

Industrial Pre-Treatment: Where we Were, Where We Are, and the Challenges Ahead

Presented

at

The MWRDGC Seminar Series

Lue-Hing R&D Complex

Stickney Water Reclamation Plant, Stickney IL May 1, 2009

by

Cecil Lue-Hing, D.Sc., P.E., NAE

Cecil Lue-Hing & Assoc. Inc., Burr Ridge, IL

Overview of Presentation

- **Where we Were – Pre CWA of 1972**
- **The Early Years of the Pretreatment Mandates**
- **Learning to Live With The Pretreatment Mandates**
- **Where we Are Now – Our Successes Under the Mandates**
- **What are the Remaining & Emerging Challenges?**
- **Where Do We Go From Here? or**
- **Where Should We/Would We Like to Go From Here?**

The Major Players

- **The Federal Govt. – USEPA**
- **The States**
- **The POTW Community**
- **The Industrial Discharger Community**
- **The NGOs – Activists Groups, NRDC**
- **The Consulting Community**

The Pre-CWA Era IW Control was

Very Rudimentary

State of Illinois

- Floatables, pH, explosive mixtures (BTXs)

Chicago

- Floatables, pH, BTXs, FOGs

Other Jurisdictions

- Probably Similar to Illinois and Chicago

Issues of Concern - National

- Acid Related Sewer Collapses
- Sewer Explosions – Chicago, Louisville
- Pass Through Events – Fish Kills

The Era Between CWA & Pretreatment

How Did We Function?

- **Very Rudimentary IW Control Ordinance/Regulations**
- **Very Minimal Plant Inspection for Pollutants**
- **Periodic Sampling for FOGs – (Limit 100 mg/L)**
- **Minimal Effluent Sampling by POTWs Except BOD, SS**
- **Virtually No Sampling by Industrial Dischargers**
- **We Knew When Campbell's Made Vegetable Soup**

The Early Years of the Pretreatment Mandate

How Did We Cope?

- There was Much Inertia to Overcome
- There was Much Discussion and Planning
- Some Serious Efforts to Design IW Control Ordinances
- Some Attempts at Enforcing New IW Control Rules
- Most Governing Boards Were Not Eager to Pressure Industry
- Industry was Not Very Impressed
- **We – In Chicago Needed A Catalyst!!!**

Learning to Live With the Pretreatment Mandates

Chicago's Industrial Categories Community – Abbreviated List

- **Electroplating – Metal Finishing – Circuit Boards (400)**
- **Leather Tanning & Finishing**
- **Iron & Steel***
- **Organic Chemicals**
- **Food Processing – Fog Generators**
- **Petroleum Refining**

Enter the Catalyst

The Chicago Experience

- In Place – 40 CFR Part 403
 - a. No significant change in quality of Industrial Discharges
 - b. Industry Had Settled Into Getting Comfortable

The Catalyst

- 40 CFR Part 503
- The Case was Made to Protect Land Application
- The 40 CFR Part 503 Enforcement Initiative
- To Reduce Metals Conc. in ~1 million lbs/day of Biosolids
- The Rest would Fall Into Place

Current Status of Pretreatment – Chicago/Nationally

The Successes of The Program

- **About 60% Biosolids Production to Land Application**
- **VOC Emissions From A/S Systems No Longer an Issue**
- **Incinerator Emissions Significantly Reduced**
- **POTW Effluents Significantly Improved**
- **Many Pretreatment Cases (Nationally) Still in Litigation**

The Federal Govt. – USEPA

Where are They Planning to Take The Program?

- **Revisiting Existing Limits/Regulations?**
- **New Categoricals, Deicers, WTP Sludges**
- **New Conditions on Existing Categories?**
- **New/Revised Analytical Approaches?**
- **New/Revised Sampling Issues?**
- **Emerging Issues of Concern?**

Hauled Wastes

Examples, Risks & Benefits

- **Chemical Toilets & Domestic Septage**
- **FOGs – Energy Conversion, Methane, Biodiesel**
- **Water Treatment Plant Sludges – (Cleveland, Chicago)**
- **Sampling & Control – Target the Owner***
- **Treat the Program as One Large SIU**
- **One Transfer Station Only!!**

Alternative Fuels – Biofuels (1)

Driving Forces

- **The Need for Energy Independence**
- **Environmental Benefits, CO₂, etc.**
- **Federal & State Tax Incentives - \$0.1-\$1.0/gal**
- **30% Cost Credit for Installing Clean-fuel Equipment**
- **MTBE Ban as Additive**

Alternative Fuels – Biofuels (2)

Challenges – Wastewater Management

- Water Demand – 3.5 to 6 gal/gal eth
- Process Feedstock is also important **Human Food-stock**
- Wastewater ~12 gal/gal eth
- BOD: 4,500-37,000 mg/L; TSS: ~150 to 2100 mg/L
- FOG: 150 to 1,000 mg/L

Pharmaceutical Wastes (1)

Types of Pharmaceuticals – Abbreviated List

- **Antibiotics, Retrovirals**
- **Endocrine System Hormones**
- **Steroids**
- **Reproductive System Hormones**
- **Narcotics**
- **OTC Drugs – Pain Killers – Cold Medicines**

Pharmaceuticals Wastes (2)

Sources – Just Where do They Come From?

- **Pharmaceutical Manufacturing Sites**
- **Hospitals, Medical & Dental Clinics & Research Centers**
- **Every Connected Household in Every Jurisdiction in the USA***
- **Universities, Veterinary Research Centers**
- **Nursing Homes**
- **Expired & Discarded Prescription Drugs**

Pharmaceutical Wastes - Inputs to

POTWs (3)

Relative Contributions by Source

- **Private Homes – Patients Taking/Excreting Medicines***
- **Hospitals**
- **Pharmaceutical Manufacturing Operations**
- **Nursing Homes/Extended Care Facilities**
- **Expired, Unused & Discarded Drugs**

*May Exceed All Other Sources Combined – Ph RMA

Personal Care Nanotech Products* - Are

We Ready?

All Major Producers - Many Categories – Cosmetics

- The Old Products - Selenium
- Toothpastes
- Beauty Soaps, Shampoos
- Skin Care – Moisturizers
- Anti-Wrinkle, Anti-Aging Creams
- Cell Exfoliation Gels

*Majority of Products Said to Contain Silver

Controlling PPCPs (1)

What Constitute a Sensible Approach?

Strategy

- **Must Share Control Responsibility Equitably Between**
 - ✍ **Pharmaceutical Companies**
 - ✍ **Pharmacies**
 - ✍ **Hospitals & Clinics**
 - ✍ **Patients**
 - ✍ **POTWs**
- **Requires Serious Cooperation of Local, State & Federal Agencies**

Controlling PPCPs (2)

Interest to Control is Universal – Need Multi-Source Control Strategy

Suggestions:

- Drug Take-Back Programs
- Drop-Off Bins @Pharmacies, Police Stations, Senior Facilities
- Safe Medicine Disposal (Days) Programs
- Acceptance at HHW Collection Sites
- The Individuals Taking Medicine(s) – What, How, When, Why?

What Role –The Pharmaceutical Industry?

The Unresolved Mercury Issues (1)

Generic Sources

- **Domestic**
- **Air**
- **Industrial**
- **National**
- **International – 83% of Hg Deposited in US is from International Sources. (EPA)**

The Unresolved Mercury Issues (2)

Selected Domestic Sources – Ave. Conc. (AMSA Aug. 2000)

* Shaving Cream	340 ng/kg	* Soap	7,908 ng/kg
* Dishwashing Detergent	1,478 ng/kg	* Shampoo	835 ng/kg
* Deodorant	1,180 ng/kg	* Bleach	6,170 ng/kg
* Laundry Detergent	1,478 ng/kg	* Toothpaste	1,230 ng/kg
* Drain Cleaners	4,230 ng/kg	* Mouthwash	15 ng/kg
* Toilet Paper	827 ng/kg		

Dental Amalgam

About 50% of Hg Entering POTWs is from Dental Offices* (ADA, 2003)

Should We?

- **Require BMPs**
- **Numerical Limits – Sampling 90th Floor Sears Tower?**
- **Installation of Amalgam Separators (AS)**
- **AS Testing, Certification, Accreditation**
- **Approved Analytical Labs./Services**

The Unresolved Mercury Issues (3)

Findings – (AMSA Aug. 2000)

- Significant amounts Hg at average conc. of 138 ng/kg consistently found in strictly domestic WW
- This was WW that contained no industrial or commercial inputs, dental offices included
- POTWs remove 97% of Hg discharged to their sewerage systems
- Household and toiletry items contain high conc. of Hg
- These items cumulatively contribute ~15% of Hg concentration in domestic WW
- Controlling these sources would require a broad national effort

The Unresolved Mercury Issues (4)

Findings – (AMSA Aug. 2000) contd.

- **Feces and urine from individuals with dental amalgam fillings are the highest Hg source >80%**
- **Data corroborated by results from studies of chemical toilet and septic tank wastes analysis**
- **While controlling human wastes is impractical, the long-term outlook is promising because of the trend for fewer cavities and less amalgam fillings expected in the population**
- **Domestic wastes contributes high concentrations of Hg to POTWs, and must be considered when addressing Hg control strategies, and the likelihood of virtual elimination of Hg?**
- **Background Hg conc. averaging >100 ng/kg can be expected even without industrial inputs**

MWRA

Massachusetts Water Resource Authority

- Adopted a Prohibition on Mercury
- Local Limit is enforced at 1 ppb
- ~ 350 MGD
- > 250 SIUs
- 13% of the Mercury Loading to Headworks was from Dentists Compared to the 3% from the Regulated Industrial Community

The MOU

Between NACWA, EPA & ADA, Signed December 29, 2008

Provides A Voluntary Program that:

- Commits NACWA, EPA & The ADA to Work Together to Decrease mercury Discharges
- Encourages Dental Clinics to Follow the ADA's Best Management Practices Including – the proper Installation & Maintenance of Amalgam Separators
- Improves Handling of Dental Amalgam Where Local Programs have not Already been Developed
- Does not Affect Local Clean-water Agency Authority

States Requiring Separators

- Connecticut, Massachusetts
- New Hampshire, Rhode Island
- Maine, Vermont,
- New York, New Jersey
- Oregon, and Michigan

What is An Amalgam Separator?

These Units are Efficient Particulate Collectors that:

- Separate Amalgam and other Particulate Material contained in the wastewater suctioned from dental operations
- Targets Particulate Material Rather than Hg directly in the Dental Wastewater Streams

Nano Technology

1 Nanometer nm = 1 Billionth of m; 1 Hair strand = 80,000 nm

Item of Major Concern is Nano Silver Particles

Nano Silver is Used as an Anti-Bacterial

The Samsung Silver Care Washing Machine Produces:

- 400 Billion nano-sized Silver Ions per cycle
- They Directly penetrates Fabrics, and
- Creates anti-bacterial/sterilization effects on clothes

These Ions are Discharged to public Sewers

- Effects????

Any Role for Pretreatment in Meeting The

Nation's Critical Infrastructure Needs?

All POTW Infrastructure is Critical & Need Protection

- Most Major Non-Terrorist Disasters Have Been Sewer Explosions – Chicago, Louisville, Guadalajara, Kobe City Japan – Earthquake
- Numerous Corrosion Related Sewer Collapses
- Numerous Age Related Sewer Collapses
- Kobe City & Guadalajara the Most Destructive
- Any Ideas?????

QUESTIONS?

