By Lonnie Boller, KRWA Technical Assistant

Conducting a Water Plant Filter Profile (Media Evaluation)

KRWA Tech Lonnie Boller collects water samples while performing a filter profile at a typical surface water treatment plant in Kansas.

Kansas Rural Water Association (KRWA) often receives requests to evaluate the performance of various treatment plant processes, especially with water treatment plants treating surface water. These plants typically consist of several units designed to remove contaminants before supplying the public. One such unit is the use of rapid sand filters designed to remove particles (turbidity) before the water enters the clearwell. These filters must perform properly to ensure compliance with the finished water turbidity standards, thereby providing safe drinking water to the public.

KRWA was recently contacted by a water system that uses surface water as the source to examine the performance of filters in their water plant because of problems they were experiencing, especially during the backwash cycle. Water plant operators noticed that when one of the filters was being backwashed, the turbidity level would increase in the other filter. At times, the combined filter effluent would show an increase in turbidity. After further discussion with plant operators, it was decided that filter number two would be taken offline for evaluation.

The first step in checking the performance of a filter is to drain the filter bed entirely and observe the surface of the media, checking for mounds, dips or other irregularities. While making these observations, it is important to check for mudballs and any coagulant carryover from the settling basins. After draining the filter, inspection of the surface revealed a noticeable amount of mounding near the back of the filter between the troughs. The next step is to take media measurements in a grid pattern across the filter surface. The original filter plans called for 24 inches of sand media; however, about 20 years ago, the filter media was replaced with anthracite and sand. Our measurements indicate the current dual media filters have about 23 to 25 inches of media across the entire filter surface. Without detailed plans, it was assumed that about 12 inches of original sand media was removed and replaced with 12 inches of anthracite. The filter surface was pretty level, with a few mounds near the back. The anthracite media was moderately sticky, indicating possible coagulant carryover.

The next step in the filter evaluation is to dig down through the media to create a depth profile. A normal dual media filter has distinct media zones, with a small transition zone where the sand and anthracite are inter-mixed. I attempted to dig down through the media, but due to some varied issues, we could not drain the filter entirely and without a dry filter bed a depth profile is nearly impossible. Without draining the water out of the filter, the media will fluidize in the water and act like quicksand, sloughing off in the hole. I was able to dig down to the sand and quickly measure about 12 inches of anthracite before the hole filled in again. We observed the water level rising in the excavation, confirming that water was back feeding into the filter. Most water plants in Kansas have a total of 30 inches of media depth when utilizing a dual media filter with at least 18 inches of anthracite coal and 12 inches of fine sand. I assume due to the age of this filter. The design was only 24 inches of media. Too much media will result in loss during the backwash, thereby wasting money.

Because of the leaking valve, filter No. Two will drain overnight while the plant is not operating. Each morning staff must open the influent valve to filter No. Two and fill the filter back up before starting the plant. As the influent water flows over and out of the troughs, hydraulic action pushes the media into a mound. While this is not an ideal situation, we do not believe it causes any turbidity problems

The anthracite media appears to be in good condition. The media in filter No. Two was jagged and sharp, consistent with good media, unlike worn-out media rounded and dull. Many operators believe just because the media's old it should be replaced. There are laboratories that can perform sieve tests and look at the media under a microscope to determine its condition. This particular filter media looks fine based on our observations and the individual filter effluent (IFE) readings during filter runs and the low filtration rates. I would not recommend the replacement of the media in normal instances. Media replacement is a costly project and I would only consider a replacement if laboratory results indicate the need to do so. I would make sure you have all information before deciding on a replacement.

After the attempted excavation, water plant staff backwashed filter No. Two. The backwash process uses system pressure for the filters. During the backwash cycle the operators used a rake to agitate the media. The raking helps to improve and clean the media during the backwash cycle.

Placing a filter back online immediately after backwashing will probably result in a spike in turbidity. This is common at most water plants in Kansas. Some newer plants have filter to waste and by running filtered water to waste for 3 to 5 minutes prior to putting the filter back into service, turbidity spikes can be reduced or eliminated. This particular plant does not have filter to waste so it is recommended to allow the filter to rest after backwashing. This allows the weight of the water to compress the filter media. In fact, at this plant, the backwashed filter can easily rest for 24 hours as other filters can handle the demand.

To summarize my discussion about the need to replace filter media, I performed a filter profile at a wholesale water district last year. They thought that due to the age of the filters, they needed to replace the media. This system had four filters and the expected cost of media replacement was $20,000 per filter. After completing a profile and visiting with the plant operators, they confirmed they were not

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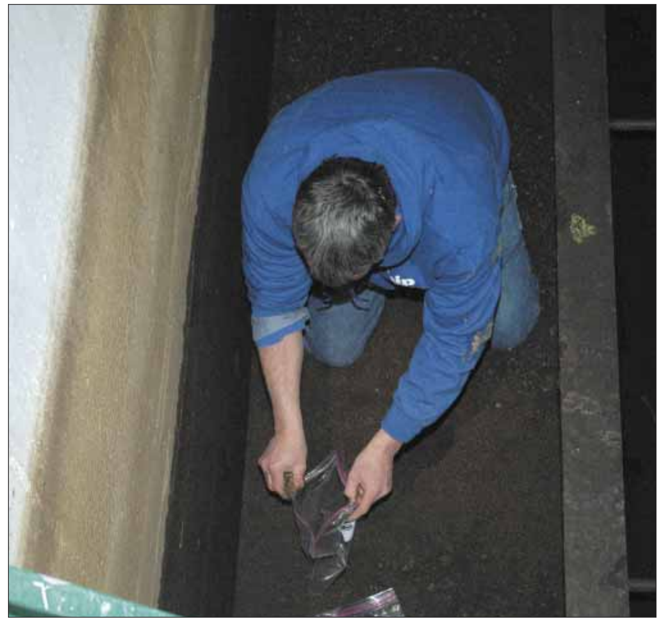

This photo shows KRWA Tech Lonnie Boller collecting a sample of media to be sent to a laboratory for analysis. For the media to be effective, it needs to be jagged and sharp. Laboratories can perform sieve analysis along with viewing with a microscope to determine its condition.

getting high turbidity readings and were not having breakthrough problems. In fact, they could not identify that they were having any problems at all. They just thought that due to the age of the filters, the media should be replaced. As discussed previously, age alone is not necessarily a reason to replace filter media. Before arbitrarily replacing media, I recommend that a filter profile be performed and that media samples be sent off to a laboratory to test its effectiveness. There are several filters in Kansas that are more than twenty years old and are still performing well.

Lonnie Boller is a Technical Assistant at KRWA. He has been employed by KRWA since 2001. Lonnie is a Class II certified operator; he previously was Water Plant Supervisor for the City of Horton. He has also attended and completed training at the University of Kansas Law Enforcement Training Center.