OKI GROUNDWATER COMMITTEE  
September 16, 2009 - 10:00 A.M.  
OKI Board Room  
720 East Pete Rose Way (at the corner of Eggleston Avenue)*

AGENDA

1. Welcome/Introductions

2. Announcements

3. OKI Staff Updates

4. Update on Local Groundwater Management Efforts  
   Scott Kirk, Mark Koch, Mike Lippert, Tim McLelland

5. Recent Research and Sampling for the Ground Water Rule  
   Chris Kenah, Ohio EPA

6. Other Business

ADJOURNMENT

** SEE the MAP and DIRECTIONS on the REVERSE HARD COPY  
(or in separate attachment to email)
Outline

- GW Rule Goal and Triggered Sampling
- Consequences of E. Coli in Triggered Raw Water Sample
- GW Rule Source Water Evaluation
  - Assessment Monitoring
  - Hydrogeologic Barrier Evaluation
- Special Studies – Sensitive Aquifers
  - Buried Valley Aquifers
  - Thin Cover Over Bedrock Aquifers
- GW Rule Pilot Study
GW Rule Goal - to identify PWSs at risk of fecal contamination

Identify GWSs At Risk of Fecal Contamination

Source Water (Well) Monitoring

Positive Fecal Results

Corrective Action(s)

Sanitary Surveys

Significant Deficiencies

Protect Public Health

Viruses

Bacteria

Sanitary Surveys
Ground Water Rule Overview

TCR Monitoring

Triggered Source Water Monitoring

State Required Assessment Source Water Monitoring

Sanitary Survey Significant Deficiency

Corrective Actions

4 – Log Treatment

Compliance Monitoring
EC+ in Raw Water Requires Corrective Actions

TSWM Source Sample(s)

TC-
TSWM Sampling Complete

TC+, EC-

EC+
Requires 5 Confirmation Samples within 24 hours
Corrective Action Requirements

PWSs with E. coli contamination or significant deficiencies must:

• Consult with the Ohio EPA to discuss appropriate corrective action - within 30 days.
• Complete corrective actions or be in compliance with a State-approved schedule - within 120 days.
Corrective Action Options

- Correct significant deficiencies;
- Eliminate the source of contamination;
- Provide an alternate source of water; or
- Provide treatment that reliably achieves at least 4-log treatment of viruses.
GW Rule Source Water Evaluation

PWSs that are considered:
• Susceptible to fecal contamination; &/or
• Located in a sensitive aquifer;
may be required to complete additional sampling:
- Assessment Source Water Monitoring
- Hydrogeologic Barrier Data Review
In order to evaluate PWS source water.
GW Rule Pilot Project

Pilot designed to evaluate PWSs with history of recent E. coli detections by completing:
  • Assessment Monitoring, and
  • Hydrogeologic Barrier Review.

Focus of this presentation is to summarize recent special studies to illustrate hydrogeologic settings of PWSs most sensitive to pathogens.
Sensitive Aquifers in Ohio

Buried Valleys

Sand and gravel aquifers are sensitive to nitrate contamination, but natural filtration may remove pathogens. Sensitive setting for GW Rule?

Thin drift over bedrock aquifers

Karst and fractured bedrock are sensitive hydrogeologic settings when unconsolidated cover is thin or not present.
Sensitivity of buried valley aquifer was evaluated in a 2006 special study on:

Infiltration of Wastewater in a Sand and Gravel Aquifer at Catalina MHP in NE Butler County.

Cooperative project with, CO and SWDO (DDAGW & DSW), USGS, and U.S. EPA.
Situation - Discharge to Ground Water

- Partially treated wastewater discharged to unlined lagoons (since late 1960’s)
- Lagoons overlie the Great Miami River Aquifer
- Infiltration is discharged to ground water
- Does ground water quality impact from infiltration pose a public health threat?
Catalina MHP
Contour of Chloride Concentration in Shallow Ground Water
August 2005

Chloride Contours (mg/L)
CI Concentration (mg/L)
Storm Water Lagoon
Wastewater Lagoons

Ohio EPA
Division of Drinking and Ground Waters
Catalina MHP
Location of Borings, Monitoring Wells, and PWS Well

- C1 - Catalina PWS well
- MW - Monitoring wells
- B - Borings
- W1 - Wise Well
- Wastewater Lagoons
- Storm Water Lagoon

Ohio EPA
Division of Drinking and Ground Waters
Longitudinal Cross Section, Chloride (mg/L)
West to East Cross Section, Chloride (mg/L)
Microbiologic Results

• GW samples produced non-detect to low counts of pathogens compared to lagoons
• Most pathogen detections were less than 10 CFU/100 mL
• Elevated microbiological results do not all correlate with core of plume
### Microbiologic Indicators - Total Coliforms
(Colilert Method, colonies/100mL)

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<th>August-05</th>
<th>January-06</th>
<th>April-06</th>
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-- Indicates no sample collected
* Sample 2/3 sediment - results inaccurate
## Microbiologic Indicators - *E-coli*

#/100mL

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-- Indicates no sample collected
----- Sample collected, no results
* Sample 2/3 sediment; results inaccurate
Longitudinal Cross Section, Pathogens

Contours show Chloride concentrations in mg/L

Coliform (*/100mL)

Enterococcus (*/100mL)
Catalina MHP F+ Phage in Boring Samples
August 2005

F+ Phage
Shallow Samples
- 0 pfu/50 ml
- 1 - 2 pfu/50 ml
- 3 - 4 pfu/50 ml
- 5 - 54 pfu/50 ml

Depth of Sample
- 0 Shallow Sample
- 0 Mid Sample
- 0 Deep Sample

Stormwater Lagoon
Wastewater Lagoons

Ohio EPA
Division of Drinking and Ground Waters
Catalina MHP Study Conclusions

- Wastewater plume clearly identified, GW quality impacts do not exceed inorganic MCLs;
  - Nitrate below 10 mg/L (as high as 6.0 but mostly <5.0)
- Non-detect to low counts of pathogen indicators indicates significant filtration, not perfect;
  - Pathogens below 10 cfu/100mL
- Pharmaceutical parameter distribution is consistent with infiltrate mixing with local ground water.
Study Implications for GW Rule

• Document that buried valley aquifers provide significant filtration of pathogens – but not perfect.

• Supports focusing GW Rule implementation on PWSs in fractured bedrock aquifers with thin, overlying glacial drift.
Geologic schematic of buried valley aquifer with potential flood flow pathways.
Thin Drift on Bedrock – Scenic Heights

Sensitivity of thin drift over bedrock aquifer was evaluated in 2006 special study.

Unsafe Water Supply Investigation: Scenic Heights Area, Wooster Township, Wayne County

Cooperative project with, CO and NEDO (DDAGW), USGS, ODH, ODNR, and Wayne County Health Department.
Study Area
Distribution of Potential Sources

- Cannot identify depth to bedrock for individual household sewage treatment systems
Summary of Impacts

- Highest nitrate concentrations and *E. coli* occur in same areas over time
- Overall area with elevated nitrates fluctuates in size over time
- Northern part of area most likely to experience elevated nitrate levels
Chloride

- Impacts are from human activities – deicing, sewage effluent, and softener discharge
- Cannot identify individual households as probable sources
- Cannot differentiate between sources of chloride
Fractures Exhibited in Wells
Correlation Between Nitrate, Dissolved Oxygen, and Bromide

Symbol size varies with bromide concentration
Oxygen & Nitrogen Isotopes

- Mix of effluent with nitrogen in soil water

Diagram showing the relationship between $^{15}N/^{14}N$ (NO$_3$) per mil relative to AIR and $^{18}O/^{16}O$ (NO$_3$) per mil vs mow. The graph includes areas labeled for different sources:
  - Air O$_2$ composition (fertilizer source)
  - NO$_3$ in fertilizer
  - NH$_4^+$ in fertilizer and rain
  - Soil Nitrogen
  - Manure and septic waste
  - Composite sample

The graph also includes a linear trend line connecting various data points.
Scenic Heights Study Conclusions

• Rapid infiltration to ground water is enhanced by fractures in bedrock sandstone.

• The persistence of elevated nitrate (> 3.0 mg/L) and *E. coli* detections in areas where the glacial cover is thin or absent, documents the sensitivity of fractured bedrock where glacial till is thin or absence.

• The distribution of septic systems, bromide/chloride ratios, and the oxygen & nitrogen isotope data all point to a septic systems as the primary source of contamination.
Well Construction Control

![Graphs showing the relationship between well construction and nitrate/chloride concentrations.](image-url)
Study Implications for GW Rule

- Fractured bedrock in areas of thin or absence till is sensitive to pathogen contamination.
- Nitrate, chloride, bromide, and of course E.coli are indicators of rapid recharge to ground water.
- Results support considering PWS wells in fractured bedrock aquifers with thin or absence cover as likely to be more sensitive to pathogen contamination than PWS wells in sand and gravel aquifers.
Geologic schematic of thin till over fractured bedrock and flow pathways.
GW Rule Pilot Project

Pilot selected 20 PWSs with recent E. coli detections to complete:

• Assessment Monitoring
  • 12 months pathogen sampling
  • Quarterly inorganic sampling
• Hydrogeologic Barrier Review
  • Data review to evaluate the presence of hydrogeologic barriers for pathogens
GW Rule Pilot - Parameters

Monthly Sampling - Pathogens
• Quantitray analysis for total coliform, E. coli, and Enterococci (MPN - most probable number)

Quarterly Sampling – Inorganics
• Nitrate/TKN/Ammonia (nutrients and oxidation)
• TOC (organic carbon)
• FE, Mn, As (oxidation proxy)
• Cl, Br, and TDS (septic waste input)
• Phosphate (nutrients)
The goal is to correlate E. coli concentrations with sensitive hydrogeologic setting and to identify parameters that help recognize hydrogeologic settings characterized by rapid recharge:

- Oxidized vs. Reduced geochemistry;
- Length of saturated casing needed to isolate production from top of water table with water quality impacts;
- Parameters that help distinguish well construction pathways from geologic vulnerability;
- etc.
• To date: 2-3 rounds of monthly samples collected;

• Few detections of E. coli;

• Too early to say anything significant about results.
Special Study Presentations
Final Reports

Catalina MHP

Scenic Heights Subdivision
http://www.epa.state.oh.us/portals/28/documents/gwqcp/scenic_hts.pdf
OKI GROUNDWATER COMMITTEE MEETING SUMMARY
Wednesday, September 16, 2009
OKI Board Room – 10:00 a.m.

Attendees:
Jack Thornsberry, Vice Chair, Butler County Water & Sewer Department
Lowell Allen, Brown County Rural Water Association
Milovan Beljin, M.S. Beljin & Associates
Scott Belcher, City of Middletown
Frank Bell, Village of Indian Hill
Ken Broberg, S.M. Stoller
John Bui, City of Hamilton
Kyle Cribbet, Village of Williamsburg
Dan Cutshaw, GRW Engineers
Frank Divo, Southwestern Ohio Water Company
Mike Ekberg, Miami Conservancy District
Donna Francy, U.S. Geological Survey
Bill Gollnitz, Earthworks
Doug Hunter, Leggett Brashears, Inc.
Cindy Klopfenstein, City of Loveland
Jim Lauver, retired
Mike Lippert, City of Wyoming
Norma Pennock, Southwest Regional Water District
Greg Petredis, City of Hamilton
Bruce Pletsch, Miami Conservancy District
Dan Sarbach, BCRWA
Adam Sackenheim, Butler County Recycling & Butler County Water and Sewer District
Dean Walden, Village of Lockland
David Weihrauch, City of Oxford
Robert Wildey, Clermont General Health District

OKI Staff
Jane Wittke, Gayle Foster, Bruce Koehler, Emi Randall, Robert Lakeburg

Welcome/Introductions
Jack Thornsberry called the meeting to order and welcomed everyone. He explained that Bruce Whittleberry had been called into a meeting with U.S. EPA on source water and had to send his regrets. Those attending introduced themselves and Jack announced that the two possible dates for the next meeting are December 2 or December 16.

Jane Wittke announced that contact hour certificates from the previous meetings are available on the table in the vestibule. She encouraged everyone to pick up their certificates from the previous meeting to avoid the need to mail them. The previous December certificates were corrected to read “2008” rather than “2009.”
OKI Staff Updates

Jane Wittke announced that for the first time ever a line item for regional water quality planning was included in the Ohio Governor’s budget. Both the House of Representatives and the Senate saw the need for the item as they have in the past, but the Senate disagreed with the funding mechanism chosen by the Governor, and removed the proposed tipping fee increase. This funding mechanism was subsequently re-instated by the Conference Committee and the completed budget was signed by the Governor. The state budget for SFY2010-2011 will provide $75,000 to each of the six regional water quality planning agencies in the state for each of the next two years, for a total of $900,000 in the biennium. Jane thanked the committee for their support and efforts to encourage water quality planning, and noted that Ohio EPA Director Korleski had supported the areawides’ request for this biennium as he had previously promised.

Jane also announced that the availability of these state funds, coupled with federal stimulus planning funds, will make it possible to conduct a major update of the Water Quality Management (WQM) Plan for OKI’s Ohio counties. A major update is needed because the original plan was completed in 1977, and funding subsequently available has never been sufficient to bring the plan completely up to date. As the 1977 WQM Plan was prepared under the auspices of the Clean Water Act, and the Safe Drinking Water Act did not yet exist, updates to the plan can now reflect work in source water protection.

Bruce Koehler described how OKI will pursue identifying existing service areas for water and wastewater and distinguishing them from areas where service is planned for the future. Areas that are already served will be shown on one map and areas where service is planned will appear on another map. Bruce stated that the update effort will also look at zoning authorities for the service areas.

Local Groundwater Management Updates

Donna Francy from the U.S. Geological Survey updated the committee on USGS efforts in Southwest Ohio for groundwater quality sampling. Most of the work done in southwest Ohio is a part of the National Water Quality Assessment (NAWQA) program. Three well sampling networks were set up in 1990 and 1991 which included 30 agricultural monitoring wells and 25 residential wells. Wells were monitored for major pesticides and volatile organic compounds. Although these wells were associated with an older study, the USGS continues to sample five wells from each of the three networks. Sampling will take place this year and in 2012 with an extended sampling of organic compounds.

The NAWQA program is conducting a study of 30 public supply wells, 15 of which are classified as “groundwater under the influence of surface water” and 15 of which are not. Another USGS study in 2002 monitored wastewater compounds such as fragrances, detergents, and pharmaceuticals. Donna mentioned that none of the previously mentioned studies included pathogens. A study done from 1991-2001 in Southeast Michigan included monitoring of small community and non-community public supply wells for viruses, E. coli, and total coliform. Reports are available on request.
**Mike Lippert from the City of Wyoming** reported that their plant serves approximately 3,300 residential customers in Wyoming and a small area of Springfield Township. The plant, which uses lime softening, has a capacity of about three million gallons per day (MGD), but typically pumps just under one MGD from a wellfield with six constant speed wells. He also observed that 2009 water usage of the system is down about 8-9% from 2008 levels. He reported that Wyoming is implementing their 2007 master plan, and has been concentrating on updating their well controls and installing radio telemetry at all remote sites. Their 60-year-old water tower was painted in 2008. The City has done some substantial replacement of problem distribution lines as part of roadway reconstruction projects in 2008 and 2009.

Two big projects are planned in the next few years that will include installing 2,600 linear feet of eight inch water main on Congress Run, and replacing 3500 linear feet of 4” water main on Mount Pleasant. The City plans to clean one well next year, and has received three applications to install geothermal wells in residences so far in 2009.

**Norma Pennock** provided an update for the Hamilton to New Baltimore Ground Water Consortium. The redelineation of the Consortium’s time of travel zones has been completed and the report is forthcoming shortly. The web site has been redesigned and now includes a video feature; its address is [www.qwconsortium.org](http://www.qwconsortium.org).

The Consortium was alerted to illegal dumping of construction and demolition debris in Indian Creek along State Route 27 between Millville and Ross. The Consortium investigated the dumping and identified a local contractor as the responsible party. The contractor claimed he had a permit, which was found to be untrue. The contractor is currently removing the debris.

The Great Miami River Days event in Hamilton, Ohio this year attracted a crowd estimated at 40,000 over the two day period. The Butler County Water Festival is scheduled for October 16 and will involve 1,000 students. Volunteers are needed.

**Recent Research/Evaluation and Sampling for the Ground Water Rule**

**Chris Kenah of Ohio EPA’s Division of Drinking and Ground Waters** summarized how the state is considering implementing the sampling provisions of the federal Ground Water Rule. Chris provided an overview of the Ground Water Rule and noted that positive total coliform samples will lead to triggered source water monitoring. Triggered source water monitoring that identifies E. coli in source water requires corrective actions. Then Chris described the proposed approach for source water evaluation associated with the Ground Water Rule. Two special studies were used to illustrate sensitive aquifers in Ohio, as public water suppliers located in these sensitive aquifers are most likely to be required to complete additional monitoring called assessment source water monitoring.

Traditional sanitary surveys can also result in identification of significant deficiencies which might allow well water to be contaminated. Any problems identified through triggered or assessment source water monitoring detecting E. coli or through sanitary
surveys will require corrective actions. There are four options for corrective actions: The first is to correct significant deficiencies. The second is to eliminate the source of contamination. The third is to provide an alternate source of water. The last option is to provide treatment that reliably achieves at least 4-log treatment of viruses. There is a deadline imposed on the corrective actions: consult with U.S. EPA within 30 days and correct the significant deficiency or be in compliance with a state approved schedule for correcting the deficiency within 120 days. Chris also noted that the revised Total Coliform Rule will probably downplay the significance of total coliform in public drinking water, and that Ohio will use E. coli as an indicator for the Ground Water Rule.

He then described a pilot project undertaken by Ohio EPA to evaluate public water supplies with a history of recent E. coli detections. It is testing the proposed Ground Water Rule source water evaluation by completing assessment monitoring and a hydrogeologic barrier review of the settings to identify those most sensitive to pathogens. He identified the most sensitive aquifers in Ohio as buried valley aquifers and bedrock aquifers lying below thin glacial drift. Two special studies illustrate why these areas are sensitive to ground water contamination and suggest that thin till over fractured bedrock is more vulnerable to pathogen transport than the sand and gravel aquifers.

The sensitivity of the buried valley setting was evaluated at the Catalina Mobile Home Park, where wastewater is run through an aerator prior to discharging into surface lagoons. Because of infiltration, this is a discharge to groundwater, and the purpose of the study was to evaluate the impact and to determine if it is a public health threat. Chris explained that while the wastewater plume was clearly identified in shallow groundwater, pathogen concentrations were not strongly correlated with the chloride concentrations used to identify the plume, but pharmaceutical parameters showed a good correlation with the plume. It appears that the infiltration process provided some effective natural filtration for bacteria but not dissolved constituents. These results imply that buried valley aquifers provide some significant natural filtration to remove pathogens from recharge in sand and gravel aquifers if flow paths are not short-circuited.

The sensitivity of the thin glacial drift over a bedrock aquifer setting was evaluated in Wayne County at Scenic Heights in an unsafe water investigation in 2006. The study found that rapid infiltration to ground water is enhanced by fractures in bedrock sandstone. The persistence of elevated nitrate (> 3.0 mg/L) and E. coli detections in areas where the glacial cover is thin or absent documents the sensitivity of fractured bedrock. In that investigation, the distribution of septic systems, bromide/chloride ratios, and oxygen and nitrogen isotope data all pointed to septic systems as the primary source of contamination and documented the limited filtration provided by fracture flow. Chris Kenah’s presentation is can be found electronically via this filepath: http://www.scribd.com/doc/22334633/OKI-Groundwater-Rule-Presentation-9-16-09?secret_password=rmt4j6ieu3f68jaacci

Adjournment
Jack Thornberry reminded the group that the next meeting would be either December 2 or 16. He adjourned the September 16th meeting at 11:55 a.m.