

Observations on Recent Arsenic Cost Models

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Recent PC Models

- “Arsenic Adsorbent Design and Costing Tool” (AADCT.xls)
- “Cost Estimating Tool for Arsenic Removal by Small Drinking Water Facilities” (ARCE.xls)

AADCT

- Sponsor: AwwaRF
 - Development: engineering consulting firm in collaboration with academia
 - Platform: PC
 - Software: MS Excel (90%) and VB (10%)
 - Technology: Adsorptive media
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ARCE

- Sponsor: USEPA/ORD Cincinnati
 - Development: Battelle National Lab
 - Platform: PC
 - Software: MS Excel (10%) and VB (90%)
 - Technology: Adsorptive media
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Design Approach

	AADCT	ARCE
Approach	Multiple Reg.	Experimental
Media Mass	Algorithms (7 media)	Bed volumes
Interfering ions		
Split flow		
pH Adjustment		

System Cost Analysis

	AADCT	ARCE
Cost components	$C(Q)=a+bQ+cQ^2+dQ^3+eQ^f$	Nuts and bolts
Regeneration		
ENR Index Update		

AADCT Model Maturity

- Easy to use
- Validity depends on algorithm accuracy
- Robust and ready for use
- Should be validated against field data

ARCE Model Maturity

- Easy to use and potentially very powerful
- Questions on assumptions and results
- Disconcerting statements in code:
 - “Don't be surprised if this isn't right.”
 - “the calculation for BRPC cannot be right - BRPC depends on Fbase, which we don't have for this system. Again, don't be surprised if this is wrong”
- ARCE in Beta version?
 - New release available soon
- Should be validated against field data

Lessons Learned



Typical Rural Community

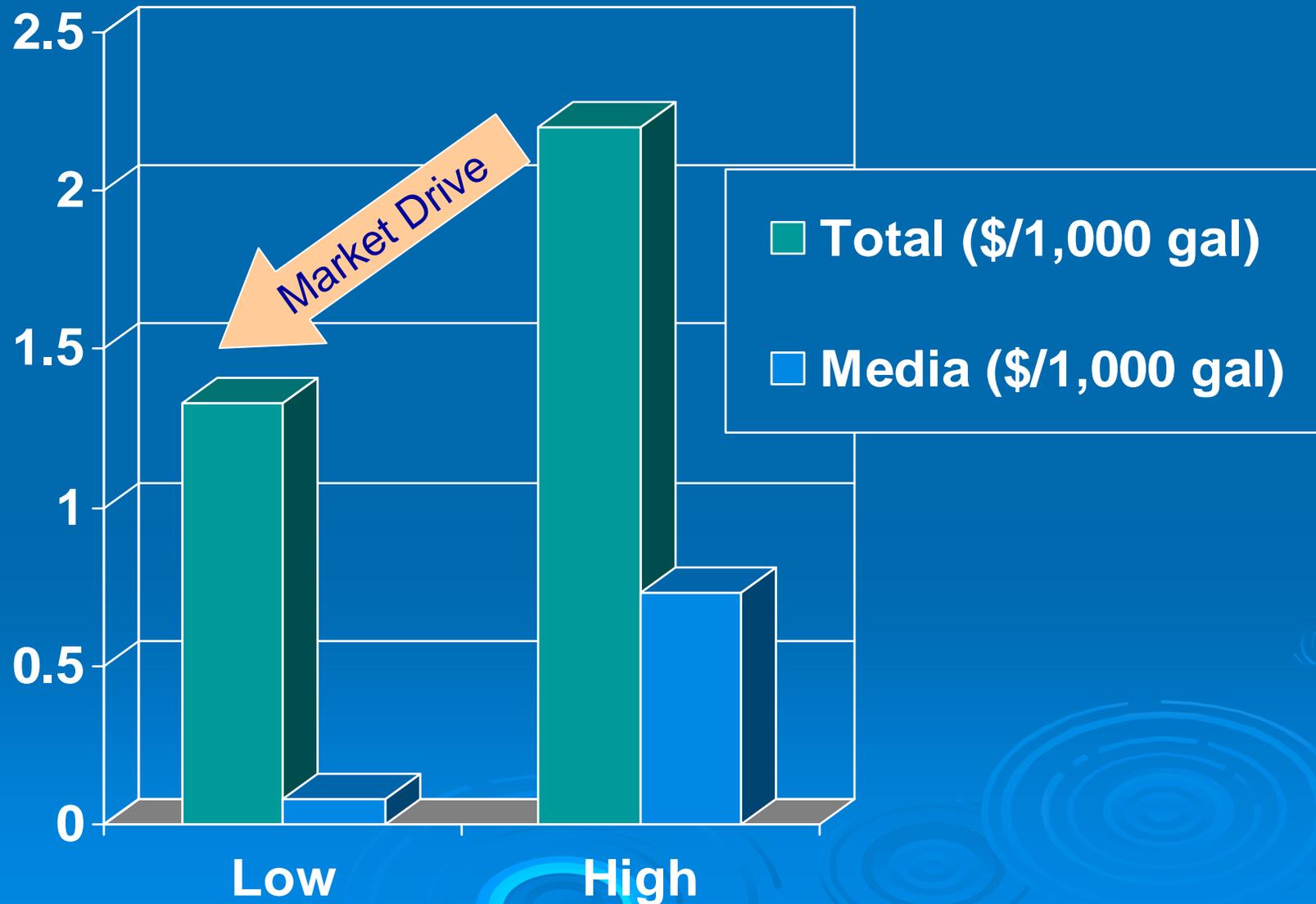
- Population: 1,000
 - Water Consumption: 100 g/cap-day
 - Source As = 20 ppb
 - Goal As = 8 ppb
 - Cl₂ disinfection in place
 - Interest Rate: 6 percent
 - Payback Period: 20 yr
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Typical NM Groundwater

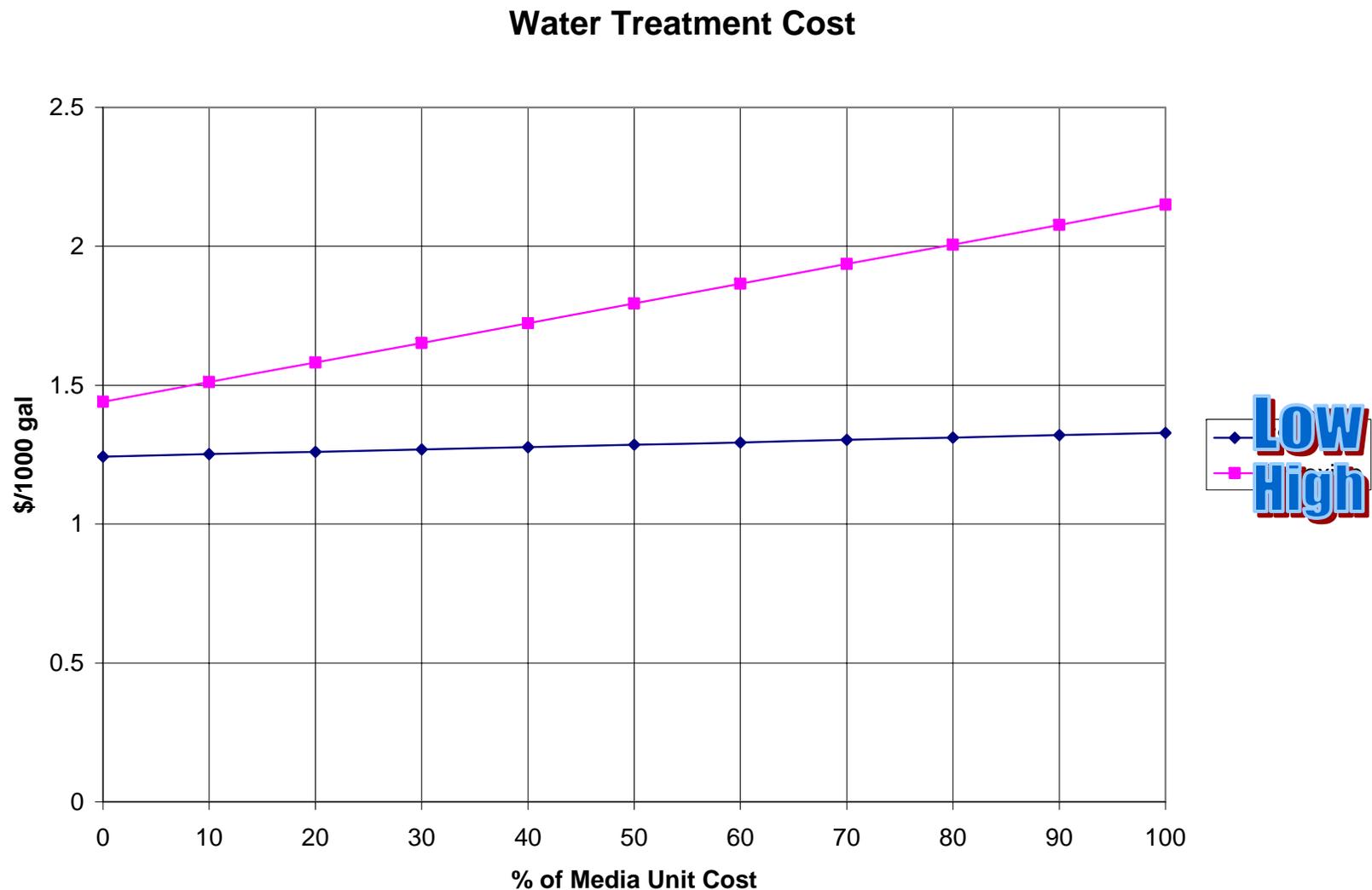
Input Values

Parameter	Value	Parameter	Value
Split Stream	yes	Raw Water pH	7.5
Isotherm	Freundlich	Phosphate, µg/L	0.00
pH Adjustment	yes	Alkalinity (as CaCO ₃), mg/L	100.00
Treatment Design Flow, gpm *	467	Silica, mg/L	0.00
Treatment Average Flow, gpm *	233	Vanadium, µg/L	0.00
Raw Water Arsenic Concentration, µg/L	20.00	Fluoride, mg/L	0.00
Treated Water Arsenic Goal, µg/L	8.00	Iron, mg/L	0.00

Contribution of Media Cost



Effect of Media cost on Treated Water Cost



Conclusions

- ARCE and AADCT are user friendly and comprehensive arsenic treatment cost models
- AADCT recommended until ARCE is updated
- Both need validation against field data
- Cost of media represents a small fraction (7%) of water treatment cost