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ArsenX^np

Nano-Particle Technology

Agenda

- Capacity and Properties
- Advantages *PLUS* extra benefits
- Independent Pilots & Lab Data
- Installations
- Design + O&M Considerations
- Summary

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ArsenX^np

for As III + As V

NSF-61 certified

- Removes Arsenic III and V – **no oxidation needed**
- Suitable for CWTS & POE + POU devices
- 50,000 to 200,000 BVs capacity typical
- 3 months to 1 year before exhaustion (muni)
- Regenerable media – done offsite

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ArsenX^{np}

Typical Properties

Structure	M/P Styrene-DVB matrix
Bulk Density	790-840 g/l (49-52 lbs/CF)
Particle Size Distribution	300 – 1200 micron
EBCT	2-3 minutes
Static As Capacity	38 mg As / g resin
Operating pH	4 – 9
Operating Temp.	80^{o}C max. (172^{o}F)

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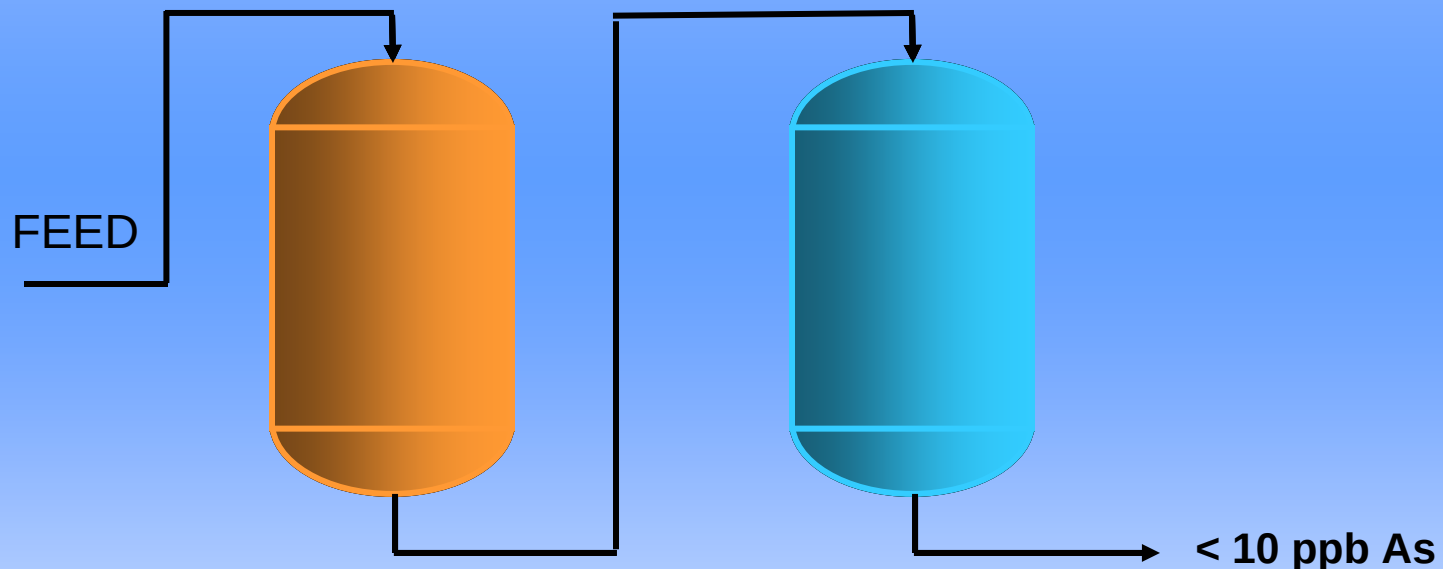
ArsenX^{np} Lead-Lag Operation

Off-site regenerable media



On exhaustion of lead, replace lead with lag, put freshly regenerated resin in lag position

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ArsenX^{np} Advantages

- Superior to AA – minimal impact of high pH
- Superior to GFH / GFO
  - No compaction of bed and restriction of flow
  - No release of iron fines with As into treated water
  - Minimal backwashing needed (vs. GFH/GFO)
  - No backwash fines/sludge to haul away
  - No air-borne arsenic from dried-out media (vs. GFH/GFO)

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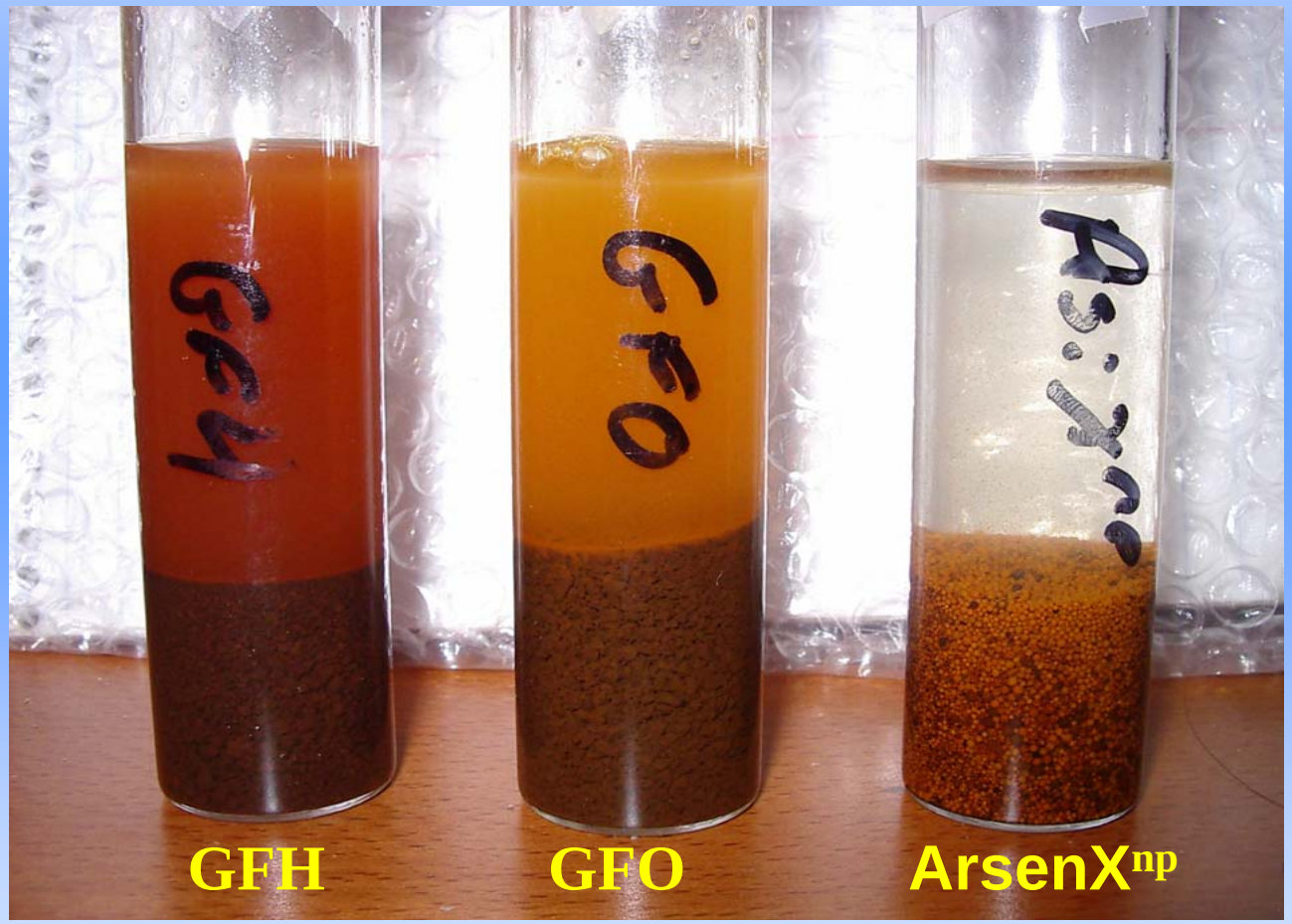
ArsenX^{np} Advantages



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ArsenX^{np} Advantages

- ✓ Great hydraulics of ion exchange beads
- ✓ 2.5 minutes contact time normal – 24 BV/H
- ✓ Bed depth similar to ion exchange system design
- ✓ Pressure drop predictable as for ion exchange beads
- ✓ Reduced pressure drop across media vs. GFH/GFO
- ✓ Media sluiceable for filling and removal from vessel
- ✓Smaller diameter vessels than GFH/GFO
- ✓ Smaller footprint
- ✓ Lower capital costs

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ArsenX^{np} Cost $ / 1000 Gals*

- ArsenX^{np} - $0.25 to $0.75 (regenerable)
- GFH / GFO - $0.40 to $1.00 disposable
- IER - $0.25 to $0.75 (brine recycle)
- Coagulation /Filtration ~ $0.35

*** Includes amortized capital and O&M costs**

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ArsenX^{np} PLUS

As III + As V + U + Sb + Cr^6 + V

- Removes:
  - Arsenic III and V
  - **Uranium**
  - **Antimony**
  - **Chromium-6**
  - **Vanadium**
- Cr^6 & U dependent on water chemistry – **we can predict capacity !!**

Extra Benefits !!

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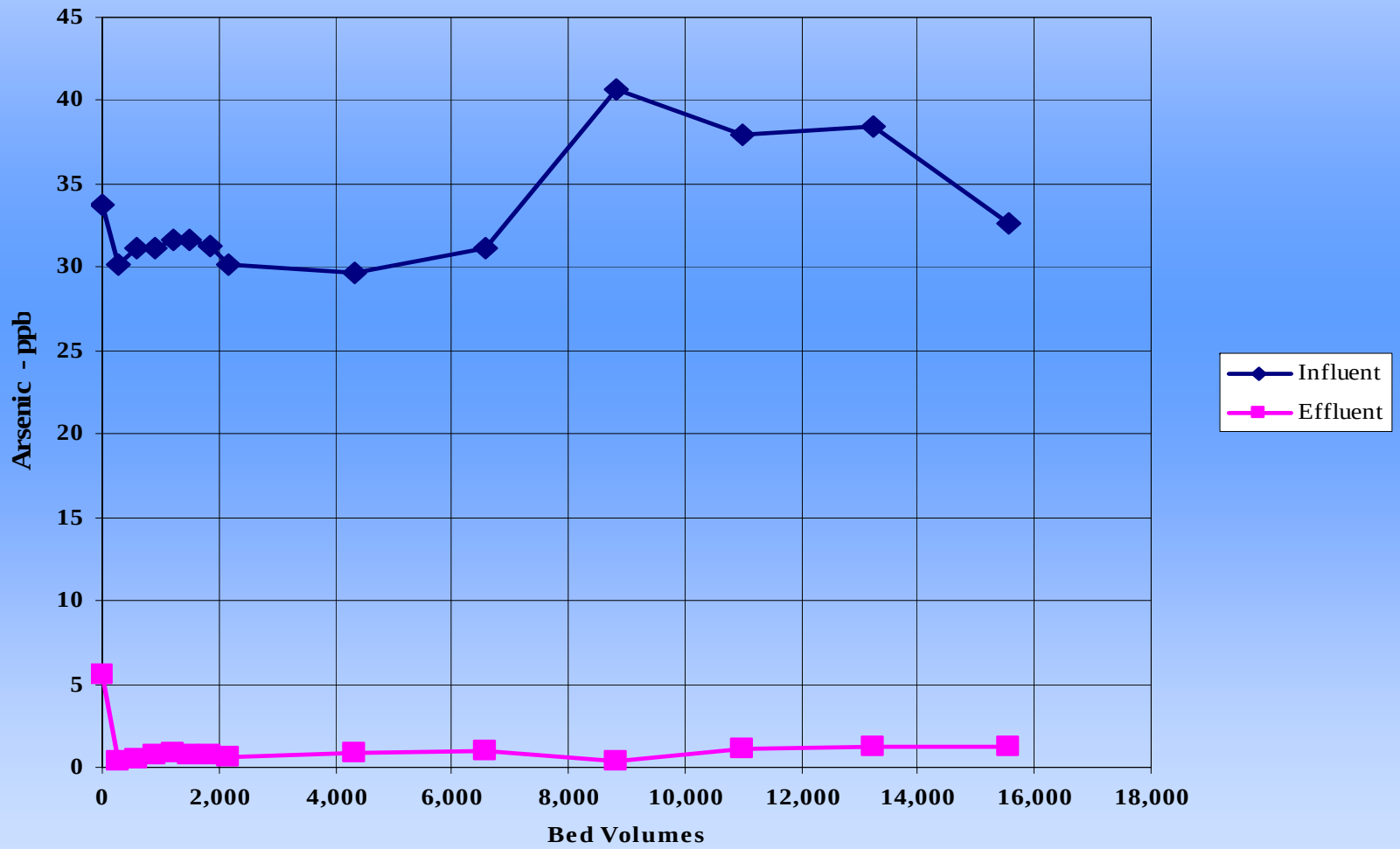
ArsenX^{np} MESA* Pilot

(Data by DSWA)



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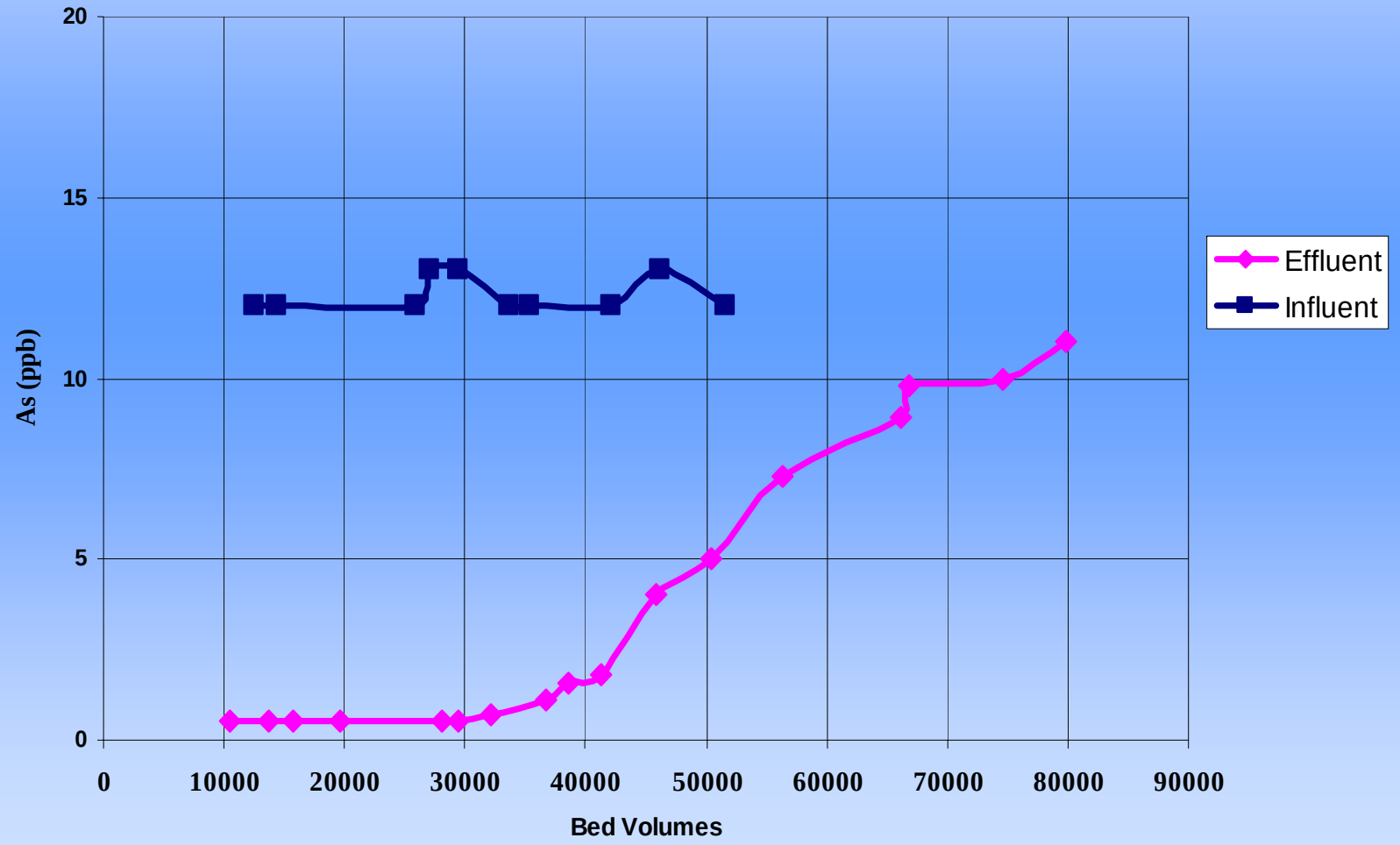
ArsenX^{np} Chandler Pilot

(Data by NCS Inc.)



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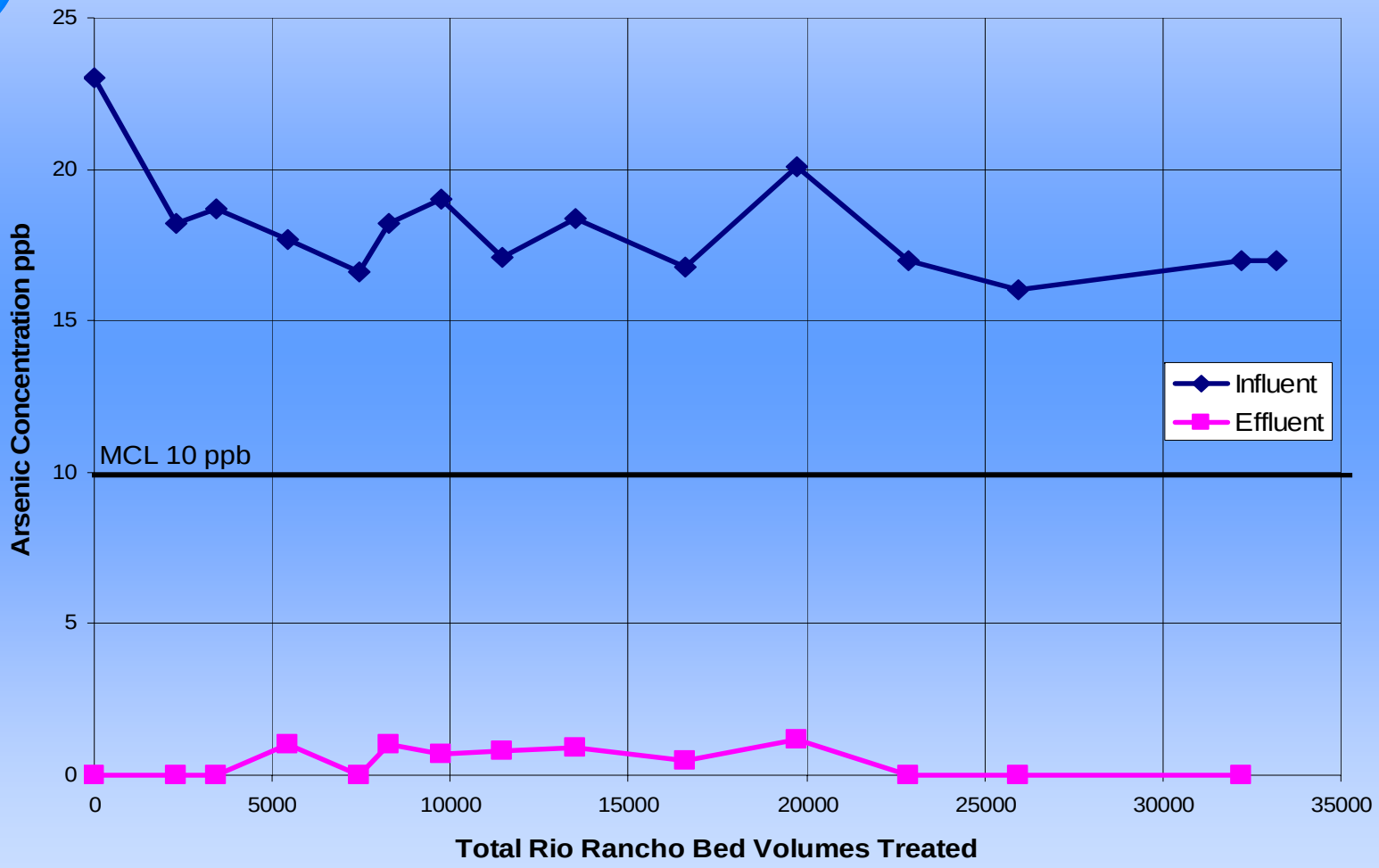
ArsenX^{np} Rio Rancho Pilot

(Data by McPhee Environmental)



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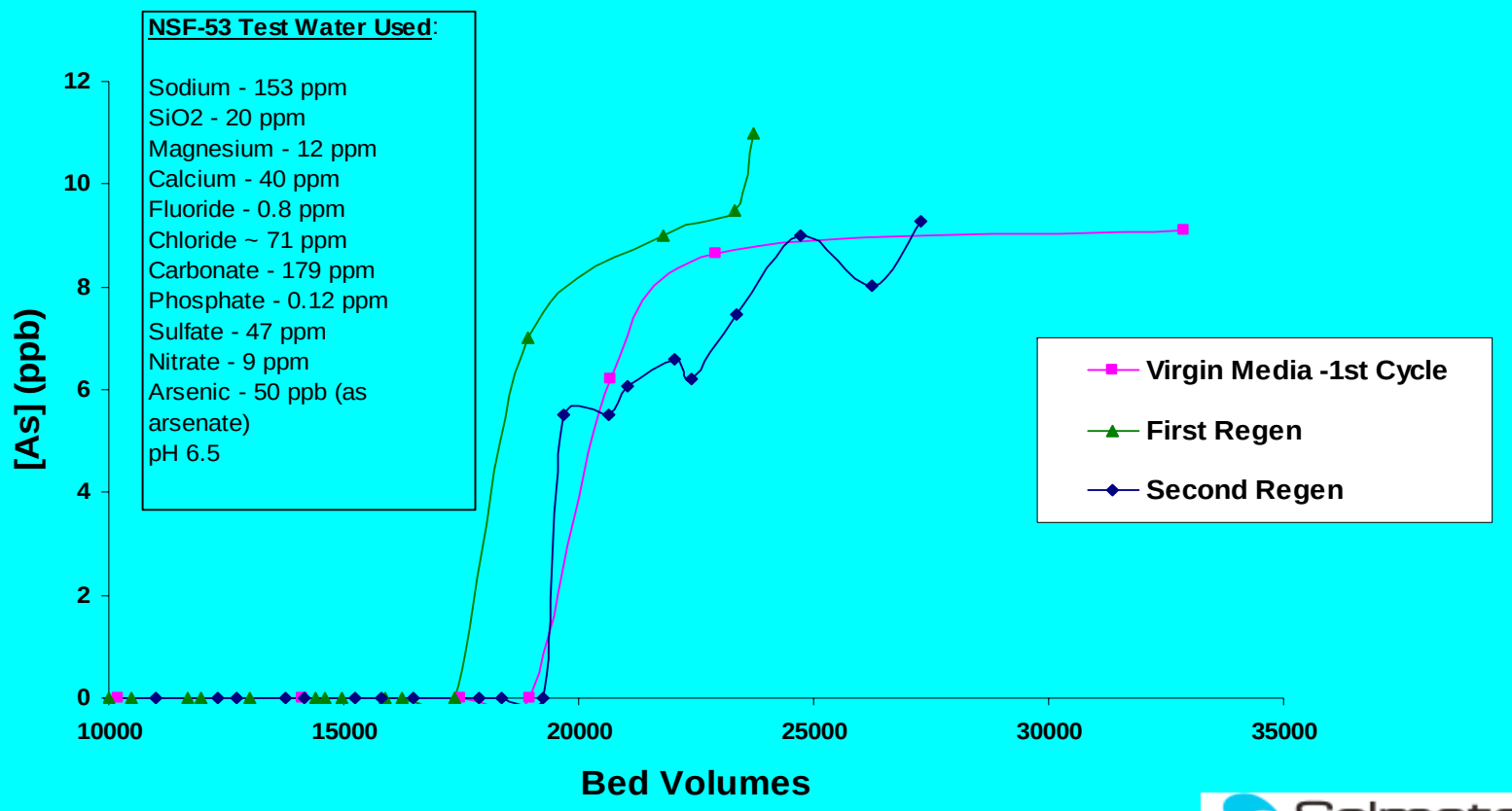
ArsenX^{np} Regeneration Curves

(Data by SolmeteX Inc.)

- Breakthrough Curves Before & After Regeneration
- 1 Min Contact Time with NSF-53 Water Quality



mfg. under license from SolmeteX™

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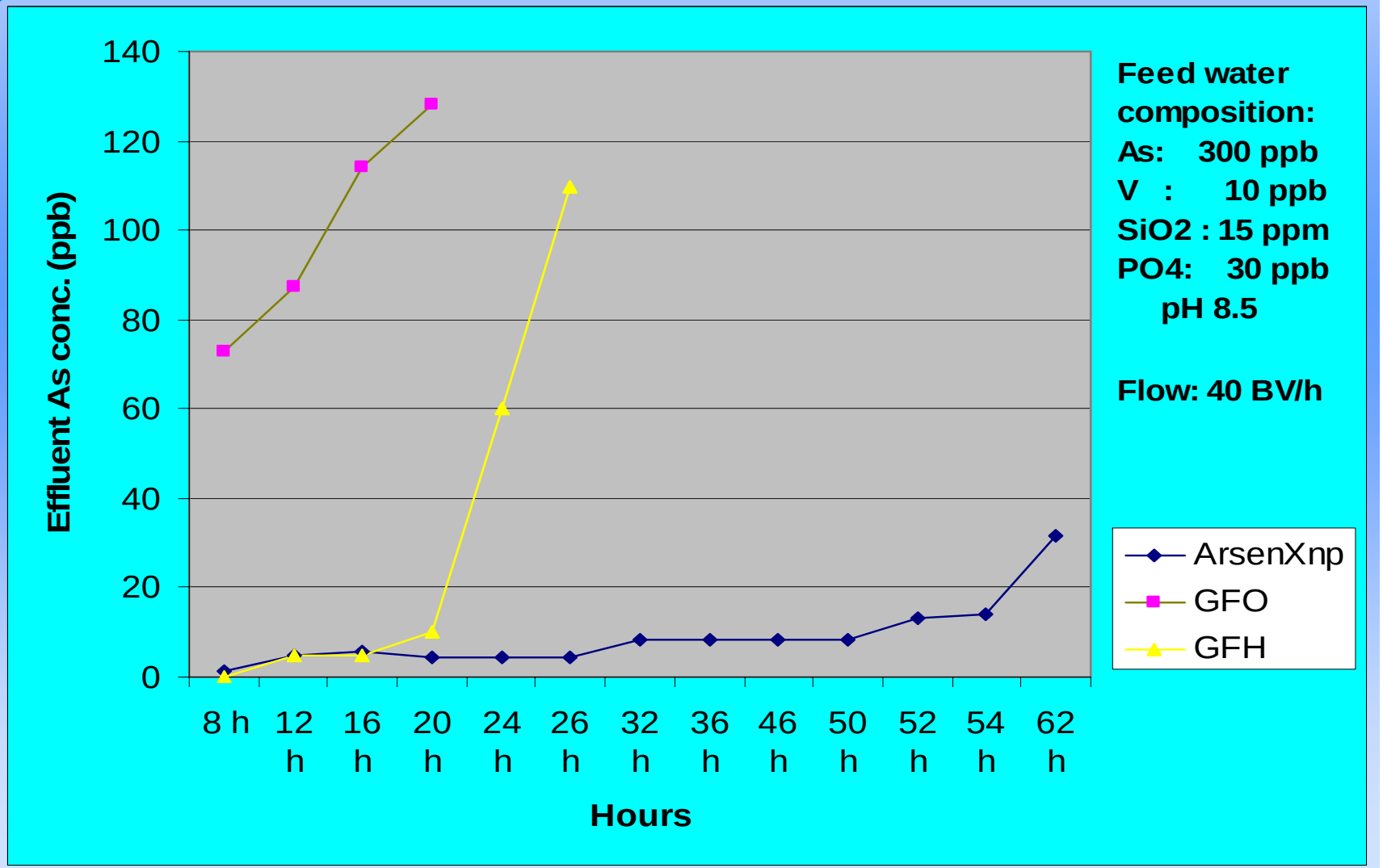
ArsenX^{np} vs. GFO and GFH

(Data by Purolite Romania)



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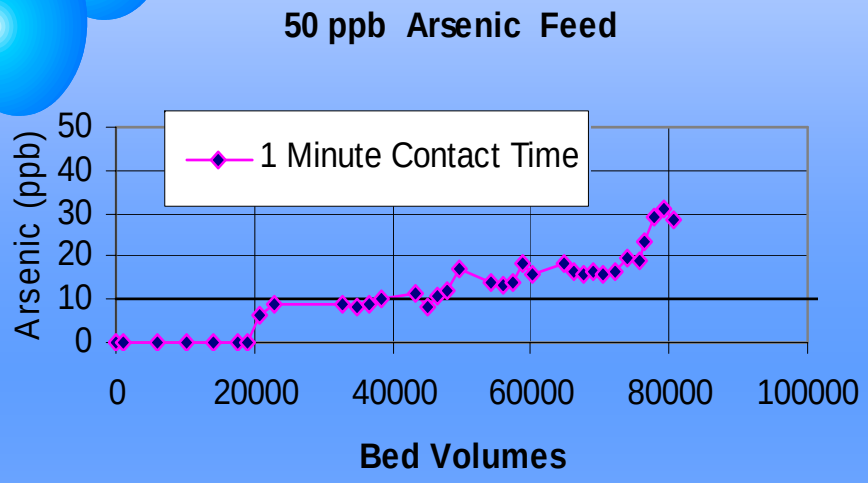
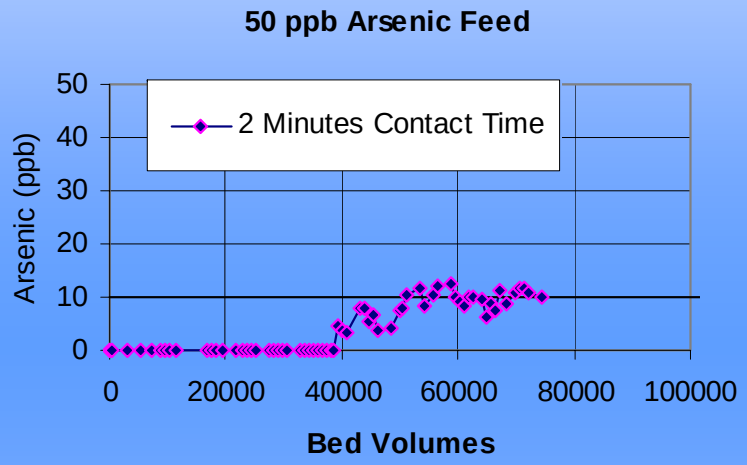
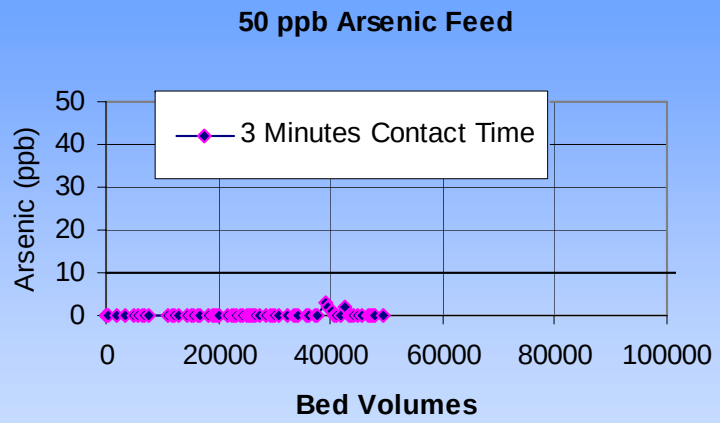
ArsenX^{np} Lab Pilots

(Data by SolmeteX Inc.)







Using NSF-53 test protocol water

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ArsenX^{np} Pilots

Location	Influent Arsenic µg/L	pH	Bed Volumes to 10 µg/L Breakthrough	Notes
	1st Generation Media			
Mesa, AZ	34	7.7	22,000	1st generation product - Lower capacity.
	2nd Generation Media			
Chandler, AZ	12 -1 3	8.2	77,000	Regenerated by ASU ;2nd cycle started 6/14/04 ; High V
SolmeteX	50	6.5	> 75,000	NSF-53 protocol -on-going
	91 day pilot			
Rio Rancho, NM	17 – 23	8.2	> 33,200	Non-detect As; terminated after 91 days
	Other On-Going Pilots			
Community Water, AZ	13 - 15	7.5	> 10,800	30 Day efficacy demo
Green Valley, AZ	14-16	7.6	> 7,160	10 Day efficacy pilot - As + U
California Purolite Trial	25	7	> 3,000	As + Antimony
New River, AZ	350	7.8	> 2,500	High arsenic – non-detect
	10 Other Pilots			

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ArsenX^{np} Operating Systems

- NTNC POE systems operating in ME & NH
  - ✓ **Many systems operating at flow rates < 50 gpm**
  - ✓ **Influent Arsenic concentration 30 –100 ppb**
  - ✓ **Effluent arsenic for all systems N/D**
  - ✓ **Non-regenerable systems installed by 3 different OEM's**
- Groundwater Remediation:
  - ✓ **CA: non-potable system operated at ~ 200 gpm**
  - ✓ **Influent Arsenic 127 ppb – Effluent < 0.6 ppb**
  - ✓ **AZ: Commitment for multiple 500 gpm potable systems**
  - ✓ **AZ: Commitment for 5 potable systems all <200 gpm**
  - ✓ **NM: Commitment for ~3,000 gpm potable system**

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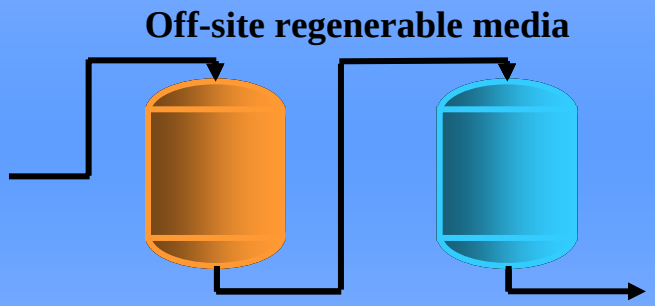
ArsenX^{np} Design - Municipal



On exhaustion of lead, replace lead with lag, put fresh vessel in lag position

Disposable or Regenerable

- 2.5 minutes contact time (1 – 3 OK)
- 3 gpm /ft^3 flowrate (24 BV/H)
- Bed depth > 30” (760mm)
- Distributor design for 16-50 mesh media (300-1200 microns)
- Sluice port on each vessel for media transfer
- Sample ports inlet/outlet (both)

Design & Internals same as standard IX vessels

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ArsenX^{np} Regeneration + O&M

- ✓Off-site Regeneration:
  - ✓NaCl brine (U, Cr^{6+}, SO_4 removal) - metals ppt. & solution neutralized for disposal
  - ✓Dilute NaOH for As strip; As adsorbed on natural ore for non-hazardous disposal
  - ✓DI Rinse, Neutralization, return to service
- ✓O&M:
  - ✓Minimal labor and electrical required
  - ✓Bag filters + lead/lag vessels to be skid mounted
  - ✓Sample ports readily accessible

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ArsenX^{np} Summary

- ✓Applicable for Muni, POE & POU
- ✓NSF-61 Certified and patent-pending
- ✓Ideal for turnkey Muni installations
- ✓Can re-bed GFH/GFO vessels
- ✓Regenerability offers cost effective solution vs. other technologies
- ✓Purolite will guarantee capacity

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Questions or Comments??

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