

**13. Occurrence, Treatment and Costs of Complying
with the Arsenic Rule in El Paso, Texas**

Presenter

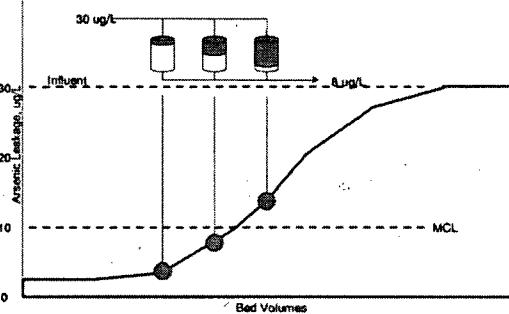
Mr. Edmund G. Archuleta, El Paso Water Utilities

GFH Specifics and Results

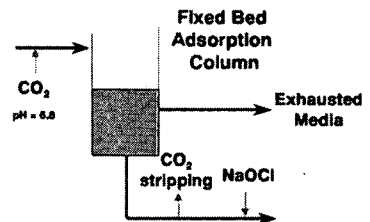
GFH Specifics

- Must be shipped moist because media will not rewet easily.
- Around 4% by weight as fines that must be washed out.
- Cost: \$2.50 to \$4.00 per lb
- Design for 5 min. Empty Bed Contact Time, 5 to 7 gpm/sf
- Need 35,000 lbs of media for each 1 MGD capacity

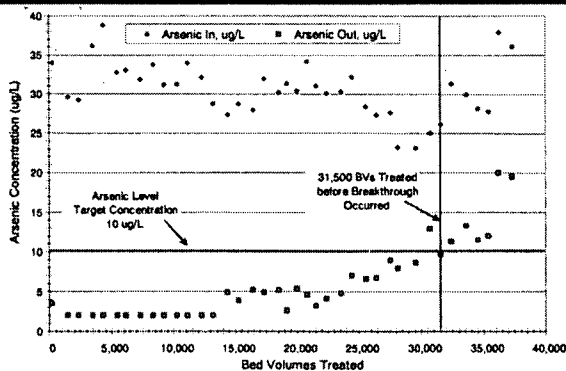
GFH Specifics and Results Adsorption Systems Operation: Series



GFH Specifics and Results Process Schematic



GFH Specifics and Results Pilot Data



C/MF Specifics and Results

Occurrence, Treatment and Costs of Complying with the Arsenic Rule in El Paso, Texas

Japan-US Governmental Conference on Water Quality Management and Wastewater Control
Tokyo, Japan October 22, 2002

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El Paso Water Utilities
Public Service Board



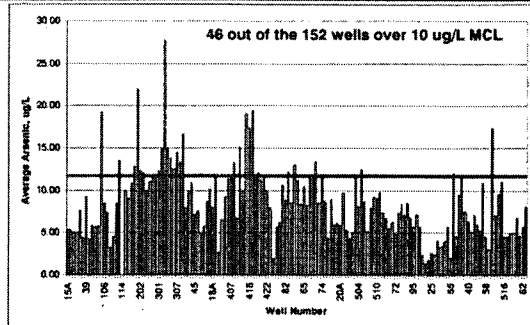
Background

Arsenic Rule

- Became effective February 22, 2002
- Compliance by January 23, 2006
- Arsenic Maximum Contaminant Level set at 10 mg/L (0.01 mg/L)
- Compliance based on quarterly running average, single sample can not exceed 40 mg/L.

Background

Arsenic in El Paso



Background

Arsenic Removal Technologies Considered

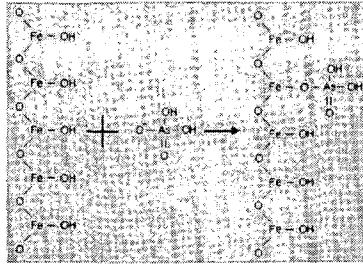
- Screened Out Technologies
 - Ion Exchange
 - Activated Alumina or Regenerable Media
 - Membranes
 - Softening Water Treatment Plant
- Potentially Appropriate Technologies
 - Coagulation/ Microfiltration
 - Fixed Bed Adsorption Technologies

Background

Arsenic Pilot Testing

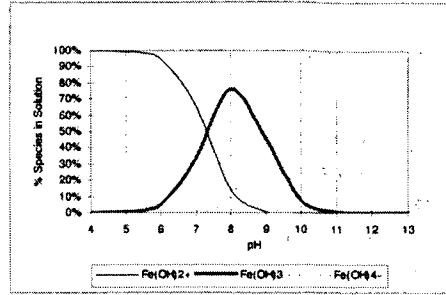
- Pilot testing required to evaluate arsenic removal technologies
 - Fixed Bed Adsorption
 - Granular Ferric Hydroxide (GFH)
 - Coagulation / Microfiltration (C/MF)
 - Ferric chloride coagulation
 - Pall microfiltration

**C/MF Specifics and Results
Chemistry of Iron Oxyhydroxide and Arsenic**



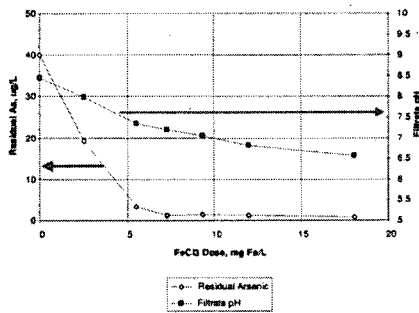
- Particle Size 2 to 10 microns
- As must be in +5 oxidation state rather than +3

**C/MF Specifics and Results
Ferric Hydroxide Speciation**

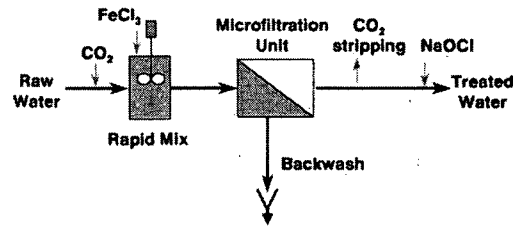


- pH needs to be less than 7.3 for arsenic removal

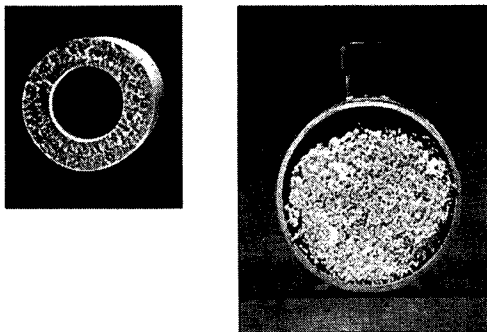
**C/MF Specifics and Results
FeCl₃ Dose Vs Arsenic Removal**



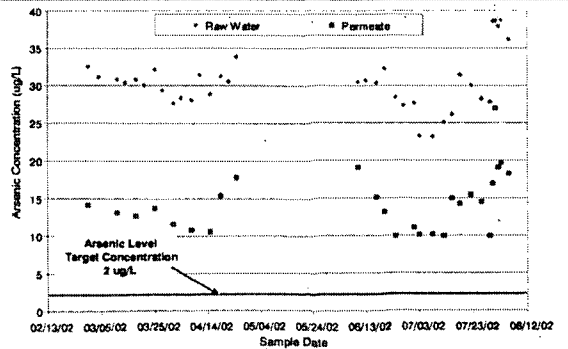
**C/MF Specifics and Results
Process Schematic**



**C/MF Specifics and Results
Pall Microfilter**



**C/MF Specifics and Results
Pilot As Data**



C/MF Specifics and Results Arsenic Removal

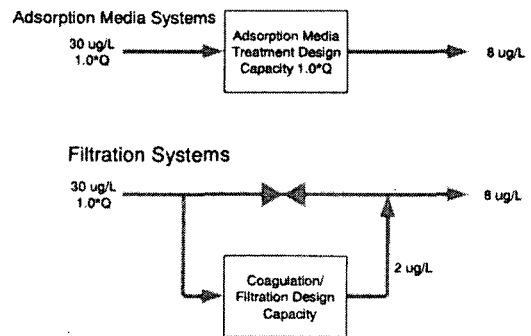
- Did not achieve 2 mg/L target
- Initially, As believed to be in +5 oxidation state
- Further As speciation indicated approximately 10 mg/L in +3 form
- Requires addition of oxidant prior to filtration to oxidize As(III) to As(V)

Economic Analysis

Economic Analysis Assumptions

- 90 gfd flux for MF
- 31,500 Bed Volumes for GFH
- 10 mg/L ferric chloride dose
- 40 mg/L CO₂ dose

Media Vs. Filtration Systems

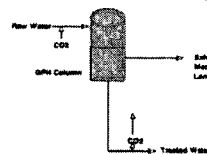


Conclusions

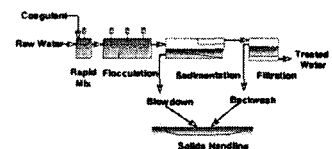
- GFH breakthrough at 31,500 BVs
 - Removed As(III) and As(V)
 - Potential for greater bed volumes with prechlorination and significant offline time
- C/MF flux rate of 90 gfd
 - Did not achieve 2 mg/L As target
 - Due to presence of 10 mg/L of As(III)
 - Will prechlorinate to convert As(III) to As(V)
- Facilities will proceed with GFH
 - Easier to start/stop operation than C/MF
 - Potential for media costs to decrease and be competitive with C/MF
 - Less maintenance is huge advantage for multiple facilities

Selected Treatment Approaches

Well Head Granular Ferric Hydroxide



Canutillo Conventional Treatment



EPWU Arsenic Compliance Program

Well Field	Average Arsenic Concentration (ppb)	Type of Treatment	Treatment Capacity (mgd)	Estimated Capital Cost
Canutillo	13.6	Centralized Conventional	30	\$50,000,000
Northeast	12.8	Four GFH Well Head	Approximately 1.5 to 2.2, each	\$11,500,000
Lower Valley	12	Three GFH Well Head	Approximately 1, each	\$3,500,000
Eastwood	11	Centralized GFH	4.2	\$4,300,000
Cielo Vista	10.4	Two GFH Well Head	0.75, each	\$3,600,000
Montana McRae	7	None	None	\$0
Airport	5.85	None	None	\$0
Shearman	5.2	None	None	\$0
Newsa	2.9	None	None	\$0
TOTAL		Eleven Facilities	47	\$74,900,000

Canutillo WTP - \$50 million
Eastside GFH - \$24.9 million

Questions ?

