OKI GROUNDWATER COMMITTEE
September 19, 2018 - 10:00 AM
OKI Board Room
720 East Pete Rose Way (at the corner of Eggleston Avenue)
Cincinnati, Ohio 45202

AGENDA

1. Welcome/Introductions (3 minutes)

2. Announcements

3. Update on Local Groundwater Management Efforts (30 minutes)
   Chris Brausch, Mike Lippert, Cindy Klopfenstein

4. OKI Staff Update (5 minutes)

5. Innovations in Source Water Protection (30 minutes)
   Michele Simmons, City of Dayton

6. Source Water Monitoring Technologies for Emerging Contaminants (30 minutes)
   Willie Steinecker, Targeted Compound Monitoring

7. Other Business

ADJOURNMENT

Next Meeting Wednesday December 12, 2018
City of Dayton

Population: ~142,000

City of Dayton: ~2,000

Department of Water: ~400

**Water Treatment Plant** (2) – 96 MGD
• Serves over 400,000 (Dayton & Montgomery Co.)

**Wastewater Treatment Plant** – 72 MGD

**Municipal Separate Storm Sewer System (MS4)**
• 563 Outfalls to 4 Major Rivers
What Do We Do in the Water Department?

**Water Supply & Treatment**
- Pump groundwater and treat to drinking water standards
- Store and pump drinking water

**Water Utilities Field Operations**
- Repair pipelines
- Deliver waste water to the treatment plant
- Convey storm water to the river

**Administration**
- Coordinate and oversee the overall administration

**Water Reclamation**
- Treat waste water and discharge to the river

**Engineering**
- Technical and engineering support services for water infrastructure

**Environmental Management**
- Environmental compliance
- Source water protection & storm water management
Dayton’s Source Water Protection Program

• Since 1985, the City of Dayton has proactively protected the region’s sole source aquifer system through the Source Water Protection Program.

• The program identifies and mitigates risk to the drinking water through various safeguards, including a network of over 400 early warning ground water monitoring wells.

• The City is expanding the network. Installed 134 additional monitoring wells since November 2017. Approximately 16 additional monitoring wells will be installed over the next few years.
Source Water Protection Team

Water Directors Office - Communications Mgmt., and Strategic Planning
Mike Powell, Director, Aaron Zonin, Deputy Director

Water Supply and Treatment – Drinking Water Capacity and Quality
- Keshia Kinney, Manager
- Brandon Turner, Drinking Water Sample Collection, Laboratory Analysis, Data Compilation

Environmental Management – Groundwater Risk Management, Monitoring and Remediation
- Michele Simmons, Manager
- James Shoemaker, Hydrogeologist, Investigation Well Placement and Remediation
- Paul Fleischman, Groundwater Scientist, Well Installation, Sample Collection
- Aaron Colson, Environmental Risk Assessor, Risk Management, Site Assessments
- Darius Hixon, Toxicologist, Conjunctive Delineations (Source ID & Land Use Mapping)
- Gayle Galbraith, Chemist, Business Inspections, Marketing

- Consultant: WOOD
Source Water Protection Area
Dayton’s Source Water Protection Program

- Safeguards public water supply for more than 400,000 residents/businesses
- Multi-Jurisdictional
- Total Maximum Daily Inventory (TMDI) – “Quantity Limit”
- Facility Hazard Potential Rating – “Quality Limit”
- Source Water Protection Site Assessments (SWPSAs) “Considerations for Improvement”
- Source Water Protection Fund – Financial Incentives to businesses who reduce risk (BMPs)
Innovations in Source Water Protection

- Risk Reduction thru Business Incentives
- Groundwater Monitoring Technology
- Education and Outreach
Source Water Protection Site Assessment (SWPSA)

- Identify and address concerns of potential of contaminants entering the aquifer
- Assisting businesses to:
  - Implement and track personnel training programs,
  - Track equipment performances, chemical handling, and business equipment operations,
  - Install engineering controls, BMPs
- Provide realistic recommendations on equipment or methods that allow businesses to meet the Source Water Protection Program requirements through improved processes
- Assist with funding requests as needed to implement recommendations
Potential Sources of Contamination in the SWPA

1) Existing: Plumes and Spills
2) Transportation: Highway & Rail
3) Direct Conduits: Dry Wells, USTs, Septic Systems
4) Subsurface pipelines: Petroleum, Sanitary
5) Superfund Sites, Brownfields, Old Dumps
6) Upstream Surface Water
Ground Water Monitoring Well Network Expansion

Miami Well Field
Collaborations for Innovations in Ground Water

• **MicroGas Chromatography - UTC/TCM** – 10 units, Real-time monitoring of VOCs in groundwater
Remote VOC Monitoring for Ground Water: Purge-and-trap gas chromatograph

- Automated well sampling
  - Low-flow continuous well sampling
- Automated chemical analysis
- Lab quality data (<1 ppb LOD)
- Can target most VOCs
- Wireless communication
- Remote health monitoring, QA/QC
- Rugged/weatherproof
- Temperature resistant
  - Geothermal
- Solar powered (4 day battery backup)
Collaborations for Innovations in Ground Water

• Vacuum Air Lift (VAL) – Searen – Replace energy intensive air strippers which remove Volatile Organic Compounds (VOCs) from groundwater (Left).
Vacuum Air Lift System

1. Initial liquid
2. VAL tower composed of two concentric vertical tubes
3. Vacuum pump which allows liquid to rise in the inner tube
4. Harvest tank, to collect extracted elements
5. Atmospheric air or gas source used to create micro bubbles inside the tower

- Same efficiency as air stripping units
- Reduced energy costs
- Reduced O&M
Education and Outreach

H2knOw: Lunch and Learn Events

• Provide presentations on topics of interest identified by businesses: examples of Best Management Practices and Risk Reduction projects, Emergency Response Preparedness
• Speakers provide testimonials of how they have used Source Water Protection Program incentives
• Hosted 2 events since 2017, 50+ attendees from business and governmental community
• Next event scheduled for October 10, 2018 (11:45 am – 1 pm at the Business Solutions Center, 1435 Cincinnati St. Dayton, OH 45417).

For more information, visit daytonwater.org
The City of Dayton’s Source Water Protection Program is:

• Comprehensive...Protective...Sustainable
• A Strong Model for Source Water Protection
• A Highly Effective Use of Multiple Protective Strategies
  • Management
  • Prevention
  • Reaction
  • Mitigation
  • Involvement
• A Broadened & Enhanced Perspective on Risk Management

Conclusion
Autonomous, Solar-Powered Gas Chromatograph for Remote Monitoring of VOC Plumes in Ground Water

Willie Steinecker
Targeted Compound Monitoring (TCM)
www.tcmglobalinc.com
On-line, Automated VOC monitor

purge and trap gas chromatograph for water analysis

Capabilities
• Rugged/weatherproof
• Temperature resistant
• Battery/solar power options
• Low-flow continuous well sampling
  • Pneumatically driven bladder pump
• Automated chemical analysis
  • Lab quality data (<1 ppb LOD)
  • Can target most VOCs
• Wireless communication
• Remote data availability

www.tcmglobalinc.com
Remote Telemetry
Designed for in-situ transducers

- Autonomous data logging for 3rd party telemetry transducers (water level, etc)
  - Builds on our Remote/Autonomous Electronics Architecture
- Solar powered
- Autonomously drives transducer, records data
- 3G communications
- Daily/hourly updating
- Remote configurable

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Targeted Compound Monitoring
intelligent analytical informatics

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Installation Options

Stick-up Well

Flush-Mount Well

Solar Panel

microGC

Drain/Leach Field

microGC
**Online VOC Monitoring Update**

**Page One: Monitoring locations and Most Recent Results**

<table>
<thead>
<tr>
<th>Well</th>
<th>Date</th>
<th>VC</th>
<th>11DCE</th>
<th>t12DCE</th>
<th>11DCA</th>
<th>c12DCE</th>
<th>?</th>
<th>12DCA</th>
<th>TCE</th>
<th>?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well 1</td>
<td>11/19/2016</td>
<td>0.0</td>
<td>0.0</td>
<td>0.8</td>
<td>0.0</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>6.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Well 2</td>
<td>11/17/2016</td>
<td>0.0</td>
<td>0.0</td>
<td>1.1</td>
<td>0.0</td>
<td>90.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>3.7</td>
</tr>
<tr>
<td>Well 3</td>
<td>11/14/2016</td>
<td>0.0</td>
<td>12.6</td>
<td>0.0</td>
<td>74.9</td>
<td>26.4</td>
<td>0.0</td>
<td>0.0</td>
<td>66.8</td>
<td>0.0</td>
</tr>
<tr>
<td>Well 4</td>
<td>11/24/2016</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- **Well 1:** 11DCE = 0.0, t12DCE = 0.0, 11DCA = 0.8, c12DCE = 0.1, 12DCA = 6.1, TCE = 0.0
- **Well 2:** 11DCE = 0.0, t12DCE = 0.0, 11DCA = 1.1, c12DCE = 90.1, 12DCA = 0.0, TCE = 3.7
- **Well 3:** 11DCE = 0.0, t12DCE = 12.6, 11DCA = 0.0, c12DCE = 74.9, 12DCA = 26.4, TCE = 0.0
- **Well 4:** Data not available

**Legend:**
- K-14
- K-15
- PG3
- 10M

**Graphs:**
- Well 1: Data for 9/7/2016 to 10/1/2016
- Well 2: Data for 9/7/2016 to 10/1/2016
- Well 3: Data for 9/7/2016 to 10/1/2016
- Well 4: Data not available

**Note:**
- This monitoring data is shown with permission from an anonymous customer; however, this fictitious map is only for illustrative purposes.
Geothermal Performance

- Consistently maintains >35° F
  - Tested to -22° F
- Freeze/failure testing
  - No permanent damage
  - Self-starts when thawed
Solar Performance

- 30-60 minutes downtime required between runs for cooling

- Max current draw is 14 amp
  - Average is ~9 amp
- Solar current on cold/cloudy day is 5 amp
- 1 hour GC operation requires at least 1 hour of partial sun to recharge battery
- Multiple GC analyses per day are possible!
Weather Resistance
Winter, Spring, Summer, Fall | -22° F to 103° F

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Maintenance, QC, Calibration

• Majority of Maintenance is performed remotely
  – Many embedded sensors to monitor health/performance
  – Hands-on maintenance scheduled in advance
  – Remotely manage power (for low-solar periods)

• All QA/QC is performed remotely
  – Vitals indicate flow and temperature
  – Chromatographic metrics monitored continuously

• GC calibration required 1-2 times a year
  – Scheduled to coincide with other maintenance
  – Maximum drift is +/- 20% over 6 months
Commercialization – SERVICE MODEL

- Monthly fee, like renting with benefits
  - TCM takes responsibility for accuracy, not you!
  - TCM works with customer to place units in field
  - TCM handles maintenance, calibration, QA, QC
  - Data hosted via TCM website
  - Reduces technical burden on customer, saving resources for data analysis and decision making
  - Far more affordable than purchasing, training, etc.
Command Center

• TCM application specialists handle everything remotely
  – Monitoring state of health
  – Monitoring GC performance metrics
  – Overseeing GC quality control
    • Peak identification and quantification
  – Scheduling maintenance visits
  – Emergency alerting, diagnostics

www.tcmglobalinc.com
Examples...
Field Data – First Nine Days

t1,2-DCE

TCE

c1,2-DCE

Concentration (ppb)

Day

Concentration (ppb)

Day

Concentration (ppb)

Day

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Normalized Concentration Distributions

- t1,2-DCE
- c1,2-DCE
- TCE

Graphs showing concentration distributions over days for tDCE, cDCE, and TCE.
Trends

VOC Concentration (ppb mass) [Full Scale]

Cl
C＝C

Cl
Cl

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Slugs
What’s Next?

Illustration by Chris Gash

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www.tcmglobalinc.com
**Fully Integrated/Autonomous microGC (8”x6”x3.5”)**

![Image of microGC device]

### Power For One Analysis

<table>
<thead>
<tr>
<th>Component</th>
<th>V (V)</th>
<th>A (A)</th>
<th>t (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main</td>
<td>12.0</td>
<td>0.6</td>
<td>continuous</td>
</tr>
<tr>
<td>PI</td>
<td>5.0</td>
<td>0.3</td>
<td>continuous</td>
</tr>
<tr>
<td>PCT</td>
<td>26.0</td>
<td>0.5</td>
<td>30-90</td>
</tr>
<tr>
<td>Column</td>
<td>18.0</td>
<td>0.7</td>
<td>30-600</td>
</tr>
</tbody>
</table>

### Mass Break-Down

<table>
<thead>
<tr>
<th>Component</th>
<th>kg</th>
<th>lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>GC &quot;guts&quot;</td>
<td>1.0</td>
<td>2.3</td>
</tr>
<tr>
<td>Batteries</td>
<td>1.0</td>
<td>2.3</td>
</tr>
<tr>
<td>3D Parts</td>
<td>0.5</td>
<td>1.1</td>
</tr>
<tr>
<td>Full System</td>
<td>2.6</td>
<td>5.7</td>
</tr>
</tbody>
</table>

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- **Triggers:** Wake, analyze, stop via GPIO
- **States:** Ready, waiting, running, etc via GPIO
- **Coms:** TCP/IP over Ethernet or 3G Modem
- ****Needs remote Quality Control for accuracy
- **Data:** <10 MB/analysis

(a) Chromatograms of 6 VOCs (100 ppm each) from the PEMM 4-μCR array (sample volume: 2.5 mL; μcolumn: 30 °C for 35 s, then 40 °C/min to 105 °C; μCR array: 30 °C; compounds: 1, benzene; 2, heptane; 3, toluene; 4, methyl isobutyl ketone; 5, butyl acetate; 6, m-xylene); (b) Normalized response patterns for a subset of compounds derived from peak areas in (a). Acronyms refer to the MPN interface films.

[www.tcmglobalinc.com](http://www.tcmglobalinc.com)
• Remote Ground Water Monitoring for VOCs
  – The Technology is Here
  – Early Warning Monitoring and Plume Management
  – Ground Water Research has Only Just Begun

• Look for new technology from TCM
  – Water level monitoring
  – PFC monitoring
  – And lots more!

www.tcmglobalinc.com
Thanks!

• Questions?

• Please come by the table
Welcome/Introductions:
Groundwater Committee Chair Bruce Whitteberry opened the meeting and requested introductions from all attendees.
Announcements:
A reminder that the remaining meeting date for this year is December 12th.

Ohio EPA representatives acknowledged Cincinnati’s excellence in water planning and urged surrounding cities to review the Cincinnati water plans. Also Dan Cloyd retired and OEPA will be hosting a retirement party for him.

Update on Local Groundwater Management Efforts:
Chris Brausch – Warren County
Warren County currently is in a growth mode due to increased usage and rapid development in the surrounding areas. In 2017, there were 29 new subdivisions created and in the last 3 years the county has experienced a growth rate in customers of 10%. The main project, which will start in 2020, focuses on the expansion of water softening at their treatment plants. They will use membrane softening systems; therefore, reducing the amount of pressure needed to filter the water through the permeable membrane. They hope to have this system up and running by 2021. In addition, they are wrapping up the asset management plan as well as updating the north water treatment plan and source water plan.

Brausch shared an account of a recent incident at a treatment facility to the group. A scheduled bleach truck arrived on site and the operator of the truck began unloading bleach into the fluoride tank which caused an instantaneous gas to occur. Luckily no one was injured. Damages to equipment are still being evaluated and the tank was emptied, cleaned and refilled properly. Brausch’s recommendations to prevent events like this are to make sure there is more signage than seems necessary, always have a treatment facility officer waiting for deliveries and lock the tank nozzles.

Mike Lippert – City of Wyoming
The City of Wyoming currently operates a lime softening plant and serves 9,000 people. They are experiencing decreased usage due to water saving fixtures. With the City being land locked no increase in usage is to be expected from new development. They are also experiencing water age issues in storage tanks and plan to resolve this by turning water over more quickly. A recent project replacing a 100yr old water main was considered a success. They are examining valves in a distribution system for faults and also working on improving their GIS library by using a GPS locator in the field to collect location data for all lines.

Cindy Klopfenstein – City of Loveland
The City of Loveland has not replaced a water main system since 2015 and are currently not working on any major projects. Their funding has been frozen for several years as they are working to retire debt for past upgrades and have seen a reduction in funds available due to revenue decreases as water usage per household has dropped. This year they are applying for a SKIP loan which would potentially be used to update a water main. The received a bond to repaint water towers this year and recommended that towns make sure they have a clear policy about what goes on the water tower. They recently were able to install five new valves at no cost to the city after receiving community development block grant funds.
OKI Staff Update:
Aaryn Gray is leaving OKI for full time employment with Duke Energy. A reminder to register for the October 31st Water Management Association of Ohio (WAMO) conference in Cincinnati if interested.

Presentations: (For more information on each presentation check out the Groundwater Committee website at http://www.oki.org/about-oki/committees/groundwater-committee/)

Michele Simmons, City of Dayton
Dayton: Innovations in Source Water Protection
Michelle Simmons reported on how the City of Dayton has increased mitigation, prevention and management for the source water areas surrounding their wells. The program to identify and mitigate risk to drinking water started in 1985. Since then over 400 early warning ground water monitoring wells have been installed with 134 installed since November 2017 and an additional 16 wells will be installed over the next few years. They have established a 5 year time of travel zone, 1 year time of travel zone, and immediate zone over the well fields to determine where best to install the early warning monitors. On top of the increased use of technology the City of Dayton has been partnering with businesses within the 5 year zone to help them understand that protecting groundwater needs to be a priority. Specifically, the city reaches out to businesses to insure they are using proper water quality techniques based on an inspection. If issues are found the city will offer incentives to help the business make changes. This strategy effectively motivates change within the business community and also helps prevent ground water contamination from that site. Many businesses ask how Dayton determines if there is a risk. The answer, a risk model uses hydrology, distance to well field and other inputs to numerically calculate the potential risk for a site. Another important component is continuing education and outreach within each project.

Willie Steinecker, Targeted Compound Monitoring
Autonomous, Solar-Powered Gas Chromatography for Remote Monitoring of VOC Plumes in Groundwater
Willie talked to the group about his start-up company that uses remote monitoring to sense contaminants in ground water. Specifically he shared how to manage VOC plumes using the technology he and his team developed. His company installs these black boxes with mini-wells for sampling to areas that could have potential risk of contamination. The sensors are calibrated to continually sample and record the water at that location. The data is sent wirelessly to a data station where conditions can be monitored remotely. This method allows VOC’s and other contaminants to be found before it is an extreme threat to well fields and action can be taken to prevent a disaster. What is unique about this monitor is that it is entirely autonomous and solar-powered meaning the maintenance is low and the amount of data collected is high. The units also heat and cool themselves by geothermal. Glitches and malfunctions can be fixed without going to the site. TMC is responsible for everything regarding the unit, maintenance, calibration,
data analysis, accuracy, replacement etc. The customer does not deal with the messy stuff they simply receive a final, polished data set.

**Other Business:**
Bruce Whitteberry asks anyone who has exciting ideas or suggestions for presentation topics for future meetings to contact him.