Former Manufactured Gas Plant (MGP) Sites

Albion & Battle Creek
Michigan

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Overview

• MGP Process
• Albion
• Battle Creek
• Regulatory Challenges
Typical MGP

Small gas works showing principal elements

Note: Purifiers would be under a roof or gantry

Condenser

Ammonia washer

Purifiers

Coke quenching tank

Gas holder

Retort house & stores
MGP Process

Gas Production (Retort) → Tar Removal (Tar Well) → CN/H₂S Removal (Purifier) → Gas Storage (Gas Holder) → gas

Ash, Clinker, Coke → tar → spent oxide → tar
Retort Ovens
Purifier
Prussian Blue Soils
Gas Holder
Other Components

- Coal Storage Area
- Ammonia Scrubbers
- Fill Material
Typical MGP Contaminants

**PAHs**
- Acenaphthene
- Acenaphthylene
- Anthracene
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(g,h,i)perylene
- Benzo(k)fluoranthene
- Chrysene
- Dibenzo(a,h)anthracene
- Dibenzofuran
- Fluoranthene
- Fluorene
- Indeno(1,2,3,cd)pyrene
- Naphthalene
- Phenanthrene
- Pyrene
- 2-Methyl Naphthalene

**Metals**
- Aluminum
- Antimony
- Arsenic
- Barium
- Cadmium
- Chromium
- Copper
- Iron
- Lead
- Manganese
- Mercury
- Nickel
- Selenium
- Silver
- Vanadium
- Zinc

**VOCs**
- Benzene
- Ethyl Benzene
- Toluene
- Total Xylenes

**Inorganics**
- Ammonia
- Cyanide
- Nitrate
- Sulfate
- Sulfide
- Thiocyanates

**Phenolic Compounds**
- Phenols
- 2-Methylphenol
- 4-Methylphenol
- 2,4-Methylphenol
Project History

- 1970s – Decommissioning
- Early 1990s – USTs removed
- Late 1990s – Part 213 releases closed/addressed under Part 201
- 2005/2006 – Investigation activities
- 2007 – Investigation report submitted
Partnership

- June 2007 – initial meeting
- Common goal
- Open sharing
- Consensus building
- Strategy development
Partnership

• “Multiple bites at the apple”
• DEQ approval along the way
• Status meetings
Albion MGP Site
Hydrogeology
Western Area Plume Stability Analysis
Western Groundwater – Constituents of Concern

• BTEX (total):
  5.0 µg/l (benzene DWC)

• PAHs (total):
  1.6 µg/l (fluoranthene GSI)

• Cyanide:
  5.2 µg/l (GSI)

• Ammonia as nitrogen:
  10,000 µg/l (DWC)
Eastern Groundwater – Constituents of Concern

- Cyanide: 5.2 µg/l GSI
- Sulfate: 250,000 µg/l DWC, no GSI
- Ammonia (unionized): 29 µg/l GSI
- PAH and BTEX not present
Cyanide Iso-Concentrations

2008

2009

2010

2011

2012

Legend:
- Active Monitoring Well (Eastern)
- Active Monitoring Well (Western Plume)
- Geoprobe Boring with MGP Source Material (Eastern Source Area)
- Geoprobe Boring with Non-MGP Source Material
- Modeled Impact Extent (Eastern Source Area MGP)
- Cyanide Iso-Concentration Contour (Concentrations in µg/l)
- Approximate ROW/Property Boundary

Figure 1a

CYANIDE ISO-CONCENTRATIONS
Eastern Area Dissolved-phase Groundwater Impacts
2008 - 2012
SEMCO ENERGY Gas Company
Albion Former MGP Site
Albion GSI Summary

• Stable/decreasing dissolved impacts
• Mixing zone determination
• De minimis finding
• NFA approved August 2015
• No post-closure GW monitoring
Albion Today
Battle Creek MGP Site
Hydrogeology
DNAPL Extent
**DNAPL Stability and State**

- Stable groundwater plume
- 70 to 100 year-old DNAPL
- No ongoing sources
- Driving forces dissipated
- DNAPL not observed in wells
DNAPL Stability and State (continued)

- PTS water drive/centrifuge tests
  - No DNAPL driven off samples in lab tests
  - DNAPL is in residual state (not mobile)
Conservative Mixing Zone Calculations

\[
\begin{align*}
\text{Kalamazoo River} & \quad Q_{\text{mix1}} \\
\text{} & \quad C_{\text{mix1}} \\
\text{} & \quad Q_{\text{upstream}} \\
\text{} & \quad C_{\text{upstream}} \\
\text{} & \quad Q_{\text{groundwater}} \\
\text{} & \quad C_{\text{groundwater}} \\
\end{align*}
\]

\[Eq. 1 \quad \frac{C_{\text{mix1}}}{Q_{\text{mix1}}} = \frac{(Q_{\text{upstream}} \times C_{\text{upstream}}) + (Q_{\text{groundwater}} \times C_{\text{groundwater}})}{(Q_{\text{mix1}})}\]

\[Eq. 2 \quad Q_{\text{groundwater}} = -(k \times i \times A)\]
De Minimis Conclusion

- Conclusion supported by:
  - Site characterization
  - Plume stability
  - DNAPL stability and state
  - Mixing zone calculations
MDEQ Evaluation

• District project manager and GSI TAPS point of contact review

• District peer review and TAPS team review combined
  – Additional information required
  – Date extension granted
MDEQ Evaluation

• Reasonable potential analysis performed by WRD
• Other factors considered:
  – Channelized Kalamazoo River
  – Site characterization
  – Source removal efforts
  – River infrastructure
MDEQ Conclusion

- No reasonable potential to exceed Michigan water quality standards
- MDEQ concurred with de minimis determination
Regulatory Challenges

De minimis determination:

• One of the first requests to DEQ
• De minimis - what does it mean?
• Reasonable potential for adverse impacts
• Water Resources Division discussions
Regulatory Challenges

Part 201 Regulatory Changes & Implementation:

• December 2012
• December 2014
• Communicating changes
• Date of the submittal dictated which statutes applied
• Statutory review times
Regulatory Challenges

Statutory review times:

• District Peer review
• TAPS Teams review
• Toxicology review
• Water Resources Division review
Project History & Partnership

• Mutually agreed to formal request for approval (2008)
• Response Activity Plan (ReAP) Requests
  – Albion: 18 ReAPs submitted
  – Battle Creek: 9 ReAPs
• Informal reviews – non-critical items
Overcoming Challenges:

- 2008 - Meet Annually
- 2010 - Invited Barr/SEMCO to District Peer Reviews
Project History & Partnership

Results:

• April 24, 2015 – Battle Creek Remediation Plan approved
• August 18, 2015 – Albion NFA approved
• 2016 – Anticipate submittal of Battle Creek NFA
Conclusions

Large Complex sites:
- Meet regularly
- “Bites of the apple” approach

Collaborative Approach Builds Trust:
- Issues identified and resolved
- Quick decisions when needed
QUESTIONS?

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