 911” service. Only after calling 911 should they call the NepRWA office at 781-575-0354.

### ***Non-Emergency Problems***

Non-emergency problems should be reported to NepRWA at 781-575-0354.

### ***Automobiles and Roadways***

Many sites are located on busy roadways, which are not commonly used by pedestrians. Your presence may be a surprise to motorists. Please observe the following precautions:

- Wear high-visibility clothing.
- Warn approaching traffic of your presence by parking your car nearby on the same side of the street.
- Use extreme caution when crossing the street.

### ***Bridges***

Most CWMN sites are located at bridges. Always use extreme caution at the edge of a bridge.

- Test railings before leaning against them.
- Never climb or sit on railings.

### ***Wading***

Wading is necessary at a few CWMN sites. If a site calls for wading, consult with a NepRWA staff member to see if it might be possible to sample using a pole instead and use the following precautions:

- Do not wade alone!
- Only wade when the water is less than knee-deep and not fast moving.
- Waders and life jackets are required for wading.

### ***Weather Conditions***

The CWMN program requires that volunteers be outside during cold and/or rainy conditions. Monitors should expect to be at their site for up to 45 minutes and should dress appropriately. If there is lightning in the area, stay out of contact with the water, avoid contact with metal on bridges and stay away from all tall trees.

## ***Pollution Hazards***

While most of the Neponset River and its tributaries are now swimmable during dry weather, some CWMN sampling locations are known to be seriously polluted.

- Volunteers should presume that most CWMN sampling locations are significantly polluted during heavy rain.
- Be aware of the degree of probable pollution associated with your site.
- Wear the disposable latex gloves in your sampling kit (they help protect you and the sample!)
- Avoid putting hands or wet clothing in your mouth.
- Never hold pens, pencils or other sampling equipment in your mouth (even though it would be helpful to have a third hand!)
- Carry disinfectant self-drying hand-washing soap available at pharmacies.
- Avoid eating until after you have washed your hands.

## **Sampling Procedures**

This section outlines preparation and procedures in detail. Once familiar with these procedural details the Optical Brightener Sampling Checklist may be referred to as a reminder.

### **Choosing the proper sampling container**

Because sampling locations and conditions are likely to be different every time out, it is important to choose a proper container for sampling. The cotton pads used in this type of sampling are so light weight that a secondary container is needed to ensure that the sample pad remains in the same location in the stream, outfall, or catch basin being sampled. When choosing a sampling device it is important to take into account the access to the water body as well as water velocity when choosing a delivery device.

For most waters (streams, ponds, outfalls, etc.) the cage delivery system should be adequate to ensure that the sampling pad remains submerged in the water throughout the duration of the sampling period. In instances where a sample must be lowered into a catch basin or lowered into a stream from a bridge, a mesh bag might be a more appropriate delivery system.

Since there is no hard and fast rule regarding appropriate delivery system selection, the sampler should always evaluate each sampling location prior to initiating sampling. In some instances a novel delivery system may need to be "invented" in order to submerge the sampling device sufficiently.

### **Sampler Rigging**

Each delivery system for Optical Brightener sampling has specific rigging instructions prior to deployment. Rubber or latex gloves should be worn while deploying optical brightener sampling devices and contact with clothing should be avoided. Samplers should be deployed in a dark area if at all possible.

#### ***Cage Delivery System***

For cage delivery, the sampling pad should be placed inside the sampler completely flat in order to expose the maximum surface area

of the cotton pad to the water. The open end of the cage should then be closed with an elastic band to keep the pad firmly in place.

Once the pad is in place the cage should then be placed in the area to be sampled and anchored in some manor. Anchoring can be done with the use monofilament fishing line tied to a tree branch, rock, or aluminum spike.

### ***Bag Delivery System***

For sampling catch basins a bag delivery system made from plastic netting is most often the appropriate choice. Rocks should be placed in the net bag and the cotton pad stapled to the side of the netting. Then the bag is cinched at the top. Fishing line is then attached to the bag and wrapped several times and lowered into the catch basin. The bag should be lowered in a manner that submerges the entire bag if possible, and at the very least the cotton sampling pad. Once lowered to the appropriate depth the other end of the line should be tied securely to a craft (popsicle) stick and wedged into the side of the grate cover.

### **Retrieval**

Cotton pads should be left in place for up to one week period and retrieved thereafter. When retrieving samples it is important to wear disposable rubber or latex gloves as sampling locations may also have high bacteria levels associated with them, and to avoid contamination of the samples.

First, the cotton pad should be removed from the sampling device and washed in the receiving waters to remove as much sediment as possible from the pad. For samples taken from catch basins where this is not possible the cotton pad should be rinsed with deionized water.

Once the pad has been rinsed, the excess water should be squeezed out prior to labeling and storage.

After these procedures have been completed the pad should have a label stapled to it that denotes the location of sampling, the date the pad was placed and the date the pad was retrieved. The label should be constructed of manila folder or some other stiff paper product that is known not to contain optical brighteners. All materials used for labeling should be verified prior to sampling under UV light to be sure that they do not contain optical brighteners. Once the label has been

affixed to the cotton pad the sample should be placed into a small plastic bag and put in a dark area.

Once the pads have been retrieved, cleaned and labeled they need to be dried out. Pads should be hung to dry on monofilament fishing line as it does not contain optical brighteners. The drying area should be a location where the pads will not come into contact with direct sunlight. After drying, the monofilament drying line should be wiped clean or replaced entirely before more samples are hung.

## **Analysis**

There are three qualitative results in optical brightener testing: Positive, Negative, and Retest.

When pads are finished drying they are individually analyzed for optical brighteners against a control cotton pad that has not been exposed to brighteners.

Each pad, along with a control, is read under long wave Ultra Violet (UV) light in a dark room or in a dark viewing box.

A pad will very definitely glow (fluoresce) if it is positive. If it is negative it will be noticeably drab and similar to the control pad. All other samples are undetermined or retests. As each pad is read it is placed in either the positive, negative, or retest pile.

In some instances only a portion of the pad or simply the outer edge will fluoresce after being exposed to Optical Brightener. This can be caused by many factors but is usually the result of an uneven exposure to the dye in the watercourse due to sedimentation or the way the pad was placed in the water.

In these cases, one can always account for the unevenness by associating the pattern with the sedimentation distribution, folds in the pad, etc. Regardless, as long as a portion of the pad fluoresces and one can explain why the remainder was not, it should be considered positive.

Since paper and cotton dust is so pervasive, it is common to see specks or spots of fluorescence on the sample or control pads. These should be ignored and not used to indicate a positive result.

There is never a borderline positive or a negative call. All borderline situations are categorized as retest.

In the case of borderline results, samplers can be left in the watercourse for a longer period of time and/or placed closer to a suspected source in order to get a more definitive result.

After all the pads have been read, lights are turned back on and the labels read as to the sampling location.

## **Data Interpretation**

Although the data acquired from Optical Brightener sampling is qualitative in nature, there are inferences that can be drawn when this data is combined with other types of water quality testing.

## Optical Brightener Sampling Checklist

1. Choose sampling location
2. Choose sampling device (Cage or Bag)
3. Properly rig cotton pad inside sampling device
4. Place sampler in water to be sampled, being sure to completely immerse the pad
5. Secure sampling device and leave in sampling location for one week
6. Retrieve sampler and sample from stream
7. Rinse sampling pad in water from the sampling location or deionized water
8. Remove as much excess water as possible
9. Create label denoting sampling location, date placed and date retrieved from paper known NOT to contain optical brighteners
10. Staple label to cotton pad and place sample in a plastic bag in a dark place such as a cooler.
11. Dry out sample pads on monofilament line away from direct sunlight
12. Read samples under long wave UV light in a viewing box or in a completely dark room
13. Evaluate results

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