Citywide Total Residual Chlorine Management Program

Jamaica Bay Advisory Committee Workshop

Overview of NYC WPCP Disinfection Program

November 14, 2006

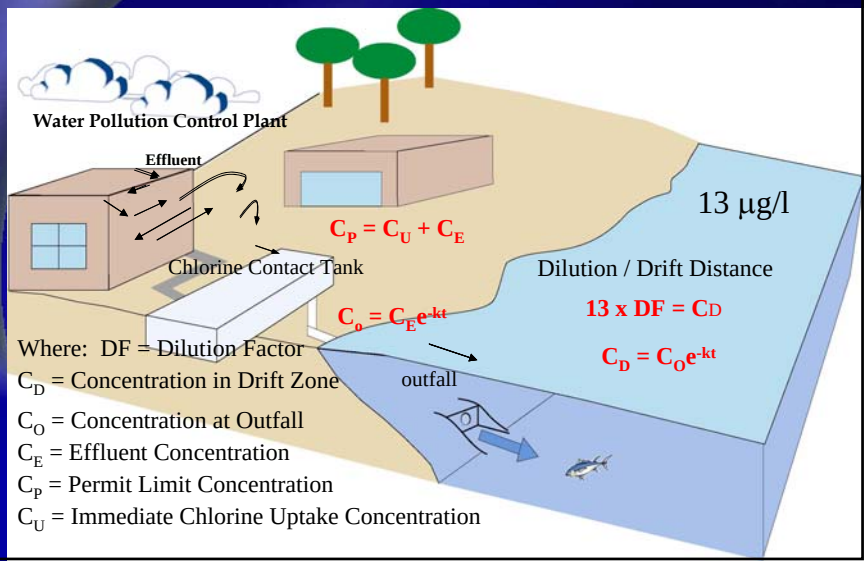
Background of NYC Disinfection Program

- All NYC WPCPs currently chlorinate the wastewater using hypochlorite prior to discharging:
  - Existing SPDES Limit for All NYC WPCPs is 2 mg/L
  - Design Hydraulic Retention Time is 30 minutes for DDWF and 15 minutes during a wet weather event.
- NYSDEC has proposed more stringent TRC limits based on EPA marine chlorine toxicity criteria:
  - Acute TRC < 13 ug/l
  - Chronic TRC < 7.5 ug/l
- NYSDEC has included TRC requirements in the new SPDES permit

SPDES TRC Compliance Schedule for Non-BNR WPCPs

Milestone	Current Date
Submit Scope of Work	10/1/03
Verify TRC Limits	8/1/04
Submit Alternatives Evaluation	10/1/05
Final Limit Verification	4/1/06
Submit Facility Plans	10/1/07
Submit Plans and Specs	10/1/08
Begin Construction	4/1/09

Calculation of New TRC Limits



Where: DF = Dilution Factor

C_D = Concentration in Drift Zone

C_O = Concentration at Outfall

C_E = Effluent Concentration

C_P = Permit Limit Concentration

C_U = Immediate Chlorine Uptake Concentration

New TRC Limits for Jamaica Bay WPCPs

WPCP	New TRC Limits	Average Eff TRC (2005-2006)	% Compliance
	(mg/l)	(mg/l)	
26th Ward	0.45	0.80	0.00
Coney Island	0.64	0.85	0.3
Jamaica	0.53	0.70	0.82
Rockaway	0.59	0.51	83

Treatment Technologies Evaluated

- Existing Chlorination Process Optimization
- Chlorination/Dechlorination
- UV Disinfection
- Chlorine Dioxide
- Brominated Compounds
- Peracetic Acid
- Ozone

Chlorine Dioxide

Benefits

- Very Effective Bactericide and Viricide
- Shorter Contact Time Required than for Sodium Hypochlorite

Drawbacks

- No Large Scale Wastewater Treatment Applications Identified
- On-site Generation Required
- Potential Chlorite Toxicity
- Corrosive
- Potential Odor Concerns

Brominated Compounds

Benefits

- Effective Bactericide and Viricide
- Capital and Operating Costs Similar to Chlorine

Drawbacks

- Same Discharge/Toxicity Constraints as Chlorine
- Not Widely Used in the U.S.
- Requires an Additional Chemical (Sodium Bromide and Sodium Hypochlorite)
- Potential DBP Formation

Peracetic Acid

Benefits

- Similar to Chlorination in Terms of Application and Equipment
- No DBPs
- Long Shelf Life

Drawbacks

- Not Yet Approved by USEPA as a Wastewater Disinfectant
- No Full-Scale U.S. Application
- Significantly Higher Costs ($7-8/gallon)

Ozone

Benefits

- Highly Effective Bactericide and Viricide

Drawbacks

- Not Widely Used in U.S. for Wastewater Disinfection
- Significantly Higher Capital Cost
- Significantly Higher Operational Costs
- More Complicated to Operate than Other Technologies
- Most Effective on Filtered and/or Nitrified Wastewaters

Optimized Chlorination

Benefits

- Familiar Application, Requires Only Minor Modifications to Existing Disinfection Facilities
- Very Low Capital Cost

Drawbacks

- Chlorine Level May Be Difficult to Control with Low Ammonia Effluents
- Potential for DBP Formation with Low Ammonia Effluents
- Increase I&C requirements

Chlorination/Dechlorination

Benefits

- Familiar Application, Similar to Chlorination in Terms of Equipment
- Relatively Minor Modifications to Existing Disinfection Facilities
- Lower Capital Cost

Drawbacks

- Chlorine Level May Be Difficult to Control with Low Ammonia Effluents
- Potential for DBP Formation with Low Ammonia Effluents
- Re-aeration May be Required
- Higher Operational Costs

UV Disinfection

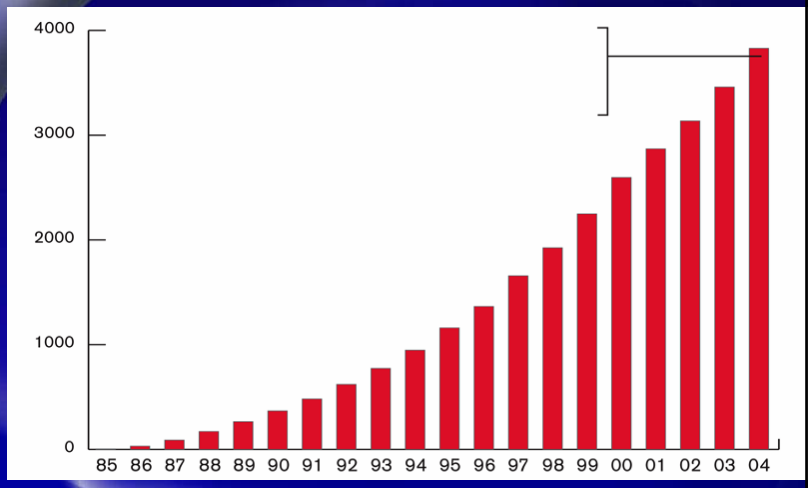
Benefits

- Simple Operation
- No DBP Generation
- Not Affected by Ammonia Level
- Smaller Space Requirements
- Lower Operating Costs
- Proven Technology

Drawbacks

- Greater Power Requirements
- Higher Capital Costs

UV Disinfection – Proven Technology



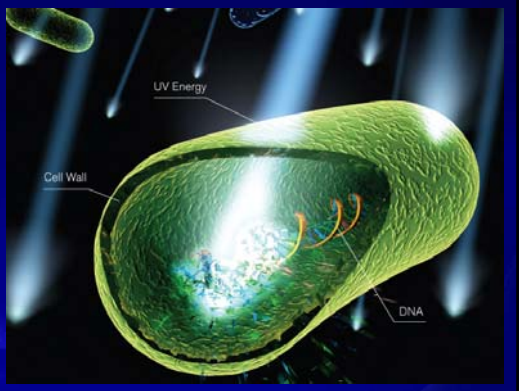
* Over 20% of North American Wastewater Treatment Plants now disinfect with UV light

Bench Scale Testing/Wastewater Characterization

- UVT
  - 26th Ward
  - Coney Island
  - North River
  - Port Richmond
  - Rockaway
  - Tallman Island
  - PO-55 Pilot

UV Basics - How Does UV Work?

- Irradiation of Wastewater with UV Light
- Inactivation vs Kill
  - UV Inactivates
    - Causes damage to DNA preventing replication
    - Organism no longer infective



UV Dose Requirements for Secondary Effluent

WPCP	Disinfection Influent		Required Log Reduction		Required UV Dose (mJ/cm2)	
	Fecal Coliform (cfu/100 ml)	Enterococcus (cfu/100 ml)	Fecal Coliform	Enterococcus	Fecal Coliform	Enterococcus
SECONDARY EFFLUENT - Based on Monthly Limits of			200 cfu/100 ml	35 MPN		
26th Ward	6.03E+05	2.44E+05	3.5	3.8	20	25
Coney Island	2.40E+05	1.01E+05	3.1	3.5	18	40-50
North River	8.65E+05	3.36E+05	3.6	4.0	15	30
Port Richmond	1.08E+06	1.47E+05	3.7	3.6	30	30-40
PO-55	1.56E+05	1.07E+05	2.9	3.5	< 10	30
Tallman Island	7.75E+05	2.84E+05	3.6	3.9	20	45

Bench Scale Testing/Wastewater Characterization

- Chlorination/Dechlorination Dose Response Tests
  - Coney Island (non-nitrifying)
  - 26th Ward (BNR)
  - Wards Island (BNR)
  - Port Richmond (Low Ammonia Effluent)
  - Rockaway (Low Ammonia Effluent)
  - PO-55 (Low nitrogen)

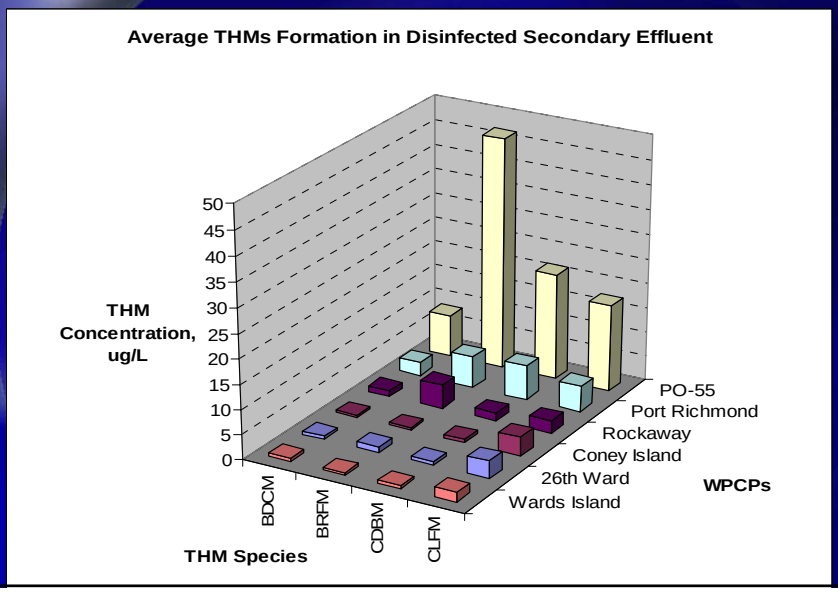
Chlorination/Dechlorination Basics - How Does It Work?

- Chlorination Kills
  - Attacks cell wall, enzymes, & DNA
- Sodium Bisulfite is then added at the end of the process to remove excess residual chlorine
  - No toxicity issues associated with Sodium Bisulfite
  - An excess could result in lower effluent DO concentrations.

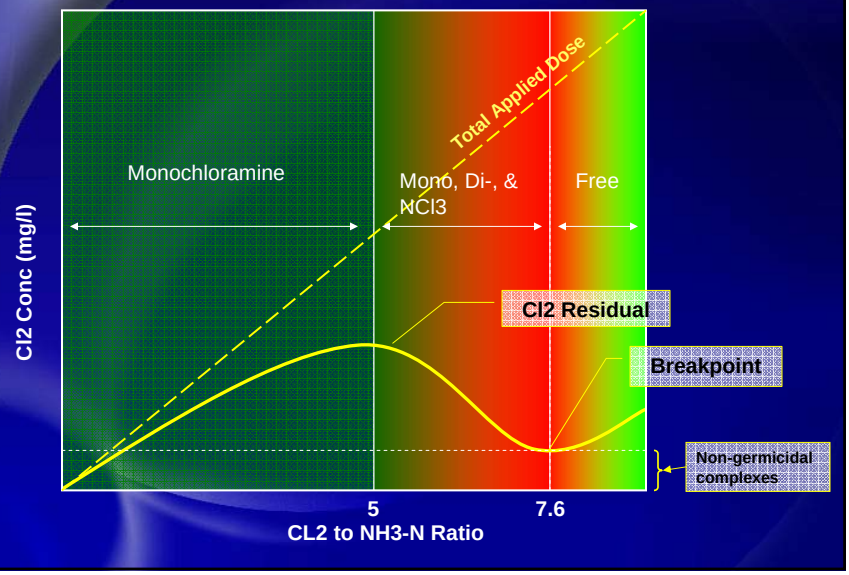
Predicted Chlorine Requirements

WPCP	Flow (MGD)	Contact Time (Minutes)	Required Chlorine Residual Based On 200 FC/100 ml (mg/l)	Based On 35 Entero/100 ml (mg/L)	Limit (mg/L)
26th Ward	60.3	46.3	0.8	0.8	0.45
Coney Island	90.8	23.5	1.4	2.8	0.64
Rockaway	19.2	68.4	0.25	0.9	0.59

Disinfection By Products Associated with Chlorination



Chlorine Breakpoint Chemistry

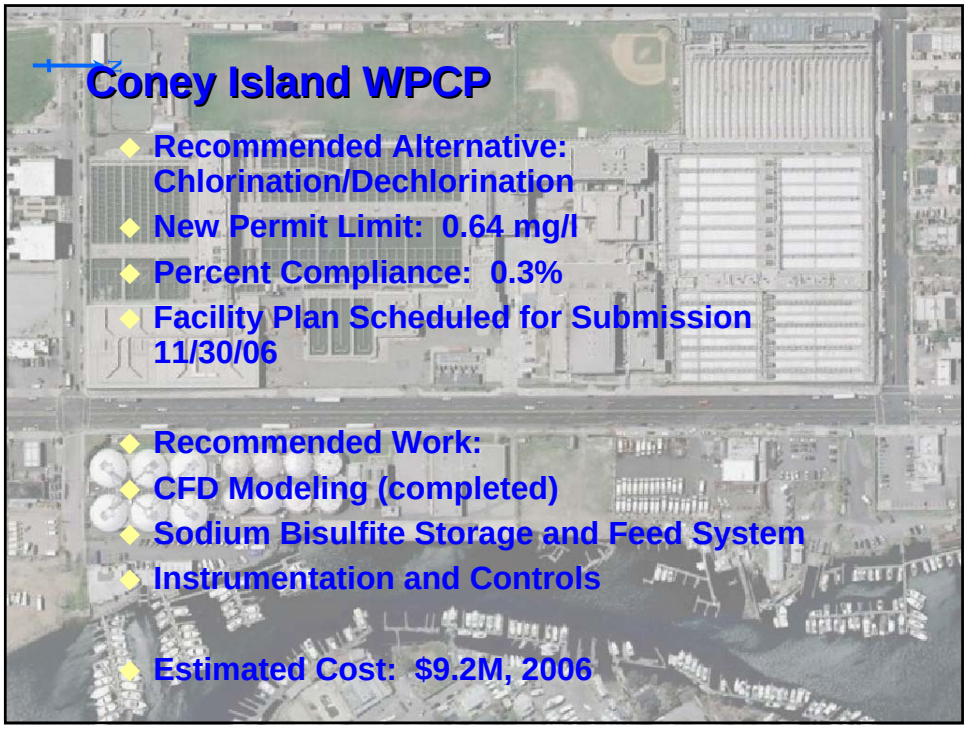


Revised SPDES TRC Compliance Schedule for BNR WPCPs

Milestone	Current Date
Submit Scope of Work	10/1/03
Verify TRC Limits	8/1/04
Submit Alternatives Evaluation	10/1/05
Final Limit Verification	4/1/06
Submit Testing Plan	10/1/06
Begin Operating Demonstration Facilities	4/01/09
Submit Demonstration Report	10/01/10
Submit Facility Plans	4/1/11
Begin Construction	According to Schedule in Facility Plan

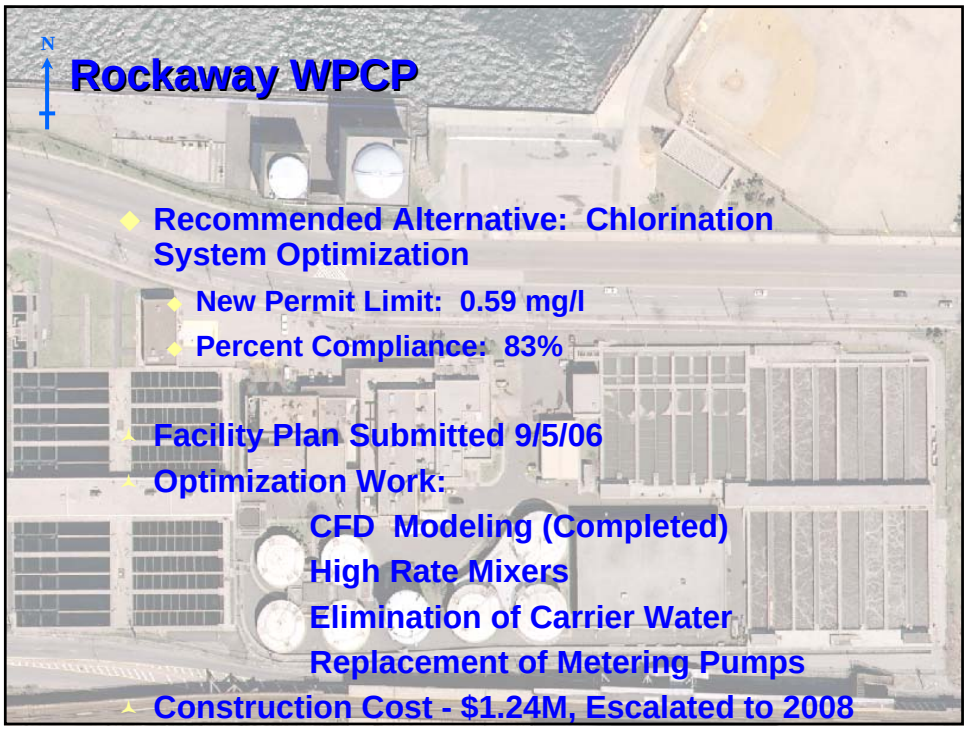
26th Ward Disinfection Demonstration Facilities

- Side-by-side comparison of UV disinfection and chlorination/dechlorination to assess effectiveness and operation & maintenance requirements
- Full-scale operation and testing for one year



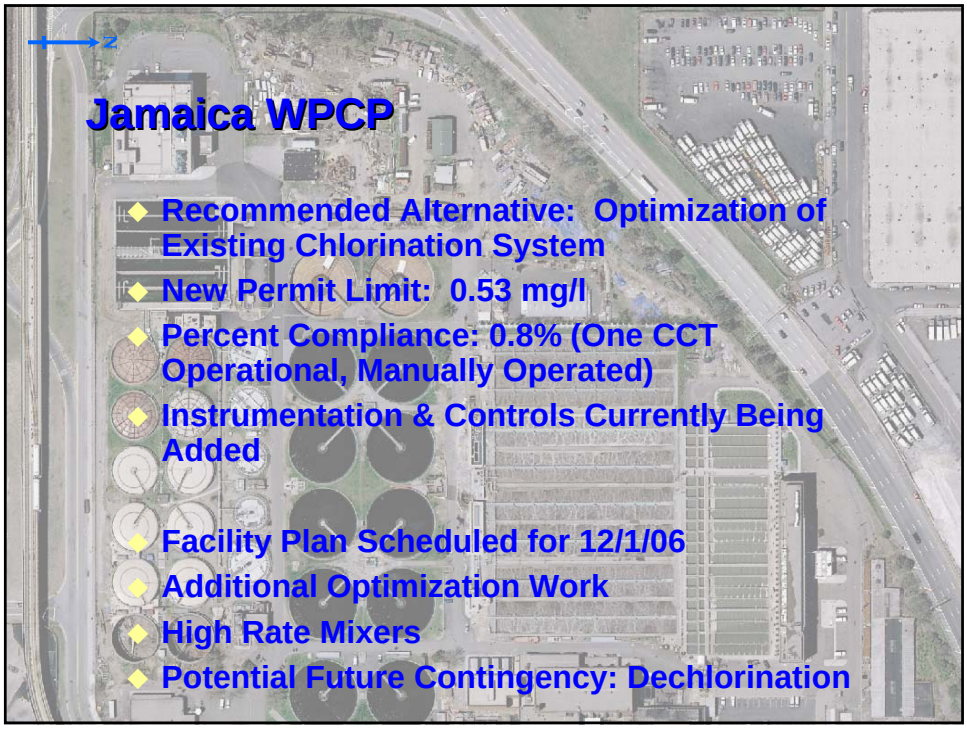
Coney Island WPCP

- Recommended Alternative: Chlorination/Dechlorination
- New Permit Limit: 0.64 mg/l
- Percent Compliance: 0.3%
- Facility Plan Scheduled for Submission 11/30/06
- Recommended Work:
- CFD Modeling (completed)
- Sodium Bisulfite Storage and Feed System
- Instrumentation and Controls
- Estimated Cost: $9.2M, 2006



Rockaway WPCP

- Recommended Alternative: Chlorination System Optimization
  - New Permit Limit: 0.59 mg/l
  - Percent Compliance: 83%
- Facility Plan Submitted 9/5/06
- Optimization Work:
  - CFD Modeling (Completed)
  - High Rate Mixers
  - Elimination of Carrier Water
  - Replacement of Metering Pumps
- Construction Cost - $1.24M, Escalated to 2008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Jamaica WPCP
Recommended Alternative: Optimization of Existing Chlorination System
New Permit Limit: 0.53 mg/l
Percent Compliance: 0.8% (One CCT Operational, Manually Operated)
Instrumentation & Controls Currently Being Added
Facility Plan Scheduled for 12/1/06
Additional Optimization Work
High Rate Mixers
Potential Future Contingency: Dechlorination


Questions