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CEE 680: Water Chemistry

Lecture #52

Redox Chemistry: Arsenic I, Intro and Treatment

(Stumm & Morgan, Chapt.8)

Benjamin; Chapter 9

Regulatory Dates I

- 1942, Public Health Service Establishes 50 ppb Standard
- 1975, EPA formalizes 50 ppb Standard
- 1989, EPA misses the First of Several Deadlines for Revising Rule
- June 22, 2000, EPA Proposes MCL of 5 ppb
- January 22, 2001, EPA Publishes Final Rule, MCL of 10 ppb

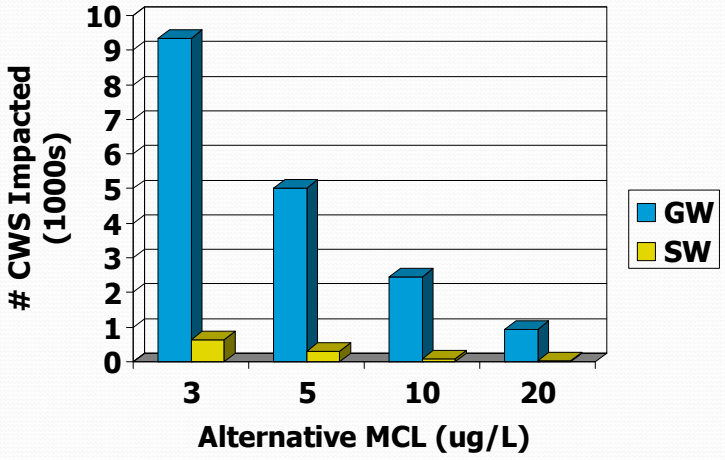
From presentation by Philip Brandhuber (2001)

Regulatory Dates II

- March 20, 2001, EPA Announces it will "Reassess" Costs and Scientific Issues, Delay Rule 60 Days
- April 23, 2001, EPA Announces Additional Delay of Nine Months
- May 22, 2001, EPA Announces Delay Until February 22, 2002
- July 19, 2001, EPA Request Comment on MCL's of 20, 5 and 3 as Alternative to 10 ppb
- October 31, 2001, EPA announces that As standard will be 10 ppb (effective 2006?)

From presentations by Brandhuber (2001) & Kempic (2001)

Impact to Utilities, Alternative MCL's



From presentation by Philip Brandhuber (2001)

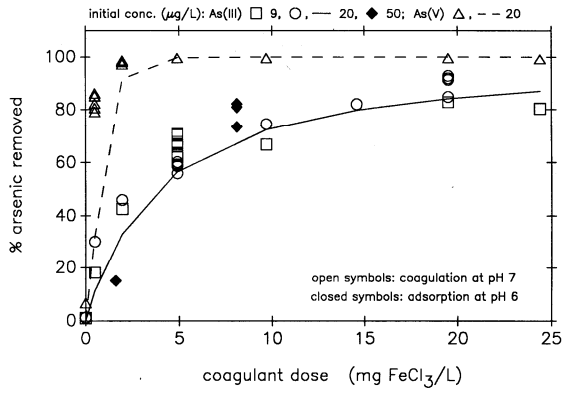
EPA: Federal Register 65(121):38888

- Key Features of Arsenic's Chemistry in Water
  - Present in two Oxidation States
  - Behaves as an Acid
- Arsenate (As(V))
  - H_3AsO_4 => $H_2AsO_4^-$ => $HAsO_4^{2-}$ => AsO_4^{3-}
- Arsenite (As(III))
  - H_3AsO_3 => $H_2AsO_3^-$ => $HAsO_3^{2-}$

From presentation by Philip Brandhuber (2001)

Coagulation

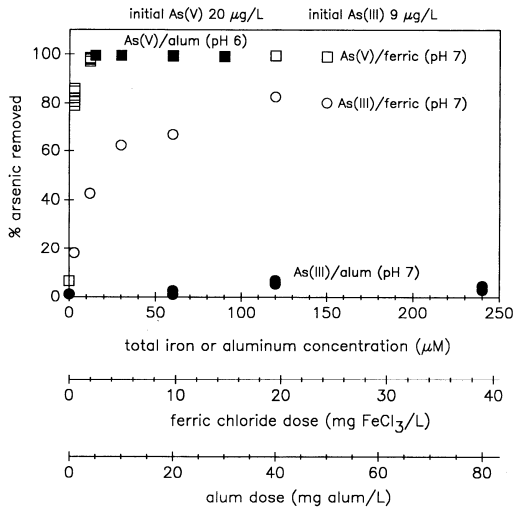
- As(V) is much better removed than As(III)



From: Hering & Elimelech, 1996; AWWARF Report

Coagulation

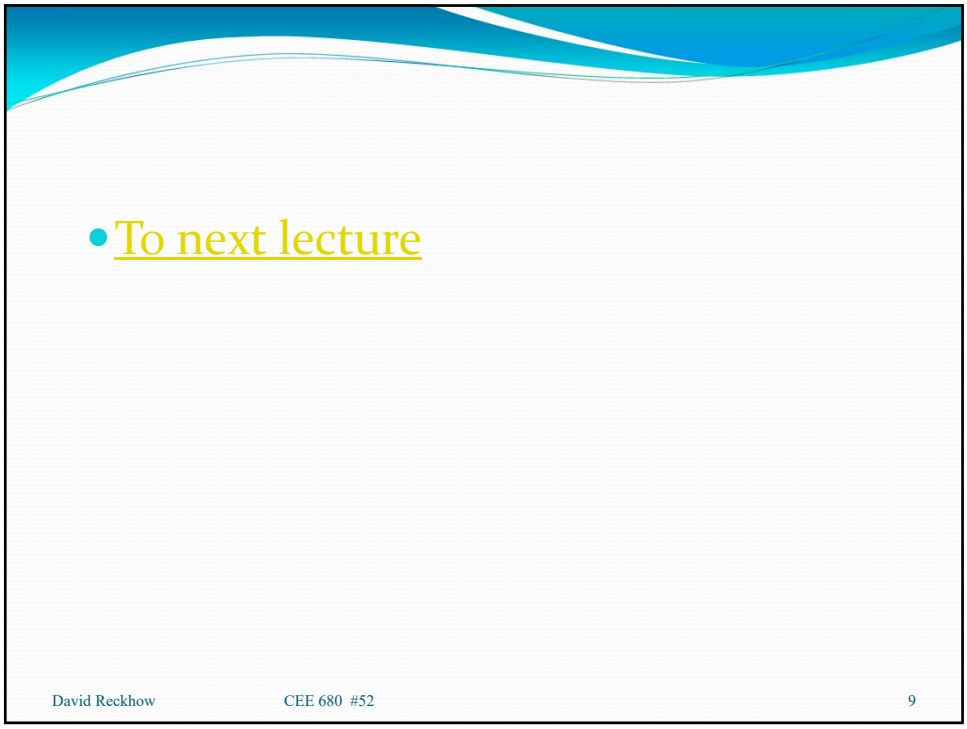
- Alum vs Ferric



From: Hering & Elimelech, 1996; AWWARF Report

- Oxidize
  - - Cl_2 - MnO_4^- - O_3
- Treat
  - - RO/NF - Coagulation/MF - Activated Alumina - Ion Exchange - Greensand - Iron media (GFH)
- Dispose of Residual
  - - POTW - Dewater - Landfill

From presentation by Philip Brandhuber (2001)


To next lecture
David Reckhow
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