

Multi-Contaminant Control with Ion Exchange

by

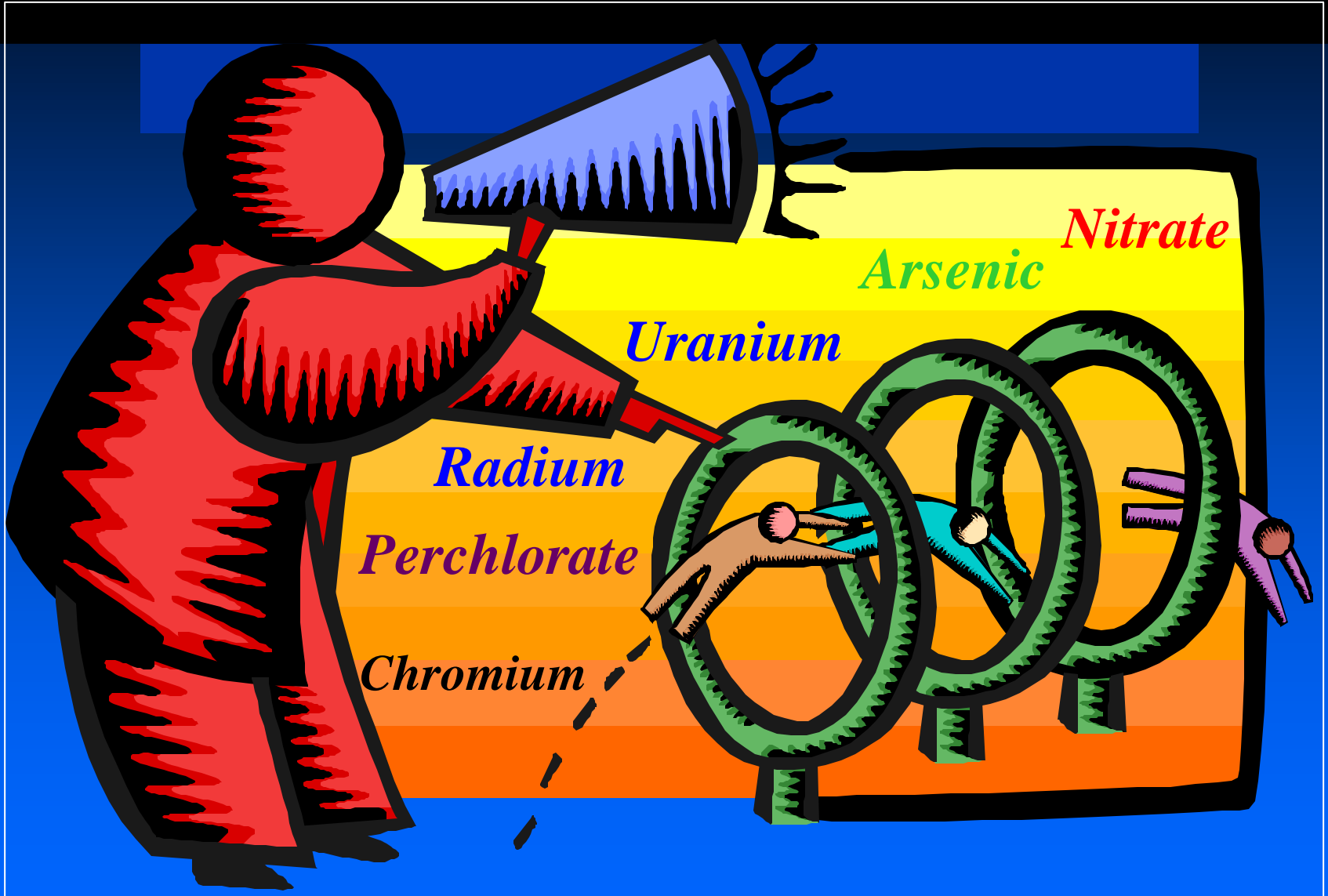
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What will be covered

- *Regulation of multiple contaminants*
- *Cost control measures at consumer level*
- *Examples*
- *Summary*

Tightening Drinking Water Regulations



Consumer Costs Rising !!

No more space in the basement !!??



Controlling Cost

Option 1

- *Reduce cost of individual treatment technology*



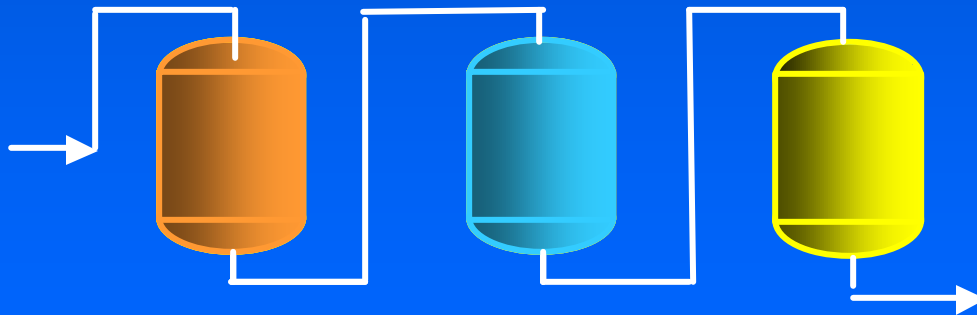
how much more can this be done ???



Softening

Nitrate

Arsenic

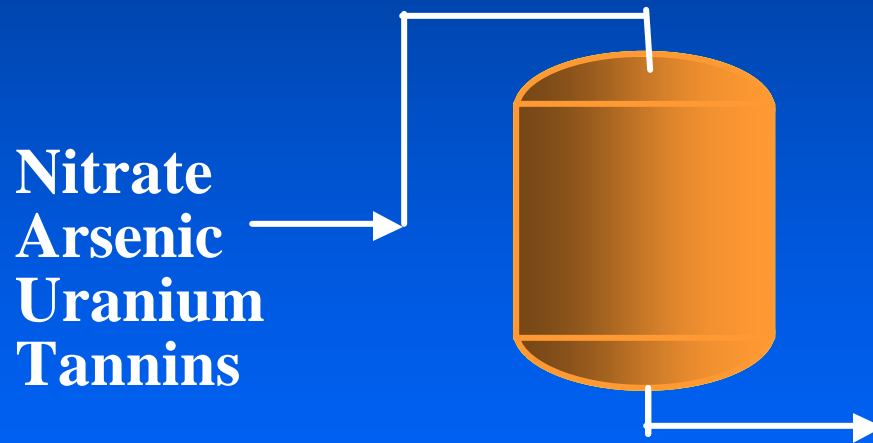




Controlling Cost

Option 2

Combined Removal of Contaminants !!!



2 or more for the price of 1

IX Best for Most Contaminants

	MCL	Treatment by
Arsenic III & V	10 ppb	IX ; AA; GFH; MZ
Chromium-6	50 ppb	IX ; RO
Nitrate	45 ppm	IX
Perchlorate	4 ppb (AL)	IX ; BIO
Radium	5 pCi/L	IX
Uranium	30 ppb	IX
Tannins / Organics	N/A	IX ; AC; AOX

IX – ion exchange

AA – activated alumina

RO – reverse osmosis

GFH – granular ferric hydroxide

MZ – manganese zeolite

BIO – biological

AOX – advanced oxidation

Treatment Choices

- *Central Municipal Treatment*
- *Household Treatment:*
 - *Point-of-Entry (POE) or*
 - *Point-of-Use (POU)*
- *Regenerable or disposable media*
- *Waste recycle / disposal options*

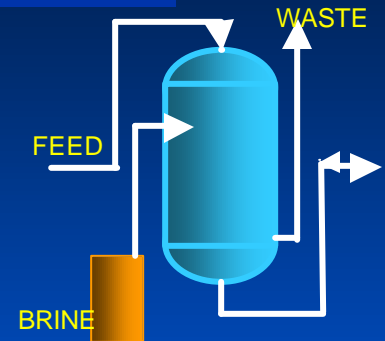
Example 1: Nitrate + Arsenic V

- *POE for single household:*

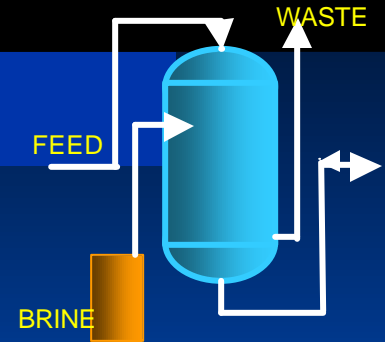
- *Nitrate – 60 ppm as NO₃*
- *Arsenic – 80 ppb*

- *Treating Jointly:*

- *Use SBA resin to remove Nitrate & Arsenic V*
- *Regenerate with brine*
- *Which resin is best for both ?*
- *Disposal issues*



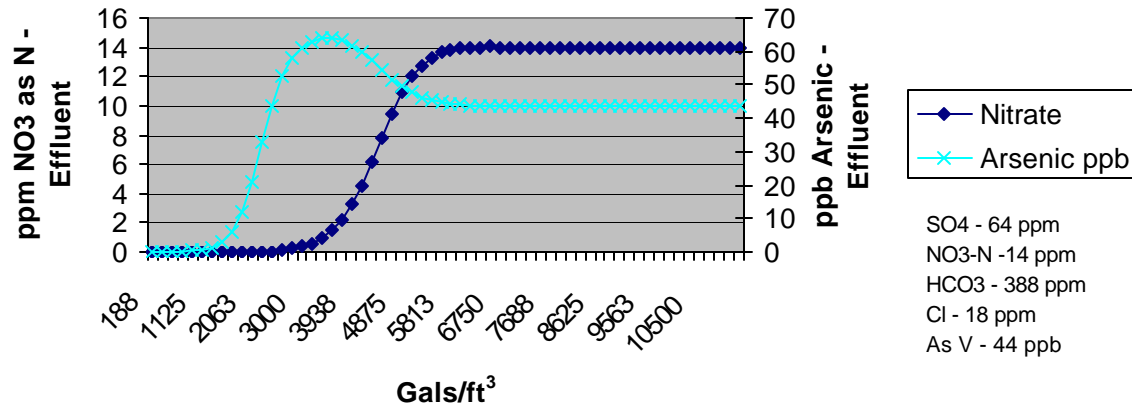
Removal of Arsenic with SBA resin



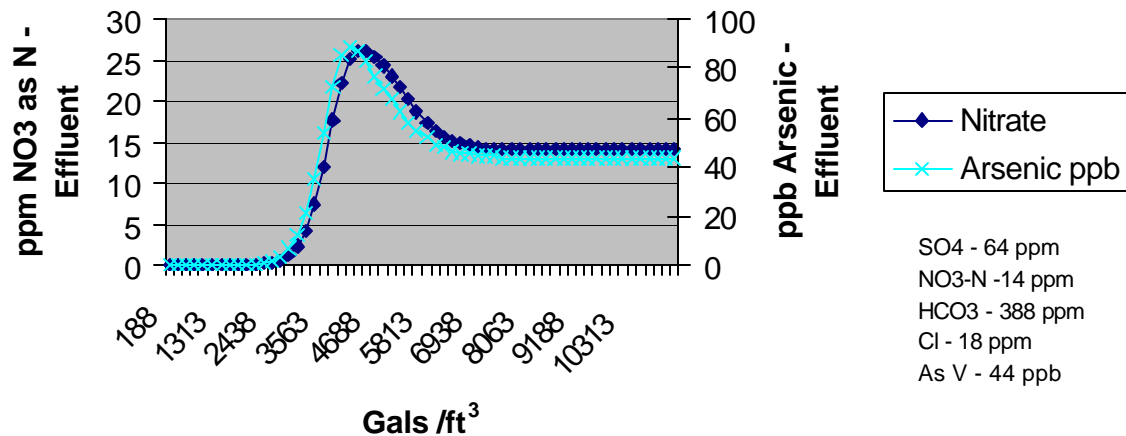
- *Type II and derivatives best (As III is preoxidized)*
- *Effective at elevated pH vs AA, GFH, GFO*
- *5 to 10 lbs salt/ft³ adequate for regeneration*
- *High sulfate reduces capacity*
- *Software can simulate capacity and leakage*

Choose Type II vs Nitrate Select

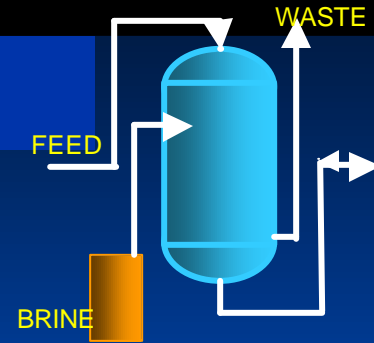
IX-SIMULATOR - Arsenic & Nitrate Removal
with Nitrate Select Resin



IX-SIMULATOR - Arsenic & Nitrate Removal
with Type II SBA Resin



Jointly Remove Nitrate + Arsenic

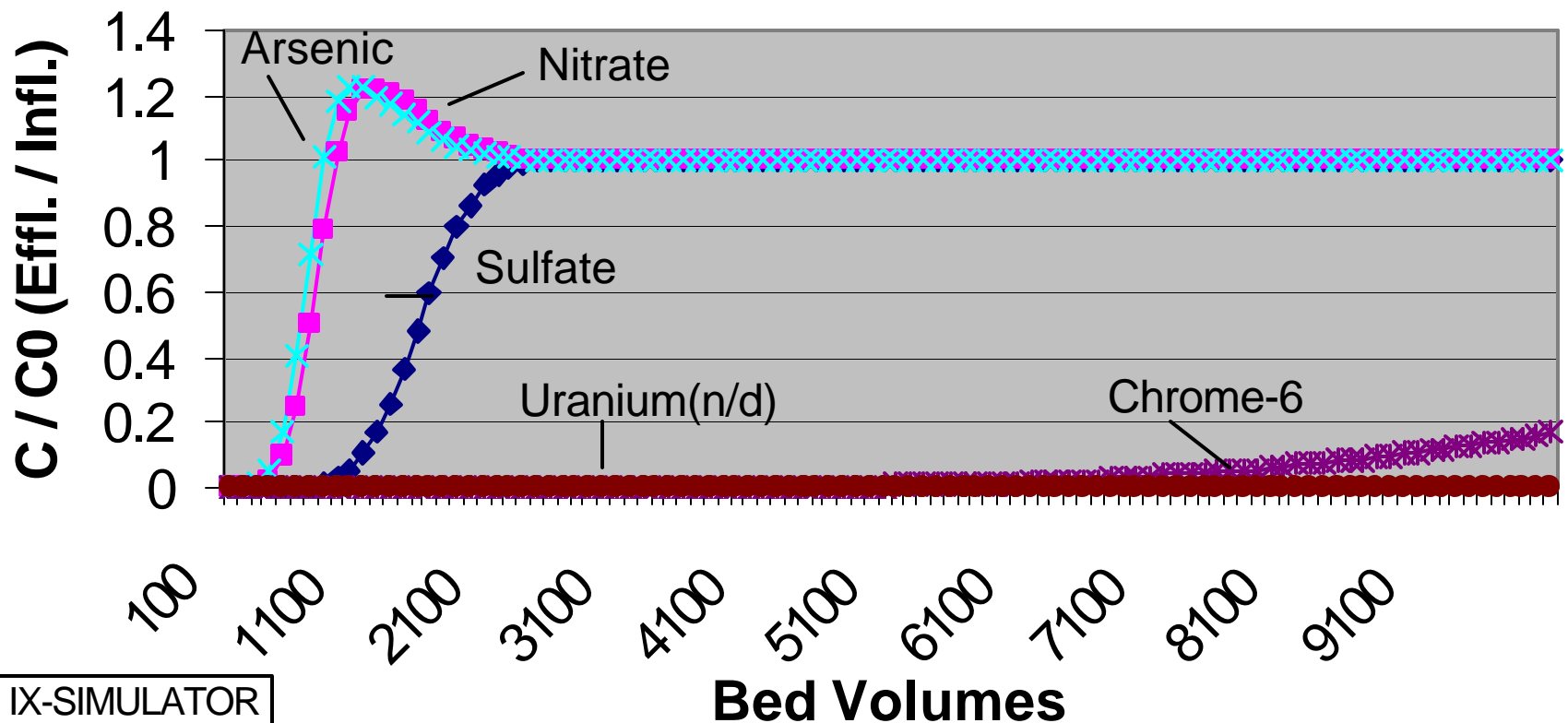


- *Treat entire stream – no bypassing*
- *Choose Type II Resin - best As & NO₃ capacity*
- *Salt dosage – typically 7 to 10 lbs/ft³*
- *Lower cost than treating separately*
- *Get “2 for the price of 1”*

Modeling Several Contaminants

- the key to multi-contaminant control technology !!

Using type II resin for multiple contaminant removal

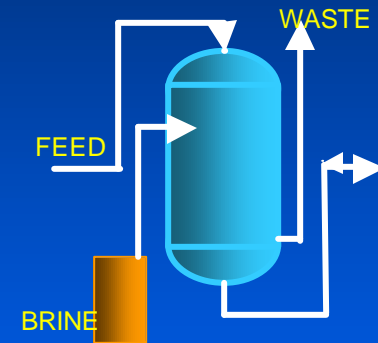


IX-SIMULATOR

Example 2: Nitrate + Uranium

- POE for single household:

- Nitrate – 60 ppm as NO_3
- Uranium – 100 ppb



- Treating Jointly:

- Use brine for NO_3 and Uranium regeneration
- Which resin is best ?
- Disposal issues ?

Removal of Uranium with SBA resin

- *Strong affinity for uranium as $UO_2(CO_3)_3^{4-}$*
- *Huge Capacity - 200,000 to 2,000,000 Gals/ft³*
- *Sulfate, etc. impacts capacity*
- *Model capacity with software*

Removal of Uranium with SBA resin

- *Max loading guideline - EPA evaluating*
- *Suggested interim guideline ~40000 gals/ft³*
- *Use 25 lbs salt/ft³ - elutes ~75% of U on resin*
- *Residual Uranium will not cause leakage !!*

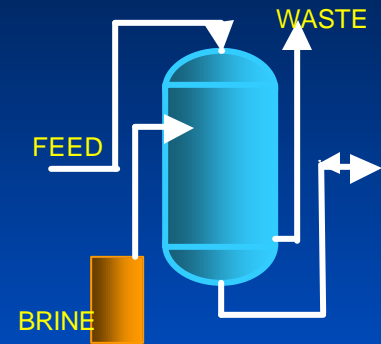
Jointly Remove Nitrate + Uranium

- *Use Type II or Nitrate Select SBA resin*
 - *e.g. use nitrate select for high SO₄)*
- *Regenerate based on by nitrate capacity*
 - *typically 1500 – 3000 Gals/ft³)*
- *Use higher salt dosage of ~15 lbs/ft³*
 - *to elute NO₃ and > 50% of Uranium*
- *Uranium residual on resin will eventually stabilize*
 - *will not cause Uranium leakage*

Example 3: Nitrate + Arsenic + Tannins

- *POE for single household:*

- *Nitrate – 60 ppm as NO₃*
- *Arsenic – 80 ppb*
- *Tannins -- 1 ppm*



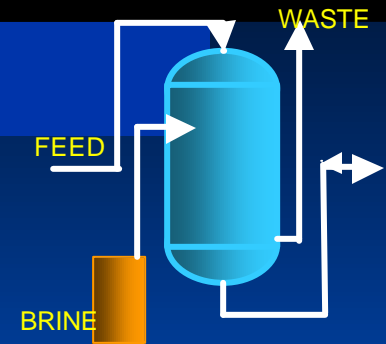
- *Treating Jointly:*

- *Brine regeneration effective for all 3 species*
- *Which resin is best for all 3 species ?*

Removal of Tannins with SBA resin

- *Macro acrylic - best for > 1K*
- *Macro styrenic - good for < 1K*
- *Capacity – typically 1000 - 2000 gals/ft³*
some results higher e.g. 15,000 gals/ft³
- *Brine regeneration generally effective*
(alkaline brine better)
- *Regenerate at least every 3 days*

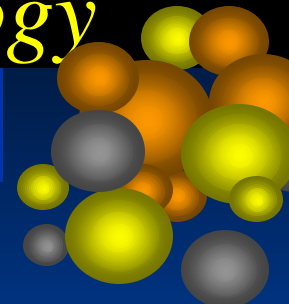
Jointly Remove: Nitrate + Arsenic + Tannins



- *Treat entire stream – no bypassing*
- *Model leakage and capacity - macro acrylic and styrenic*
- *Base run length on specie with lowest capacity*
 - *3 days maximum for tannin removal*
- *Use 10 lbs salt/ft³ – to satisfy needs for all 3 species*
- *Consumer benefit - lower cost - “3 for the price of 1”*

Summary

Multi-Contaminant Control Technology (MCT)



- *Consumers demanding cleaner but lower cost water*
- *Resins ideal for simultaneous contaminants removal*
- *Software modeling effective for optimizing treatment*
- *Significant cost-reduction to consumers using IX*
- *Provides real VALUE to Consumers*
- *Offers a competitive advantage to OEMs / dealers*