I. Introduction

For eleven years Rule 17-520.300(6), F.A.C., has specified that..." compliance with ground water standards shall be determined by analyses of unfiltered ground water samples, unless a filtered sample is as or more representative of the particular ground water quality". Since the adoption of this language in 1982 there has been continuous discussion of whether filtered samples would generate more consistent analytical results, and which sample is more representative of the water quality moving within an aquifer.

The Department has pursued unfiltered analyses for protective health reasons, because approximately 20 percent of the State's population drinks untreated, unfiltered ground water and 90 percent of the population relies on ground water for their drinking water. Analyzing unfiltered samples is considered a prudent and protective public policy but it does not exclude reliance on filtered samples if certain site specific conditions exist.

Since 1983 when the original rules became effective, the procedures and equipment for collecting and analyzing ground water samples have been refined tremendously. The current quality assurance program has been implemented to assure that the Department receives quality data which is appropriately collected, handled, and analyzed. Thousands of facilities have implemented ground water monitor plans, and scores of articles have been published which report on investigations concerning colloid size particles moving in ground waters.

The Department recognizes that in some cases filtered samples (for metals) are justified or even preferable, but an assessment procedure has been lacking whereby this determination is consistently applied. These guidelines are intended to provide assistance to Department permitting, cleanup, and enforcement personnel in assessing site-specific data, on a case-by-case basis, to determine the appropriate ground water sample for compliance and assessment determinations.

II. Discussion

The majority of monitor wells constructed in Florida are drilled to assess the ground water quality around potential pollution sources. Since the water table for Class G-II ground water is usually
encountered at shallow depths below land surface, many monitor wells are completed at shallow depths and occasionally within materials of low hydraulic conductivity. It is difficult to properly develop such low yield wells and equally difficult to obtain a water sample that is free of sediment. However, the monitoring well design and construction procedure is intended to produce a well that is properly drilled, screened, and developed. All future activities at this sample site, especially the ground water sampling protocol and subsequent analyses and data reviews, assume the well satisfies these criteria. Thus, it is essential that before ground water monitoring is approved, the responsible party must demonstrate that the subject monitor wells have been properly constructed and developed.

The surficial and intermediate aquifers occasionally contain intervals with a relatively high content of clay material in the unconsolidated geologic formations. When water flows within unconsolidated sediments, the majority of particulates settle out because of the tortuosity of the flow path around the intergranular porosity and gravitational effects. However, substantial research has documented that colloidal size particles can travel notable distances in unconsolidated formations. Many researchers conclude that sediment produced from monitor wells in unconsolidated formations is due to sloughing of particulate material from the borehole under the turbulent flow conditions induced by well development and pumping, and only minimal colloidal matter in ground water samples is from natural ground water flow. Obviously, this problem must be evaluated site by site. But it can be concluded that responsible parties with monitor wells installed into certain surficial and intermediate aquifers should be allowed to demonstrate that filtered ground water samples may be warranted on a case-by-case basis.

Particulate matter is readily transportable in karst environments where cavernous flow systems exist. Its presence in cavernous systems is more likely to represent ground water particulates "in transport". Thus, in these situations unfiltered samples should be considered as more likely to be representative of the ground water quality.

Preservation (e.g. acidification to a pH of <2.0) of a ground water sample containing sediment will result in some dissolution of particulates and an increase in the soluble metals concentration of the sample. On the other hand, the act of sample filtration may also affect the soluble metals content since filtration can aerate the sample causing loss of dissolved carbon dioxide, an increase in solution pH, and some metals precipitation on the filter which will decrease their concentration in solution. The Department must render its judgment on which procedure generates a representative sample for each site while providing public health and environmental
III. Demonstrations

This document will focus its attention to the metals and radionuclides (excluding radon); since these chemical groups are most frequently used to demonstrate that their concentrations are influenced by the method of sample collection.

Criteria: The following criteria must be demonstrated to justify the use of filtered samples for metal and radionuclide compliance monitoring:

Criteria

1. The monitor wells are completed in a surficial or intermediate aquifer, and
2. The request to use filtered samples is restricted to the metals and radionuclides (excluding radon), and
3. The responsible party provides a statement, signed and sealed by the professional geologist or professional engineer who prepared or approved it, documenting that the monitor wells were properly constructed and developed in accordance with standard practices described in EPA Document 600/4-89/034, 1989, Handbook of Suggested Practices for the Design and Installation of Ground Water Monitoring Wells, Sections 4, 5, 6, 7 and Appendix A, or ASTM D 5092-90, Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers, and the applicable water management district's regulations on water well construction, and
4. The ground water samples were collected and analyzed according to a Department approved quality assurance plan and any specific permit requirements, and
5. Good faith efforts have been undertaken to remove contributing factors and minimize any persistent turbidity problems in the monitor well water samples. These can include well redevelopment, sampling using a slow well-purging technique during sample collection, and low impact sampling procedures. To demonstrate that a good faith effort has been taken, a document shall be submitted by the professional geologist or professional engineer documenting the well construction, well development, and the steps taken to reduce the turbidity of the samples from the monitor wells, and providing field turbidity measurements taken during well development and purging. It is anticipated that an attempt will be made to purge and sample the well at a very slow, constant pumping rate of, e.g. <0.2 gallons per minute. The use of bailers to purge wells has been shown to contribute high turbidity to many
monitor well samples and these are not recommended for this purpose. Any pertinent
observations which the responsible party desires to discuss should be included, and

6. Submission of analytical results on filtered and unfiltered samples from a
representative number of the monitor wells, including the background well. Turbidity
measurements must be determined within five minutes of sample collection, and the
samples shall be filtered in accordance with this Department technical document.

If the unfiltered ground water sample field turbidity is less than 5 NTU, then either
filtered or unfiltered samples may be used at the site; if the field determined turbidity
of an unfiltered sample exceeds 5 NTU, then the ground water samples should be
field filtered, using the procedure described in (b) below.

The Department will review the submittal documents and any file information, and
consider the metals analyses and turbidity data, site geologic conditions, sampling
procedures and background water quality.

IV Implementation

If positive documentation of the above criteria is provided to the Department, then the
Department will consider samples from the assessed wells when filtered in accordance with this
Department technical document to be as or more representative of the ground water quality,
unless the Department has evidence, or reason to believe, the submittal is deficient in one or
more of the criteria. When a positive demonstration is questioned, the applicant may request
any item in dispute to be resolved by a review between representatives from the quality
assurance section, district staff, headquarters ground water technical support section, and the
chemistry section.

The Department will determine if a submittal is complete within 45 days of receipt of the request,
and will notify the responsible party of the Department action within 45 days after the submittal is
complete. When a permit condition needs to be changed the Department will issue a permit letter
of modification to the permittee. Otherwise, for consistency, permits or consent orders shall
refer to the rule language in Rule 17-520.300(6), F.A.C.

The following implementation conditions apply:

(a) Acceptance of filtered samples shall be limited to metals and radionuclides (excluding
radon) analyses from monitor wells completed within the surficial or intermediate aquifers.

(b) The accepted procedure is that water samples from monitor wells shall be field filtered prior to preservation using high capacity, in-line molded and disposable nominal 1.0 micron filter units, and follow the metals sample collection procedures outlined in the Department of Environmental Regulation Standard Operating Procedures Manual, September 1992 or the Department approved quality assurance plan. Only one filter should be used for each metals sample. The quality assurance plan shall be revised to incorporate this or another procedure approved by the Department.

(c) Once the filtration of ground water samples at a site is permitted, the turbidity of an unfiltered sample (determined in the field) should continue to be reported. All the metals data reports based on filtered samples should state "filtered sample" on the sample reporting form.

(d) To determine whether this provision should continue, the Department may require an unfiltered ground water analysis along with any filtered analysis at permit renewal, or when turbidity measurements exhibit significant variation over previous reported measurements at the wells.

(e) Whenever more than one filter is necessary to provide a ground water sample suitable for a metals analysis, the sample shall be assessed as non-representative of the particular ground water quality. Such wells should be redeveloped, or resampled using a low impact sampling procedure.

(f) When sampling a private water well, a representative water sample shall be obtained by sampling at the water tap without the use of a filter.

(g) If an unfiltered ground water sample exhibits a sheen on the water surface, then filtration is not allowed.
V  Other Analytical Parameters

Base Neutral and Acid Extractable Organics
Since the analytical method for base neutral and acid extractable organic analysis involves solvent extraction of the aqueous phase, any organics absorbed on sediment in the ground water will be co-extracted. This may introduce a bias in the reported organic concentration in water. On the other hand, filtration of the water sample will generate a decrease in the dissolved organic content because of adsorption on the filter matrix. Since there is no simple experimental way to resolve these unknowns, filtration is not recommended.

Volatile Organic Compounds
Volatile organic compounds (VOCs) are low molecular weight species and their soil adsorption coefficients are correspondingly low. For a ground water sample containing sediment under equilibrium conditions, the VOC will remain predominantly in the aqueous phase. Therefore, field filtration of VOC water samples is unnecessary and should be avoided to prevent loss of VOCs from the sample by adsorption and stripping.

Major Cation and Anions
The major cations in ground water are sodium, calcium, magnesium, and potassium and these are normally associated with the major anions chloride, sulfate, carbonate, and bicarbonate. The principal reason for requiring accurate dissolved cation/anion concentrations in ground water is not so much for compliance with ground water standards (only sodium of the above cations has a standard), but in order to carry out cation/anion charge balance calculations. Sediment contributions in ground water from major ions are mainly due to calcium and magnesium carbonates (the corresponding sodium and potassium salts are much too soluble). When acidified, dissolution of these sediment carbonates can render any charge balance calculations meaningless. Hence, it is recommended that ground water samples that are analyzed for major cations and anions be field filtered. This is regardless of whether the formation is consolidated (limestone) or unconsolidated since compliance with ground water standards is not an issue.