SULFUR and COLLECTION SYSTEMS: A COMMON BUT OVERLOOKED CHALLENGE

Wisconsin Wastewater Operators Association
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OVERVIEW

• BACKGROUND

• CHALLENGES

• STRATEGIC SOLUTIONS
OVERVIEW

• BACKGROUND
  • SULFUR
  • CASE STUDY EXAMPLES

• CHALLENGES
  • SOURCES
  • FACTORS and RELATIONSHIPS
  • BIO / CHEMISTRY
  • EFFECTS

• STRATEGIC SOLUTIONS
  • SOURCE PREVENTION
  • PRETREATMENT
  • MITIGATION
  • REHABILITATION and REPAIR

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BACKGROUND

• **SULFUR**
  - REQUIRED for WASTEWATER PROTEIN SYNTHESIS

• **CASE STUDY EXAMPLES**
  - ADELL
  - CASCADE
  - HEART of the VALLEY METROPOLITAN SEWERAGE DISTRICT
CHALLENGES

- SOURCES
- FACTORS and RELATIONSHIPS
- BIO / CHEMISTRY
- EFFECTS / CONCERNS
CHALLENGES

• SOURCES
  • GROUNDWATER
  • INDUSTRIAL SULFUR BASED ACIDS
  • $\text{SO}_4^{2-}$ SULFATE ION

• FACTORS and RELATIONSHIPS
  • CONCENTRATION
  • DIURNAL FLOWS
  • TURBULENCE $\rightarrow$ $++\text{O}_2$ $\rightarrow$ $\text{H}_2\text{S}$ $\uparrow$
  • pH $\downarrow$ for BACTERIA
CHALLENGES

• Bio / Chemistry

  • $\text{SO}_4^{2-} + \text{ORGANIC MATTER} \rightarrow S^{2-} + \text{H}_2\text{O} + \text{CO}_2$

  ANAEROBIC BIOLOGIC REDUCTION

  • $S^{2-} + 2\text{H}^+ \rightarrow \text{H}_2\text{S}$

  • $\text{H}_2\text{S} + \text{O}_2 \rightarrow \text{H}_2\text{SO}_4$

  AEROBIC BIOLOGIC OXIDATION

  Thiobacillus thiooxidans (concretivorous) - Latin for “concrete-eating”
  common sulfur-oxidizing bacteria
CHALLENGES

• **Effects / Concerns**
  - **H₂S**
    - HAZMAT / SAFETY
    - ODOR fⁿ (H₂S + IRON)
    - GAS is CORROSIVE
    - BURNED GAS CAN DAMAGE EQUIPMENT
    - HEAVIER than AIR GAS
    - RELATIONSHIP to DIURNAL FLOW CYCLE
  - **S²⁻ SULFIDES**
    - > 200 ppm CAN AFFECT DIGESTOR BIOLOGY
CHALLENGES

• EFFECTS / CONCERNS
  • \( \text{H}_2\text{SO}_4 \) \( f^n \) (MICROBially INDUCED CORROSION - MIC)
  • LOW but PERSISTENT CONCENTRATIONS
  • CORRODES METALS, MASONRY, CONCRETE

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CHALLENGES

• EFFECTS / CONCERNS
  • \( \text{H}_2\text{SO}_4 \) and MIC
CHALLENGES

• Effects / Concerns
  • $\text{H}_2\text{SO}_4$ and MIC
STRATEGIC SOLUTIONS

- SOURCE PREVENTION
- PRETREATMENT
- MITIGATION
- REHABILITATION and REPAIR
STRATEGIC SOLUTIONS

- **SOURCE PREVENTION**
  - MONITOR and INVENTORY SOURCES
  - INDUSTRIAL USE of SULFUR ACIDS

- **PRETREATMENT**
  - SOURCE REDUCTION
  - POTABLE WATER SYSTEMS
STRATEGIC SOLUTIONS

• Mitigation
  • Venting (Remove “food” source)
  • Odor / Removal
    • Primarily H₂S, Reduced Sulfur and Nitrogen Based

• Typically Not Conventional Carbon Based Filters
STRATEGIC SOLUTIONS

- MITIGATION
  - VENTING and ODOR CONTROL
STRATEGIC SOLUTIONS

- **Mitigation**
  - NEW CONSTRUCTION
    - CRYSTALINE TECHNOLOGIES
      - e.g. CONSHIELD, XYPEX
    - COATING SYSTEMS
      - EPOXIES
    - CALCIUM ALUMINATE CEMENTS
      - e.g. APS PERMAFORM, RAVEN
  - AVOID TURBULENT FLOW / DROPS / TRANSITIONS
STRATEGIC SOLUTIONS

- **REHABILITATION, REPAIR and REPLACEMENT**
  - LINERS - PIPE and STRUCTURES
  - CRYSTALINE TECHNOLOGIES
    - eg. CONSHIELD, XYPEX
  - COATING SYSTEMS
STRATEGIC SOLUTIONS

- REHABILITATION, REPAIR and REPLACEMENT
  - QUALITY CONTROL – STANDARD TESTS
  - CORROSION RESISTANCE
  - ADHESION
  - UNIFORM and COMPLETE COATING

- “TIPS”
  - NOT POLY-UREA / MOISTURE SENSITIVE SYSTEMS

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THANK YOU …