TOWN OF BERNALILLO
CORRECTIVE ACTION PLAN
ARSENIC TREATMENT SYSTEM FOR DRINKING WATER FACILITIES
WELLS 3 & 4

Wilson & Company, Inc.
March 26, 2010

Wilson & Company has recently been retained by the Town of Bernalillo to evaluate the operations of arsenic treatment facilities at the Wells 3 & 4 sites. Previously these facilities were designed by another firm which is no longer employed by the Town. This consultant also provided construction, startup, and operational assistance since the facilities were constructed in 2008. Wilson & Company has been in contact with manufacturers of equipment, the previous consultant, NMED, as well as the present operators of the facilities for the Town of Bernalillo. It is on the basis of these investigations and discussions that our Corrective Action Plan has been developed.

The previous consultant also had issued a proposed Corrective Action Plan almost simultaneous to the termination of their services with the Town. Wilson & Company reviewed this CAP, in general agrees with many of the steps proposed, and has incorporated some of them within this proposed plan.

NMED has recently issued two Notices of Violation to the town of Bernalillo for the treated drinking water. In addition: 1) the arsenic treatment system has experienced difficulties since initial installation in producing consistent water quality below the drinking water standard of 10 ug/L; and2) high levels of aluminum sludge have been recently observed in the finished water. While aluminum is a secondary water quality issue, its presence in high quantities is a concern to the public. This aluminum sludge has been captured on home filtration units, thus has proved the presence of residuals that have discharged into the distribution system.

1. Well 4 - Augment Electro Flocculation with Ferric Chloride Coagulant

Throughout the period that the electro flocculation system has been in operation the drinking water standard of 10 ug/l has not been met on a regular basis. There have been many changes to the operation to optimize the facilities including changing the media of the pressure filters, changing the current to the electro-flocculation units and changing filter run times. Results have been inconsistent. Change to a zeolite media at Well 3 was reported to have breakthrough occurring after about 3 hours. Increasing the amperage from 80 amps to as high as 130 amps has not proven effective in increasing the arsenic removal rate. Increasing frequency of aluminum plate cleaning and replacement has been more effective but not in accordance with previous manufacturer's promises and expectations. Both increased electricity use and increased plate replacement/cleaning have dramatically increased the operation and maintenance of the arsenic removal system beyond that originally expected.

Addition to the treatment process of the coagulant ferric chloride (FeCl) has been suggested to be used as a replacement or perhaps supplemental coagulant. Ferric chloride is: 1) NSF/ANSI

Standard 60 certified for use in potable water; 2) a commonly used coagulant for arsenic removal; and 3) can be added to the existing treatment process with relative ease. The floc-development time for the ferric coagulant is generally 8-30 minutes depending on the water characteristics.

Multiple injection points (see attached schematic) for the usage of ferric chloride at Well 4 have been identified: A) downstream of the filter feed pumps; B) filter feed pump wet well; and C) upstream containment vessels, if made available. Injection of ferric chloride into the existing arsenic treatment system at Well 4 without major equipment modifications, or loss of water production, would limit the detention time to less than one minute. While the flocculation formation time is not considered to be adequate, such chemical feed application can be investigated to quantify improved arsenic removal with and without the electro flocculation treatment process.

The ferric chloride injection rate will be varied in 1.5 mg/L increments (1.5, 3.0, 4.5 mg/l). The electrical amperage of the electro-flocculation units will also be adjusted from 0-130 amps in increments (0, 30, 80, 130 amps) relative to each ferric chloride dosage rate. The injection of ferric chloride will be suspended if the treated effluent is found to have an iron concentration of above 0.2 mg/L. (The secondary standard for iron in drinking water is 0.3 mg/l.) Each daily filter run will maintain a constant ferric dosage and amperage for the electro-flocculation. Thus for a single set of data points, a total of 12 days are required. Once these 12 filter runs are completed, the process will be repeated to verify that the data is repeatable. See the attached data collection sheet for demonstration of collection of the data points.

The relative success of using both aluminum and ferric chloride as simultaneous coagulants for improved arsenic removal is expected given that both are essentially positively charged ions in solution, whereas the arsenical species is typically negatively charged. The New Mexico Environment Department Drinking Water Bureau (DWB) has conditionally agreed that the concept of this pilot study appears valid.

Untreated, filtered, unfiltered and blended water samples of 100 mL will be collected at two hour intervals (see attached spreadsheet) during each filter run at a given ferric chloride dosage rate and/or amperage amount. Concentrations of aluminum, iron and arsenic will be analyzed and recorded. The pH and turbidity of the collected water samples will also be recorded.

Arsenic removal with ferric chloride has been proven to be more effective at reduced pH levels. If improved arsenic removal is not consistently achieved by usage of ferric chloride as described above, pH adjustment could be preformed on the untreated water at Well 4 for enhanced arsenic removal. However, such a test would be conducted only after the series of tests are completed at ambient condition.

2. Change Well 3 Filter Media Back to Sand/Anthracite

The previous investigations by others at Well 3 using zeolite as a filter media for electro-flocculation have reportedly not proven effective on a consistent basis. Depending on the outcome of tests at Well 4, the media at Well 3 could be changed back to the original

sand/anthracite media at Well 3. Use of zeolite as a filter media with ferric chloride is reported to not be a good combination. Thus, this recommended change should be delayed until the tests are completed at Well 4.

3. Remove Backwash Decant Water from Process Stream

Backwash is completed at the end of filter runs and stored in a large backwash tank outside the process building at each well site. Normal operations are to allow the tank to sit idle for at least 5-6 hours. During this time the sludge material settles to the bottom of the backwash tank. There is a standpipe in the tank interior that then can be used to decant by gravity the top portion of the backwash water as decant water. Most treatment systems discharge the decant water to the local sanitary sewer. However both Wells 3 and 4 are in the City of Rio Rancho and do not have an adjacent sanitary sewer into which the decant water can be discharged. Thus, the decant water is re-introduced into the filter feed sump to be re-filtered. From limited profiling completed at Well 4 site, it has been demonstrated that reintroduction of the decanted backwash water is the cause of increased aluminum in the finished water. Thus if use of the electro flocculation process is to be continued the decant water must be removed from the process stream.

Decant water can be discharged to the Bernalillo sanitary sewer system on the east side of NM528 ultimately using a pump and force main arrangement. This can be temporarily simulated by removing the decant water from the tank on a daily basis using septic tank hauler trucks. Cost for such tanker truck activities has been quoted at approximately $900/day and can be accomplished if such work would prove effective. Due to the large cost for such experimentation, we recommend to defer action until such time as the ferric chloride investigations are complete.

As a test alternative to the high cost of permanently removing the decant water from the process stream now, the decant water will be held out of the process stream until the completion of the first 2 hours of filtration. In this way, the first two data points (hours 0 and 2) can demonstrate if the high aluminum concentrations previously noted in the finished water is indeed emanating from the decant water.

4. Install a Cartridge Filter at Well 4 Site

In the past 2-6 months, a Town resident had demonstrated materials that were in the finished water, reportedly aluminum hydroxide sludge that had broken through the filter system at Well 4. This was supposedly reported to the Town as early as last summer or fall. There is a possibility that such residual sludge continues to be in the system, and may be attributed to the decant water previously re-introduced into the distribution system. However, all this is speculation. If true, then there is a significant amount of water that needs to be flushed from the piping and tanks for a full cleanup of the system. Such cleanup may take months, even if started now. Until the arsenic treatment system operation is under better control, such cleanup is not recommended at this time.

As part of the investigations conducted at Well 4, installation and observation of a home cartridge-type filter would assist in determining what materials are being now discharged in

the finished water. If, during the treatment using the electro flocculation, decant water continues to have aluminum hydroxide which breaks through the filter media, such a home filter installed at the well site that is monitored on a regular basis could identify any sludge in the finished water. In addition, use of this side-stream filter, used in a controlled manor could also verify if any other materials are breaking through the media and may assist in refining the operations. Such a unit can be installed directly downstream of the pressure filter.