A CASE FOR KEEPING HIGH-RATE AUXILIARY TREATMENT FACILITIES IN THE SECONDARY TREATMENT PICTURE

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USEPA wet-weather treatment policies are a work-in-progress.

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USEPA wet-weather treatment policies are a work-in-progress.

1994 CSO Control Policy
2003 Draft "Blending Policy"
2005 Draft "Peak Flows Policy"
2009 Draft UA Guidance
2010 Listening Sessions

USEPA 1994 Final CSO Control Policy
1994 USEPA wet-weather treatment policies are a work-in-progress.
TECHNICAL CHALLENGES
Wet-weather flows are generally highly variable...

Flow peaking factors much greater than envisioned by conventional WWTP design standards (Ten States, NEIWPCC TR-16, etc.)

- $Q_{PKHR} \approx 5 \text{ to } 10 \times Q_{AA}$
- Similar for both CSS and SSS
Some climates have extended wet seasons, but similar peaks
Don’t forget about pollutant first-flush and dilution dynamics

Wet-weather influent characteristics are much different than conventional standards

- $C \ll C_{AA}$ after first flush
- Similar for both CSS and SSS
Biological treatment processes can handle some wet-weather flows, but have inherent limitations

- Inexact capacity - Different storm-to-storm, antecedent conditions, etc.
- Cold influent (snowmelt) challenges
- More treatment infrastructure won’t necessarily increase amount of biological treatment...biomass has finite capacity...slow kinetics
- Protect your biomass
  - Absolutely critical treatment “equipment”
  - Recovery can take weeks or months
- Biological nutrient removal (BNR) processes are particularly sensitive to wet-weather upsets
TREATMENT STRATEGIES AND TECHNOLOGIES
Historically, the most common strategies have been...

Store for Future Treatment

- Space Intensive
- Odor Issues
- Waste Characteristics Outside of Design Range

Diversions to Receiving Stream

- Combined Sewer Overflow (CSO)
- Sanitary Sewer Overflow (SSO)
- Bypass
Strategies to help activated sludge “weather the storm”

- Deep step-feed or contact stabilization modes (a.k.a. biological contact or biocontact).

Reduce SLR to clarifiers... temporarily
Strategies to help activated sludge “weather the storm” (cont’d)

- Transfer some biomass to offline aerated storage. Return it after storm flows pass.

Offline Aerated Storage at BNR Facility

Reduce SLR to clarifiers... temporarily
Strategies to help activated sludge “weather the storm” (cont’d)

- Turn off aeration (unless ceramic diffusers) and allow biomass to settle
- We’ll talk about high-rate contact stabilization in a little while
- Fixed-film and hybrid technologies (TF, BAF, MBBR, IFAS) offer slightly higher peaking factors
  - But capacity still limited due to bio-film sloughing and kinetics

Reduce SLR to clarifiers... **temporarily**
Peak flow auxiliary treatment has a long track record as an effective wet-weather strategy

- Complement inherent limitations of biological processes
- Auxiliary facilities optimized for wet-weather influent
- Enable POTW to consistently achieve secondary treatment effluent quality
Wet-weather water quality concerns are generally different than during dry-weather conditions

- Oxygen demand not concern vs. dry weather
  - High flows, turbulence, etc. in receiving stream
  - Larger assimilative capacity
- Main wet-weather POCs are generally:
  - **Floatables.** (Trash, plastics, etc.). Aesthetics; ingestion and entanglement by wildlife
  - **Suspended Solids.** Benthic macroinvertebrate habitat. Prevent silt and sediments from burying eggs and larvae.
  - **Biological pathogens** (bacteria, viruses, etc.). Human health concern vs. aquatic toxicity concern
  - Predominantly non-point sources
Some perspectives on auxiliary treatment technologies...

- **Primary Clarification + Disinfection**
  
  - Performance equivalent referenced in USEPA 1994 CSO Control Policy
  
  - Long understood by water quality profession to generally support CWA and codified secondary treatment requirements (40 CFR 133)
A little closer look at auxiliary treatment facilities

- Permitted alternative to bypass per 40 CFR 122.41(m)(4)(i)(B)
- Peak wet-weather flows are amenable to advanced physical or chemical treatment
  - USEPA (2008), Emerging Technologies for Wastewater Treatment and In-Plant Wet Weather Flow Management, EPA 832-R-06-006
  - USEPA (2007), Wastewater Management Fact Sheet, In-Plant Wet Weather Peak Flow Management, EPA 832-F-07-016
  - USEPA (2004), Report to Congress, Impacts and Control of CSOs and SSOs, EPA 833-R-04-001
Many of today’s advanced physical or chemical technologies weren’t feasible when “bypass” and “blending” were defined.
Chemically enhanced sedimentation continues to prove its effectiveness

1500 BC – Alum coagulation by Egyptians
1740 AD – Chemical sewage treatment in Paris

- Today – CEPT (Chemically Enhanced Primary Treatment), CEC (Chemically Enhanced Clarification), CAS (Chemically Assisted Settling)...

2007 CEPT Trials at 75th & Nall PEFTF
No Chemicals
After Chemical Dosing
Final Effluent

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Sludge recirculation and ballasted flocculation can further enhance sedimentation performance
Currently operating auxiliary HRC facilities include...

- Salem, Oregon River Road Park Wet Weather Facility
  - 50 MGD Actiflo
  - Satellite PEFTF
  - In-plant Facilities
  - SSO Control

- Lawrence, Kansas WWTP
  - 40 MGD Actiflo
  - 25 MGD Activated Sludge
  - Excess Flow Treatment Facilities
  - In-plant Facilities
  - SSO Control

- Toledo, Ohio Bay View WWTP
  - 232 MGD DensaDeg
  - 17 MG EQ
  - 8 MG EQ
  - In-plant Facilities
  - SSO Control

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Results prove that auxiliary HRT can help POTWs consistently achieve secondary treatment standards.

**BAY VIEW WWTP (TOLEDO, OHIO)**

**WET-WEATHER DISCHARGE MONITORING RESULTS**

- Influent TSS
- Influent CBOD
- Final Effluent TSS
- Final Effluent CBOD
- NPDES 7-Day Average Limit

Notes:
1. Flow-proportional composite samples

**LAWRENCE, KANSAS WWTP**

**MONTHLY AVERAGE RESULTS**

Effluent Concentration (mg/L)

- Effluent TSS
- Effluent BOD
- TSS Removal
- BOD Removal

Parallel excess flow treatment system commissioned in summer 2003.
HRF alternatives offer similar TSS & BOD as HRC, but...no chemicals required

- 2000 BC – Granular filtration in ancient Sanskrit writings
- Today
  - Deep-bed granular media
  - Compressible media
  - Cloth media
Compressible media filtration has made recent advances in wet-weather treatment

85-mgd Schreiber Fuzzy Filter (Atlanta, GA)

10-mgd WWETCO Filter (Columbus, GA)

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Side-by-side pilot testing continues to demonstrate HRT effectiveness
City of Springfield, Ohio is moving forward with 100-mgd CMF facility
HRT research and development continues

- High-rate biocontact...contact stabilization with parallel HRT for solids/liquid separation.

Will biocontact provide meaningful benefit to HRT for added complexity and expense?
HRT research and development continues

- Toledo pathogen study
  - True pathogens and indicator organisms
  - Full-scale parallel AS and DensaDeg HRC
  - Pre- and post- chlor/dechlor
  - Actual wet-weather discharge conditions

- Milwaukee side-by-side trials
  - Full-scale CEPT
  - Pilot-scale Biocontact
  - Pilot-scale CMF

Lack of data on pathogens following treatment during actual wet-weather conditions
REGULATORY POLICY CONSIDERATIONS
A CASE FOR KEEPING HIGH-RATE AUXILIARY TREATMENT FACILITIES IN THE SECONDARY TREATMENT PICTURE

⚠️ CAUTION

USEPA WET-WEATHER EXCESS FLOW TREATMENT POLICIES UNDER CONSTRUCTION.

⚠️ CAUTION

SOME OF THE VIEWS EXPRESSED ON THE NEXT FEW SLIDES MAY NOT ENTIRELY REFLECT CURRENT THINKING OF EVERY REGULATOR.
A wet-weather bypass is not well defined by current CWA regulations

What if it does meet permit limits?

- 40 CFR 122.41(m)(2)
- Essential maintenance of biomass

Source: USEPA, Sanitary Sewer Overflows and Peak Flows Listening Session, June 30, 2010
“Blending” is not the same as “Bypass”

NPDES Permit Limits
• Secondary treatment limits based on weekly and monthly averages.
• Have water quality based limits been adjusted for wet-weather flows?
• Mixing zone?

Source: USEPA, Sanitary Sewer Overflows and Peak Flows Listening Session, June 30, 2010
“Secondary treatment” standards are based on much different raw material than wet-weather flows

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A. Based on monthly average influent and effluent concentrations only. Special considerations for lower requirements with combined sewers and less concentrated influent for separate sewers.

- Assumes steady influent... TSS/BOD = 200/200 mg/L
- Long-term performance across entire POTW...not short-term performance criteria for biological trains...not wet-weather influent conditions
- Narrative allowances in 40 CFR 133 and 122(m) for wet weather
The meaning of “secondary treatment” in recent draft policies may have been misinterpreted...

...but underlying regulations appear to support a more holistic approach.

“Secondary” ≠ “Biological”. Unintended consequence from focusing only on dry weather.
As the clean water industry matures...

- When the secondary treatment regulation was promulgated, the regulatory significance of “primary treatment” changed.

- More emphasis now being placed on water quality-based effluent limits.

- As technologies advance into new applications, new technology-based effluent limits may need to be developed.

...the relevance and meaning of “primary treatment” and “secondary treatment” will continue to evolve.
HRT effluent quality is clearly superior to what was considered for “bypass” and “blending”
Wet-weather HRT is not “bypass” or “blending”

“Auxiliary treatment” - Various technology and design alternatives depending upon effluent quality goals.

Source: USEPA, Sanitary Sewer Overflows and Peak Flows Listening Session, June 30, 2010
Wet-weather HRT needs to remain in our toolbox

- Variety of alternatives needed to provide sustainable solutions to complex problems
- No “one-size-fits-all”

We can’t afford policies that don’t allow technically sound alternatives
For more information...

BLACK & VEATCH
Building a world of difference.

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Thank You!